

## TABLE OF CONTENTS

<b>1.0</b>	<b>OVERVIEW</b> .....	<b>2</b>
<b>2.0</b>	<b>INITIAL CONDITIONS</b> .....	<b>3</b>
2.1	External Probe Filter, (2193025).....	3
2.2	Hydrogen ONLY Spectroscopy EPROM .....	3
<b>3.0</b>	<b>TOOLS REQUIRED FOR SNR TESTS</b> .....	<b>4</b>
3.1	Optional Tools when performing Tuning ONLY .....	4
<b>4.0</b>	<b>PROBE/SV TUNING PROCEDURE (ECHO PEAK LOCATION CALIBRATION)</b> .....	<b>5</b>
4.1	BRM ONLY — Probe/S Tuning Procedure .....	5
4.1.1	Specification Criteria (absolute value):.....	6
4.2	BRM ONLY — Probe/P Tuning Procedure .....	6
4.2.1	Specification Criteria (absolute value):.....	7
4.3	TRM ONLY — Probe/S Tuning Procedure .....	7
4.3.1	Specification Criteria (absolute value):.....	8
4.4	TRM ONLY — Probe/P Tuning Procedure .....	8
4.5	CRM ONLY — Zero Procedure .....	9
<b>5.0</b>	<b>PROBE/SV SNR PROCEDURE</b> .....	<b>10</b>
5.1	Probe-S SNR Procedure.....	10
5.2	Probe-P SNR Procedure.....	12
<b>6.0</b>	<b>HELP</b> .....	<b>14</b>
6.1	Example SNR Spectra .....	14
6.2	Probe-P Tuning File and Backup.....	16
6.3	Probe-P Tuning File and Backup.....	16
6.4	Logging Probe Auto Prescan .....	16
6.4.1	Directory Creation .....	16
6.5	PROBE Raw Data Files .....	17
6.5.1	P Raw Data File Location .....	17
6.5.2	Transfer the "mrraw" P File.....	17
<b>7.0</b>	<b>APPENDIX A — DATA SHEETS</b> .....	<b>19</b>
7.1	PROBE/S TUNING DATA SHEET-FOR T/S .....	19
7.2	PROBE/P TUNING DATA SHEET-FOR T/S .....	19
7.3	PROBE-S SNR DATA SHEET.....	20
7.4	PROBE SNR DATA SHEET .....	20
7.5	PROBE SNR DATA SHEET .....	20
7.6	PROBE-P SNR DATA SHEET.....	21
7.7	PROBE-P SNR DATA SHEET.....	21
7.8	PROBE-P SNR DATA SHEET.....	21
<b>8.0</b>	<b>APPENDIX B — RE-CALIBRATION REQUIREMENTS</b> .....	<b>22</b>
8.1	Acronyms .....	23
8.2	Definitions .....	24
<b>9.0</b>	<b>APPENDIX D — MANUAL ENTRY PROBE/SV SNR PROTOCOLS</b> .....	<b>25</b>
9.1	Probe-S SNR Protocol .....	25
9.2	Probe-P SNR Protocol .....	26
<b>10.0</b>	<b>REVISION HISTORY</b> .....	<b>27</b>

## 1.0 OVERVIEW

This material applies to 1.5T Signa 8X systems ONLY and describes two separate Hydrogen ONLY Spectroscopy (PROBE/SV) procedures:

- Echo Peak Location Calibration (automated PROBE Tuning script) for BRM ONLY.
- CRM ONLY sites (with 8.2.5 software or greater) zero procedure.
- TwinSpeed (TRM) systems.
- PROBE SNR performance test.

The Tuning procedure determines the values of control variables (CVs) that are necessary for PROBE/SV scanning. Each Tuning scan will result in 18 coordinate values (three sets of six). Within each set of six, the first four values are described as A, C, B, and D. The 5th is E or - Verification, and the 6th is F or + Verification. Additional calculations (using the first four values of each set) are performed, and the resulting values will be automatically entered into a calibration file producing site specific Control Variables. The SNR procedure will be performed after the Tuning procedure.

### Note

8.X software will not correct specific sites effected with Tuning anomalies. Sites with APS failures due to Water Suppression during SNR should use the appropriate type-in PSD (probe-s2, probe-p2). If necessary, call the OLC for assistance. Depending on the failure a CQA may be required.

## 2.0 INITIAL CONDITIONS

- Fully operational 1.5T Signa 8X system with all performance specifications met.
- M1090LK installed:
  - (Spectroscopy Option Key [46-317350G1].
  - External PROBE Filter used with the CERD -2 Exciter Module ONLY.  
See Sub-Section 2-1.
  - RF Cabinet Erbtec RF Amplifier Processor Board U17 EPROM.
- Magnet is shimmed and acceptance specifications have been met.
- Grafidy or ECMT has been performed and all acceptance specifications have been met.

### 2.1 *External Probe Filter, (2193025)*

This External PROBE Filter is located in the System Cabinet inside the rear door above the I/F Panel. The External PROBE Filter (used to correct EFB issues) is in the MR2A11J1 line.

- Used with the CERD -2 Exciter Module ONLY in conjunction with the RF/Pen 1 or 2 style Cabinet.
- The -6 Exciter Module on the CERD has filtering incorporated on the circuit board and should not be used with an External PROBE Filter.
- RF/PDU Cabinet sites should not use an External PROBE Filter.

### 2.2 *Hydrogen ONLY Spectroscopy EPROM*

The U17 EPROM is required and installed on the Processor Board inside the ERBTEC style Amplifier. The ERBTEC Amplifier is used with the RF/PEN 1 & 2 style Cabinets.

### 3.0 TOOLS REQUIRED FOR SNR TESTS

- MRS Phantom, (2152220), without the loader is required for Probe SNR and is used for the Tuning process.

**Note**

The MRS Phantom is self-loaded does not use a phantom loader. Centering the phantom before performing tests is required.

#### 3.1 *Optional Tools when performing Tuning ONLY*

If the MRS Phantom is not available the TLT Phantom with loader may be used for the Tuning process ONLY. Centering is always very important.

- Head TLT phantom, (46-265826G6).
- Head Loader Cylinder with Solution, (46-287899G1).

## 4.0 PROBE/SV TUNING PROCEDURE (ECHO PEAK LOCATION CALIBRATION)

CRM sites with 8.X software do not perform the Probe s/p tuning procedure. However, a total of 6 values must be set to 0.0 (CRM ONLY) before performing the Probe s/p SNR procedures.

### 4.1 BRM ONLY — Probe/S Tuning Procedure

1. Position the Phantom on the Head Support in the Head Coil with the temperature strip visible. Do not use the Tuning Ring or Head Loader with the MRS Phantom. Use foam padding as necessary to center phantom in Head Coil. Phantom centering (up/down/left/right/in/out) is important. Centering within +/-4mm of isocenter in any direction is satisfactory. Run any head localizer to insure the phantom is properly centered before beginning the PROBE Tuning procedure.
2. Refer to Table 4-1 and 4-2 for PROBE/S Tuning. Do not use geservice protocol probescal.

