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GE Medical Systems

Technical Publications

Direction 2202522
Revision 2

Signa® Cardiac Phased Array Coil

Operating Documentation

DAMAGE IN TRANSPORTATION

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.

Immediately complete a "Damage Loss Claim Form", available via MS Exchange Mail, after the damage is found.

MS Exchange Path:

Outlook/Public Folder/All Public Folders/Medical Systems/!Global Initiatives/Information Management/Forms/ Common Forms/DAMAGE LOSS CLAIM FORM.

Send the completed form to the email address listed in the form.

For more information about the Transportation Claim Procedure, access the GE Medical Systems Intranet and enter the following URL address (case sensitive):

FTP://3.87.40.2/GLOBEPRO/QUALSYS/DOCS/190016MF.PDF

Rev. 11/15/2000

W A R N I N G

- **THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.**
- **IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.**
- **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.**

AVERTISSEMENT

- **CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.**
- **SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L'ANGLAIS, C'EST AU CLIENT QU'IL INCOMBE DE LE FAIRE TRADUIRE.**
- **NE PAS TENTER D'INTERVENTION SUR LES EQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ETE CONSULTE ET COMPRIS.**
- **LE NON–RESPECT DE CET AVERTISSEMENT PEUT ENTRAINER CHEZ LE TECHNICIEN, L'OPERATEUR OU LE PATIENT DES BLESSURES DUES A DES DANGERS ELECTRIQUES, MECANIQUES OU AUTRES.**

WARNUNG

- **DIESES KUNDENDIENST-HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.**
- **FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.**
- **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 SOLO EXISTE EN INGLES**
- **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.**

ATENÇAO

- **ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.**
- **SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.**
- **NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.**
- **O NÃO CUMPRIMENTO DESTE AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A' CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.**

AVVERTENZA

- **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.**

警告

- このサービスマニュアルは英語版しかありません。
- GEMS以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
- このサービスマニュアルを熟読し、理解せずに装置のサービスを行わないでください。
- この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

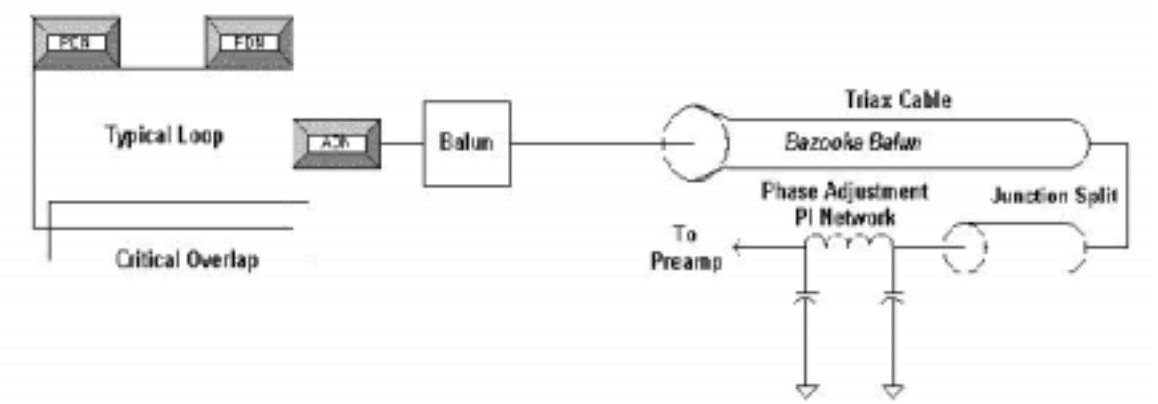
- 本维修手册仅存有英文本。
- 非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。
- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

TABLE OF CONTENTS

SECTION 1 - INTRODUCTION

1-1 HOW THE CARDIAC PHASED ARRAY COIL OPERATES

This coil consists of four loops. An anterior portion contains two critically overlapped loops, while a posterior portion contains another two critically overlapped loops. The primary application is the imaging of the heart and great vessels. See Illustration 1-1.



CARDIAC ARRAY FUNCTIONAL BLOCK DIAGRAM
ILLUSTRATION 1-1

The Cardiac multicoil is a four loop array to obtain the higher SNR of smaller MRI surface coils and retain a large field of view. Also, because the array is split in two halves (one in the front and one in the back) there is a "volume" affect that increases the SNR at the center of the body. Each half consists of two individual loops that are approximately 7.5 inches (19 cm) by 4.5 inches (11.5 cm) with a 0.75 inch (2 cm) overlap. This translates to a coil area of approximately 8.3 inches (21 cm R/L) by 7.5 inches (19 cm S/I) overall for each half.

The array is intended to be used in one mode only utilizing all four coils.

The interface to Signa is a 30 pin Bendix connector with a double banana plug mechanical enhancement. This connection plugs into the multicoil port and is keyed for a specific field strength use only. The two halves are connected to each other via Cabling.

The array is designed for feet first cardiac imaging. This implies a cable length of approximately 85 inches (216 cm).

The only active components, including the PIN diodes, are on the input boards via an access cover over the input circuitry of the coil. The PIN diodes may be replaced in the Field.

