GE Site Yearly Performance Evaluation GE Horizon LX 16-Jul-08

Table of Contents

Summary and Signature Page	2		
Specific Comments	3		
Site Information	4		
Equipment Information	4		
Table Position Accuracy	4		
Magnetic Field Homogeneity	4		
Slice Thickness Accuracy	4		
Slice Crosstalk	5		
Soft Copy Displays	6		
RF Coil Performance Evaluation			
Coil Inventory List	7		
Anterior Neck Coil	8		
Body - Integrated	9		
CTL Phased Array	10		
CTL Phased Array - USA	13		
Dual 3 inch	16		
GP Flex	17		
Head Quad	19		
Knee Phased Array	20		
Knee/Foot	25		
Shoulder Array	27		
Torso Array	29		
Appendix A: Magnet Homgeneity Map	30		
Appendix B: Slice Thickness / Profiles / RF Crosstalk	35		
Appendix C: ACR Phantom Analysis	37		
Appendix D: Explanation of RF Coil Test Format			

Address: City, State, Zip MRI Mfg: _G					
City, State, Zip MRI Mfg:				Survey Date:	7/16/08
MRI Mfg: <u>G</u>				Report Date:	7/17/08
	E	Model:	Horizon LX	Field:	1.5T
MRI Scientist: <u>M</u>	Ioriel NessAiver, Ph.D.	Signature:	Moriel 1	lesstwer, 6	h.D.
	Equipment Evaluat	ion Tests		Pass Fail * N/A	
1. M	lagnetic field homogeneity:				
2. S	lice position accuracy:				
3. T	able positioning reproducibi	lity:			
4. S	lice thickness accuracy:				
5. R	F coils' performance:				
a.	Volume QD Coils				
b.	Phase Array Coils				
c.	Surface Coils				
6. Ir	nter-slice RF interference (C	rosstalk):			
7. Se	oft Copy Display				
7. H	ard Copy Display				
Ev	aluation of Site's Technolo	gist QC Pro	gram	Pass Fail * N/A	
1. S	et up and positioning accura	cy: (daily)			
2. C	enter frequency: (daily)				
3. T	ransmitter attenuation or gai	n: (daily)			
4. G	eometric accuracy measurm	ents: (daily)			
5. Sj	patial resolution measureme	nts: (daily)			
6. L	ow contrast detectability: (d	aily)			
7. H	ead Coil SNR (daily)				
8. B	ody Coil SNR (weekly)				
9. Fa	ast Spin Echo (FSE/TSE) gł	nosting levels	s: (daily)		
10. F	ilm quality control: (weekly)			
11. V	isual checklist: (weekly)				

Specific Comments and Recommendations

- Overall, the magnet homogeneity is pretty good for this generation magnet. There IS a small region of magnetic field distortion that appears to be located to the patient's Superior/Right/Posterior, maybe 15-20 cm from isocenter.
 There could be some sort of metal under the table or in the magnet bore. Look at Appendix A for contour plots that clearly indicate the location of the non-uniformity.
- 2. All of the ACR phantom measurements will pass ACR specs. However, please look at the axial diameters plot of the ACR T2. There is a significant dip in the plot which may be indicative of a local inhomogeneity possibly from some metal in the magnet. Additionally, last year the diameter plots were almost a straight line.
- 3. Channel 4 of the Phased Array Knee coil is about 10-15 lower than the other 3 channels. This is not enough of a drop that I would say it needs to be replaced, but we should keep an eye on it. This Knee PA coil has almost exactly the same SNR in the sagittal plane as the Knee/Foot coil and about 15% higher in the axial plane.
- 4. All of the Fire Extinguishers are magnetic. At least the closest units to the manget should be MRI compatible
- 5. Two of the small ball phantoms (CTL coil) have leaks. This is a potential health hazard. They should be replaced. (Not having them made testing the CTL coil rather difficult.)
- 6. The LCD monitor's power supply is dying. The monitor fails the ACR minimum brightness requirement.
- 7. There is very poor correspondence between the image on the screen and what is printed on film.

8.	You now have a USAI CTL coil. This is SUPPOSED to come with a pair of phantoms for testing. I could not
	find these phantoms which made it difficult to test the coil.
9.	
10.	
11.	
12.	
13.	

NOTE: Please be sure to read appendix D for an explanation of the format of this document.