TABLE 4-1  
PREPARING SYSTEM TO SCAN PROBE/S TUNE

Note: This is the alternate proprietary procedure available for GE use, and to sites with a valid Advanced Service Package Limited License.

- A. Select the **[SCAN]** icon.
- B. Click on **[New Pt]**  
Id: **geservice<ENTER>**  
Name: **probe<ENTER>**  
Weight (Lb.): **111<ENTER>**  
At front enclosure, press **LANDMARK**, then **MOVE TO SCAN**.
- C. Select the **[TOOLS]** icon.
- D. In the Service Desktop Manager select **[Cal/Checks]**.
- E. Select **[Probe/S Tune]**.
- F. Select **[Start...]**.

2. Refer to Appendix A for the Tuning Data Sheet.

TABLE 4-2  
PROBE/S TUNING WINDOW

- A. The PROBE/S Tuning Window pops up:
  - Probe-S Cal Started
  - xshim=#          yshim=#          zshim=#
  - APS: R1=##          R2=##          TG=###          CF=#####The tuning process will proceed automatically for each axis:
  - delta#\_val: #.##The checking process will proceed automatically for each axis:
  - # AXIS Calibration completed SuccessfullyA message will appear after completion of the 3 axis:
  - Probe/S Tuning completed successfully.
  - Results are stored in the /usr/g/caldir/probes\_cal.logIf probescal does not complete successfully: rescan, if still failing re-run grafidy.

B. Press **[Enter]** to quit →

3. View the complete results (does not contain APS information):

- Select [C Shell...]
- Type: **more /usr/g/caldir/probes\_cal.log**.

#### 4.1.1 Specification Criteria (absolute value):

- Single delta parameter,  $| < .8 |$
- Sum of all delta parameters,  $| < 1.0 |$

#### 4.2 BRM ONLY — Probe/P Tuning Procedure

1. Position the Phantom on the Head Support in the Head Coil with the temperature strip visible. Do not use the Tuning Ring or Head Loader with the MRS Phantom. Use foam padding as necessary to center phantom in Head Coil. Phantom centering (up/down/left/right/in/out) is important. Centering within +/-4mm of isocenter in any direction is satisfactory. Run any head localizer to insure the phantom is properly centered before beginning the PROBE Tuning procedure.
2. Refer to Table 4-3 and 4-4 for PROBE/P Tuning. Do not use geservice protocol probecal.

TABLE 4-3  
PREPARING SYSTEM TO SCAN PROBE/P TUNE

Note: This is the alternate proprietary procedure available for GE use, and to sites with a valid Advanced Service Package Limited License.

- A. Select the **[SCAN]** icon.
- B. Click on **[New Pt]**  
Id: **geservice<ENTER>**  
Name: **probe<ENTER>**  
Weight (Lb.): **111<ENTER>**  
At front enclosure, press **LANDMARK**, then **MOVE TO SCAN**.
- C. Select the **[TOOLS]** icon.
- D. In the Service Desktop Manager select **[Cal/Checks]**.
- E. Select **[Probe/P Tune]**.
- F. Select **[Start...]**.

3. Refer to Appendix A for the Tuning Data Sheet.

TABLE 4-4  
PROBE/P TUNING WINDOW

- A. The PROBE/S Tuning Window pops up:
  - Probe-S Cal Started
  - xshim=#            yshim=#            zshim=#
  - APS: R1=##            R2=##            TG=###            CF=#####The tuning process will proceed automatically for each axis:
  - delta#\_val: #.##The checking process will proceed automatically for each axis:
  - # AXIS Calibration completed SuccessfullyA message will appear after completion of the 3 axis:

- Probe/P Tuning completed successfully.
- Results are stored in the /usr/g/caldir/probep\_cal.log

If probepcal does not complete successfully: rescan, if still failing re-run grafidy.

B. Press **[Enter]** to quit →

4. View the complete results (does not contain APS information):

- Select [C Shell...]
- Type: **more /usr/g/caldir/probep\_cal.log**.

**4.2.1 Specification Criteria (absolute value):**

- Single delta parameter,  $| < .8 |$
- Sum of all delta parameters,  $| < 1.0 |$

**4.3 TRM ONLY — Probe/S Tuning Procedure**

1. In the TwinSpeed (TRM) there are two gradient modes, WHOLE and ZOOM. The procedures should be repeated for both. Start with WHOLE, finish and then restart with ZOOM mode.
2. Position the Phantom on the Head Support in the Head Coil with the temperature strip visible. Do not use the Tuning Ring or Head Loader with the MRS Phantom. Use foam padding as necessary to center phantom in Head Coil. Phantom centering (up/down/left/right/in/out) is important. Centering within +/-4mm of isocenter in any direction is satisfactory. Run any head localizer to insure the phantom is properly centered before beginning the PROBE Tuning procedure.
3. Refer to Table 4-5 and 4-6 for PROBE/S Tuning. Do not use geservice protocol probescal.

TABLE 4-5  
**PREPARING SYSTEM TO SCAN PROBE/S TUNE**

Note: This is the alternate proprietary procedure available for GE use, and to sites with a valid Advanced Service Package Limited License.

- A. Select the **[SCAN]** icon.
- B. Click on **[New Pt]**
- C. Id: **geservice<ENTER>**
- D. Name: **probe<ENTER>**
- E. Weight (Lb.): **111<ENTER>**
- F. At front enclosure, press **LANDMARK**, then **MOVE TO SCAN**.
- G. Select the **[TOOLS]** icon.
- H. In the Service Desktop Manager select **[Cal/Checks]**.
- I. Select **[Probe/S Tune]**.
- J. Select **[Start...]**
- K. If whole mode: Select **[Whole]** than **OK**
- L. If zoom mode: Select **[Zoom]** than **OK**.

4. Refer to Appendix A for the Tuning Data Sheet.

TABLE 4-6  
**PROBE/S TUNING WINDOW**

C. The PROBE/S Tuning Window pops up:

- Probe-S Cal Started
- xshim=#            yshim=#            zshim=#

• APS: R1=## R2=## TG=### CF=#####

The tuning process will proceed automatically for each axis:

- delta#\_val: #.##

The checking process will proceed automatically for each axis:

- # AXIS Calibration completed Successfully

A message will appear after completion of the 3 axis:

- Probe/S Tuning completed successfully.
- Results are stored in the /usr/g/caldir/probes\_cal.log.WHOLE or ZOOM

If probescal does not complete successfully: rescan, if still failing re-run grafidy.