Each coil loop must be turned off during transmit. This is accomplished with active blocking which includes a tuned L-C network and a single PIN diode per coil element. The input capacitor is chosen such that the transmit blocking impedance (at 250 mA DC bias to the diode) is greater than 1K ohm. The coil loop size is 7.5 inches (19.1 cm) X 4.5 inches (11.4 cm) which is 34 in*in (218 cm*cm).

The input capacitor is chosen for both matching and blocking circuitry. The blocking circuitry and matching circuit reside on the Cardiac Phased Array Input Board.

In addition to the active blocking components there are two passive decoupling networks, PDN, for each loop. These PDN provide both heat distribution for UFI pulse sequence compatibility as well as maintaining the coils safe in a first fault condition should the active network fail to operate properly. The PDN are not serviceable by Field personnel.

A shielded resonant cable trap on each loop minimizes the ground currents on the shield due to its high impedance.

A 50 ohm phase shift network ensures a multiple of a half wavelength from the 30 pin connector to the coil input. This phase compensation network takes into account cable lengths and the balun circuit. The phase shift networks for all four loops reside on the Cardiac Phase Adjust Board located in the Quick Disconnect Enclosure which is sealed.

1-2 COMPATIBILITY

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

- Signa® Horizon™ and Lx Horizon™ Systems with Phased Array(1.5T only)
- Signa® CVMR (1.5T only)

BURN HAZARD! TO PREVENT PATIENT WARMING OR BURNS, DO NOT INSTALL THE CARDIAC PHASED ARRAY IN SIGNA® ADVANTAGE™ SYSTEMS. THE CARDIAC PHASED ARRAY IS NOT COMPATIBLE WITH THE LOWPASS BODY COIL ASSOCIATED WITH THE SIGNA® ADVANTAGE™ SYSTEMS. THIS INCLUDES SIGNA® ADVANTAGE™ SR-17 SYSTEMS.

1-3 RELATED DOCUMENTS

- Direction 2187583-3, MR Release 5.x/8.x Signa® Horizon Service Methods
- Direction 2124201-3, MR Release 5.x Signa® Service Methods
- Direction 2160623-3, MR Release Signa® Lightning Service Methods

1-4 ORGANIZATION OF THIS DOCUMENT

This manual is divided into the following sections:

Section 1, Introduction, describes how the Cardiac Phased Array Coil operates and when and where the Cardiac Phased Array Coil 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 Cardiac Phased Array Coil in the Scanner Room.

SECTION 2 – SETUP AND CALIBRATION

2-1 CHECKING THE SHIPPING LIST - PRELIMINARY

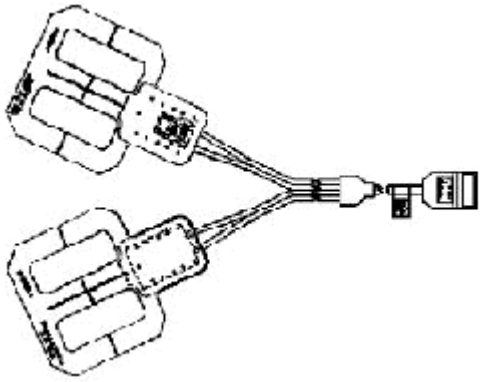
Table 2-1 lists the M1087CA Signa 1.5T Cardiac Phased Array Coil parts. Check that all parts have been shipped.

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

QTY.	ITEM	PART NUMBER
1	1.5T Cardiac Phased Array Flex Coil	2174499
1	Service Direction	2202522
1	Operator Manual	2200460-100
2	Coil Positioning Strap	2211425
1	Pad - Foot End	2213746
1	Pad - Coil End	2208990

2-2 INSTALLING THE CARDIAC PHASED ARRAY COIL

For **5.**x, at the Terminal, install a new soft key. This key will be used by the operator to select CARDIAC (elements 1-4) imaging. Name the key "CARDIAC". See Illustration 2- 1.



CARDIAC ARRAY COIL
ILLUSTRATION 2-1

For **5.x, and 8.x,** refer to the Signa Configuration File procedure for information on installing a new coil (use Coil/Phased Array default values in Table 2-4, 2-5, and 2-6).

TABLE 2-4
1.5T COIL VALUES

SYSTEM	COIL NAME	COIL TYPE	EXTREMITY COIL	CABLE LOSS	COIL LOSS	RECON SCALE FACTOR	XMIT COIL	MULTI-COIL
1.5T	CARDIAC	SURF.	NO	1.05 $ 1.05 & 1.20 @	0.313 $ 1.720 & 0.952 @	Head Coil Recon Scale Factor x 1.00	QUAD	YES

NOTE: $ - 55 cm Bore, & - 60 cm Bore, @ - CRM Bore

TABLE 2-5
1.5T PHASED ARRAY VALUES

MULTICOIL NAME	NUMBER OF RECEIVERS	START RECEIVER	STOP RECEIVER	PORT ENABLE MASK	ERROR ENABLE MASK
CARDIAC	4	0	3	15	15

TABLE 2-6
1.5T TG VALUES

START TA VALUE	START RG VALUE
90	12

2-3 FUNCTIONAL CHECKS

1. Perform a Body coil scan SNR verification. Refer to Section 3-1, BODY COIL SNR VERIFICATION.
2. Perform a Cardiac Phased Array Coil SNR Verification. Refer to Section 3-2, CARDIAC PHASED ARRAY COIL SNR VERIFICATION.

