TROUBLESHOOTING GUIDANCE FOR 16BEAT - HNU COIL

imagination at work

22nd April 2013, Field Training on 16BEAT HNU coil Troubleshooting
by Bangalore Coils IB Engineering

HNU Coil Failure modes identified from SV16 systems :

1. HNU Coil not detected (SV16): This was due to faulty LPCA bezel. Issue was solved on replacing the bezel.

2. Grainy images during head scans using HNU (SV16): This was due to high external noise due to CCTV camera installed in the magnet room.

3. HNU Coil not detected (SV16): This issue was solved by replacing the coil cable assembly.

HNU Coil Failure modes identified from SV8 systems

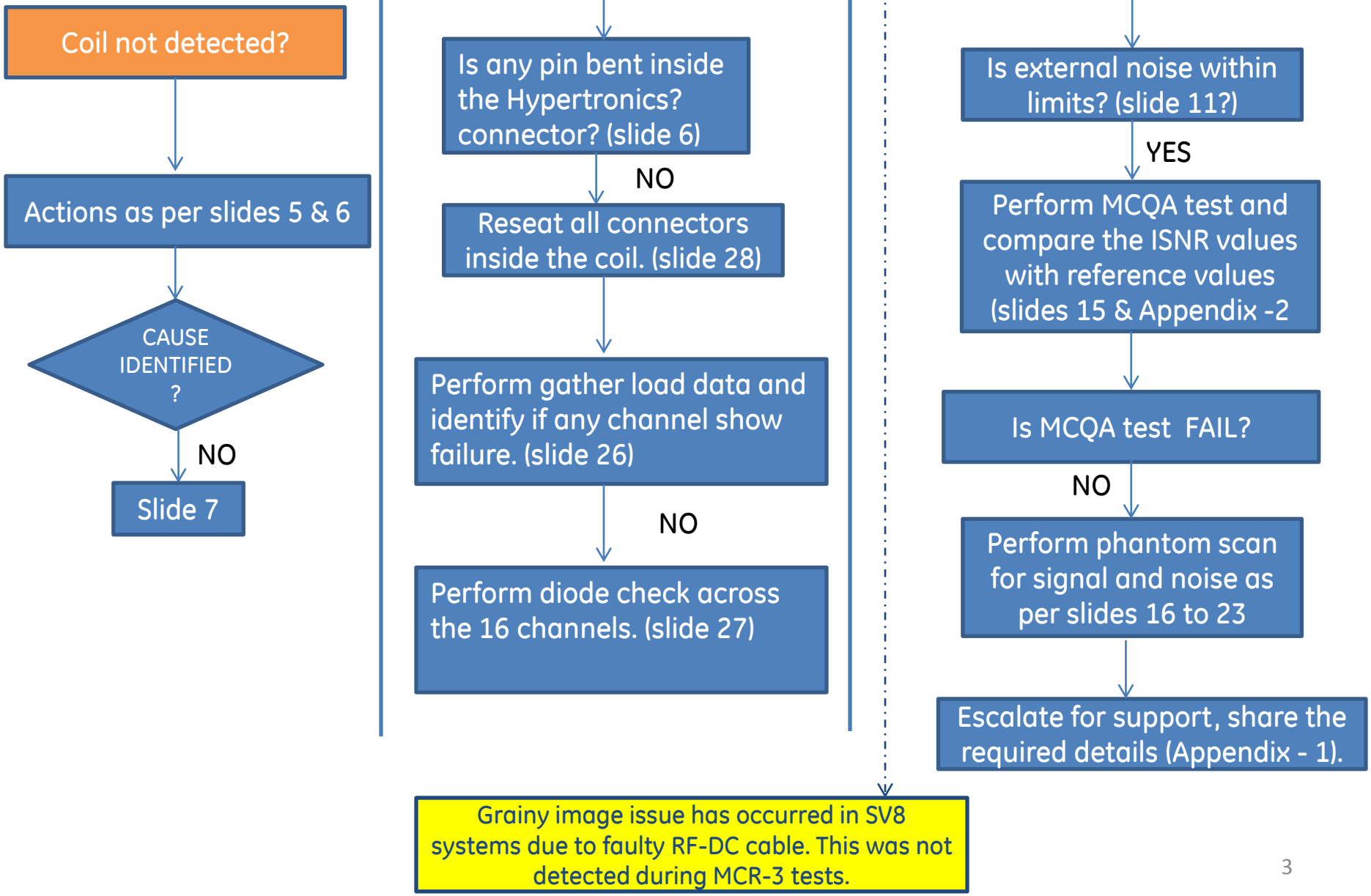
(which can be applicable to 16BEAT HNU coil):

1. HNU Coil giving grainy image (SV8): This was due to faulty RF-DC cable. Issue was solved on replacing the cables. This fault was not detected by MCR-3 tool.

Note: When escalating to MR Online Engineer** for technical support, please provide the required details as specified in **Appendix 1** for Initial Engineering Evaluation.

** Follow Local regional Service procedure for field reporting with Online Engineers
For EU Region contact: OLC - by phone at +33130831000, or by email at OLCDispatchCenter@ge.com

Failure modes:



COIL NOT DETECTED

NORMAL CONDITION:

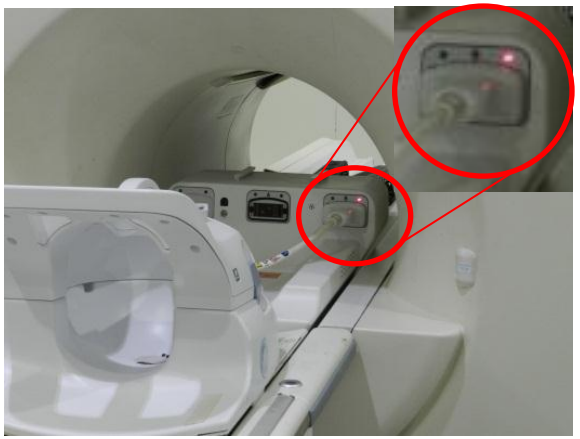
For a coil to be detected normally:

1. Ensure that the connector fits firmly into LPCA and there is no gap between the coil side connector and LPCA.

2. LED status: If connector engagement is GOOD as per step 1:
   - Ideal case:
     - when the coil side connector is connected into LPCA, RED and GREEN LEDs glow simultaneously at first. Within a few seconds, the RED LED will turn off and GREEN LED glows consistently as long as there is no change in coil configuration and the coil is kept connected to LPCA coil.
   - Coil ID Failure cases:
     - GREEN and RED LEDs glow simultaneously at first, when the coil is connected. Within a few seconds, GREEN LED turns OFF and RED LED glows consistently.
     - No LED glows at all when the coil is connected to the system.

3. Correct Port: 16BEAT HNU coil should be connected to **Port B only**. Also, 9E AA coil should be connected to **Port A only**. They will not be recognized by any other ports

Ideal case



Coil ID Failure Case

IN CASE OF COIL NOT BEING DETECTED :

In case of coil not being detected, perform the following checks sequentially. Check if the coil is detected after each step:

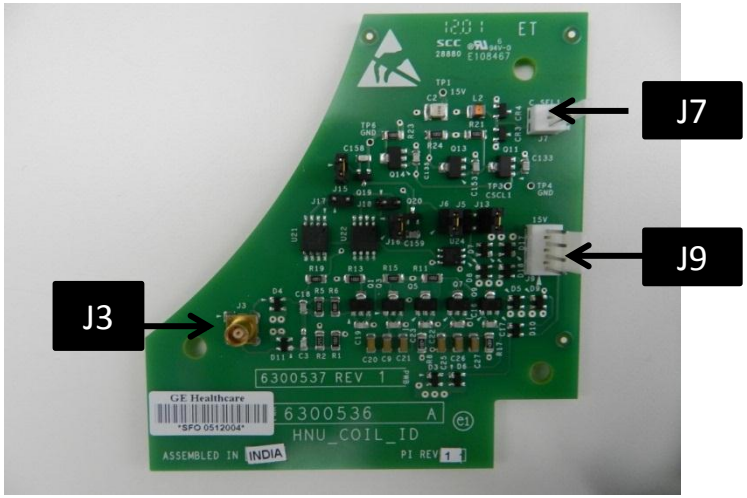
1. Is the coil connected to the correct Port?

2. VISUAL CHECK: Visually check the coil side connector AND LPCA side connector for any broken/bent pins, loose pins, possibility of non-engagement due to loose pins etc.