D. Press **[Enter]** to quit →

5. View the complete results (does not contain APS information):
  - Select [C Shell...]
  - Type for Whole grad mode : **more /usr/g/caldir/probes\_cal.log.WHOLE** or
  - **more /usr/g/caldir/probes\_cal.log.ZOOM** for Zoom grad mode.
6. Repeat steps 1-5 for ZOOM mode

**4.3.1 Specification Criteria (absolute value):**

- Single delta parameter,  $| < .8 |$
- Sum of all delta parameters,  $| < 1.0 |$

**4.4 TRM ONLY — Probe/P Tuning Procedure**

1. In the TwinSpeed (TRM) there are two gradient modes, WHOLE and ZOOM. The procedures should be repeated for both. Start with WHOLE, finish and then restart with ZOOM mode.
2. Position the Phantom on the Head Support in the Head Coil with the temperature strip visible. Do not use the Tuning Ring or Head Loader with the MRS Phantom. Use foam padding as necessary to center phantom in Head Coil. Phantom centering (up/down/left/right/in/out) is important. Centering within +/-4mm of isocenter in any direction is satisfactory. Run any head localizer to insure the phantom is properly centered before beginning the PROBE Tuning procedure.
3. Refer to Table 4-7 and 4-8 for PROBE/P Tuning. Do not use geservice protocol probepcal.

TABLE 4-7  
**PREPARING SYSTEM TO SCAN PROBE/P TUNE**

Note: This is the alternate proprietary procedure available for GE use, and to sites with a valid Advanced Service Package Limited License.

- C. Select the **[SCAN]** icon.
- D. Click on **[New Pt]**  
 Id: **geservice<ENTER>**  
 Name: **probe<ENTER>**  
 Weight (Lb.): **111<ENTER>**  
 At front enclosure, press **LANDMARK**, then **MOVE TO SCAN**.
- G. Select the **[TOOLS]** icon.
- H. In the Service Desktop Manager select **[Cal/Checks]**.
- I. Select **[Probe/P Tune]**.
- J. Select **[Start...]**.
- K. If whole mode: Select **[Whole]** than **OK**

L. If zoom mode: Select **[Zoom]** than **OK**.

4. Refer to Appendix A for the Tuning Data Sheet.

TABLE 4-8  
**PROBE/P TUNING WINDOW**

C. The PROBE/S Tuning Window pops up:

- Probe-S Cal Started
- xshim=#            yshim=#            zshim=#
- APS: R1=##            R2=##            TG=###            CF=#####

The tuning process will proceed automatically for each axis:

- delta#\_val: ###

The checking process will proceed automatically for each axis:

- # AXIS Calibration completed Successfully

A message will appear after completion of the 3 axis:

- Probe/P Tuning completed successfully.
- Results are stored in the /usr/g/caldir/probep\_cal.log.WHOLE or ZOOM

If probepcal does not complete successfully: rescan, if still failing re-run grafidy.

D. Press **[Enter]** to quit →

5. View the complete results (does not contain APS information):

- Select [C Shell...]
- Type for Whole grad mode : **more /usr/g/caldir/probes\_cal.log.WHOLE** or
- **more /usr/g/caldir/probes\_cal.log.ZOOM** for Zoom grad mode.

6. Repeat steps 1-5 for ZOOM mode

- Specification Criteria (absolute value):
- Single delta parameter, | < .8 |
- Sum of all delta parameters, | < 1.0 |

#### 4.5 CRM ONLY — Zero Procedure

Perform the following sub-section for CRM sites with 8.2.5 software or greater ONLY.

1. Verify the software release is 8.2.5 software or greater.
2. Perform the zero procedure per Table 4-6.

TABLE 4-6  
**CRM ONLY — ZERO PROCEDURE**

A. Select the **[TOOLS]** icon.

- Select and open a **[C Shell...]**
- Type: **cd /usr/g/caldir<Enter>**
- Type: **jot probesfix.dat<Enter>**

B. A window will appear. It may contain 3 values that must be set to 0.0, use the backspace or delete key as required. If no values are present enter 0.0 values. The result should be as follows (column form):

0.0  
0.0  
0.0

C. Select: **[File] [Save] [File] [Exit]**

D. In the [C Shell...]

- Type: **cd /usr/g/caldir<Enter>**
  - Type: **jot probefix.dat<Enter>**
- E. A window will appear. It may contain 3 values that must be set to 0.0, use the backspace or delete key as required. If no values are present enter 0.0 values. The result should be as follows (column form):
- 0.0  
0.0  
0.0
- F. Select: **[File] [Save] [File] [Exit]**
- G. In the [C Shell...]
- Type: **more probefix.dat<Enter>**
  - Verify 3 values are 0.0 as above. Type: **q** to exit.
  - Type: **more probesfix.dat<Enter>**
  - Verify 3 values are 0.0 as above. Type: **q** to exit.
  - Type: **exit** to remove the C Shell
- H. Proceed to PROBE/SV SNR Procedure.

## 5.0 PROBE/SV SNR PROCEDURE

The MRS Phantom (without the loader) must be used for the SNR procedure. The greenest value of temperature strip must be entered as a Control Variable (tempC). In the TwinSpeed (TRM) there are two gradient modes, WHOLE and ZOOM. The procedures should be repeated for both. Start with WHOLE, finish and then restart with ZOOM mode.

### 5.1 Probe-S SNR Procedure

1. Setup the SERVICE scan prescription per Table 5-1 or refer to Appendix D.

**Note**

MRS Phantom must be used for all SNR procedures. Position the MRS Phantom on the Head Support in the Head Coil with the temperature strip visible. Do not use the Tuning Ring or Head Loader. Use foam padding as necessary to center phantom in Head Coil. Phantom centering (up/down/left/right/in/out) is important. Centering within +/-4mm of isocenter in any direction is satisfactory. Run any head localizer to insure the phantom is properly centered before beginning the PROBE SNR procedure.

TABLE 5-1  
**SERVICE PROBE-S SNR PROTOCOL**

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

- A. **[New Pt]**  
Id: **geservice<ENTER>**  
Name: **probes snr**  
Weight (Lb.): **111<ENTER>**  
Set Patient Protocols to **Service**.  
At front enclosure, press **LANDMARK**, then **MOVE TO SCAN**.
- B. In the Patient Position Protocol field:

For release 8.2.5, type **o.49.1<ENTER>**(o=Other, 49.1 =series) to load the Probe-S SNR protocol  
 For release 8.3 or later, type **o.56.1 <Enter>**(o=Other, 56.1 =series) to load the protocol