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 and coil foam for cracks or breaks once a week. Refer to Section 4-5, CHECKING THE CABLES.
2. Perform a coil SNR verification. Refer to Section 3-2, CARDIAC ARRAY COIL SNR 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 6 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 BODY COIL SNR 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 appropriate proprietary Service Methods CD-RO*M, navigate to System:Troubleshootin*g.

Phantom Required

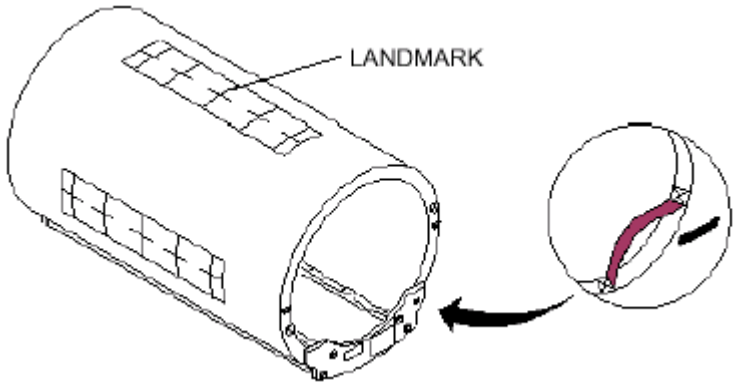
- Body TLT Phantom, 46-265635G6 or Body SPT Phantom, 2298119
- Body TLT Loader, 46-287902G1 or SPT Short Loader, 2125244

Setup Procedure

CAUTION

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 HEAD COIL T/R NETWORK.

1. Remove Quad Head Coil (if present) from cradle.
2. Select **[New Exam] (5.x and 8.x)** to allow a new Landmark to be set.
3. Position the Body Phantom in the center of the Body Loader at 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.



BODY PHANTOM/LOADER LANDMARK SETUP
ILLUSTRATION 3-1

4. **For 5.x and 8.x:** Setup Scan Prescription as shown in Table 3-1.

TABLE 3-1
BODY COIL SNR - SCAN PROTOCOL (5.X AND 8.X)

Id:	**geservice**	Rep Time (TR):	**[500 msec]**
Name:	**body snr**	Auto CF:	**[Peak]**
Patient Weight:	**300**	Field of View:	**[48 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** End Loc (I/S): **0**
Coil Type:	**[Body Coil]**	No. of Scan Location:	**1**
Scan Plane:	**[Axial]**	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:	**[A/P]**
or enter PSD Filename		Imaging Time:	**[1 NEX 2:15]**
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 CARDIAC PHASED ARRAY COIL SNR 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 appropriate proprietary Service Methods CD-RO*M, navigate to System:Troubleshootin*g.

Phantom Required

- Head TLT Phantom, 46-265826G6
- Head Loader, 46-287899G1

Setup Procedure

1. Select **[New Exam] (5.x and 8.x)** to allow a new Landmark to be set.

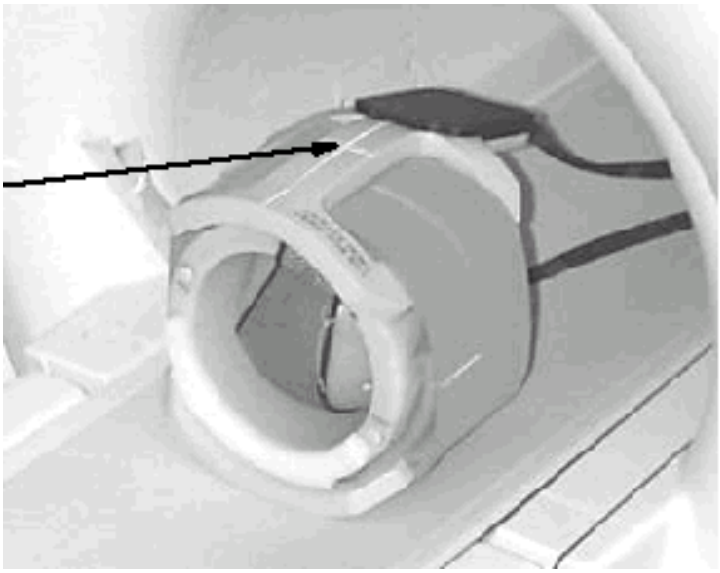
CAUTION

THE QUAD HEAD COIL MUST BE COMPLETELY REMOVED FROM THE CRADLE BEFORE PERFORMING ANY BODY SCANS. FAILURE TO DO THIS MAY RESULT IN D AMAGE TO THE HEAD COIL T/R NETWORK.