Conta	act	Title	<u> </u>	Phon	e			Fax		eMail
		Administr	ator							
		GE Serv	ice							
Equipment I	nformation									
MRI Manufa	cturer: 0	<u>GE</u>	Model:	Horizon	LX		SN:	301662MR	Software:	9.1.031b
amera Manufa	cturer: 0	GE	Model:	Drystr 8	700		SN:		Software:	
PACS Manufa	cturer: ID2	KRad	Model:				SN:		Software:	
	ACR F	hantom Nu	mber used:	J426	-					
1 Table Posi	tioning Renrod	ucibility•								Pass
Tab	ble motion out/in:	IsoCenter	Out/In	Out/In	Out	t/In				. 466
Measured	Phantom Center	-2.3	-1.9	-1.7	-1	.7				
C			I		•					
			GRE '	TR: 500, T	E: 10 &	& 20 I	Flip A	ngle: 40. FC	NV: 40	
13	- 20	0.5						g	J V. 40	
0	5 cm 20 cm	25 cm	10 mm	n skip 10 m	ım, BW	V: 10.4	i iKHz,	256x128, 2	nex	- 4
Axial: 0	5 cm 20 cm 0.27 0.43 0.28 0.42	25 cm 0.7 0.61	10 mm Comm	n skip 10 m nents: <u>In ge</u>	m, BW	V: 10.4	4KHz, shim.	256x128, 2 However, th	nex	on with
Axial: 0 Coronal: 0 Sagittal: 0	5 cm 20 cm .27 0.43 .28 0.42 0.2 0.31	25 cm 0.7 0.61 0.45	10 mm Comm signifi	n skip 10 m nents: <u>In ge</u> icant field cl magnet Se	m, BW neral, a hange i	V: 10.4 good n the l	4KHz, shim. Right/S	256x128, 2 However, th Superior/Pos	nex here is a regionation	on with t relative)
Axial: 0 Coronal: 0 Sagittal: 0	20 cm .27 0.43 .28 0.42 0.2 0.31	25 cm 0.7 0.61 0.45	10 mm Comm signifi of the	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se	m, BW neral, a hange i ee appen	V: 10.4 good n the l ndix A	4KHz, shim. Right/S	256x128, 2 However, th Superior/Pos	nex here is a regionation (patien	on with t relative)
Axial: 0 Coronal: 0 Sagittal: 0	5 cm 20 cm .27 0.43 .28 0.42 0.2 0.31	25 cm 0.7 0.61 0.45	10 mm Comn signifi of the	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se	neral, a hange i	V: 10.4 good n the l ndix A	4KHz, shim. Right/S	256x128, 2 However, th Superior/Pos	nex here is a regio terior (patien	on with t relative)
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Axial: 0 Coronal: 0 Sagittal: 0 3. Slice Thicl FOV	5 cm 20 cm 0.27 0.43 0.28 0.42 0.2 0.31 kness Accuracy :: 250mm :: 250mm Sequence SE (ACR) SE (Site T1) SE (20/80) SE (20/80) FSF(16)	25 cm 0.7 0.61 0.45 (atrix: 256x) TR 500 500 2000 2000 2000	10 mm Comm signifi of the 256 TE 20 15 20 80 96.6	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se (Slic Flip 90 90 90 90 90	and ange i hange i hange i	V: 10.4 <u>good</u> <u>n the l</u> <u>ndix A</u> <u>rom A</u> <u>C:</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u> <u>5.4</u>	4KHz, shim. Right/S A. CR P alc 01 07 10 07 35	256x128, 2 However, th Superior/Pos hantom) A Target 5 5 5 5 5 5 5	nex here is a region terior (patien ll values in % Error 0.2% 1.4% 2.0% 1.4% 7.0%	on with t relative) mm
Axial: 0 Coronal: 0 Sagittal: 0 3. Slice Thicl FOV	5 cm 20 cm 0.27 0.43 0.28 0.42 0.2 0.31 kness Accuracy :: 250mm M Sequence SE (ACR) SE (Site T1) SE (20/80) SE (20/80) FSE(16) FSE(2)	25 cm 0.7 0.61 0.45 (atrix: 256x) TR 500 500 2000 2000 2000 6000 450	10 mm Comm signifi of the 256 TE 20 15 20 80 96.6 9	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se (Slic Flip 90 90 90 90 90 90 90	and the second	V: 10.4 <u>good</u> <u>n the l</u> <u>ndix A</u> <u>rom A</u> <u>C:</u> <u>5.0</u> <u>5.1</u> <u>5.1</u> <u>5.1</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u> <u>5.2</u>	4KHz, shim. Right/S	256x128, 2 However, th Superior/Pos hantom) A Target 5 5 5 5 5 5 5 5 5 5 5	nere is a regio terior (patien ll values in % Error 0.2% 1.4% 2.0% 1.4% 7.0% 2.2%	on with <u>t relative)</u> mm
Axial: 0 Coronal: 0 Sagittal: 0 3. Slice Thick FOV	5 cm 20 cm 0.27 0.43 0.28 0.42 0.2 0.31 kness Accuracy :: 250mm M Sequence SE (ACR) SE (Site T1) SE (20/80) SE (20/80) FSE(16) FSE(2) FSE(2)	25 cm 0.7 0.61 0.45 (atrix: 256x) TR 500 500 2000 2000 6000 450	10 mm Comm signifi of the 256 TE 20 15 20 15 20 9	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se (Slic Flip 90 90 90 90 90 90 90	and ange i hange i i hange	V: 10.4 <u>good</u> n the l ndix A rom A C: 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	4KHz, shim. Right/S A. CR P alc 01 07 10 07 35 11	256x128, 2 However, th Superior/Pos hantom) A Target 5 5 5 5 5 5 5 5 5 5 5 5 5	nex here is a region terior (patien ll values in % Error 0.2% 1.4% 2.0% 1.4% 7.0% 2.2%	on with t relative) mm
Axial: 0 Coronal: 0 Sagittal: 0 3. Slice Thicl FOV	5 cm 20 cm 0.27 0.43 0.28 0.42 0.2 0.31 kness Accuracy 250mm M Sequence SE (ACR) SE (Site T1) SE (20/80) SE (20/80) FSE(16) FSE(2)	25 cm 0.7 0.61 0.45 (atrix: 256x) TR 500 500 2000 2000 2000 450	10 mm Comm signifi of the 256 TE 20 15 20 80 96.6 9	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se (Slic Flip 90 90 90 90 90 90	and ange i hange i hange i hange i ha	V: 10.4 <u>good</u> n the l ndix A rom A C: 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	4KHz, shim. Right/S CR P alc 01 07 10 07 35 11	256x128, 2 However, th Superior/Pos hantom) A Target 5 5 5 5 5 5 5 5 5 5	nex nere is a regio terior (patien ll values in % Error 0.2% 1.4% 2.0% 1.4% 7.0% 2.2%	on with (t relative) mm
Axial: 0 Coronal: 0 Sagittal: 0 3. Slice Thick FOV	5 cm 20 cm 0.27 0.43 0.28 0.42 0.2 0.31 kness Accuracy :: 250mm M Sequence SE (ACR) SE (Site T1) SE (20/80) SE (20/80) FSE(16) FSE(2) FSE(2)	25 cm 0.7 0.61 0.45 (atrix: 256x) TR 500 500 2000 2000 6000 450	10 mm Comm signifi of the 256 TE 20 15 20 15 20 9	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se (Slic Flip 90 90 90 90 90 90	e #1 fr NSA 1 1 1 2 2 2	V: 10.4 <u>good</u> n the l ndix A rom A C: 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	4KHz, shim. Right/S CR P alc 01 07 10 07 35 11	256x128, 2 However, th Superior/Pos hantom) A Target 5 5 5 5 5 5 5 5	nere is a regional for the regional for	on with t relative) mm
Axial: 0 Coronal: 0 Sagittal: 0 3. Slice Thicl FOV	5 cm 20 cm 0.27 0.43 0.28 0.42 0.2 0.31 kness Accuracy 2 250mm M Sequence SE (ACR) SE (Site T1) SE (20/80) SE (20/80) FSE(16) FSE(2)	25 cm 0.7 0.61 0.45 (atrix: 256x) TR 500 2000 2000 6000 450	10 mm Comm signifi of the 256 TE 20 15 20 80 96.6 9	n skip 10 m nents: <u>In ge</u> icant field cl magnet. Se (Slic Flip 90 90 90 90 90 90 90	and the set of the se	V: 10.4 <u>good</u> n the l ndix A rom A C: 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	4KHz, shim. Right/S CR P alc 01 07 10 07 35 11	256x128, 2 However, th Superior/Pos hantom) A Target 5 5 5 5 5 5 5 5	nere is a regional for the second sec	on with It relative) mm

4. Slice Crosstalk (RF interference)

The following data were obtained using the ACR phantom slice thickness wedges to measure the slice profile of a two common T1 weighted sequences when the slice gap varies from 200% down to 0% (contiguous) As the slices get closer together it is expected that the edges of the slices will overlap causing a deterioration of the slice profile. The data shown below clearly demonstrates this effect. Once the slice gap reaches 40% (FSE) or 30% (SE) of the slice thickness, the measured slice profile begins to drop. The FSE curve is rather strange, normally one would expect to see a steady drop, not a levelling off. All of the slice profiles can be seen in Appendix B. In those plots, it is easy to see that the simple SE sequence has a much squarer pulse profile than the FSE(2) sequence which will improve SNR while minimizing slice crosstalk.

Sequence Type	450	TE	FOV (cm ²)	Matrix	NSA	Thickness	# of slices	Slice Measured
SE	450	20	25	256x256	1	5	11	6
FSE(2)	450	9	25	256x256	2	5	9	5

Skip	ACR T1	FSE(2)
0	4.77	4.79
0.2	4.8	4.72
0.5	4.82	4.73
1	4.91	4.86
1.5	5.03	5.01
2	5.05	5.13
2.5	5.08	5.13
5	5.11	5.2
10	5.11	5.14



5. Soft & Hard Copy Displays

Luminance Meter Make/Model: Tektronix J16 Digital Photometer

Monitor Description: Efilm workstation

Luminance Measured: Ft. lamberts

Measured Data							
Which Monitor	Center of Image Display	Top Left Corner	Top Right Corner	Bottom Left Corner	Bottom Right Corner		
Console	17.6	15.8	15.2	16.3	15.3		

_					
	Uniformity				
	MAX	MIN	Percent Delta		
	17.6	15.2	15%		

Cal Expires:

SMPTE
OK?
Y

4/6/06

% delta =200% x (max-min)/(max+center) (>30% is action limit)

Minimum Brightness must be > 26.24 Ft. Lamberts

The display's power supply is not capable of generating enough current to maintain a large percentage of white

on the screen. The signal sent to the laser camera does not well match what is seen on the screen.