3. Connect the issue coil to LPCA and type the command hmrestart cim in the C Shell and press ENTER. This is to aid in configuring the system to the coil, if it is being used for the first time.

4. Re-connect the connector at the respective port 4-5 times repeatedly and check if the coil is detected.

5. If the coil is still not detected, then open the posterior part of HNU coil. Reseat all connectors on the coil id: 3 connectors in total. Check for coil detection.



Connectors on the coil ID board

Normal Hypertronics connector

IF ISSUE STILL PERSISTS:

If the coil is not being detected after the above checks and you require support to troubleshoot the issue, please escalate. It is recommended that you maintain a record of the following, as long as the case is OPEN. Provide descriptions for clarity.

1. Coil details: Coil SN
2. Screen shot of the error message appearing in the error log, if any.
3. How the LED indicators respond when the coil is connected?
4. Is any other coil working normally at the port where the 'issue coil' is not detected?
5. History of error:
    a. Is this the first time the error has occurred?
    b. Has the coil worked normally anytime before the error occurred?
    c. Was any change made to the system following which the coil started showing issue?

Note:
Coil id detected, can be verified from the file 'coilid.log' file. Location for the file is: /usr/g/service/log/

The coil ids for 16BEAT express coil are:

PA coil:	1.5T GBGL6d8oxt42Mg3J9g5ObVMYT832YTQs
16CH HNU coil:	
Anterior	1.5T GBGLPf7aOJhVsIfAQJuk4VAoeirsBGDA
Adaptor	1.5T GBGLXiVcV6g9sJFA0gELPtZdn9iXEaQd
9E AA coil:	1.5T GBGLGTvnCocjWiYAeCmn9tPA8jg31qKO

Error reported by the system will be available in: Error log in the UI

Coilid.log file:

For reference only – No action required in field

Location: /usr/g/service/log/

Note: The unique serial number could be used to identify the coil. It is recommended that FE keeps a record of this unique serial number for any future reference or communication.

```
 Date/Time                    Connector Status  BTE SerialId
CoilId
 WED MAR 20 07:51:14 2013   MNS       OUT
 WED MAR 20 07:51:14 2013   C         OUT
 WED MAR 20 07:51:14 2013   A         OUT
 WED MAR 20 07:51:14 2013   B         IN
 WED MAR 20 07:51:14 2013   B         ID      1
500000001156e70f GBGL6d8oxt42Mg3J9g5ObVMYT832YTQs
 WED MAR 20 07:51:21 2013   B         ID      1
500000001156e70f GBGL6d8oxt42Mg3J9g5ObVMYT832YTQs
 WED MAR 20 07:51:22 2013   B         VALID
 WED MAR 20 07:54:50 2013   A         IN
 WED MAR 20 07:54:50 2013   A         ID      1
```

PA coil id

Unique serial number of the coil (will vary from coil to coil)

GRAINY IMAGES

GRAINY IMAGES

Grainy images are caused due to loss of signal or high noise along the path of the signal.

From historical data, some of the causes identified for grainy images are:

- High external noise due to faulty power line filters of lighting, CCTV camera, white pixel noise etc.
- Short circuited preamp protection diodes
- Faulty diodes on the decoupling boards
- Faulty preamps

Isolate the system side using the following tests:

1. Perform MUX control check for Port B (both for channel 1-8 & channel 9-16) as per service manual.

2. Perform MCRIII tool check for B port after swapping J21 & J23 in the LPCA to test channels 9-16 of receive chain as per service manual.

3. Perform White pixel test for the system as per service manual.

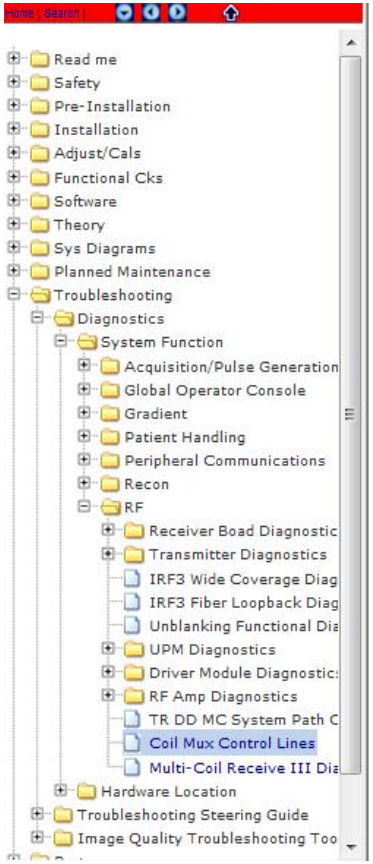
4. Perform Body SPT test (including coherent noise test) for the system as per service manual.

Note: Before performing checks on the coil for IQ related issues, ensure that there is no failure on the system side, and external noise is within limits.

Check coil side:

1. Perform MCQA test with anterior or adapter, according to the failure symptom. Compare the ISNR values with the reference values provided in appendix.

Mux Control Line check: refer Service Manual



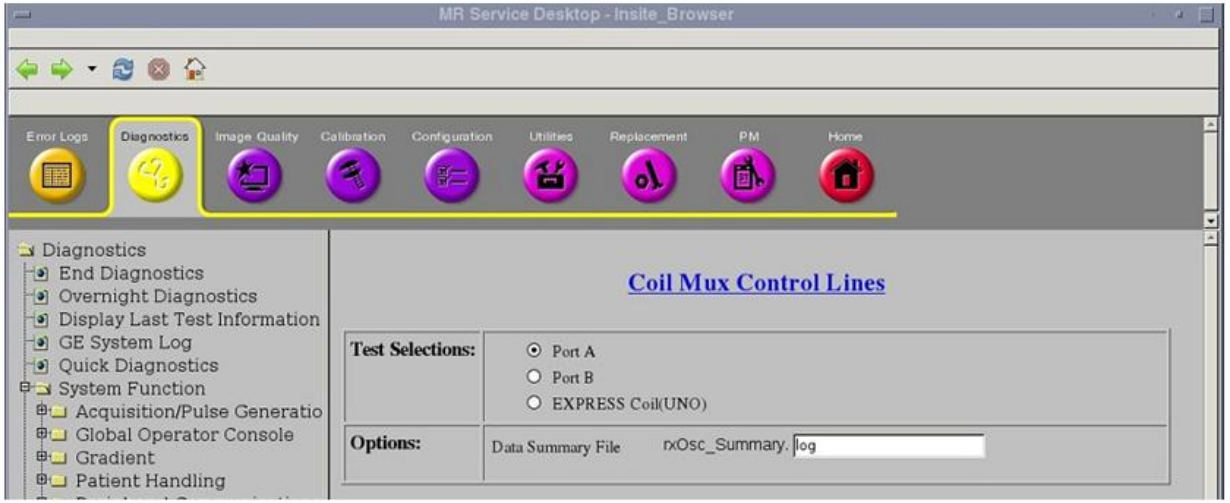
Coil Mux Control Lines

1 Diagnostic Link

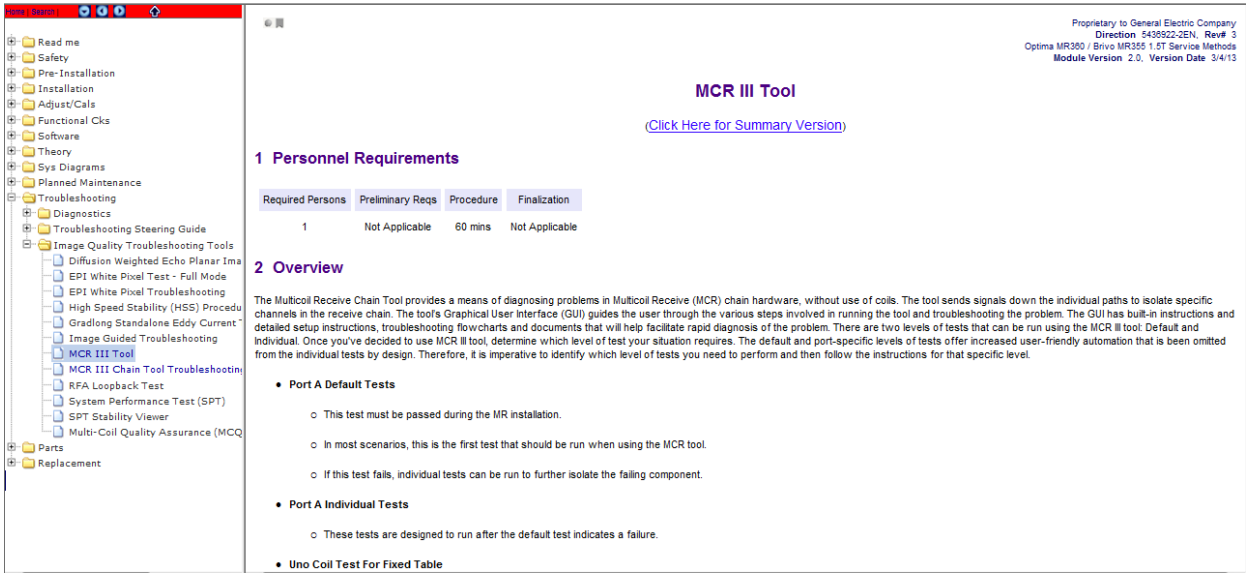
Diagnostics >> System Function >> RF >> Coil Mux Control Lines