**OR** select **other** and select protocol **49** (for Rel. 8.2.5) or **56** (for Rel. 8.3) and select series **1**.

- C. If whole mode: Select [**Whole**] than **OK**
- D. If zoom mode: Select [**Zoom**] than **OK**.
- E. [**Save Series**].
- F. [**Prepare to Scan**].
- G. [**Research Operations**] with the mouse cursor, and right click.  
**[Display CVs]**. Highlight CV Name and enter the following:  
 CV Name: **opfov<ENTER>**, CV Value: **240<ENTER>** (24).  
 CV Name: **opte<ENTER>**, CV Value: **30000<ENTER>** (30).  
 CV Name: **optr<ENTER>**, CV Value: **200000<ENTER>** (2000).  
 CV Name: **tempC<ENTER>**, CV Value: **##<ENTER>** (greenest portion of temperature strip).  
 CV Name: **deltax<ENTER>**, CV Value: **verify per tuning results<ENTER>**.  
 CV Name: **deltay<ENTER>**, CV Value: **verify per tuning results<ENTER>**.  
 CV Name: **deltaz<ENTER>**, CV Value: **verify per tuning results<ENTER>**.
- H. [**Accept**].
- I. [**Research Operations**] [**Download**].
- J. [**Prepare to Scan**] if required

2. [**Scan**] (the system will Auto Prescan then Scan).
3. Select Message Window, which is located in upper left-hand corner of scan desktop. Record R1, R2, TG, AX, (if present record FWHM, WS Angle, WS%) on the Appendix A Data Sheet. Close window.
4. SNR is not annotated on the auto viewer, you must access the image from the Browser on the [**Display (Advantage Windows) Desktop**]. On this desktop, click on [**Sort**], [**Sort examinations by date**]. Once you have done this, the most current exams will be displayed in the upper window. Select the most current Image from the most current Series from the lower window, and click on [**Viewer**]. Select [**Format**], click on the [**1 on 1 box**] (upper left corner).
5. Record the displayed results on the Appendix A Data Sheet for Probe-S SNR.
6. Retain (hardcopy) the Probe SNR image for reference. This can be used to make a comparison of the Cr SNR from these most recent probe-s and probe-p scans with the Cr SNR previous/future scans.

#### Note

It is important to understand that a minimum of three scans should be performed (back to back) to get an estimated average Probe-S SNR.

7. Probe-S SNR specification 30.0 minimum.
8. For the TwinSpeed, repeat the procedure with the ZOOM gradient mode.

#### Note

Refer to the Overview section note concerning type-in PSDs.

## 5.2 Probe-P SNR Procedure

1. Setup the SERVICE scan prescription per Table 5-2 or refer to Appendix D.

### Note

MRS Phantom must be used for all SNR procedures. Position the MRS Phantom on the Head Support in the Head Coil with the temperature strip visible. Do not use the Tuning Ring or Head Loader. Use foam padding as necessary to center phantom in Head Coil. Phantom centering (up/down/left/right/in/out) is important. Centering within +/-4mm of isocenter in any direction is satisfactory. Run any head localizer to insure the phantom is properly centered before beginning the PROBE SNR procedure.

TABLE 5-2  
SERVICE PROBE-P SNR PROTOCOL

Note: This is the alternate proprietary procedure available for GE use, and to sites with a valid Advanced Service Package Limited License.

For Non-Service protocol refer to the Appendix.

- A. **[New Pt]**  
Id: **geservice**<ENTER>  
Name: **probes snr**  
Weight (Lb.): **111**<ENTER>  
Set Patient Protocols to **Service**.  
At front enclosure, press **LANDMARK**, then **MOVE TO SCAN**.
- C. In the Patient Position Protocol field:  
*For release 8.2.5, type **o.50.1**<ENTER>(o=Other, 50.1 =series) to load the Probe-S SNR protocol*  
*For release 8.3 or later, type **0.57.1** <Enter>(o=Other, 57.1 =series) to load the protocol*  
**OR** select **other** and select protocol **50** (*for Rel. 8.2.5*) or **57** (*for Rel. 8.3*) and select series **1**.
- D. If whole mode: Select **[Whole]** than **OK**
- E. If zoom mode: Select **[Zoom]** than **OK**.
- F. **[Save Series]**.
- G. **[Prepare to Scan]**.
- H. **[Research Operations]** with the mouse cursor, and right click.  
**[Display CVs]**. Highlight CV Name and enter the following:  
CV Name: **opfov**<ENTER>, CV Value: **240**<ENTER> (24).  
CV Name: **opte**<ENTER>, CV Value: **37000**<ENTER> (37).  
CV Name: **optr**<ENTER>, CV Value: **2000000**<ENTER> (2000).  
CV Name: **tempC**<ENTER>, CV Value: **##**<ENTER> (greenest portion of temperature strip).  
CV Name: **deltax**<ENTER>, CV Value: **verify per tuning results**<ENTER>.  
CV Name: **deltay**<ENTER>, CV Value: **verify per tuning results**<ENTER>.  
CV Name: **deltaz**<ENTER>, CV Value: **verify per tuning results**<ENTER>.  
**[Accept]**.
- I. **[Research Operations]** **[Download]**.
- J. **[Prepare to Scan]** if required

2. **[Scan]** (the system will Auto Prescan then Scan).
3. Select Message Window, which is located in upper left-hand corner of scan desktop. Record R1, R2, TG, AX, (if present record FWHM, WS Angle, WS%) on the Appendix A Data Sheet. Close window.
4. SNR is not annotated on the auto viewer, you must access the image from the Browser on the **[Display (Advantage Windows) Desktop]**. On this desktop, click on **[Sort]**, **[Sort examinations by date]**. Once you have done this, the most current exams will be displayed in the upper window. Select the most current Image from the most current Series from the lower window, and click on **[Viewer]**. Select **[Format]**, click on the **[1 on 1 box]** (upper left corner).
5. Record the displayed results on the Appendix A Data Sheet for Probe-P SNR.
6. Retain (hardcopy) the Probe SNR image for reference. This can be used to make a comparison of the Cr SNR from these most recent probe-s and probe-p scans with the Cr SNR previous/future scans.

**Note**

It is important to understand that a minimum of three scans should be performed (back to back) to get an estimated average Probe-P SNR.

7. Probe-P SNR specification 60.0 minimum.
8. For the TwinSpeed, repeat the procedure with the ZOOM gradient mode.

**Note**

Refer to the Overview section note concerning type-in PSD's.