Coil and Other Hardware Inventory List

Site Name GE Site

ACR Magnet # 01

Nickname GE Horizon

ctiv	e Coil Description	Manufacturer	Model	Rev	Mfg. Date	SN	Channe
ב	Torso Array	Gore	2104700			#2	4
ן	Shoulder Array	Medrad	87305-T-466		Mar, 1998	SPAA0171	3
1	Anterior Neck Coil	Medical Advances	310GE-64		Dec, 1998	22440	1
₫	Body - Integrated						1
1	CTL Phased Array	GE	2074799		Apr, 1996	29730VP9	4
1	CTL Phased Array USA	USA Instrument	222545-6		May, 2000	1436	4
3	Dual 3 inch	GE	M1085GA		Apr, 2005	1116oWH9	2
]	GP Flex	GE	2128554		Apr, 1998	981662	1
]	GP Flex	GE	2128554		Apr, 1998	981686	1
1	Head Quad	GE	4628211862		Apr, 1998	141761MR7	1
1	Knee Phased Array	Medical Advances	46-320406P1		Apr, 1998	KPA0518	4
1	Knee/Foot	Medical Advances	472GE-64		Mar, 2001	29035	1
3	Shoulder Array	Medrad	2100937-17		Apr, 1998	SPAA0188	3
1	Torso Array	Gore	2104700			#1	4
]							
							7

RF Coil Performance Evaluation	Test Date: 7/16/2008				
Coil: Anterior Neck Coil	Model: 310GE-64				
Mfg.: Medical Advances	Revision:				
Mfg. Date: 12/7/1998 Coil ID: 802	SN: 22440				
Phantom: Volume Neck Phantom Jug	# of Channels 1				
SequenceTRTEPlaneFOVNxNyBWNSAThicknessGapSE30020T3025625615.613-					
Coil Mode: ANTNECK TX gain: 139 R1: 11 R2: 29					
Analysis of Test Ima	age				
Measured Data	Calculated Results				
Back Noise Noise Label Mean Max Min ground SD Type	Mean Normal- Max Uni- SNR ized SNR formity				
N 606 737 515 -0.3 2.13 NEMA	<u>201.2</u> <u>201.2</u> <u>244.7</u> <u>82.3%</u>				
A 60/ /3/ 516 3.4 1.82 Air					
Norm OOD DOLM: 0.20 Moore O					
Mean: 606 ROTM: -0.32 Mean: 60 ROIsd: 2.13	Air M: 3.39 Airsd: 1.82				
0737	0737				
0.51/5	Q516				
ROI Area: 146.96 ROI Area	a: 146.96				

RF Coil Performance Evaluation Coil: Body - Integrated Mfg.:	Ny BW 56 256 15.6	Test Date: 7/16/2008 Model:
Coll Mode: Body - Isocenter		<u>164</u> R1: <u>11</u> R2: <u>30</u>
Analysis (Mossured Data	of lest image	Calculated Results
Back Noise	Noise Mean	Normal- Max Uni-
Label Mean Max Min ground SD	Type SNR NEMA 24.3	9.5 26.2 91.2%
A 236 254 213 12.2 6.09	Air 25.4	9.9 27.3 91.2%
Mean: 236 ROI M: 0.18 ROIsd: 6.86 O254 Col Area: 703.15	Mean: 236 0 254 ROI Area: 703.15	Air M: 12.19 Airsd: 6.09

Coil: CTL Phased Array Model: 2074799 Mfg.: GE Mfg. Date: 4/1/1996 Coil ID: 801 Phantom: 6 small balls in CTL holder SN: 29730VP9 # of Channels _4 Sequence TR TE SE 300 20 S 48 256 256 15.6 TX gain: 160 R1: 11 R2: 30
Mfg.: GE Revision:
Mfg. Date: 4/1/1996 Coil ID: 801 SN: 29730VP9 Phantom: 6 small balls in CTL holder # of Channels 4 Sequence TR TE Plane FOV Nx Ny BW NSA Thickness Gap SE 300 20 S 48 256 256 15.6 1.5 3 - Coil Mode: a CTLTOP TX gain: 160 R1: 11 R2: 30
Phantom: 6 small balls in CTL holder # of Channels _4 Sequence TR TE Plane FOV Nx Ny BW NSA Thickness Gap SE 300 20 S 48 256 256 15.6 1.5 3 - Coil Mode: a CTLTOP TX gain: 160 R1: 11 R2: 30
SequenceTRTEPlaneFOVNxNyBWNSAThicknessGapSE30020S4825625615.61.53-Coil Mode: a CTLTOP
Coil Mode: a CTLTOP TX gain: 160 R1: 11 R2: 30
Analysis of Composite Image
Analysis of Composite Image
Measured Data Calculated Results
Label Mean Max Min ground SD Type SNR ized SNR formity
1 1,727 2,299 1,260 2.8 0.79 Air 1432.6 456.9 1907.0 70.8% 2 700 1.069 516 2.9 0.70 45 200.7 905.0 65.29
2 789 1,068 516 2.8 0.79 Air 654.5 208.7 885.9 65.2% 3 923 1,517 508 2.8 0.79 Air 765.6 244.2 1258.4 50.2%
4 1,614 2,126 992 2.8 0.79 Air 1338.8 427.0 1763.5 63.6%
Analysis of Uncombined Images
Measured Data Calculated Results
Noise Noise Mean % of Max % of
Ch Mean Max SD Type SNR Mean SNR Max 1 1.498 2.074 0.64 Air 1533.8 100% 2123.6 100%
2 893 1,197 0.81 Air 722.5 47% 968.4 46%
3 791 1,311 0.69 Air 751.2 49% 1245.1 59% 1
4 1,627 2,142 0.76 Air 1402.9 91% 1846.9 87%
Mean: 1727 Air M: 2.81 Mean: 789 Air M: 2.82 Mean: 923 Air M: 2.81 Mean: 1614 Air M: 2.81 Mean: 1727 Air M: 2.81 Mean: 789 Air M: 2.82 Mean: 923 Air M: 2.81 Mean: 1614 Air M: 2.81
Composites ROI Area: 30.18 ROI Area: 50.65 ROI Area: 49.86 ROI Area: 49.86 ROI Area: 33.61 Area: 33.61
Mean: 1498 Air M: 1.05 Mean: 893 Air M: 1.44 Mean: 791 Air M: 1.18 Mean: 1627 Air M: 1.32 Channels ROI Area: 30.18 ROI Area: 50.65 ROI Area: 49.86 ROI Area: 49.86 ROI Area: 33.61 Channel 1 Channel 2 Channel 3 Channel 4

RF Coil Performance Evaluation	Test Date: 7/16/2008
Coil: CTL Phased Array	Model: 2074799
Mfg.: GE	Revision:
Mfg. Date: 4/1/1996 Coil ID: 801	SN: 29730VP9
Phantom: <u>6 small balls in CTL holder</u>	# of Channels
Sequence TR TE Plane FOV Nx Ny	BW NSA Thickness Gap
SE 300 20 S 48 256 256	15.6 1.5 3 -
Coil Mode: <u>b CTLMID</u> TX	gain: <u>159</u> R1: <u>11</u> R2: <u>30</u>
Analysis of Composite Imag	е
Measured Data	Calculated Results
Back Noise Noise Label Mean Max Min ground SD Type	Mean Normal- Max Uni- SNR ized SNR formity
2 1,390 2,032 850 3.0 0.84 Air	1084.4 345.9 1585.2 59.0%
3 995 1,618 541 3.0 0.84 Air	776.2 247.6 1262.2 50.1%
4 978 1,535 571 3.0 0.84 Air	763.0 243.3 1197.5 54.2% 1322.3 421.7 1773.2 61.5%
3 1,075 2,275 1,007 5.0 0.04 All	1322.3 421.7 1773.2 01.370
Analysis of Uncombined Imag	es
Measured Data	Calculated Results
Noise Noise Me <u>Ch Mean Max SD Type</u> SN	an % of Max % of I <u>R Mean SNR Max</u>
2 1,617 2,398 0.79 Air 134	1.3 94% 1989.2 100%
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\frac{7.9}{4}$ $\frac{53\%}{57\%}$ $\frac{1243.2}{1279.6}$ $\frac{62\%}{64\%}$
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
· ·····	
Mean: 1390 Air M: 2.98 Mean: 995 Air M: 2.98 M	ean: 978 💫 Air M: 2.98 Mean: 1695 Air M: 2.98
Airsd: 0.84	Airsd: 0.84 Airsd: 0.84
Composites	
	535
	68093
ROI Area: 32.60 ROI Area: 50.23 RO	DI Area: 50.01 ROI Area: 35.19
Mean: 1617 Align 1.41 Mean: 798 Air M. 1.17 M Airsd: 0.69 Airsd: 0.69	ean: 941 Air M: 1.32 Mean: 1706 Air M: 1.37 Airsd: 0.76 Airsd: 0.78
Channels	F 484
ROI Area: 32.60 ROI Area: 50.23 R	OI Area: 50.01 ROI Area: 35.19
Channel 1 Channel 2	Channel 3 Channel 4