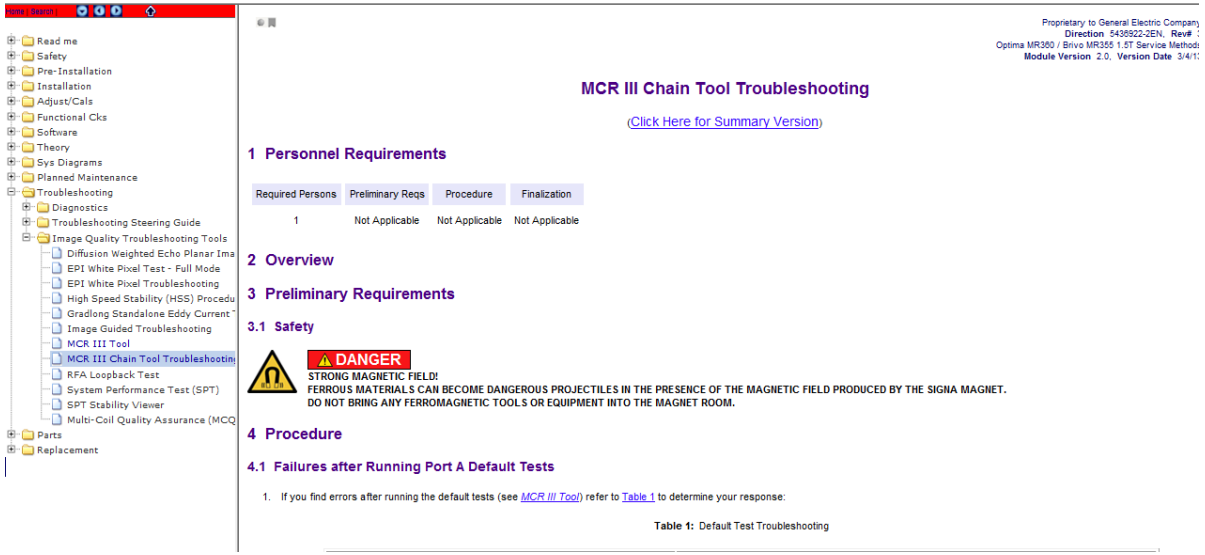
Diagnostics >> Hardware Location >> System Cabinet >> RF >> Coil Mux Control Lines

Illustration 1: Coil Mux Control Lines



MCRIII tool to isolate Port A, Port B and PA coil cables: refer Service Manual





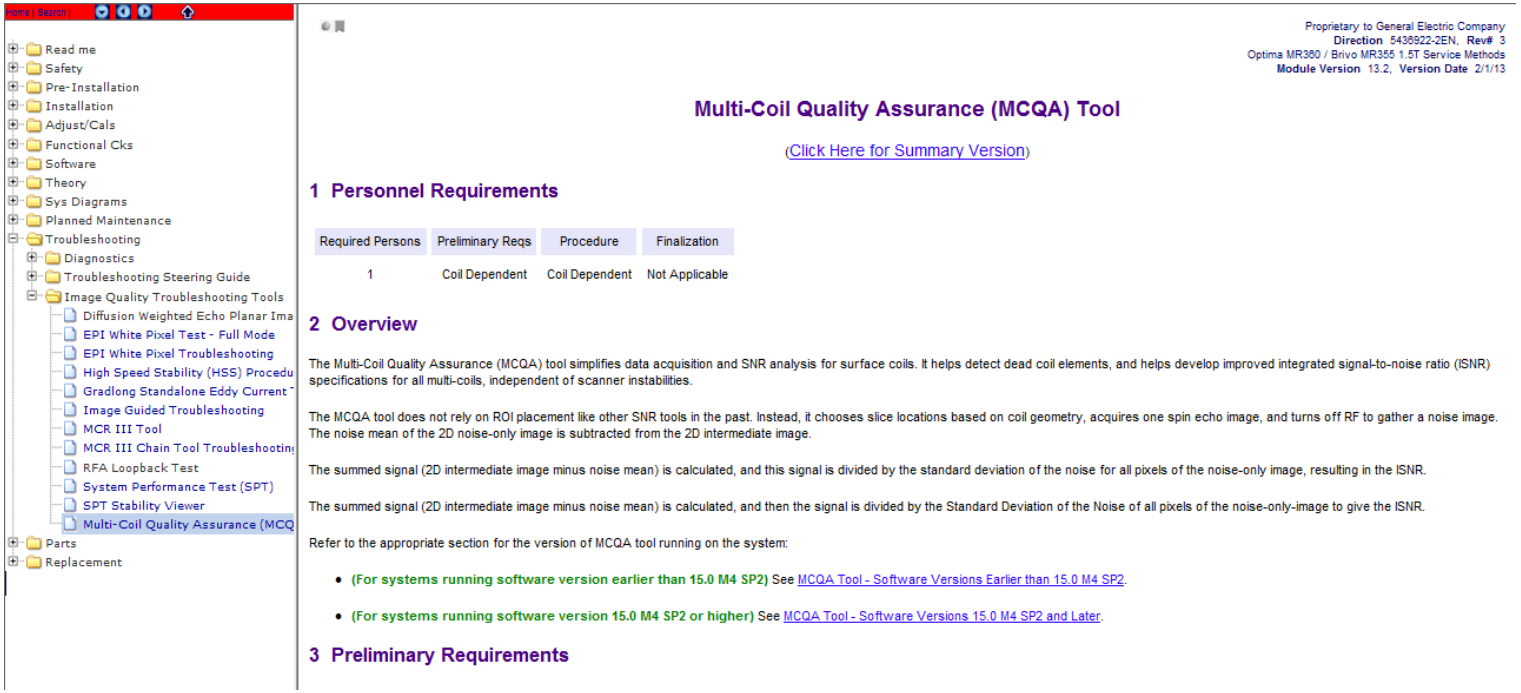
White pixel test: refer Service Manual

Multi Coil Quality Assurance (MCQA) : refer Service Manual

This tool shows whether any element in the coil is dead or not. The phantom position is very critical since it determines the ISNR value obtained from the test. Please refer the operator manual attached for correct phantom positioning and land marking directions.

Result of the test will be available at: /export/home/signa/tools/mc_qa_tool/XXXXXXX.mcqa

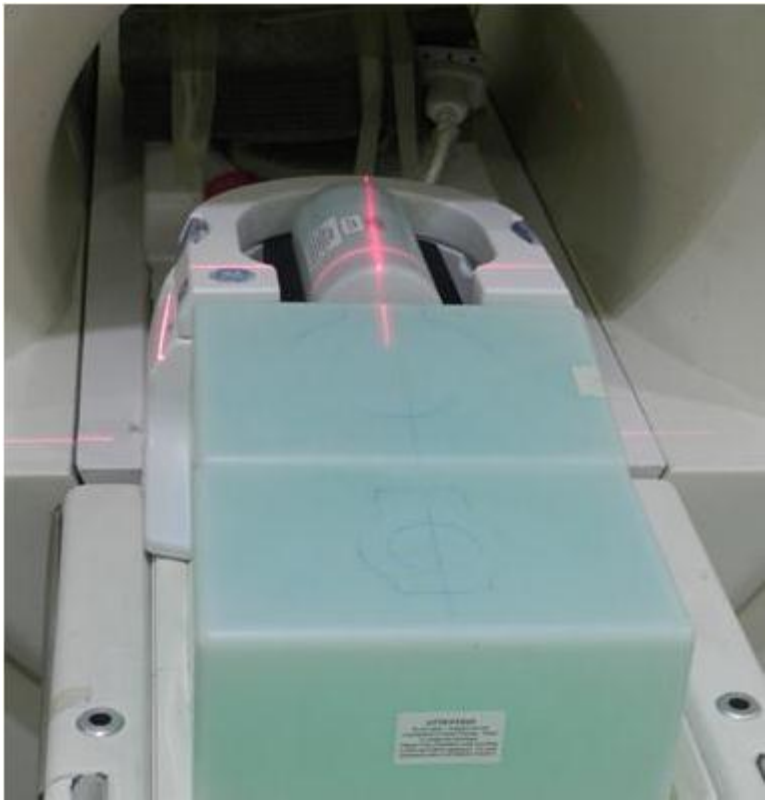
Note: Always send the **.mcqa** file whenever communicating IQ issues. Also, backup MCQA test result for any new coil, before handing them over to customer.