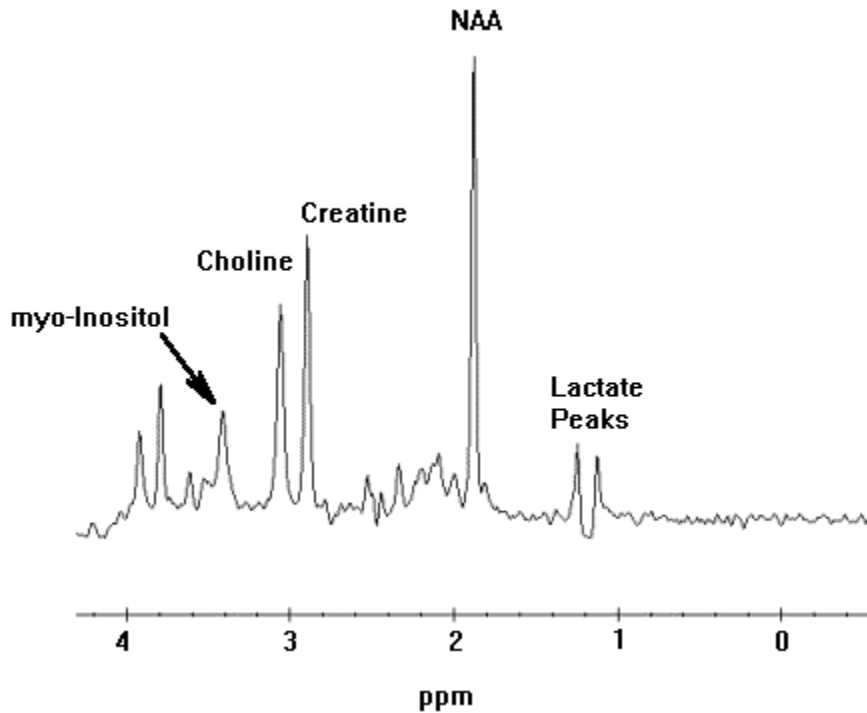
## 6.0 HELP

This section contains Illustrations of PROBE SNR Spectra, both incorrectly Tuned and correctly Tuned to enable the user to become familiar with what a good spectrum looks like. During Tuning or SNR troubleshooting it may necessary for a site to backup the original echoloc.dat file. This backup process requires renaming it, otherwise, it will be overwritten during the Tuning Calibration.

Additional information can be obtained concerning the cause of an AWS (Auto-Water Suppression) failure by logging the messages generated during the PROBE APS. A site may be required to send PROBE SNR raw data to an expert for review. This section explains the P raw file location process and how to transfer it.

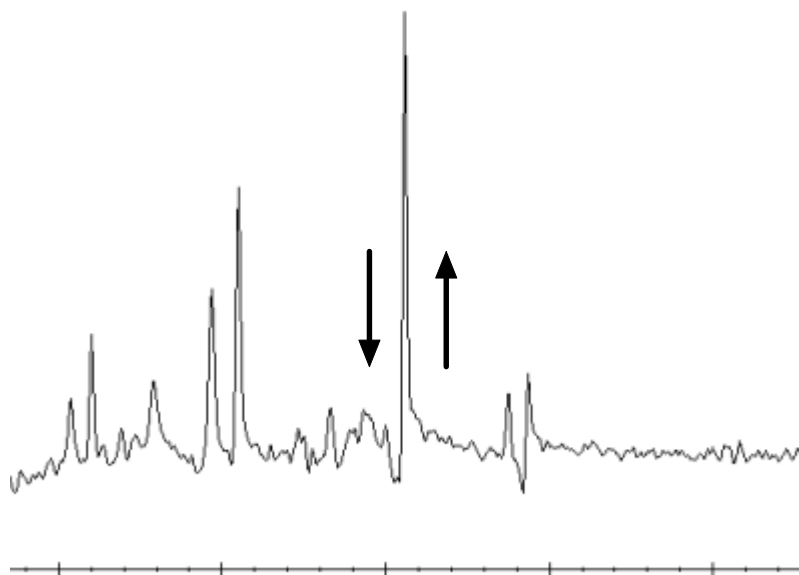
### 6.1 Example SNR Spectra

Errors in the PROBE Tuning Calibration Procedure can introduce changes in the appearance of the resulting PROBE SNR spectra. This section contains example spectra from a Probe-P SNR protocol using the MRS Phantom. Illustration 6-1 shows a correctly tuned spectra. Pay particular attention to the base (left and right) of the NAA (NA) peak (this is the largest peak located at the center of the spectrum). Refer to Illustration 6-2 and Illustration 6-3 to view spectra with an un-calibrated tuning parameter (a delta was offset + or - from the correct value by 0.5 units).



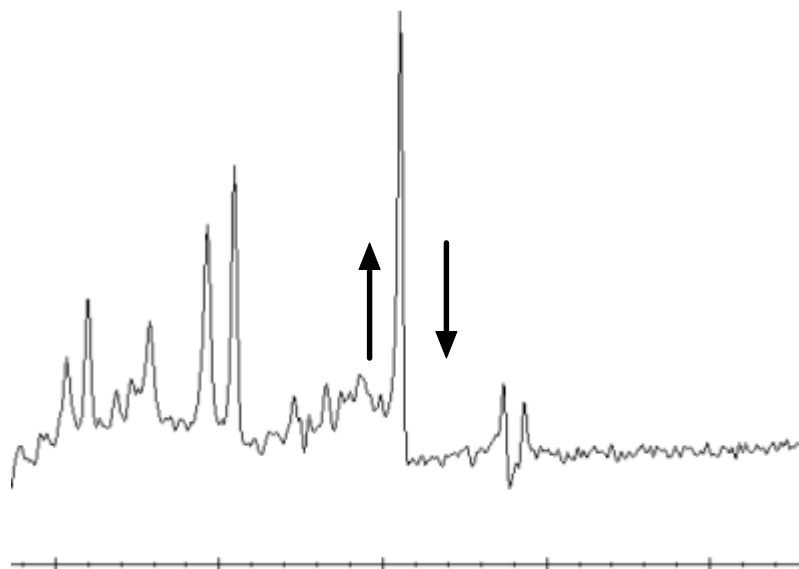
CORRECTLY TUNED PROBE SNR SPECTRA

ILLUSTRATION 6-1



**INCORRECTLY TUNED PROBE SNR SPECTRA**

ILLUSTRATION 6-2



**INCORRECTLY TUNED PROBE SNR SPECTRA**

ILLUSTRATION 6-3

### 6.2 Probe-S Tuning File and Backup

1. At the Service Desktop Manager, click on **[C Shell]**.
2. At the prompt enter the following:  
`cd /usr/g/caldir <Enter>`  
`mv echoloc.dat echoloc.bak0 <Enter>`
3. Close the C Shell.

#### Note

The echoloc.dat file does not exist for initial software loads.

The actual file that contains the PROBE Calibration values is contained in the caldir directory as probesfix.dat. The unlabeled values are respectively deltax, deltax, and deltax.

For the TwinSpeed, the file extensions .WHOLE and .ZOOM should be used and maintained when moving files.

### 6.3 Probe-P Tuning File and Backup

1. At the Service Desktop Manager, click on **[C Shell]**.
2. At the prompt enter the following:  
`cd /usr/g/caldir <Enter>`  
`mv echoloc.dat echoloc.bak1 <Enter>`
3. Close the C Shell.

#### Note

The echoloc.dat file does not exist for initial software loads.

The actual file that contains the PROBE Calibration values is contained in the caldir directory as probeprefix.dat. The unlabeled values are respectively deltax, deltax, and deltax.