2. Remove Quad Head Coil (if present) from cradle.
3. Place Cardiac Phased Array Coil to be tested around the head loader/head phantom with the Cardiac coils placed on the top and bottom side of loader. See Illustration 3-2. Use positioning straps provided with Cardiac Phased Array Coil.
4. Connect Cardiac Phased Array Coil connector to its mating connector in the Carriage Assembly.

CARDIAC ARRAY/HEAD LOADER SETUP
ILLUSTRATION 3-2

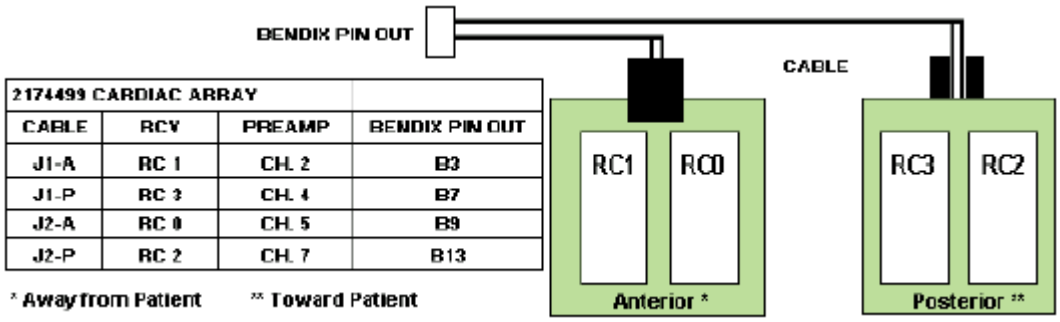
5. Position the Cardiac Array/loader in the center of the cradle. Landmark for center of head phantom and advance to isocenter using the **[ADVANCE TO SCAN]** button. See Illustration 3-3.



CARDIAC ARRAY/HEAD LOADER LANDMARK
ILLUSTRATION 3-3

Phased Array Coil Receiver Paths

The Phased Array Coils have multiple individual antenna loop elements inside the assembly; the TPS chassis has multiple receivers (RCV0-RCV3). See Illustration 3-4.



2174499 CARDIAC ARRAY			
CABLE	RCV	PREAMP	BENDIX PIN OUT
J1-A	RC 1	CH. 2	B3
J1-P	RC 3	CH. 4	B7
J2-A	RC 0	CH. 5	B9
J2-P	RC 2	CH. 7	B13

* Away from Patient ** Toward Patient

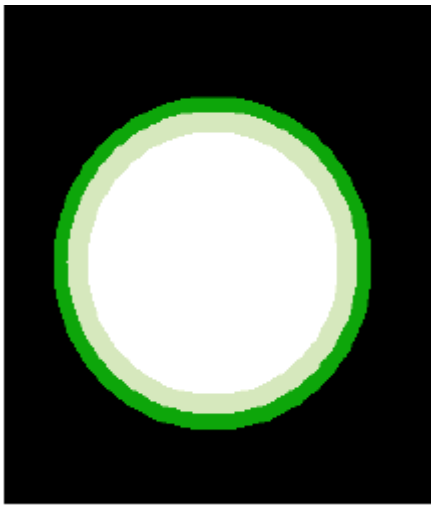
CARDIAC ARRAY COIL TO TPS RECEIVER CORRESPONDENCE
ILLUSTRATION 3-4

6. **For 5.x and 8.x:** Setup Scan Prescription as shown in Table 3-2.

TABLE 3-2
CARDIAC ARRAY COIL SNR - SCAN PROTOCOL (5.X AND 8.X)

Id:	**geservice**	Rep Time (TR):	**[500 msec]**
Name:	**body snr**	Auto CF:	**[Peak]**
Patient Weight:	**300**	Field of View:	**[48 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** End Loc (I/S): **0**
Coil Type:	**[Body Coil]**	No. of Scan Location:	**1**
Scan Plane:	**[Axial]**	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:	**[A/P]**
or enter PSD Filename		Imaging Time:	**[1 NEX 2:15]**
Number of Echoes:	**[1]**	Contrast:	**[No]**
Echo Time (TE):	**[20 msec]**	Table Delta:	0 mm

7. Select **[Auto Prescan]** to properly calibrate the RF power level for the 90 degree and 180 degree pulses.
8. Select **[Scan**]. Observe the resulting image of the sphere. See Illustration 3-5 (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.
9. Select **[Scan]** again. This second image of the sphere will be used for determination of Cardiac mode SNR.
10. Select **[Cancel**]. Refer to Section 3-3 for SNR image analysis.



CARDIAC ARRAY COIL IMAGE

3-3 SNR IMAGE ANALYSIS

3-3-1 SNR Image Analysis (Release 5.x)

(See Section 3-3-2 for Release 8.x)

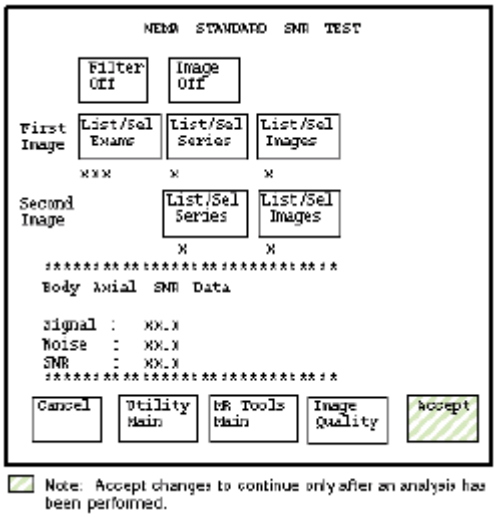
Description

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 3-7.
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.