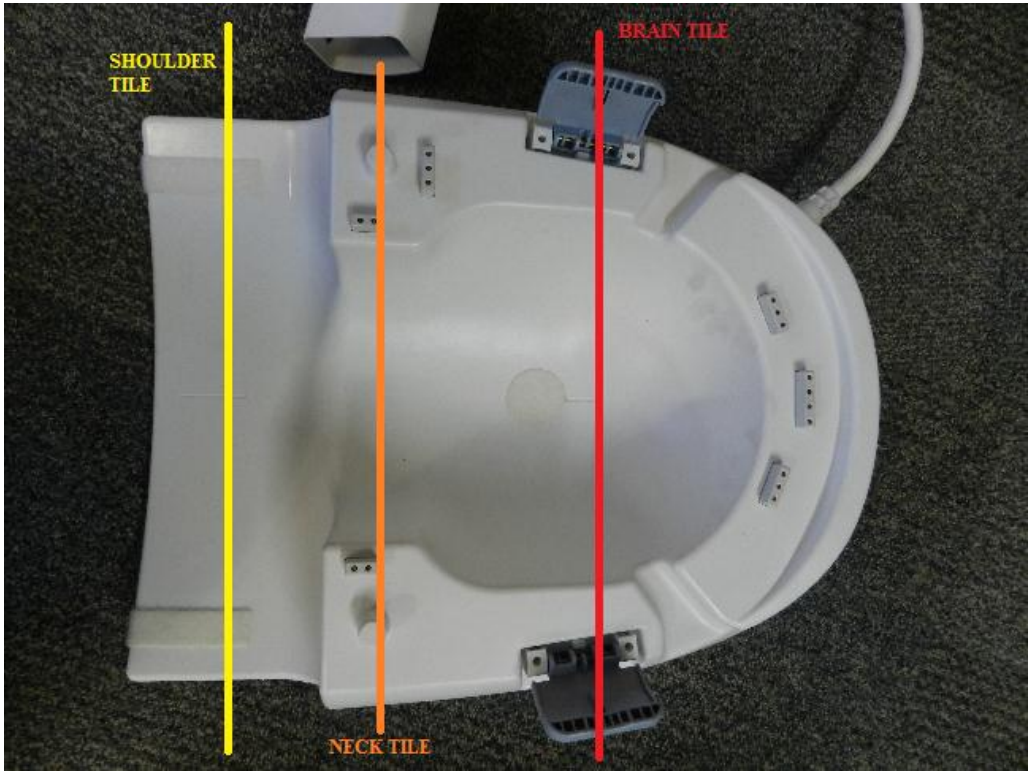


Phantom Scans: for SNR calculation

For issues when scanned using HNA adapter: Perform scans using the shown phantom arrangement and land marking, to obtain signal and noise images. Use CSPINE adaptor mode.

For each landmark, follow the same protocols as explained in the following slides. In the end, we shall have 3 sets of signal and 3 sets of corresponding noise images.

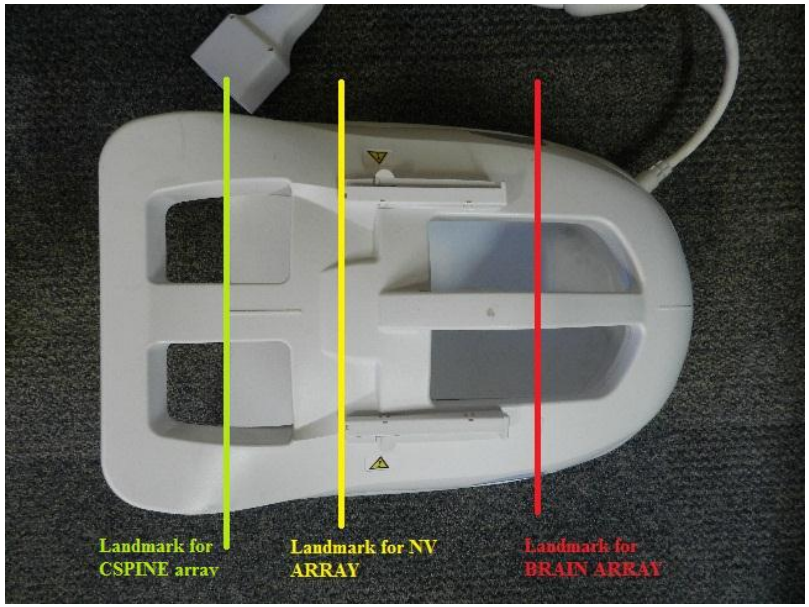


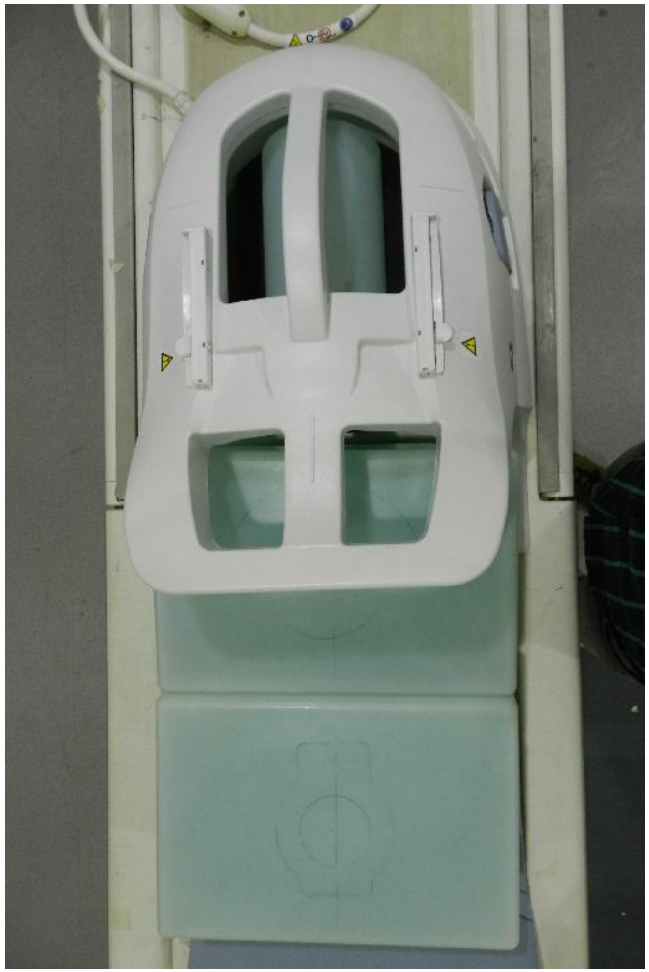


For issues when scanned using HNA anterior: Perform scans using the shown phantom arrangement and land marking, to obtain signal and noise images.

Follow the same protocols as explained in the following Slides. 3 slices shall be obtained for each mode, so that all the elements could be analyzed from the images.

Note: Follow the same protocol setup for modes using HNA adapter and HNA anterior. Ensure the correct phantom setup and land marking for correct measurements.