For the TwinSpeed, the file extensions .WHOLE and .ZOOM should be used and maintained when moving files.

### 6.4 Logging Probe Auto Prescan

Additional information can be obtained concerning the cause of an AWS (Auto-Water Suppression) failure by logging the messages generated during the PROBE APS. This works similarly on 5.X and LX (although the messages are slightly different).

#### 6.4.1 Directory Creation

Open the Service Desktop Manager, click on **[C Shell]**.  
Per the following create a directory to hold the log file:

```
cd /usr/g <Enter>
mkdir probe_data <Enter>
cd probe_data <Enter>
```

Login to the TPS and direct the output to a file as well as the screen. Use the grav key (`) and the pipe key (|) as identified below. Local is the lower case L key.

**rlogin `hostname` -tps | tee tps\_log <Enter>**

Log onto local (l) or remote (r) vxWorks console . . . ?l <Enter>

Login:

Username: **tps <Enter>**

Password: **tpsservice <Enter>**

At this point the logging is running. DO NOT type anything in the TPS window. Watch the TPS messages appear on the screen, everything will be logged into the file entered after the tee command (**tee tps\_log**). This file will be overwritten each time.

Select the RX Manager Icon.

Run APS (and scans . . .).

Select the Service Desktop Manager Icon to review the APS log using the scroll bar.

When done, type **logout** in the TPS window. This will disconnect the TPS from the C Shell. A message will appear confirming *logoutConnection closed*.

To view the log file created verify the current directory is `cd /usr/g/probe_data`.

Type: **more tps\_log <Enter>**

Close the C Shell if done.

The log file can be sent to the OLC, or e-mail to whoever the site is working with to resolve problems.

## **6.5 PROBE Raw Data Files**

During the troubleshooting process the site may be required to identify the P raw data files generated when PROBE SNR was performed. These files may be helpful in determining a reason for failing SNR.

### **6.5.1 P Raw Data File Location**

This portion of the procedure should be performed after running a PROBE SNR protocol so that P Raw File identification will be straightforward.

1. At the Service Desktop Manager, click on **[C Shell]**.
2. At the prompt enter the following:  
**cd /usr/g/mrraw <Enter>**  
**ls -lt P\* | head <Enter>**
3. The most recent P files will be displayed. Record the PROBE raw data file (P#####.7). The P files size is ~449584.
4. Close the C Shell if done.

### **6.5.2 Transfer the "mrraw" P File**

#### **Note**

The OLC can be contacted and will perform this transfer for the site after a modem connection is made.

A second alternative is to ftp the P raw file to the FE laptop. Then the file may be able to be transferred from the laptop to globe.

A third alternative is to ftp the P raw file to the FE laptop. Then the file may be able to be attached to an email and sent from the laptop.

Most sites will not be able to perform the following, however, if an internal MR Building site is connected to the "GE Intranet".

While still in the mrraw directory type the following:

```
ftp 3.87.40.2 <Enter>
```

OR

```
ftp globe <Enter>
```

```
Connected to globe.med.ge.com
```

```
..... ready.
```

```
Name (some name):anonymous <Enter>
```

```
Password:anonymous <Enter>
```

```
ftp>bin <Enter>
```

```
Example--> cd l
```

```
ftp>cd (first letter of some name) <Enter>
```

```
Example--> mkdir lambert
```

```
ftp>mkdir (enter some name) <Enter>
```

```
Example--> cd lambert
```

```
ftp>cd (enter some name) <Enter>
```

```
ftp>put P#####.7 <Enter>
```

```
ftp>bye <Enter>
```

```
exit <Enter>
```

Now write an e-mail or call whoever is helping with this site issue that the P#####.7 is on globe under whatever significant name you chose.

#### Note

Files will remain on globe for a very limited amount of time.

## 7.0 APPENDIX A — DATA SHEETS

### 7.1 PROBE/S TUNING DATA SHEET-FOR T/S

GradMode=

xshim=		yshim=		zshim=	
R1=	R2=	TG=		CF=	

(Y-Axis Tuning)	(X-Axis Tuning)	(Z-Axis Tuning)
ylocA _____	xlocA _____	zlocA _____
ylocC _____	xlocC _____	zlocC _____
ylocB _____	xlocB _____	zlocB _____
ylocD _____	xlocD _____	zlocD _____
yloc- _____	xloc- _____	zloc- _____
yloc+ _____	xloc+ _____	zloc+ _____
deltay_val _____	deltax_val _____	deltaz_val _____

### 7.2 PROBE/P TUNING DATA SHEET-FOR T/S

GradMode=

xshim=		yshim=		zshim=	
R1=	R2=	TG=		CF=	

(Y-Axis Tuning)	(X-Axis Tuning)	(Z-Axis Tuning)
ylocA _____	xlocA _____	zlocA _____
ylocC _____	xlocC _____	zlocC _____
ylocB _____	xlocB _____	zlocB _____
ylocD _____	xlocD _____	zlocD _____
yloc- _____	xloc- _____	zloc- _____
yloc+ _____	xloc+ _____	zloc+ _____
deltay_val _____	deltax_val _____	deltaz_val _____

7.3 PROBE-S SNR DATA SHEET

GradMode=

Record:

X \_\_\_\_\_, Y \_\_\_\_\_, Z \_\_\_\_\_ Shim Values.

R1 \_\_\_\_\_, R2 \_\_\_\_\_, TG \_\_\_\_\_, AX \_\_\_\_\_

FWHM: (phantoms = 2 Hz) , WS Ang: \_\_\_\_\_ Degrees, WS: \_\_\_\_\_ %

MACHINE # RATIO

NA	_____	_____
Cr	_____	__REF__
Ch	_____	_____
m1	_____	_____
H <sub>2</sub> O	_____	_____

RMS Noise

Cr SNR

\_\_\_\_\_

\_\_\_\_\_

7.4 PROBE-S SNR DATA SHEET

GradMode=

Record:

X \_\_\_\_\_, Y \_\_\_\_\_, Z \_\_\_\_\_ Shim Values.

R1 \_\_\_\_\_, R2 \_\_\_\_\_, TG \_\_\_\_\_, AX \_\_\_\_\_

FWHM: (phantoms = 2 Hz) , WS Ang: \_\_\_\_\_ Degrees, WS: \_\_\_\_\_ %

MACHINE # RATIO

NA	_____	_____
Cr	_____	__REF__
Ch	_____	_____
m1	_____	_____
H <sub>2</sub> O	_____	_____

RMS Noise

Cr SNR

\_\_\_\_\_

\_\_\_\_\_

7.5 PROBE-S SNR DATA SHEET

GradMode=

Record:

X \_\_\_\_\_, Y \_\_\_\_\_, Z \_\_\_\_\_ Shim Values.