SNR TEST SCREEN
ILLUSTRATION 3-7

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 3-7 (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.

3-3-2 SNR Image Analysis (Release 8.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 for positioning the ROI. A difference image is created by subtracting the second image from the first and to calculate noise from the subtracted image. Signal value, noise value, and SNR are reported.

8.x SNR Image Analysis Procedure

Procedure

1. Select [Service Desktop], [Calibration/Checks], then [Image Quality].

<<< NEMA Image Quality Analysis >>>
1. Signal To Noise Check
2. Slice Offset Checks
3. Slice Thickness/Resolution Check
4. T2 Uniformity Check
5. Full Field Distortion Check
6. Exit NEMA test

Select Test: ..... **1 [ENTER]**
****
* Select First Image *
****

==========
Image Selection Menu
==========
Current Selection:
Exam_No = 50210, Series_No = 1, Image_No = 1
A. Select Exam
B. Select Series
C. Select Images
D. List/Select Exam
E. List/Select Series
F. List/Select Image
X. Execute the selected test
YOUR CHOICE :..... **A [ENTER]** *(Enter appropriate selection, A-F to choose image.)*
Exam No. ?..... **50201 [ENTER]** *(Enter appropriate number.)*

(Iterate image selection process until Current Selection *is correct.)*

==========
Image Selection Menu
==========

Current Selection:

Exam_No = 50201, Series_No = 1, Image_No = 1

A. Select Exam
B. Select Series
C. Select Images
D. List/Select Exam
E. List/Select Series
F. List/Select Image
X. Execute the selected test
YOUR CHOICE :
Invalid Entry (Invalid Entry*,* always occurs here.)

==========
Image Selection Menu
==========

Current Selection:

Exam_No = 50201, Series_No = 2, Image_No = 1

A. Select Exam
B. Select Series
C. Select Images
D. List/Select Exam
E. List/Select Series
F. List/Select Image
X. Execute the selected test
YOUR CHOICE :..... **X [ENTER]** *(Perform this step* Current Selection *is correct*.)

****
* Select Second Image *
****

==========
Image Selection Menu
==========

Current Selection:

Exam_No = 50210, Series_No = 1, Image_No = 1

A. Select Exam
B. Select Series
C. Select Images
D. List/Select Exam
E. List/Select Series
F. List/Select Image
X. Execute the selected test
YOUR CHOICE :..... **A [ENTER]** (Enter Appropriate selection, A-F to choose image.)
Exam No. ?..... **50201 [ENTER]** *(Enter appropriate number.)*

(Iterate image selection process until Current Selection *is correct.)*

==========
Image Selection Menu
==========

Current Selection:

Exam_No = 50201, Series_No = 2, Image_No = 2

A. Select Exam
B. Select Series
C. Select Images
D. List/Select Exam
E. List/Select Series
F. List/Select Image
X. Execute the selected test
YOUR CHOICE :..... **X [ENTER]** *(Perform this step when* Current Selection *is correct.)*

****
* SNR results *
* *
* Signal = 801.040222 Noise = 10.062437 snr = 79.606979 *
****

<<< NEMA Image Quality Analysis >>>

1. Signal To Noise Check
2. Slice Offset Checks
3. Slice Thickness/Resolution Check
4. T2 Uniformity Check
5. Full Field Distortion Check
6. Exit NEMA test

Select Test: ..... **6 [ENTER]**

2. 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.

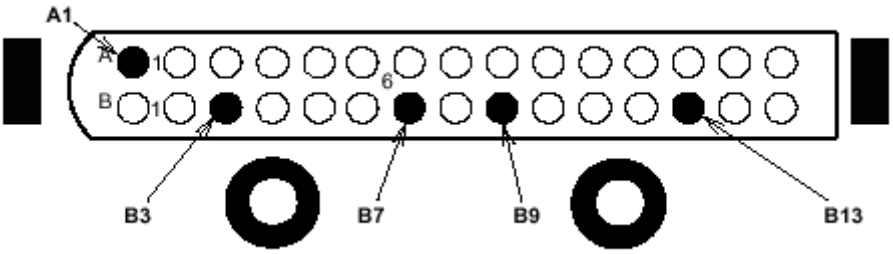
3-4 CHECKING THE PIN DIODES WITH DIGITAL MULTIMETER (DMM)

NOTE: There is one PIN diode for each antenna element. This procedure will indicate if the PIN diode is defective.

1. Select the DIODE TEST function on the Digital Multimeter (DMM).
2. Refer to Table 3-5 and Illustration 3-8. Perform the 'FOR STEP 2' procedures.