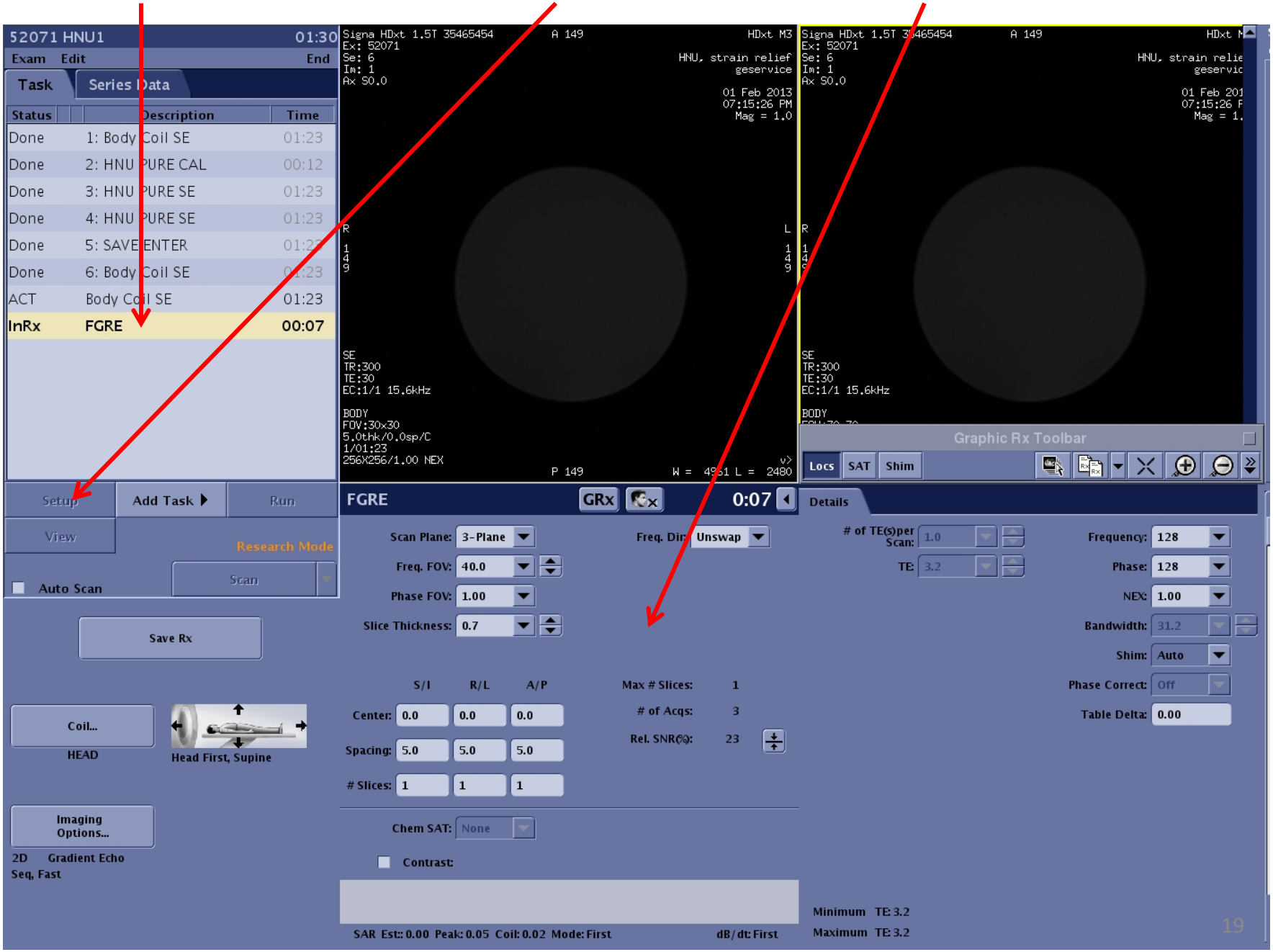




Perform a 3-plane localiser:

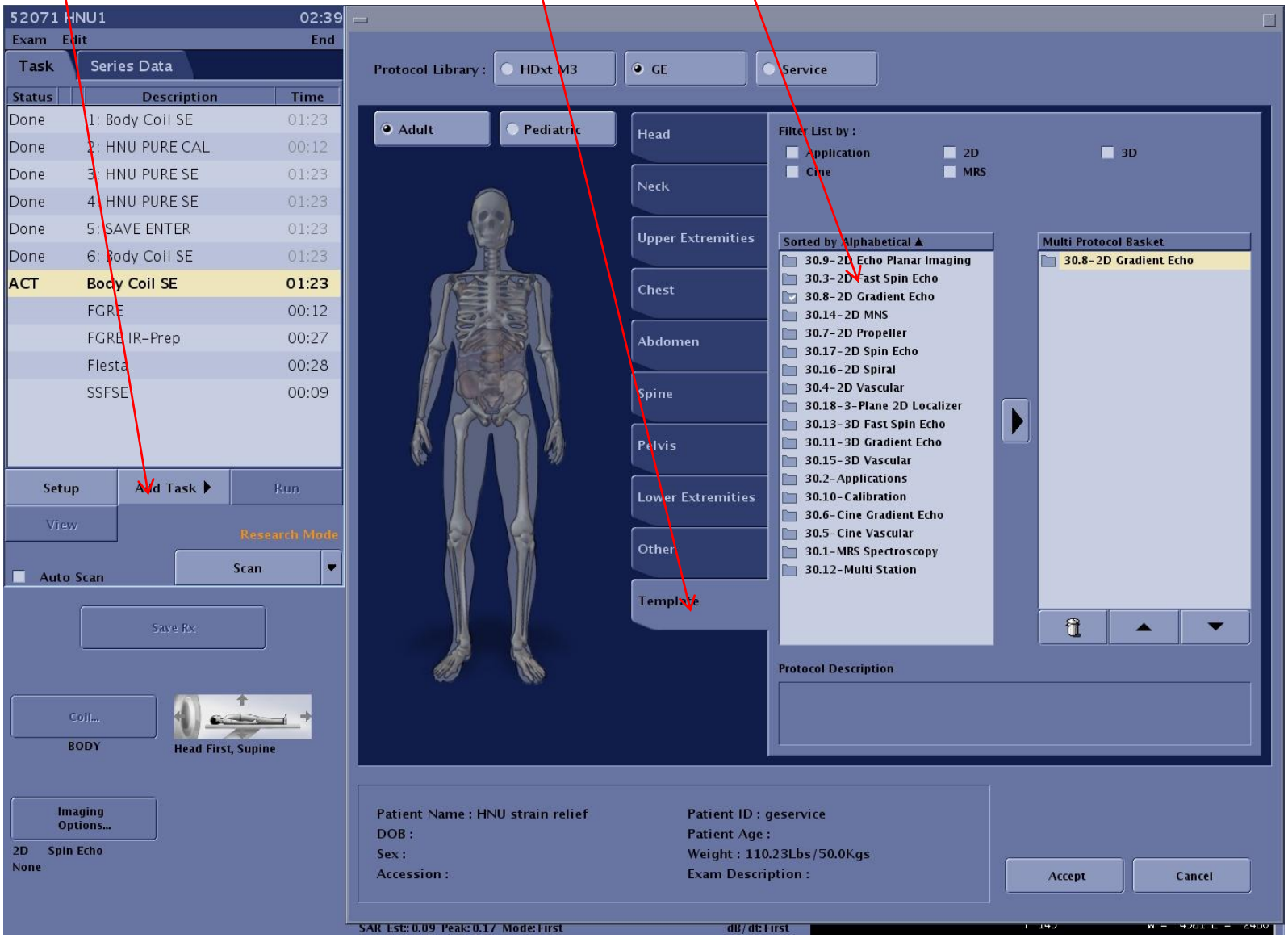
Add Task>> Add sequence>>Template>>3-Plane 2D Localiser