R1 \_\_\_\_\_, R2 \_\_\_\_\_, TG \_\_\_\_\_, AX \_\_\_\_\_

FWHM: (phantoms = 2 Hz) , WS Ang: \_\_\_\_\_ Degrees, WS: \_\_\_\_\_ %

MACHINE # RATIO

NA	_____	_____
Cr	_____	__REF__
Ch	_____	_____
m1	_____	_____
H <sub>2</sub> O	_____	_____

RMS Noise

Cr SNR

\_\_\_\_\_

\_\_\_\_\_

7.6 PROBE-P SNR DATA SHEET

GradMode=

Record:

X \_\_\_\_\_, Y \_\_\_\_\_, Z \_\_\_\_\_ Shim Values.

R1 \_\_\_\_\_, R2 \_\_\_\_\_, TG \_\_\_\_\_, AX \_\_\_\_\_

FWHM: (phantoms = 2 Hz) , WS Ang: \_\_\_\_\_ Degrees, WS: \_\_\_\_\_ %

MACHINE # RATIO

NA	_____	_____
Cr	_____	__REF__
Ch	_____	_____
m1	_____	_____
H <sub>2</sub> O	_____	_____

RMS Noise

Cr SNR

\_\_\_\_\_

\_\_\_\_\_

7.7 PROBE-P SNR DATA SHEET

GradMode=

Record:

X \_\_\_\_\_, Y \_\_\_\_\_, Z \_\_\_\_\_ Shim Values.

R1 \_\_\_\_\_, R2 \_\_\_\_\_, TG \_\_\_\_\_, AX \_\_\_\_\_

FWHM: (phantoms = 2 Hz) , WS Ang: \_\_\_\_\_ Degrees, WS: \_\_\_\_\_ %

MACHINE # RATIO

NA	_____	_____
Cr	_____	__REF__
Ch	_____	_____
m1	_____	_____
H <sub>2</sub> O	_____	_____

RMS Noise

Cr SNR

\_\_\_\_\_

\_\_\_\_\_

7.8 PROBE-P SNR DATA SHEET

GradMode=

Record:

X \_\_\_\_\_, Y \_\_\_\_\_, Z \_\_\_\_\_ Shim Values.

R1 \_\_\_\_\_, R2 \_\_\_\_\_, TG \_\_\_\_\_, AX \_\_\_\_\_

FWHM: (phantoms = 2 Hz) , WS Ang: \_\_\_\_\_ Degrees, WS: \_\_\_\_\_ %

MACHINE # RATIO

NA	_____	_____
Cr	_____	__REF__
Ch	_____	_____
m1	_____	_____
H <sub>2</sub> O	_____	_____

RMS Noise

Cr SNR

\_\_\_\_\_

\_\_\_\_\_

**8.0 APPENDIX B — RE-CALIBRATION REQUIREMENTS**

TABLE B-1  
RE-CALIBRATION REQUIREMENTS

<b>Hardware Replaced ----&gt;</b>	<b>RF Calibration</b>
External PROBE Filter (used with the CERD -2 Exciter Module ONLY on RF/PEN 1 and 2 Cabinets)	<ul style="list-style-type: none"> <li>• RF Calibration Gain Procedure — “MAX Power RF Out Setup and Calibration”. RF In adjustment.</li> </ul>
<b>Grafdy or ECMT Procedure ----&gt;</b>	<b>PROBE Tuning Calibration</b>
Gradient Subsystem is affected thus requiring the grafdy or ECMT procedure to be performed.	Probe Tuning Calibration Procedure must be performed for BRM and TRM sites.

## APPENDIX C — TERMINOLOGY

### 8.1 Acronyms

TABLE C-1  
ACRONYMS

<b>APS</b>	Auto prescan: Auto-adjustment of data acquisition (scan) parameters
<b>AVS</b>	Auto voxel shim
<b>AWS</b>	Automatic Water Suppression
<b>BRM</b>	Body Resonance Module
<b>CRM</b>	Cardiac Resonance Module
<b>CV</b>	Control variable
<b>FOV</b>	Field of View
<b>FWHM</b>	Full Width Half Max
<b>GRx</b>	Graphic Prescription
<b>IFCC</b>	Image file create and cleanup
<b>MPS</b>	Manual prescan: Manual adjustment of data acquisition (scan) parameters
<b>MRS</b>	Magnetic Resonance Spectroscopy
<b>NEX</b>	Number of excitations
<b>PRESS</b>	Point-resolved spectroscopy, basis for probe-p PSD
<b>PROBE/Q</b>	Automated analysis and display of PROBE/SV data
<b>PROBE/SV</b>	PROton Brain Exam Single voxel spectroscopy using automated STEAM or PRESS pulse sequence
<b>PSD</b>	Pulse sequence data base
<b>RECON</b>	Process that creates an image or spectrum from data acquired with a Signa MRI scanner.
<b>ROI</b>	Region of Interest
<b>RSP</b>	Real-time sequence control parameters
<b>SAT</b>	Saturation, a signal suppression technique
<b>STEAM</b>	Stimulated echo acquisition mode, basis for probe-s PSD
<b>TE</b>	Echo time
<b>TIR</b>	Tardis Image Receive
<b>TPS</b>	Transceiver and Processing subsystem
<b>TR</b>	Repetition time
<b>TRM</b>	Twin Resonance Module
<b>VOI</b>	Voxel of interest
<b>WS</b>	Water Suppression

## 8.2 Definitions

### Chemical Shift Imaging (CSI)

A data acquisition technique that combines phase encoding with the acquisition of a spectrum for each phase encoding step. The spatial resolution of these images depends on the number of phase encoding steps, while the frequency resolution depends on the spectral width and the number of data points in a spectrum. Images over a narrow range of frequencies can be created to show the spatial distribution of the chemical constituents of the tissue being scanned.

#### **probe-s**

One of two PROBE/SV pulse sequences. The probe-s sequence is a version of the stimulated echo acquisition mode (STEAM). It differs from the steamcsi sequence in the following areas: the spectral width and number of data points acquired are fixed to 2500 Hz and 2048, respectively; both water suppressed and non-water suppressed frames are acquired during the scan; and a special PROBE/SV reconstruction is used to create a spectrum from the data. This sequence is used for short echo time, single-voxel spectroscopy, i.e., TEs shorter than 35 milliseconds.

#### **probe-p**

One of two PROBE/SV pulse sequences. The probe-p sequence is a version of the point-resolved spectroscopy (PRESS) pulse sequence. It differs from the presscsi sequence in the following areas: the spectral width and number of data points acquired are fixed at 2500 Hz and 2048, respectively; both water-suppressed and non-water-suppressed frames are acquired during the scan; and a special PROBE/SV reconstruction is used to create a spectrum from the data. The PRESS sequence provides twice the SNR of the STEAM sequence but at the expense of slightly longer minimum TEs.

#### **Presscsi (press CSI)**

A research version of the probe-p pulse sequence that provides more flexibility and additional capabilities such as chemical shift imaging acquisition.