TABLE 3-5
DIODE TEST CONNECTIONS PART 2174499

	POSITIVE LEAD CONNECTION		NEGATIVE LEAD CONNECTION	
CABLE	FOR STEP 2	FOR STEP 6	FOR STEP 2	FOR STEP 6
J1-A	B3	A1	A1	B3
J1-P	B7	A1	A1	B7
J2-A	B9	A1	A1	B9
J2-P	B13	A1	A1	B13



CARDIAC ARRAY - TEST POINTS
ILLUSTRATION 3-8

3. A reading of 0.400 to 0.600 should be observed on the DMM.
4. If a reading below 0.400 is observed in either direction, either the output cable is shorted or bad PIN diode.
5. If a reading above 0.600 is observed in step 2, the PIN diode is defective.
6. Refer to Tables 3-5. Perform the 'FOR STEP 6' procedures.
7. A reading of INFINITY should be observed on the DMM.
8. If a reading of INFINITY is observed in both directions, either the output cable is open or the PIN diode is open.
9. If any of the above conditions fails, refer to **Section 4-3, Replacing the PIN Diodes.**

3-5 CHECKING THE EXTERNAL CABLE WITH DIGITAL MULTIMETER (DMM)

1. Select the DIODE TEST function on the Digital Multimeter (DMM).
2. Refer to Table 3-8 and Table 3.8. Perform the 'FOR STEP 2' procedures.

TABLE 3-8
EXTERNAL CABLE TEST CONNECTIONS PART 2174499

	POSITIVE LEAD CONNECTION		NEGATIVE LEAD CONNECTION	
CABLE	FOR STEP 2	FOR STEP 4	FOR STEP 2	FOR STEP 4
J1-A	B3	A1	A1	B3
J1-P	B7	A1	A1	B7
J2-A	B9	A1	A1	B9
J2-P	B13	A1	A1	B13

3. Flex the appropriate external cable, especially near the connectors and the strain relief, and observe that a reading of 0.400 to 0.600 should remain on the DMM, with no instability or fluctuations.
4. Refer to Table 3-8. Perform the 'FOR STEP 4' procedures.
5. Flex the appropriate external cable, especially near the connectors and the strain relief, and observe that a reading of INFINITY should remain on the DMM, with no instability or fluctuations.
6. If either cable fails any of the above tests, replace them. Refer to **Section 4-2, Replacing the External Cable.**

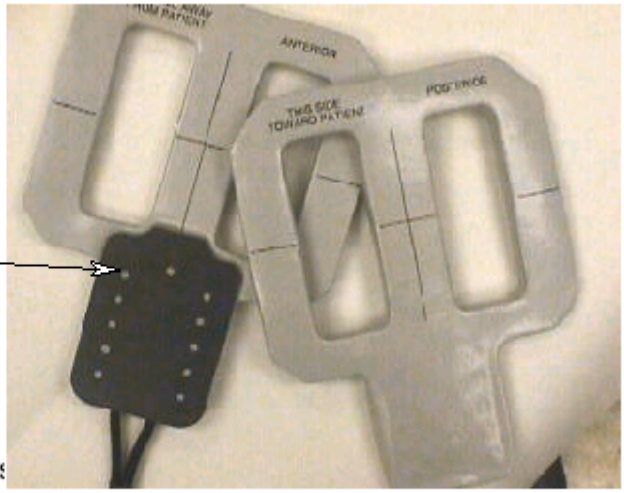
SECTION 4 – REPLACEMENT AND MAINTENANCE

4-1 DISASSEMBLY/REASSEMBLY OF CARDIAC ARRAY

The cable assemblies and diodes are accessed through the access covers.

Cables J1-P and J2-P are in the Posterior Assembly. Cables J1-A and J2-A are in the Anterior Assembly

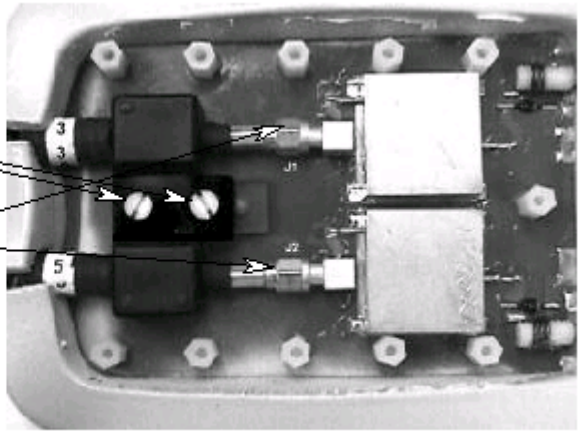
1. Remove 11 screws (46-230008P14) from each effected access cover.
2. When re-assembling the access cover, compress the cover against the coil foam and tighten the screws until they are snug. Do not tighten more than 1.3 inch-lbs (.147 N-m) torque.



CARDIAC ARRAY
ILLUSTRATION 4-1

4-2 REPLACING THE EXTERNAL CABLE

1. Remove strain relief screws. 2 places. (46-208922P5)
2. Remove SMA connectors using 5/16" open ended wrench. 2 places.
3. Repeat Steps 1 and 2 for other Assembly.