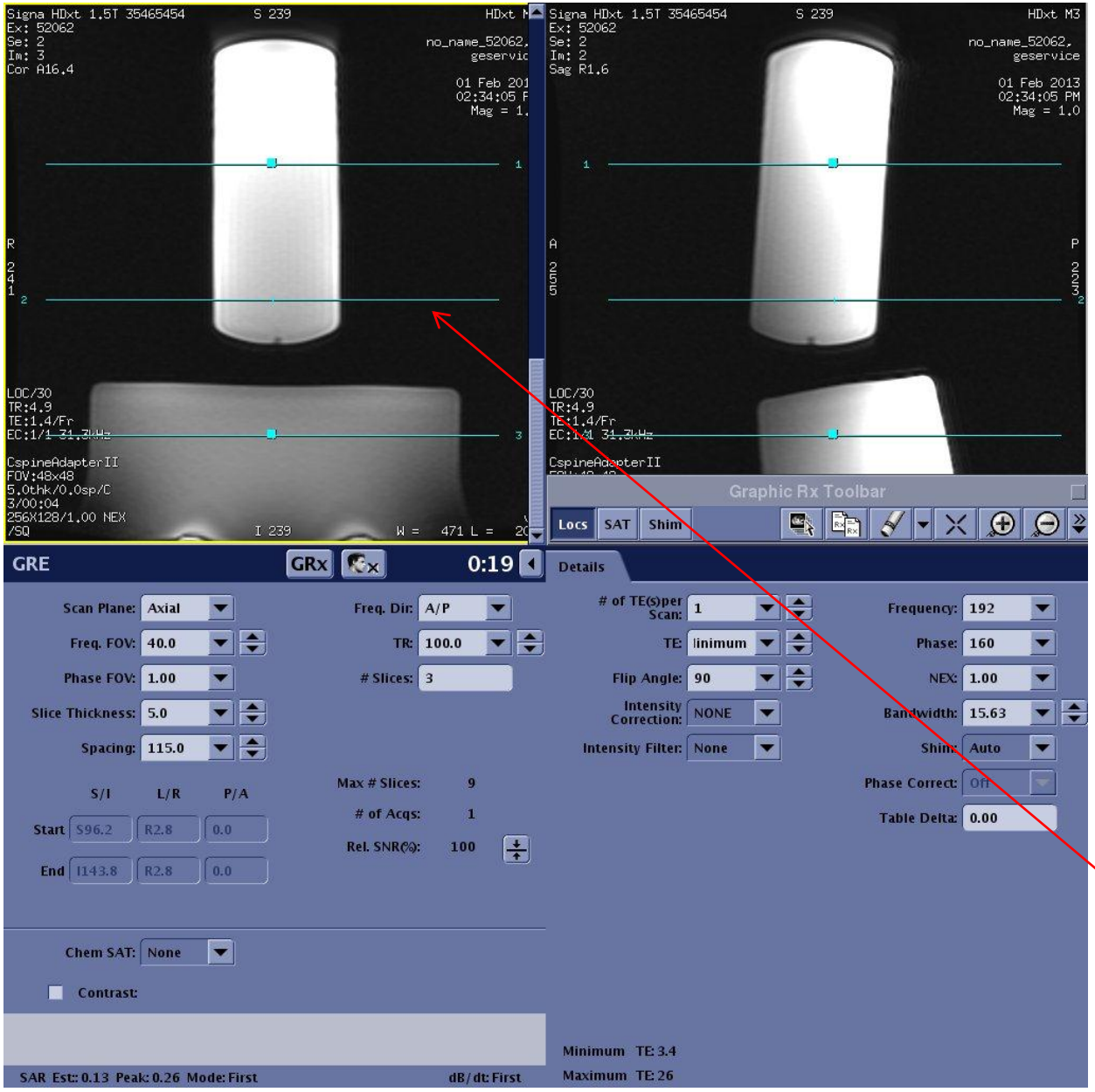
Select the pulse sequence (FGRE) and select SETUP. Give parameters as shown and SCAN.



Protocols and scan parameters for phantom scan:

Add Task>> Add sequence>>Template>>2D Gradient Echo





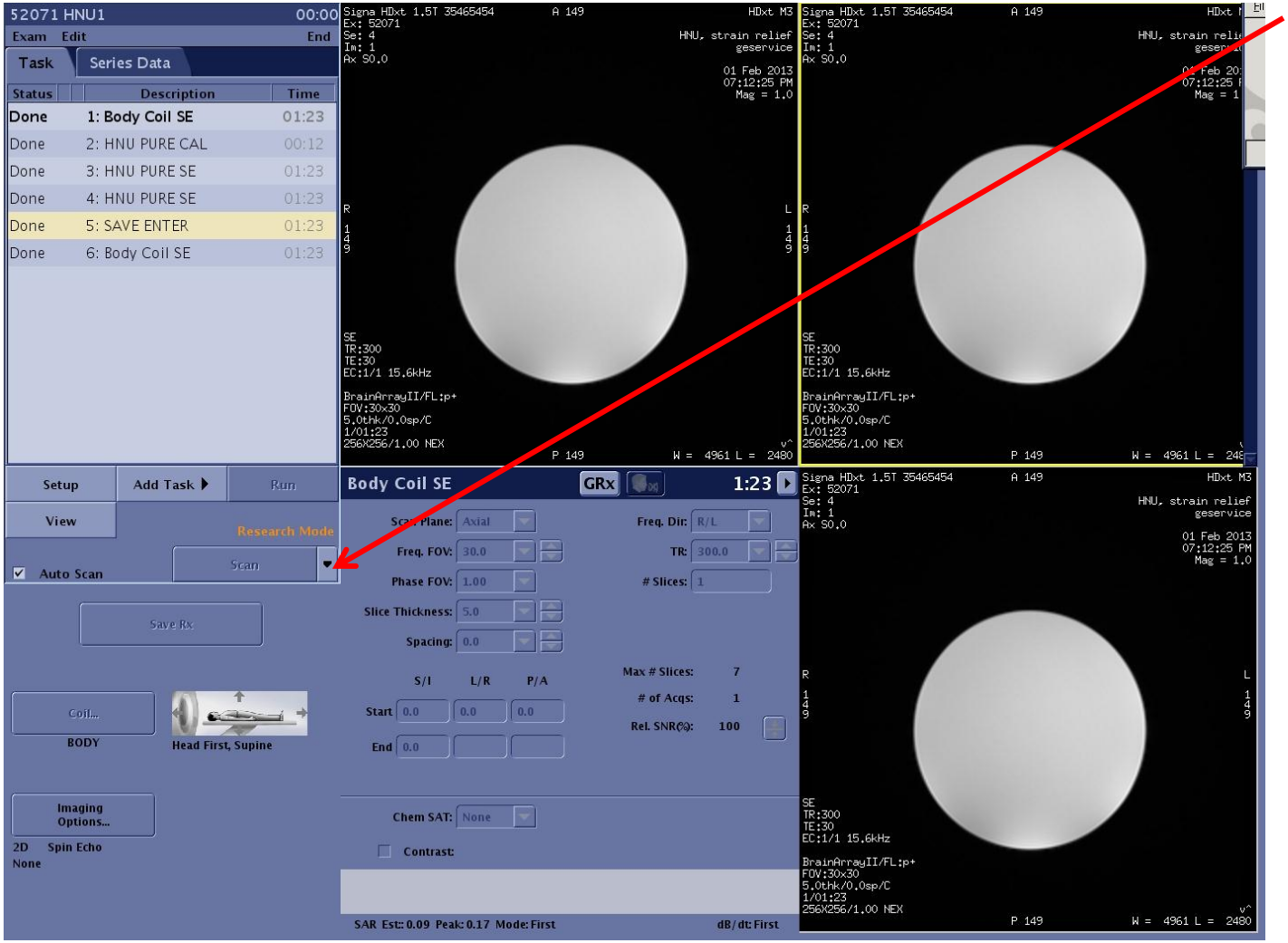
- Protocol: GRE
- Head first
- FOV: 40
- # of slices: 3
- Slice spacing: 115
- TR: 100; TE: minimum
- Flip: 90
- Freq: 192; phase: 160
- NEX: 1
- BW: 15.63

Set other parameters as shown

- Save Rx
- Download

<u>Slice position:</u>
Position the 2nd slice as shown in figure.

After the protocols are saved, set saveinter = 1 under Display CVs.



>> Click on the scroll down arrow
>>select Research
>>select Display CVs
>>type “saveinter” in the box
>>enter current value as 1
>>Accept
>>again, click on the scroll down arrow
>>select Research
>>Download
>>Scan

Noise scan: **Noise scans should be done immediately after EACH signal scan using identical phantom and protocol setups** (eg. For brain array mode, perform the phantom scan with RF enable switch in ON position. Immediately after the scan, turn OFF the RF enable switch and perform noise scan). Change the RF enable switch to OFF or DISABLED position on the cabinet. Follow the sequence as below for noise scan:

>> Copy paste the series used for Phantom scan (GRE sequence)
>> Save Rx and Download
>> Set saveinter = 1 and download, as explained before
>> Turn "RF enable" switch to OFF or DISABLE position in the cabinet.

>> **Perform MANUAL PRESCAN**. Do not change any value. Press **DONE**.
>> SCAN

Note: Once the phantom scan and the noise scan are completed, please push the DICOM images to TREASURE bay at Bangalore (ip address: 3.204.36.151). Share the exam and series numbers.

It is recommended to share screen shots of the images obtained, in case of network connectivity issues.