RF Coil Performan	ce Evaluati	on	T. M		Test Date:	7/16/2008
Coil: CTL Phased Ari	ray	Pro-			Model:	2074799
Mfg.: GE			- nd	TET	Revision:	
Mfg. Date: <u>4/1/1996</u>	Coil ID: 80	ı 📄			SN:	29730VP9
Phantom: <u>6 small balls in CTL</u>	holder				_	# of Channels
Sequence TR TE	Plane		lx Ny	BW	NSA T	hickness Gap
SE 300 20		48 25	56 256	15.6	1.5	3 -
Coil Mode: <u>c CTLBOT</u>				TX gain	: <u>158</u> R1	: <u>11</u> R2: <u>30</u>
	Ana	lysis of C	omposite l	Image		
Me	asured Data				Calculate	d Results
Label Mean Max	Min groun	d SD	Noise Type	SNF	n Normai- R ized	SNR formity
3 1,452 1,964	884 3.0	0.83	Air	1146	.4 365.6	1550.6 62.1%
4 928 1,454 5 935 1,534	554 3.0 524 3.0	0.83	Air	732.	$\frac{7}{2}$ 233.7	<u>1148.0</u> <u>55.2%</u> <u>1211.1</u> <u>50.9%</u>
6 1,822 2,480	1,092 3.0	0.83	Air	1438	.5 458.8	1958.0 61.1%
	۸naly		combined			
Measured	Data	313 01 011	combined	inages	Calculated	Results
	Noise No	oise		Mean	% of	Max % of
Ch Mean Max		/pe \ir		SNR	Mean	SNR Max
4 925 1,462	0.74	Air		797.6	53%	1260.6 61%
5 955 1,573	0.81	Air		772.6	51%	1272.6 62%
6 1,710 2,324	0.74	Air		1514.3	100%	2058.0 100%
						·
	Mean: 1452	M: 2.98 Mean Mean 0.83	: 928 Air M: 2 Airsd: 0	.98 Mean: 93 .83	5 Air M: 2.98 Airsd: 0.83	Mean: 1822 Air M: 2.98 Airsd: 0.83
Composites					50	
					6671534	
	ROI Area: 31.86	ROLA	rea: 48.12	ROI Area:	50.75	ROI Area: 34.43
	Mean: 1426	r M: 1.28 Mean ดูส9 0.74	: 925 Air M: 1 Airsd: 0	1.32 Mean: 95 0.76	5 Air M: 1.44 Airsd: 0.81	Mean: 1710 Air M: 1.28 Airsd: 0.74
			61462	6		
Channels			0544 102			
					1573	
	ROI Area: 31.86	ROLA	Area: 48.12	ROI Area	: 50.75	ROI Area: 34.43
	Channel	1	Channel 2	Ch	annel 3	Channel 4

RF Coil Performance Evaluation Coil: CTL Phased Array USA Mfg: USA Instrument Mfg. Date: 5/26/2000 Coil ID: 1722 Phantom: 5 small balls in CTL holder Sequence TR TE Plane FOV Nx Ny BW NSA Thickness Gap - Coil Mode: a USCS123 TX gain:
Analysis of Composite Image
Measured Data Calculated Results Label Mean Max Min Back ground Noise SD Noise Type Mean SNR Normal- ized Max Uni- formity N 2,208 4,100 1,012 0.9 2.89 NEMA 540.3 220.8 1003.3 39.6% A 2,207 4,100 1,011 5.2 1.67 Air 866.0 353.8 1608.8 39.6%
Analysis of Uncombined Images
Measured Data Calculated Results
Ch Mean Max Noise SD Noise Type Mean % of SNR Max % of Mean 1 725 1,458 0.98 Air 484.8 86% 974.9 59% 2 1,576 4,323 2.01 Air 513.8 91% 1409.4 85% 3 1,167 3,429 1.36 Air 562.3 100% 1652.2 100%
Mean: 2208 ROI M: 0.85 Mean: 2207 Air M: 5.22 Channel 1 Channel 2
ROlsd: 2.89 Airsd: 1.67 Mean: 725 Air M: 1.80 Mean: 1576 386 Air M: 3.77 Image: Constraint of the state of the
ROI Area: 63.18 ROI Area: 63.18 ROI Area: 63.18 ROI Area: 63.18 Composites
ROI Area: 63.18 Channel 3

RF Coil Performance Evaluation	Test Date: 7/16/2008
Coil: CTL Phased Array USA	Model: 222545-6
Mfg.: USA Instrument	Revision:
Mfg. Date: 5/26/2000 Coil ID: 1722	SN: 1436
Phantom: <u>5 small balls in taped to coil</u>	# of Channels
Sequence TR TE Plane FOV Nx Ny	BW NSA Thickness Gap
SE 300 20 S 48 256 256	5 25.6 1.5 3 -
Coil Mode: b USCTLTMID	TX gain: <u>157</u> R1: <u>10</u> R2: <u>29</u>
Analysis of Composite	Image
Measured Data	Calculated Results
Back Noise Noise Label Mean Max Min ground SD Type	Mean Normal- Max Uni- SNR ized SNR formity
N 2,060 4,428 807 0.1 14.20 NEMA	102.6 41.9 220.5 30.8%
A 2,060 4,427 808 5.2 1.66 Air	813.2 332.3 1747.6 30.9%
Analysis of Uncombined	l Images
Measured Data	Calculated Results
Noise Noise Ch Mean Max SD Type	Mean % of Max % of SNR Mean SNR Max
1 777 1,938 1.08 Air	471.5 90% 1175.9 69%
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	524.2 100% 1684.9 99% 461.1 88% 1705.0 100%
4 813 1,781 1.06 Air	502.6 96% 1101.0 65%
Moon: 2060 BOLM: 0.08 Moon: 2060 Air M: 5.20	Channel 1 Channel 2
07,4228d: 14.20 07,4427: 1.66	Mean: 777 Air M: 1.98 Mean: 1024 Air M: 2.36 Airsd: 1.28 Airsd: 1.28
	263
(2807)	
	ROI Area: 62.21 ROI Area: 62.21 8291
ROI Area: 62.21 ROI Area: 62.21	Mean: 1154 Air M: 3.09 Mean: 813 Air M: 1.93
Composites	
	225
	ROI Area: 62.21 ROI Area: 62.21 781
	Channel 3 Channel 4

GE Site

RF Coil Performance Evaluation Coil: CTL Phased Array USA Mfg.: USA Instrument Mfg. Date: 5/26/2000 Coil ID: 1722 Phantom: 5 small balls in taped to coil Sequence TR TE Plane FOV Nx Ny SE 300 20 S 48 256 25 Coil Mode: c USCTLTBOT Coil Mode: c USCTLTBOT	Test Date: 7/16/2008 Model: 222545-6 Revision:
Analysis of Composite	
Measured Data	Calculated Results
Back Noise Noise Ture	Mean Normal- Max Uni-
Label Mean Max Min ground SD Type 159 10 29 622 0.6 8.32 NEMA	0.9 0.3 2.5 191.1%
A 1,980 5,405 624 4.7 1.41 Air	920.2 376.0 2512.0 20.7%
Analysis of Uncombine	d Images
Measured Data	Calculated Results
Ch Mean Max Noise SD Noise Type 1 630 1,204 0.98 Air 2 900 2,014 1.27 Air 3 932 4,242 1.12 Air 4 885 2,429 1.12 Air	Mean % of NR Max % of SNR Max 421.3 77% 805.1 32% 464.4 85% 1039.2 42% 545.3 100% 2482.0 100% 517.8 95% 1421.2 57%
Mean: 1980 ROI M: 0.58 Olsd: 8.32 622 624 624 624 624 624 624 624 624 624 624 624 624 624 624 624 624 625 626 627 628 629 624 624 624 625 626 627 628 629 624 625 626 627 628 629 629 629 629 629 629 629 629 629 629 629 629 629 629 629 <t< td=""><td>Channel 1 Channel 2 Mean: 630 Air M: 1.78 Airsd: 0.98 Air M: 2.37 Image: 1204 Image: 230 Image: 120</td></t<>	Channel 1 Channel 2 Mean: 630 Air M: 1.78 Airsd: 0.98 Air M: 2.37 Image: 1204 Image: 230 Image: 120