CABLE ACCESS
ILLUSTRATION 4-2

4. Replacement cable should be mounted with the bevelled side facing up.

5. Attach SMA connectors using 5/16" open ended wrench. Do not tighten beyond 8 inch-lbs (.147 N-m) torque.

6. Reattach strain relief screws, 2 places. Tighten until snug. Do not tighten beyond 1.3 inch-lbs. (.904 N-m) torque.

7. Reassemble per Section 4-1.

CABLE, BEVELLED SIDE UP
ILLUSTRATION 4-2

4-3 REPLACING THE PIN DIODES

CAUTION

USE A 25W SOLDER IRON AND PROTECT THE CIRCUIT BOARD FROM STATIC ELECTRICITY. BE CAREFUL NOT TO DAMAGE THE CIRCUIT BOARD BY OVERHEATING THE SOLDER. AVOID CONTACT WITH FOAM, STANDOFFS, OR OTHER COMPONENTS, OTHER THAN PIN DIODES.

NOTE: Antenna is tuned at the factory to provide the proper input impedance. Circuit board is not field replaceable. PIN diodes are the only field replaceable components on the circuit board.

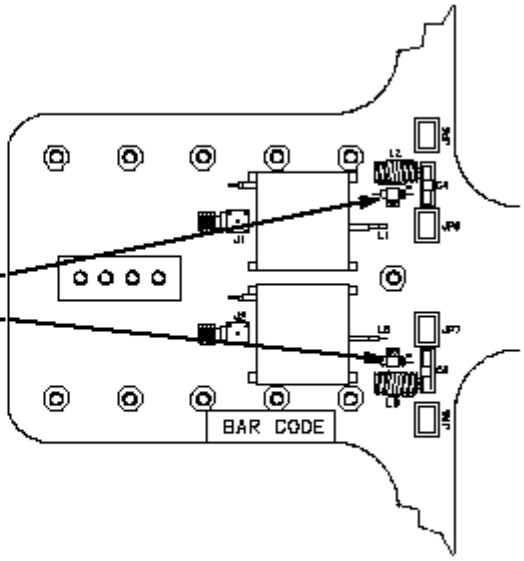
4-3 Replacing the PIN Diodes (cont'd)

1. Disassemble the coil as per **Section 4-1 Disassembly/Reassembly of Cardiac Array Coil.**

2. Use an anti-static wrist band when touching the circuit board.

3. Replace the PIN diode only with an exact replacement diode (see **Section 5, Renewal Parts**). Observe the orientation of the Cathode stripe.

4. Reassemble the coil as per **Section 4-1 Disassembly/Assembly of Cardiac Array Coil.**



PIN DIODE LOCATIONS
ILLUSTRATION 4-3

4-4 REPLACING THE MECHANICAL HARDWARE

Refer to **Section 5, Renewal Part**s, for Cardiac Phased Array Coil part numbers. Cable Screws, Hexagonal Standoffs, Access Cover, Access Cover Screws, and Standoff Screws can all be replaced.

See **Section 4-1** for the **Disassembly/Reassembly of Cardiac Arra**y.

To replace the Hexagonal Standoffs, 46-136375P23, and Standoff Screws, 46-208922P23, carefully pull back foam from around Cardiac Phased Array Input Board to expose the Standoff Screws.

Remove any broken pieces and replace with new components. Tighten until snug. Do not tighten beyond 1.3 inch-lbs. (.147 N-m) torque.

See **Section 4-1** for the **Disassembly/Reassembly of the Cardiac Arra**y.

4-5 CHECKING THE EXTERNAL CABLE

Check the external cables for cracks or breaks once each week. Replace the external cable per **Section 4-2, Replacing the External Cable** if any damage or wear is found. See **Section 5, Renewal Part**s, for the cable part number.

4-6 CLEANING THE COIL

CAUTION

AVOID DAMAGING SENSITIVE ELECTRONIC PARTS. DO NOT SPRAY OR POUR DISHWASHING SOLUTION DIRECTLY ONTO THE CARDIAC ARRAY COIL, OR EXTERNAL CABLE. NEVER SUBMERGE THE CARDIAC ARRAY COIL IN ANY LIQUID.

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

The Cardiac Array Coil can be cleaned with a 10% bleach solution. Wet a soft cloth with the solution and proceed to clean.