MC Bias failure

MC Bias failure:

MC Bias fault occurs when any of the RF channels from LPCA draws a current less than the minimum current limit or more than the maximum current limit.

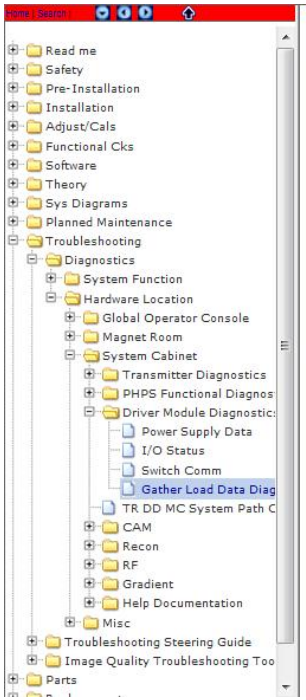
The current limits have been specified in the coil dB file.

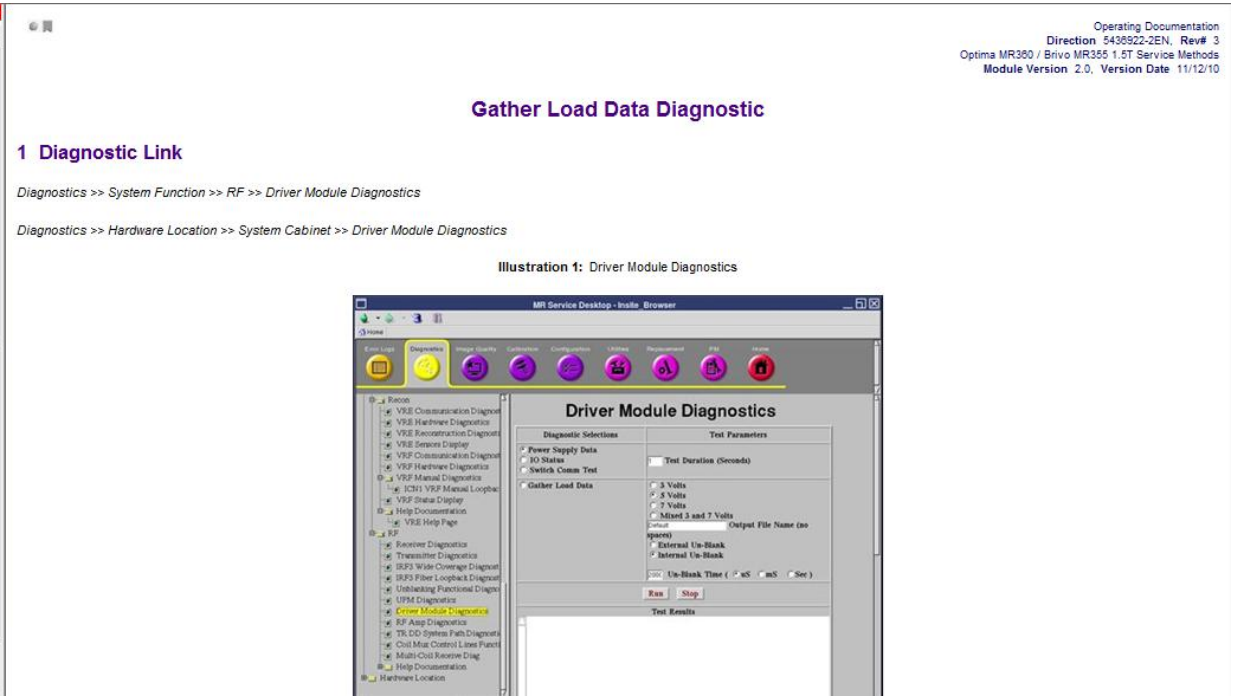
Gatherload check: This check will provide the current drawn by each channel for OPEN CIRCUIT and SHORT CIRCUIT conditions. Use 7V for HNU coil.

Observe whether there is significant difference between the current drawn by each channel. 16CH HNU coil will show the same values for all 16 channels.

In case any channels shows significantly different value, then that channel is faulty.

The result is stored in the file: usr/g/service/log/XXXXXX_mc.txt (where XXXXX is the filename)

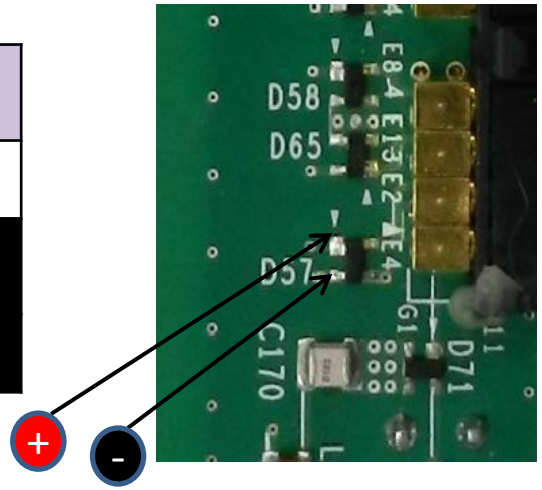




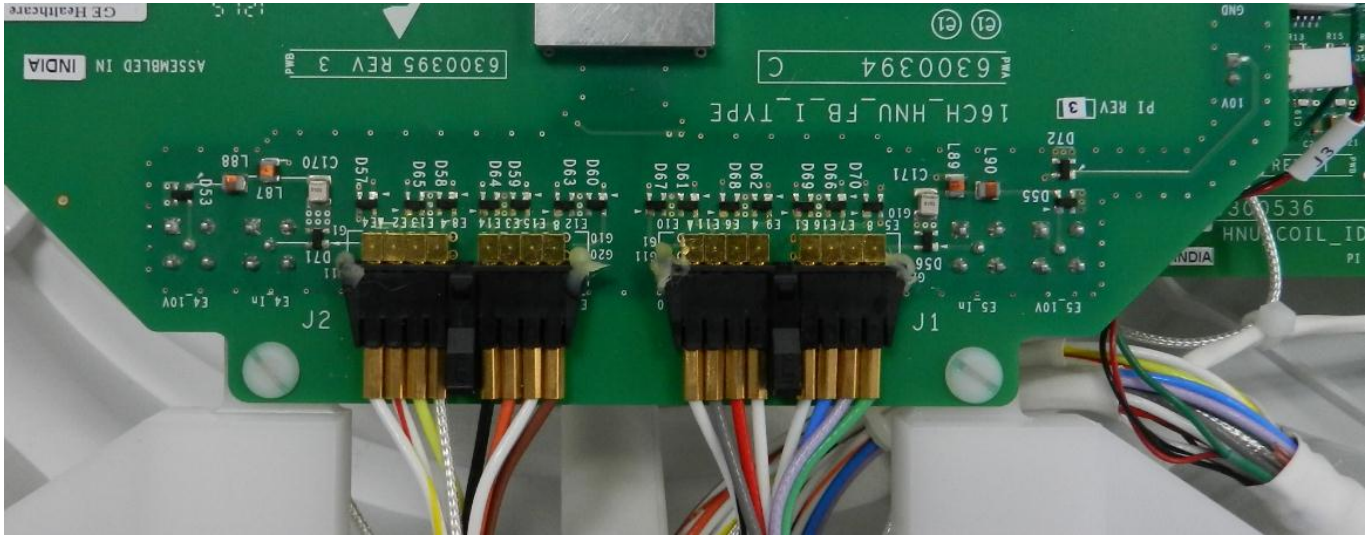
Always backup the gather load data report in case of MC bias failure.