RF Coil Performance Evaluation	Test Date: 7/16/2008
Coil: Dual 3 inch	Model: M1085GA
Mfg.: GE	Revision:
Mfg. Date: 4/01/2005 Coil ID: 800	SN: 1116oWH9
Phantom: Head TLT sphere	# of Channels 2
SequenceTRTEPlaneFOVNxNySE30020T36256256	BWNSAThicknessGap615.613-
Coil Mode: DUAL	TX gain: <u>145</u> R1: <u>11</u> R2: <u>29</u>
Analysis of Composite	Image
Measured Data	Calculated Results
Back Noise Noise Label Mean Max Min ground SD Type	Mean Normal- Max Uni- SNR ized SNR formity
N 1,478 4,187 472 1.3 7.61 NEMA	137.4 95.4 389.1 20.3%
A 1,477 4,184 473 4.8 1.84 Air	526.0 365.3 1490.1 20.3%
Analysis of Uncombined	d Images
Measured Data	Calculated Results
Noise Noise Ch Mean Max SD Type	Mean % of Max % of
1 887 4,372 1.82 Air	319.4 100% 1574.2 100%
2 769 3,796 1.59 Air	316.9 99% 1564.5 99%
Mean: 1478 ROI M: 1.32 ROIsd: 7.61 GOI Area: 157.45 ROI Area: 157.45 ROI Area: 157.45 ROI Area: 157.45 ROI Area: 157.45 Composites	387Air M: 3.37 Airsd: 1.82Mean: 769Air M: 2.95 Airsd: 1.59

RF Coil Performance Evaluation		Test Date: 7/16/2008		
Coil: GP Flex		Model: 2128554		
Mfg.: GE	Revision:			
Mfg. Date: <u>4/16/1998</u> Coil ID: <u>805</u>	Mfg. Date: 4/16/1998 Coil ID: 805			
Phantom: <u>1 gallon Volume Neck jug</u>		# of Channels		
SequenceTRTEPlaneFOVSE30020T40	Nx Ny BW 256 256 15.6	NSA Thickness Gap		
Coil Mode: GPFLEX	TX gain:	<u>126</u> R1: <u>10</u> R2: <u>29</u>		
Analy	ysis of Test Image			
Measured Data		Calculated Results		
Label Mean Max Min ground	Noise Noise Mean SD Type SNR	Normal- Max Uni- ized SNR formity		
N 1,390 1,836 537 -1.5	3.41 NEMA 288.3 1.02 Air 474.8	162.2 380.8 45.3% 267.1 626.0 45.3%		
	1.72 All 4/4.0			
Mean: 1390 BOLM:	-1.49 Mean: 1391 A	ir M: 3.54		
ROIsd:	3.41 A	irsd: 1.92		
537				
01000	01004			
ROI Area: 137.30	ROI Area: 137.30			

RF Coil Performance Evaluation Coil: GP Flex Mfg.: GE Mfg. Date: 4/16/1998 Coil ID: 806 Phantom: 1 gallon Volume Neck jug	Test Date: 7/16/2008 Model: 2128554 Revision:			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
Coil Mode: <u>GPFLEX</u> TX gain:	<u>125</u> R1: <u>10</u> R2: <u>29</u>			
Analysis of Test Image				
Measured Data	Calculated Results			
Back Noise Noise Mean Label Mean Max Min ground SD Type SNR	ized SNR formity			
N 1,386 1,831 546 0.5 2.41 NEMA 406.7 A 1,385 1,830 544 3.5 1.89 Air 480.2	228.8 537.3 45.9% 270.1 634.5 45.8%			
Mean: 1386 ROI M: 0.52 ROIsd: 2.41 ROIsd: 2.41 ROI Area: 137.41 Mean: 1385 Air M: 3.50 Airsd: 1.89				

RF Coil Performance Eval	uation		Test Date:	7/16/2008
Coil: Head Quad			Model:	4628211862
Mfg.: GE			Revision:	
Mfg. Date: 4/01/1998 Coil ID: 796 SN: 141761MR7				141761MR7
Phantom: <u>ACR Phantom - use flood regi</u>	on			# of Channels <u>1</u>
SequenceTRTEPlaneFOVNxNyBWNSAThicknessGapSE30020T4025625615.613-				
Coil Mode: <u>HEAD</u>		т	X gain: <u>121</u> R1:	<u>10</u> R2: <u>29</u>
Moseurod	Analysis o	f Test Image	Calculate	d Poculto
	Back Noise	Noise	Mean Normal-	
Label Mean Max Min 9	ground SD 1.2 3.19	Type NEMA	SNR ized 236.1 132.8	SNR formity
A 1,063 1,134 1,005	5.3 2.85	Air	244.4 137.5	260.7 94.0%
Mean: 1065	ROI M: 1.21 ROIsd: 3.19	Mean: 1063	Air M: 5.33 Airsd: 2.85	
	110130.0.15		All 50. 2.00	
0 1007 0 1005				
01	134		01182	
ROI Area: 239.03		ROI Area: 23	9.03	

RF Coil Performance Evaluation Coil Knee Phased Array Mfg.: Medical Advances Mfg. Date: 4/01/1998 Coil ID: 803 Phantom: Head TLT sphere Sequence TR TE Plane FOV Nx Ny SE 300 20 T 36 256 250 Coil Mode: KNEEPA Analysis of Composite	Test Date: 7/16/2008 Model: 46-320406P1 Revision:
Manager Data	
Measured Data	
Label Mean Max Min ground SD Type	SNR ized SNR formity
N 915 977 840 0.4 1.51 NEMA	<u>428.5</u> <u>297.6</u> <u>457.6</u> <u>92.5%</u>
A 913 970 037 4.0 1.31 All	437.7 317.7 400.2 72.370
Analysis of Uncombined	l Images
Measured Data	Calculated Results
Ch Mean Max SD Noise Type 1 517 672 1.19 Air 2 498 643 1.21 Air 3 480 542 1.22 Air 4 324 373 1.00 Air	Mean % of NR Max Mean % of SNR Max Max 284.7 100% 370.1 100% 269.7 95% 348.2 94% 257.8 91% 291.1 79% 212.3 75% 244.4 66%
Channel 4 is a little low, not bad enough to replace.	Channel 1Channel 2Mean: 517Air M: 2.16 Airsd: 1.19Mean: 498Air M: 2.21 Airsd: 1.21Image: Air M: 2.21 Airsd: 1.21Image: Air M: 2.21 Airsd: 1.21Image: Air M: 2.21 Airsd: 1.21Image: Air M: 2.22 Airsd: 1.22Image: Air M: 2.22

RF Coil Performance Evaluation Coil: Knee Phased Array Mfg.: Medical Advances Mfg. Date: 4/01/1998 Coil ID: 803 Phantom: Head TLT sphere Sequence TR TE Plane FOV Nx SE 300 20 S 36 256 Coil Mode: KNEEPA KNEEPA KNEEPA	Test Date: 7/16/2008 Model: 46-320406P1 Revision:
Analysis of Co	nposite Image
Measured Data	Noise Mean Normal- Max Uni-
Label Mean Max Min ground SD	Type SNR ized SNR formity
N 869 1,065 677 -0.1 3.84 A 869 1,071 677 4.5 1.26	NEMA 160.0 111.1 196.1 77.7% Air 452.0 313.9 557.0 77.5%
Analysis of Unco	mbined Images
Measured Data	Calculated Results
Ch Mean Max SD Noise Type 1 391 659 1.16 Air 2 413 870 1.18 Air 3 444 831 1.20 Air 4 284 481 0.99 Air	Mean % of Max % of SNR Mean SNR Max 220.9 91% 372.3 77% 229.4 95% 483.2 100% 242.5 100% 453.8 94% 188.0 78% 318.4 66%
Channel 4 is a little low, not bad enough to replace.	Channel 1Channel 2Mean: 391Air M: 2.11 Airsd: 1.16Mean: 413Air M: 2.15 Airsd: 1.18Image: Image:

RF Coil Performance Evaluation Coil: Knee Phased Array Mfg.: Medical Advances Mfg. Date: 4/01/1998 Coil ID: 803 Phantom: Head TLT sphere Sequence TR TE Plane FOV Nx Ny SE 300 20 C 36 256 25 Coil Mode: KNEEPA KNEEPA Knee PA Knee Pa	Test Date: 7/16/2008 Model: 46-320406P1 Revision:
Measured Data	Calculated Results
Back Noise Noise Label Mean Max Min ground SD Type	Mean Normal- Max Uni- SNR ized SNR formity
N 870 1,009 684 0.4 1.33 NEMA	462.6 321.3 536.5 80.8%
A 870 1,009 685 4.6 1.30 Air	438.6 304.6 508.6 80.9%
Analysis of Uncombined	d Images
Measured Data	Calculated Results
Noise Noise	Mean % of Max % of
Ch Mean Max SD Type	SNR Mean SNR Max 237.7 100% 463.2 100%
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
3 416 667 1.20 Air	227.2 96% 364.2 79%
4 310 597 1.00 Air	203.1 85% 391.2 84%
Mean: 870 ROI M: 0.35 Mean: 870 Air M: 4.58 ROIsd: 1.33 Airsd: 1.30	Channel 1 Mean: 428 Air M: 2.13 Airsd: 1.18 Mean: 375 Air M: 2.16 Airsd: 1.19
© 1009 © 684	ROI Area: 179.93 Minor 200 Air Min 2 30
ROI Area: 179.93 Composites	Mean: 416 Air M: 2.18 Mean: 310 Air M: 1.79 Airsd: 1.20 Airsd: 1.20 Airsd: 1.00 Observation Observation Observation ROI Area: 179.93 ROI Area: 179.93 Channel 3

<u>RF Coil Performance Evaluation</u>	Test Date: 7/16/2008
Coil: Knee Phased Array	Model: 46-320406P1
Mfg : Modical Advances	
Mrg. Date: 4/01/1996 Coll ID: 803	SN: <u>KPA0518</u>
Phantom: Knee/Foot bottle (for comparison to Knee/Foot results)	# of Channels 4
Sequence TR TE Plane FOV Nx Ny	BW NSA Thickness Gap
SE 300 20 T 40 256 256	<u>6 15.6 1 3 -</u>
Coil Mode: KNEEPA	TX gain: <u>151</u> R1: <u>11</u> R2: <u>29</u>
Analysis of Composite	Image
Measured Data	Calculated Results
Back Noiso Noiso	Mean Normal- Max Uni-
Label Mean Max Min ground SD Type	SNR ized SNR formity
N 508 517 495 -0.0 1.51 NEMA	237.9 133.8 242.1 97.8%
A 508 516 495 4.0 1.12 Air	297.2 167.2 301.9 97.9%
Analysis of Uncombined	l Images
Measured Data	Calculated Results
Noise Noise	Mean % of Max % of
Ch Mean Max SD Type	SNR Mean SNR Max
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $
3 284 308 1.07 Air	173.9 98% 188.6 97%
4 187 203 0.87 Air	140.9 79% 152.9 78%
Channel 4 is a little low, not bad enough to replace.	

Mean: 508 ROI M: -0.01 Mean: 508 Air M: 3.95	Channel 1 Channel 2 Mean: 264 Air M: 1 74 Mean: 269 Air M: 1 85
ROIsd: 1.51 Airsd: 1.12	Airsd: 0.97 Airsd: 1.03
Q 495 Q 495	O 289 O 289
9 517 9 516	
	ROI Area: 81.55 ROI Area: 81.55
ROI Area: 81.55 ROI Area: 81.55	Mean: 284 Air M: 1.95 Mean: 187 Air M: 1.54 Airsd: 1.07 Airsd: 0.87
Composites	
	0170
	Q 259 308 Q 203
	ROI Area: 81.55 ROI Area: 81.55
	Channel 3 Channel 4

RF Coil Performance Evaluation	Test Date: 7/16/2008							
Coil: Knee Phased Array	Model: 46-320406P1							
Mfg.: Medical Advances Revision:								
Mfg. Date: 4/01/1998 Coil ID: 803 SN: KPA0518								
Phantom: Knee/Foot bottle (for comparison to Knee/Foot results)	# of Channels							
SequenceTRTEPlaneFOVNxNySE30020S40256256	BWNSAThicknessGap15.613-							
Coil Mode: KNEEPA	TX gain: <u>151</u> R1: <u>11</u> R2: <u>29</u>							
Analysis of Composite	Image							
Measured Data	Calculated Results							
Label Mean Max Min ground SD Type	SNR ized SNR formity							
N 494 581 568 0.1 1.92 NEMIA A 494 580 368 3.9 1.13 Air	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
Analysis of Uncombined								
Measured Data	Calculated Results							
Noise Noise Ch Moan Max SD Type	Mean % of Max % of							
I 203 369 0.97 Air	SNR Mean SNR Max 137.1 94% 249.3 83%							
2 228 467 1.02 Air	146.5 100% 300.0 100% 143.0 000% 202.7 000%							
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $							
the knee/foot.coil.	of this coll is almost identical to the knee portion of							
	Channel 1 Channel 2							
ROIsd: 1.92 Airsd: 1.13	Mean: 203 Air M: 1./2 Mean: 228 Air M: 1.83 Airsd: 0.97 Airsd: 1.02							
	06 012							
	0.487							
O 581 O 580								
	ROI Area: 186.75 ROI Area: 186.75							
ROI Area: 186.75 ROI Area: 186.75	Mean: 235 Air M: 1.93 Mean: 162 Air M: 1.54 Airsd: 1.07 Airsd: 0.87							
Composites								
	O 478							
	010							
	ROI Area: 186.75 ROI Area: 186.75							
	Channel 3 Channel 4							

RF Coil Performance Evaluation Coil: Knee/Foot Mfg.: Medical Advances Mfg. Date: 3/15/2001 Coil ID: 797 Phantom:	Test Date: 7/16/2008 Model: 472GE-64 Revision:
Analysis of	Test Image
Measured Data	Calculated Results
Back Noise	Noise Mean Normal- Max Uni-
Label Mean Max Min ground SD	Type SNR ized SNR formity
N 1,358 1,499 1,324 0.1 4.10	NEMA 234.2 131.8 258.6 93.8% NEMA 190.6 106.7 221.2 40.5%
N 1,059 1,292 528 0.0 5.95 A 1.358 1.497 1.324 4.9 2.54	NEMA 189.0 100.7 251.3 40.5% Air 350.4 197.1 386.2 93.9%
A 1,059 1,290 332 4.8 2.51	Air 276.5 155.5 336.8 40.9%
Test I	mages
Mean: 1358 ROI M: 0.11	Mean: 1059 ROI M: 0.01
ROIsd: 4.10 ROI Area: 41.77	ROI Area: 178.53
Mean: 1358 Air M: 4.90	Mean: 1059 Air M: 4.82
Airsd: 2.54	Airsd: 2.51