#### **Steamcsi (steam CSI)**

A research version of the probe-s pulse sequence that provides more flexibility and additional capabilities such as chemical shift imaging acquisition.

## 9.0 APPENDIX D — MANUAL ENTRY PROBE/SV SNR PROTOCOLS

### 9.1 Probe-S SNR Protocol

1. Run any proton head localizer to insure the phantom is centered (up/down/in/out/left/right).
2. Setup the scan prescription per Table D-1.
3. For TwinSpeed, add the GradMode field, WHOLE or ZOOM.

TABLE D-1  
PROBE-S SNR PROTOCOL

<u>PATIENT REGISTER</u>	<b>[New Pt]</b>	<u>USER CVs SCREEN</u>	
<u>PATIENT INFORMATION</u>		CV3 scan mode	<b>[1.00]</b>
Patient Id	<b>geservice</b>	CV4 total # of scans	<b>[32.00]</b>
Patient Name	<b>probes snr</b>	CV15 1=fast version	
Weight (Lb)	<b>111 - IMPORTANT</b>	(fewer disdaqs)	<b>[0]</b> (default)
Landmark	<b>[Landmark]</b> <b>[&gt;] [Nasion]</b>	<b>NOTE:</b> CV15 does not appear if VLTC was performed.	
<u>PATIENT PROTOCOLS</u>	<b>[Patient Position]</b>	<u>SCANNING RANGE</u>	
<u>PATIENT POSITION</u>		FOV	<b>[24]</b>
Patient Position	<b>[&gt;] [Supine]</b>	Start	<b>S10</b>
Patient Entry	<b>[&gt;] [Head First]</b>	End	<b>R10</b>
Coil	<b>[...] [Head] [Accept]</b>	Start	<b>L10</b>
<u>IMAGING PARAMETERS</u>		End	<b>A10</b>
Plane	<b>[&gt;] [Axial]</b>	Table Delta	0.00 (default)
Mode	<b>[&gt;] [MRS]</b>	<u>ACQUISITION TIMING</u>	
Pulse Seq	<b>[...] [Probe-S]</b> <b>[Accept]</b>	Freq	<b>[256]</b>
Imaging Options	<b>[Ext. Dyn. Range]</b>	Phase	<b>[160]</b>
Psd Name	no entry	NEX	<b>[2.00]</b>
Protocol	no entry	Freq Dir	<b>[&gt;] [A/P]</b>
<u>SCAN TIMING</u>		Auto Center Freq	<b>[&gt;] [Water]</b>
* of Echoes	1 (default)		<b>Autoshim</b> selected Contrast not selected
TE	<b>[30]</b>	<b>[Save Series]</b>	
TR	<b>[2000]</b>	<b>[Prepare to Scan]</b>	
		<b>[Research Operations] [Display CVs]</b>	
		CV Name CV Value	
		<b>tempC</b> (greenest value on MRS Phantom)	
		<b>[Accept]</b>	
		<b>[Research Operations] [Download]</b>	

**9.2 Probe-P SNR Protocol**

1. Run any proton head localizer to insure the phantom is centered (up/down/in/out/left/right).
2. Setup the scan prescription per Table D-2.
3. For TwinSpeed, add the GradMode field, WHOLE or ZOOM

TABLE D-2  
PROBE-P SNR PROTOCOL

<u>PATIENT REGISTER</u>	<b>[New Pt]</b>	<u>USER CVs SCREEN</u>	
<u>PATIENT INFORMATION</u>		CV3 scan mode	<b>[1.00]</b>
Patient Id	<b>geservice</b>	CV4 total # of scans	<b>[32.00]</b>
Patient Name	<b>probep snr</b>	CV15 1=fast version	
Weight (Lb)	<b>111 - IMPORTANT</b>	(fewer disdaqs)	<b>[0]</b> (default)
Landmark	<b>[Landmark]</b> <b>[&gt;] [Nasion]</b>	<b>NOTE:</b> CV15 does not appear if VLTC was performed.	
<u>PATIENT PROTOCOLS</u>	<b>[Patient Position]</b>	<u>SCANNING RANGE</u>	
<u>PATIENT POSITION</u>		FOV	<b>[24]</b>
Patient Position	<b>[&gt;] [Supine]</b>	Start	<b>S10</b>
Patient Entry	<b>[&gt;] [Head First]</b>	End	<b>R10</b>
Coil	<b>[...] [Head] [Accept]</b>	Start	<b>L10</b>
<u>IMAGING PARAMETERS</u>		End	<b>A10</b>
Plane	<b>[&gt;] [Axial]</b>	Table Delta 0.00 (default)	<b>P10</b>
Mode	<b>[&gt;] [MRS]</b>	<u>ACQUISITION TIMING</u>	
Pulse Seq	<b>[...] [Probe-P]</b>	Freq	<b>[256]</b>
	<b>[Accept]</b>	Phase	<b>[160]</b>
Imaging Options	<b>[Ext. Dyn. Range]</b>	NEX	<b>[2.00]</b>
Psd Name	no entry	Freq Dir	<b>[&gt;] [A/P]</b>
Protocol	no entry	Auto Center Freq	<b>[&gt;] [Water]</b>
<u>SCAN TIMING</u>			<b>Autoshim selected</b> Contrast not selected
* of Echoes	1 (default)		
TE	<b>[37]</b>	<b>[Save Series]</b>	
TR	<b>[2000]</b>	<b>[Prepare to Scan]</b>	
		<b>[Research Operations] [Display CVs]</b>	
		CV Name CV Value	
		<b>tempC</b> (greenest value on MRS Phantom)	
		<b>[Accept]</b>	
		<b>[Research Operations] [Download]</b>	

## 10.0 REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	Aug 19, 1998	R. Hawthorne	Initial conversion to Word.
1	Nov 23, 1998	M. Keber	Removed obsolete Release 8.1 information; misc style guide updates.
2	Dec 8, 1998	Resa Lambert	Modified Data Sheets.
3	Mar 9, 1999	Resa Lambert	Modified overview and protocols.
4	Apr 19, 1999	Resa Lambert	Added Overview 8.2.5 note, and CV15 in Appendix D.
5	Sept 30, 1999	Resa Lambert	Added CRM Tuning process for 8.2.5 ONLY. Added 8.3 service protocol number change. CDROM Rev 8.
6	Nov 15, 1999	Resa Lambert	Added Service protocol number for Probe-P SNR for 8.3 software. Removed 8.2.5 ONLY references. CDROM Rev 9.
7	June 20, 2000	Don Thome'	Removed voxel verification comment from pages 10 and 12.
8	July 16, 2001	S. Nahmani, J.Gerber	Updated for TwinSpeed scanner for 9.0 release.
9	Aug 27, 2003	D. Thome'	Added phantom centering requirement of +/- 4mm.