Diode check: Remove the coil from MR system and then place anterior on the posterior. Perform diode check across the 2 pins for diodes. Ideal values (in volts) are as follows:

D71 – **CH12**	D57 – **CH10**	D65 – **CH3**	D58- **CH16**	D64- **CH4**	D59 – **CH11**	D63 – **CH5**	D60 – **CH8**	D67 – **CH2**	D61 – **CH7**
1.76	1.76	1.26	1.76	1.26	1.76	1.26	1.76	1.26	1.26
D68 – **CH14**	D62 – **CH1**	D69 – **CH9**	D66 – **CH6**	D70 – **CH15**	D56 – **CH13**				
1.76	1.26	1.76	1.26	1.76	1.76				



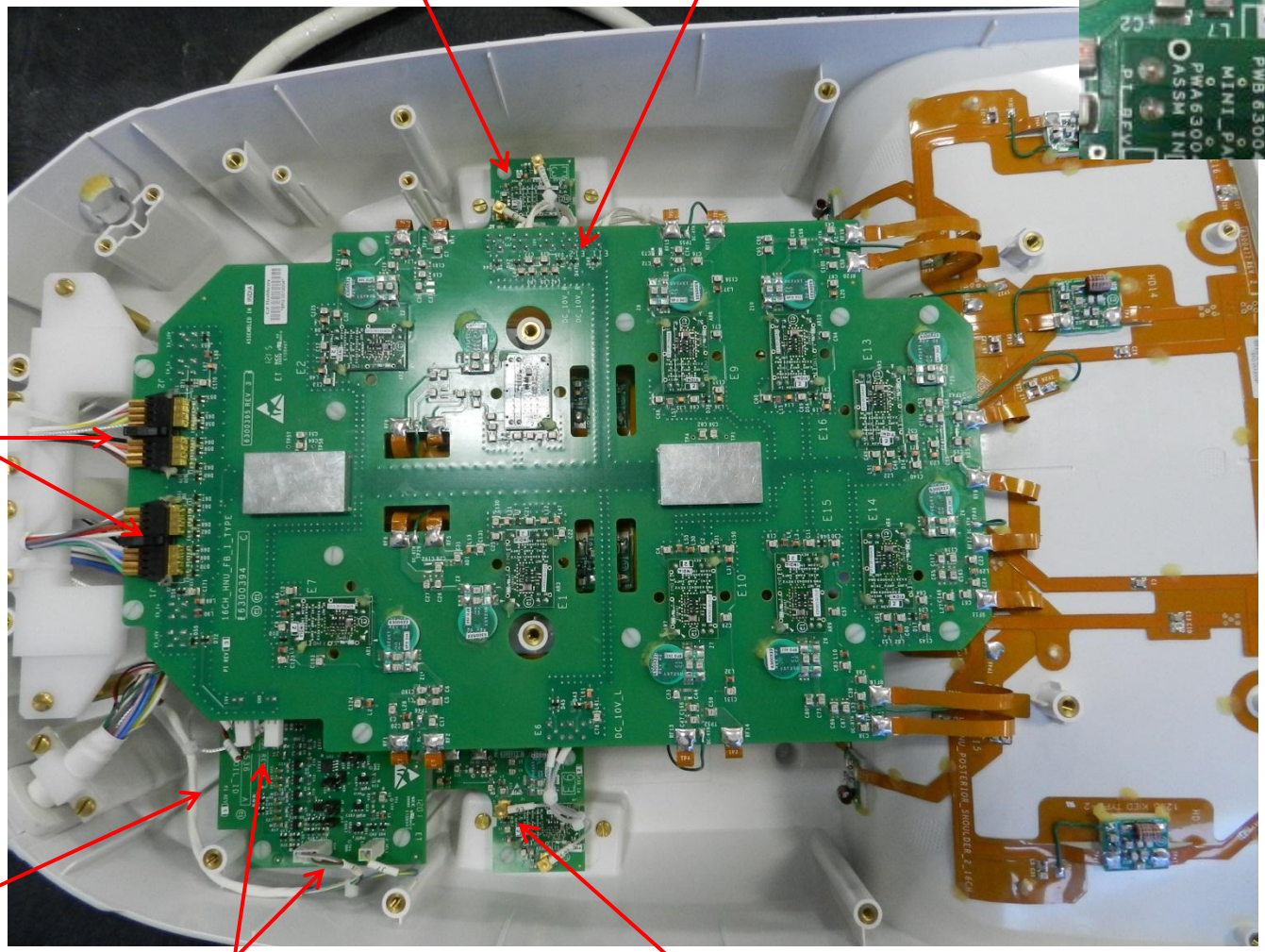
In reverse bias, Multimeter reads OL.

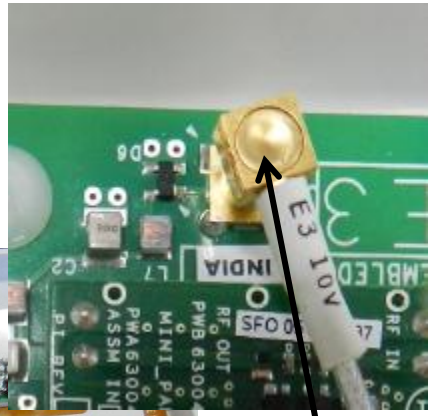


In case any of the channel readings observed are different from the Ideal values as given in the above table, then that channel is faulty .

Reseat connectors:

All Connectors shown shall be re-seated





APPENDIX

APPENDIX: 1

Please provide the below details for Initial Engineering Evaluation :

Basic Information required from site

1. Coil name + Serial number + manufacturing date or Photo of the coil rating plate label
2. Is this a FOA / FOI ?
3. Coil Installation date
4. MCQA report obtained when the coil was installed
5. What is the System ID, software version ?
6. Problem statement as told by customer
7. Is the issue reported is Intermittent or permanent ?
8. Is this a repeat issue at site ?
9. When was the last change done at system level ?
10. Is the reported issue observed in other coils in site ?

APPENDIX: 2
MCQA RESULT: HNA with anterior

Reference ISNR values

Test#	Sig_Img	Coil with Issue	Element #	ISNR Spec(LSL)	Coil Modes	Landmarking	ISNR reference values
1	1	HNA	E6-HNA	165	BrainArrayII	I0	322.6746
1	2	HNA	E3-HNA	193			319.5692
1	3	HNA	E4-HNA	202			360.3163
1	4	HNA	E5-HNA	168			313.7478
1	5	HNA	E1-HNA	135			251.0214
1	6	HNA	E8-HNA	109			208.6588
1	7	HNA	E2-HNA	134			220.2339
1	8	HNA	E7-HNA	133			284.3834
2	1	HNA	E9-HNA	84	CspineArrayII	I125	168.7194
2	2	HNA	E10-HNA	74			194.8313
2	3	HNA	E13-HNA	107			253.3307
2	4	HNA	E14-HNA	0			14.5243
2	5	HNA	E15-HNA	0			30.21855
2	6	HNA	E16-HNA	0			14.10884
2	7	HNA	E11-HNA	107			252.5771
2	8	HNA	E12-HNA	81			247.8695
2	9	HNA	E4-HNA	109			186.3411
2	10	HNA	E5-HNA	92			159.8693
2	11	HNA	E1-HNA	61			84.77776
2	12	HNA	E8-HNA	56			85.48732
3	1	HNA	E9-HNA	226	CspineArrayII	I250	485.8355
3	2	HNA	E10-HNA	221			443.8132
3	3	HNA	E13-HNA	212			461.1869
3	4	HNA	E14-HNA	397			1096.003
3	5	HNA	E15-HNA	415			1161.488
3	6	HNA	E16-HNA	351			972.8314
3	7	HNA	E11-HNA	346			686.4187
3	8	HNA	E12-HNA	331			707.8075
3	9	HNA	E4-HNA	48			81.06335
3	10	HNA	E5-HNA	34			60.13812
3	11	HNA	E1-HNA	33			81.97288
3	12	HNA	E8-HNA	32			84.79172
4	1	PA	E1-PA	40	SpineArray_12	I390	100.2836
4	2	PA	E3-PA	39			97.11848
4	3	PA	E4-PA	0			15.78777
4	4	PA	E6-PA	0			11.43798
4	5	PA	E5-PA	0			11.53895
4	6	PA	E2-PA	42			93.40969
5	1	PA	E1-PA	0	SpineArray_12	I575	17.43441
5	2	PA	E3-PA	0			17.16768
5	3	PA	E4-PA	36			76.51258
5	4	PA	E6-PA	34			67.05507
5	5	PA	E5-PA	35			66.20231
5	6	PA	E2-PA	0			16.73388

MCQA RESULT: HNA with adapter

Reference ISNR values

Test#	Sig_Img	Coil with Issue	Element #	ISNR Spec(LSL)	ISNR ref values	Coil Modes	Landmarking
1	1	HNA	E9-HNA	16	41.02192	Cspine_Adapter II	I0
1	2	HNA	E10-HNA	0	21.53275		
1	3	HNA	E13-HNA	14	34.95562		
1	4	HNA	E14-HNA	0	19.64795		
1	5	HNA	E15-HNA	0	19.122		
1	6	HNA	E16-HNA	0	16.67385		
1	7	HNA	E1-HNA	112	247.3663		
1	8	HNA	E8-HNA	94	219.092		
1	9	HNA	E2-HNA	136	307.3223		
1	10	HNA	E7-HNA	113	295.3823		