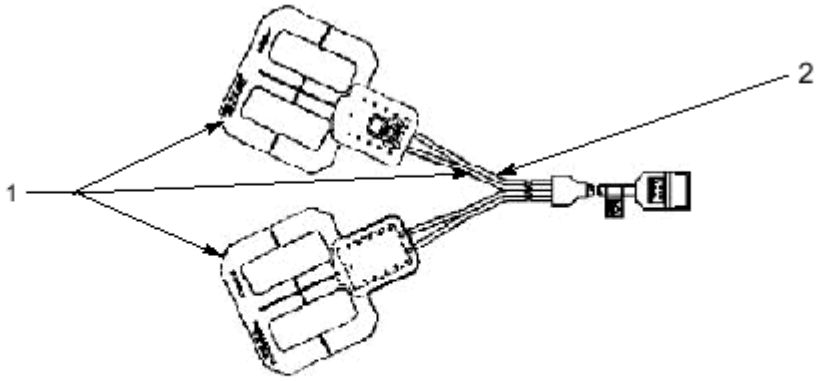
SECTION 5 - RENEWAL PARTS

WARNING

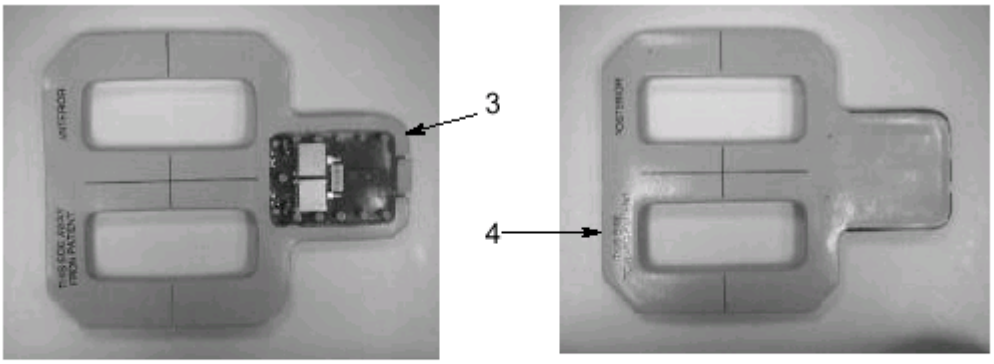
BIO HAZARD! EQUIPMENT BEING RETURNED FROM USE IN A CLINICAL SETTING MUST BE CLEAN AND FREE OF BLOOD AND OTHER INFECTIOUS SUBSTANCES. THE DEPARTMENT OF TRANSPORTATION (DOT) HAS RULED THAT ITEMS THAT WERE SATURATED AND/OR DRIPPING WITH HUMAN BLOOD THAT ARE NOW CAKED WITH DRIED BLOOD; OR WHICH WERE USED 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 4-6, Cleaning The Coil. It is the responsibility of the GEMS employee to insure the part/equipment has been properly decontaminated prior to shipment.

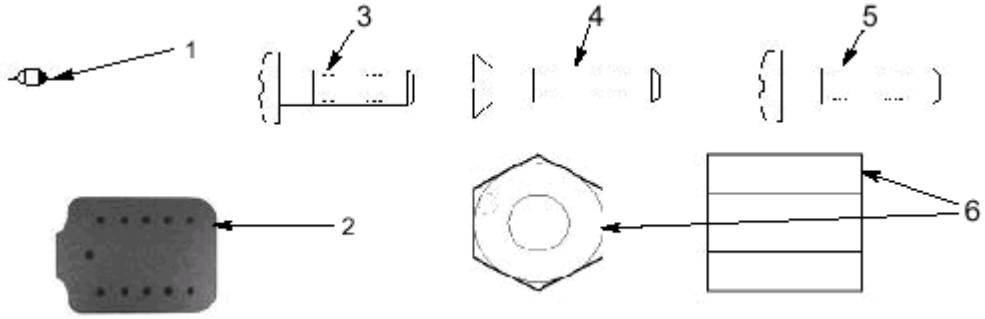
1.5T Cardiac Phased Array Coil



Item	Part Number	FRU	Name	Qty.	Description (Remarks)
1	2174499	1	CARDIAC COIL	1	1.5T CARDIAC ARRAY COIL
2	2215748	1	CABLE	1	CARDIAC ARRAY COIL CABLE



Item	Part Number	FRU	Name	Qty.	Description (Remarks)
3	2189499	1	ANTERIOR	1	CARDIAC ARRAY ASM - ANTERIOR
4	2189499-2	1	POSTERIOR	1	CARDIAC ARRAY ASM - POSTERIOR



Item	Part Number	FRU	Name	Qty.	Description (Remarks)
1	46-221735P1	2	PIN DIODE	4	UM9415B PIN DIODE
2	2196521	2	COVER	2	CARDIAC ARRAY COVER
3	46-208922P23	2	SCREW	22	NYLON BINDING HEAD 6-32 X 5/16
4	46-230008P14	2	SCREW	26	NYLON FLAT HEAD 6-32 X 7/16
5	46-208922P5	2	SCREW	4	NYLON BINDING HEAD 6-32 X 1/2
6	46-136375P23	2	STANDOFF	22	.250 X .562 LONG HEX. NYLON

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 - 4 below and the date they were obtained in column number 1 as a periodic QA check. If the ratio of any of the coils found is not greater than 85%, then there is a problem in the coil or the MR system.

Original SNR data obtained at initial coil installation:

Body Coil SNR Value: _____

Cardiac Coil SNR Value: Anterior_____ Posterior _____
Both_____

Date: _____

SNR Data QA (Quality Assurance) Check:

1	2	3	4	5
Date:	**Posterior**	**Anterior**	**Both**	**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

Make additional copies of this document as is needed.

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

Diode Drop Forward Bias _____
Diode Drop Reverse Bias _____

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
1	Aug 26, 1998	S. Davis	Addition of connection diagram per validation feedback
2	Oct. 24, 2001	K. LaBarge	Updated procedure for SPT phantom and loader