RF Coil Performance Evaluation Coil: Knee/Foot Mfg.: Medical Advances Mfg. Date: 3/15/2001 Coil ID: 797 Phantom: Sequence TR TE Plane FOV Nx Ny BW SE 300 20 T 40 256 EVENEM TV asia:							:	6/2008 2GE-64 29035 annels 1 Gap -
		Anal	ysis of	Test Ima	ige			
	Measured	Data			<u> </u>	Calculate	d Resul	te
	mouourou	Back	Noise	Noise		Normal-	Max	Uni-
Label Mean M	ax Min	ground	SD	Туре	SNR	ized	SNR	formity
N 1,296 1,4	45 1,279	0.4	3.29	NEMA	278.6	5 156.7	310.6	93.9%
N 1,178 1,2	42 1,112	0.6	3.53	NEMA	236.0	132.8	248.8	94.5%
A 1,296 1,4	44 1,279	5.7	3.02	Air	281.2	158.2	313.3	93.9%
Test Images Mean: 1296 ROI M: 0.41 ROIsd: 3.29 Roisd: 3.53 ROIsd: 3.29 Roisd: 3.53 Image: 1296 Air M: 5.66 Mean: 1178 ROI M: 0.58 Roisd: 3.53 Roisd: 3.53 Image: 1296 Air M: 5.66 Mean: 1178 Air M: 5.67								
Mean: 1296 Air M: 5.66 Airsd: 3.02 Airsd: 3.02								

RF Coil Performance Evaluation Test Date: 7/16/2008 Coil: Shoulder Array Model: 2100937-17 Mfg. Medrad Nodel: 2100937-17 Mfg. Date: 4/1/1998 Coil ID: 1721 Phantom: Body Sphere SPAA0188 Sequence TR TE SE 300 20 T 48 Coil Mode: SHOPA3 TX gain: 130 R1: 11 R2: 29
Analysis of Composite Image
Measured Data Calculated Results
Back Noise Noise Mean Normal- Max Uni- Label Mean Max Min ground SD Type SNR ized SNR formity
N 469 1,071 141 0.3 1.26 NEMA 263.2 102.8 601.1 23.3%
A 469 1,070 141 2.7 0.92 Air 334.1 130.5 762.2 23.3%
Analysis of Uncombined Images
Measured Data Calculated Results
Noise Noise Mean % of Max % of Max % of Max
$\begin{array}{c c c c c c c c c c c c c c c c c c c $
2 180 729 0.73 Air 161.6 92% 654.4 86%
3 236 791 0.88 Air 175.7 100% 589.0 77%
Mean: 469 ROI M: 0.26 ROIsd: 1.26 0107 0141 0141 0141 0141 0141 0141 0141
ROI Area: 507.92 ROI Area: 507.92 Morridal corise Morridal corise Mean: 236 Air M: 1.55
Composites Airsd: 0.88

RF Coil Performance Evaluation Test Date: 7/16/2008 Coil: Shoulder Array Model: 2100937-17 Mfg.: Medrad Model: 2100937-17 Mfg. Date: 4/1/1998 Coil ID: 1721 Phantom: Body Sphere Test Date: 4/1/1998 Sequence TR TE SE 300 20 S 48 256 256 1 3 - Coil Mode: SHOPA3
Analysis of Composite Image
Measured Data Calculated Results
Back Noise Noise Mean Normal- Max Uni- Label Mean Max Min ground SD Type SNR ized SNR formity
N 485 1,123 192 0.3 1.52 NEMA 225.7 88.1 522.5 29.2%
A 485 1,121 192 2.7 0.92 Air 345.5 134.9 798.5 29.2%
Analysis of Uncombined Images
Measured Data Calculated Results
Noise Noise Mean % of Max % of
Ch Mean Max SD Type SNR Mean SNR Max 1 232 799 0.84 Air 181.0 97% 623.3 95%
2 204 733 0.73 Air 183.1 98% 658.0 100%
3 251 714 0.88 Air 186.9 100% 531.7 81%
Mean: 485 ROI M: 0.26 Mean: 485 Air M: 2.70 Airsd: 0.92 Image: Constraint of the state o
ROI Area: 404.13 ROI Area: 404.13 Normal to the Normal to the Mean: 251 Air M: 1.55
Composites Airsd: 0.88

RF Coil Performance Evaluation Coil: Torso Array Image: Coil ID: Temp Image: Coil ID: Temp Temp Temp Image: Coil ID: Temp Temp Image: Coil ID: Temp Temp Image: Coil ID: Temp Temp	Test Date: 7/16/2008 Model: 2104700 Revision:
Analysis of Composite	e Image
Measured DataLabelMeanMaxMinBack groundNoise SDNoise TypeN2794681290.11.66NEMAA2794701295.41.51Air	Calculated Results Mean SNR Normal- ized Max SNR Uni- formity 118.9 46.4 199.4 43.2% 121.1 47.3 204.0 43.1%
Analysis of Uncombined	d Images
Measured Data Ch Mean Max SD Noise Type 1 118 369 1.37 Air 2 118 352 1.39 Air 3 121 370 1.40 Air 4 105 302 1.14 Air	Calculated Results Mean % of SNR Max Mean % of SNR Max Max 56.4 94% 176.5 100% 55.6 92% 165.9 94% 56.6 94% 173.2 98% 60.4 100% 173.6 98%
Mean: 279ROI M: 0.13Polodici 1.60Mean: 279Air M: 5.41Airsd: 1.51Airsd: 1.51Airsd: 1.51Airsd: 1.51Airsd: 1.52Bol Area: 510.29Composites	Channel 1Channel 2Mean: 118Air M: 2.49Mean: 118Air M: 2.55Old Area: 510.29Airsd: 1.30Odd Area: 510.29Mean: 12Airsd: 1.40Odd Area: 510.29Mean: 12Airsd: 1.40Airsd: 1.14Odd Area: 510.29Airsd: 1.14Odd Area: 510.29Mean: 12Airsd: 1.40Airsd: 1.14Odd Area: 510.29Airsd: 1.14Airsd: 1.14Airsd: 1.40Airsd: 1.40Airsd: 1.14Odd Area: 510.29Airsd: 1.20Airsd: 1.14Channel 3Channel 4

Appendix A: Magnet Homogeneity Field Maps GE Site GE Signa LX 1.5T - 3 central planes Measured July 16, 2008



		A	xıal			
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-6.2	2.6	8.9	0.14	-0.28	1.7
15	-12.5	4.4	16.9	0.27	-1.14	2.9
20	-20.6	6.8	27.4	0.43	-2.34	4.6
25	-32.0	12.5	44.6	0.70	-3.86	6.9
28	-39.4	16.6	56.0	0.88	-4.95	8.8
30	-44.6	21.4	65.9	1.04	-5.72	10.2

		Со	ronal			
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-5.1	4.0	9.1	0.14	0.34	1.8
15	-8.3	9.2	17.5	0.28	0.70	3.2
20	-11.3	15.3	26.5	0.42	1.29	5.0
25	-14.6	24.2	38.9	0.61	2.22	7.1
28	-17.0	30.5	47.5	0.75	3.01	8.5
30	-18.4	35.3	53.7	0.84	3.64	9.5

		Sag	jittal	-		
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV
10	-2.0	5.0	7.0	0.11	0.45	1.4
15	-2.5	10.1	12.5	0.20	1.15	2.4
20	-2.5	17.1	19.6	0.31	2.22	3.7
25	-2.5	26.0	28.5	0.45	3.71	5.5
28	-2.9	33.1	36.0	0.57	4.89	6.9
30	-5.5	38.0	43.4	0.68	5.79	8.0





Superior 20

Inferior

Posterior

Appendix A: Magnet Homogeneity Field Maps GE Site GE Signa LX 1.5T Measured July 16, 2008







Axial Field Plots



Coronal Field Plots





Appendix B: RF Crosstalk and Slice Profiles

Spin Echo TR/TE = 450/15BW = 15.6 KHz nex = 1Scan time: 2:09



Appendix B: RF Crosstalk and Slice Profiles

Fast Spin Echo TR/TE = 450/9.2BW = 31.2 KHz nex = 2ETL = 2Scan time: 2:09



GE Site

Coil Used: Head Quad

GE Horizon

7/16/2008

Test Date:

	Sagittal Locator						
1	Length of phantom, end t	o en	d (mn 148± 2)	14	7.1	=	calculated field
			(SE 500/20)	(SE 2000/20)	(SE 2000/80)	(Site T1)	(Site T2)
	Slice Location #1		ACR T1	ACR PD	ACR T2	Site T1	Site T2
2	Resolution		1.0	1.0	1.0	0.9	0.9
3	(1.10, 1.00, 0.90 mm)	ě	1.0	1.0	1.0	1.0	1.0
4	Slice Thickness	Тор	52.0	53.2	4.0	51.9	53.4
5	(fwhm in mm) Bot	tom	48.4	49.0	9.0	49.5	53.6
6	Calculated value 5.0±0.7		5.01	5.10	0.55	5.07	5.35
7	Wedge (mm) = +	= -	-2.5	-2.6	10.0	-2.4	-2.7
8	Diameter (mm) (190+2)	\square	190.2	190.1	1.0	190.0	189.9
9		θ	189.1	189.1	189.1	189.0	189.4
	Slice Location #5						
10		Φ	190.2	190.0	190.3	190.0	189.9
11] Diameter (mm) (190+2)	Ð	189.1	189.0	189.1	189.0	189.3
12		\oslash	189.0	189.0	189.0	189.2	189.5
13		\odot	187.9	188.4	187.8	188.4	188.6
	Slice Location #7						
14	Signal Big I	ROI	1262	1325	776	1305	801
15	(mean only)	Iigh	1316	1373	805	1362	843
16	L	low	1187	1258	728	1221	745
17	Uniformity (>87.5	%)	94.8%	95.6%	95.0%	94.5%	93.8%
18	Background Noise	Тор	9.6 ± 4.62	10.7 ± 4.89	7.5 ± 3.63	11.1 ± 5.30	8.5 ± 4.12
19	Bot	tom	9.5 ± 4.86	10.4 ± 4.81	7.8 ± 3.80	11.3 ± 5.64	8.8 ± 4.15
20	(mean ±std dev)	Left	12.6 ± 6.37	12.9 ± 6.03	12.0 ± 5.64	17.2 ± 7.57	11.9 ± 5.75
21	R	ight	9.4 ± 4.57	14.4 ± 6.40	10.6 ± 5.03	13.9 ± 6.60	15.3 ± 7.07
22	Ghosting Ratio (<2.5%)		0.1%	0.2%	0.5%	0.3%	0.6%
23	SNR (no spec)		266	273	209	239	194
	Low Con Detectability						
24	Slice Location #8 1	.4%	8	7	6	7	1
25	Slice Location #9 2	.5%	10	10	9	10	9
26	Slice Location #10 3	.6%	10	10	10	10	10
27	Slice Location #11 5	.1%	10	10	10	10	10
28	Total # of Spokes (>=9)	, -	38	37	35	37	30
	Slice Location #11						
29	Wedge (mm) = +	= -	-1 4	-15	-14	-15	-15
30	Slice Position Error		1.1	1.1	-11.4	0.9	1.2
	-		1.1	1.1	11.1	0.7	1.2

GE Site

Sequence parameters

Coil Used:Head Quad

GE Horizon

Test Date: **7/16/2008**

Test ID 313

Study Descrip tion	Pulse Sequence (ETL)	TR (ms)	TE (ms)	FOV (cm)	Phase Sample Ratio	Number of Slices	Thick- ness (mm)	Slice Gap	NSA (Nex)	Freq Matrix	Phase Matrix	Band Width (kHz)	Scan Time (min:sec)
ACR T1	SE	500	20	25	1	11	5	5	1	256	256	12.4	2:09
	Dual												
ACR PD	Echo SE	2000	20	25	1	11	5	5	1	256	256	15.6	8:32
			r		1					I	r		
ACR T2	Dual Echo SE	2000	80	25	1	11	5	5	1	256	256	10.4	8:32
										r			· ·
Site T1	SE	500	14	24	1	11	5	5	1	256	256	15.6	2:09
r			r			r			i	r	r		r
Site T2	FSE(16)	6000	96.6	24	1	11	5	5	2	256	256	15.6	3:12

Magnet ID: 89

Coil ID: 796

TestID: 313



ACR PD



ACR T2





Site T1



Appendix D: Explanation of RF Coil Testing Report

Introduction

The primary goal of RF coil testing is to establish some sort of base line for tracking coil performance over time. The most common measure is the Signal to Noise Ratio or SNR. In addition, we can look at overall signal uniformity, ghosting level (or better - lack of ghosting) and in the case of phased array coils we look at the SNR of each and every channel and at symmetry between channels. Unfortunately, there is no single best method for measuring SNR. Below I explain the different methods used and the rationale for each.

<u>SNR</u>

One needs to measure the signal in the phantom (either mean or peak or both) and then divide that by the background noise. Measuring the signal is fairly straightforward, the noise can be more problematic. The simplest method is to measure the standard deviation (SD) in the background 'air'. However, MRI images are the magnitude of complex data. The noise in the underlying complex data is Gaussian but it follows a Rician distribution when the magnitude is used. The true noise can be estimated by multiplying the measured SD by 1.526.

During the reconstruction process, most manufacturers perform various additional operations on the images, This could include geometric distortion correction, low pass filtering of the k-space data resulting in low signal at the edge of the images, RF coil intensity correction (PURE, CLEAR, SCIC, etc), and other processing during the combination of phased array data and parallel imaging techniques. All of these methods distort the background noise making it impossible to obtain an accurate (and reproducible) estimate of the image noise in the air region. The alternative is to use a method which I shall refer to as the NEMA (National Electrical Manufacturers Association) method. The signal in the phantom area is a sum of the proton signal and noise. Once the signal to noise ratio exceeds 5:1, the noise in the magnitude image is effectively Gaussian. To eliminate the proton signal, you acquire an image twice and subtract them. The measured SD in the phantom region should now be the true SD times the square root of 2. When determining the SNR using the NEMA method, calculate the mean signal of the average of the two source images then divide by .7071 x the SD measured in the same area as the mean signal.

Unfortunately, this doesn't always work. It is absolutely imperative that the RF channel scalings, both transmit and receive, be identical with both scans. Any ghosting in the system is not likely to repeat exactly for both scans and will cause a much higher SD. Finally, the phantom needs to be resting in place prior to the scan long enough for motion of the fluid to have died down. Depending on the size and shape of the phantom, this could take any where from 5 to 20 minutes.

One of the most common causes of ghosting is vibration from the helium cold-head. The best way to eliminate this artifact is to turn off the cold head, which will increase helium consumption. Because this vibration is periodic, the ghosting is usually of an N over 2 (N/2) nature. The affect inside the signal region of the phantom can be minimized by using a FOV that is twice the diameter of the phantom (measured in the PE direction.) If the noise is to be measured in the air, then be sure to NOT make measurements to either side of the phantom in the PE direction.

Scan parameters also significantly affect measured SNR. For most of the testing performed in this document I used a simple Spin Echo with a TR of 300, a TE of 20 and a slice thickness of 3mm and a receiver BW of 15.6 KHz. The FOV was varied depending on the size of the coil and the phantom used. All of the parameters used for each test can be found on each page immediately below the coil description.

Report Layout

Each page of this report lists the data from a single test. The top third of the page describes the coil and phantom information, followed by the scan parameters used. The middle third contains the numbers measured and calculated results. This section will contain one table if the coil being tested is a single channel coil (i.e. quadrature or surface coils) and two tables if it is a multi-channel phased array coil. The entries in the table will be described further below. The bottom section contains a few lines of comments (if necessary), a picture of the coil with the phantom as used for the testing and one or more of the images that were used for the measurements.

There is usually one image for each composite image measurement and one image for each separate channel measurement. Each image shows the ROI (red line) where the mean signal was measured and two smaller ROIs (green lines) where the signal minimum and maximum was found. In the top left corner of each image is the mean signal in the large ROI. The bottom left corner contains the large ROI's area (in mm²). The top right corner contains two numbers a mean and a standard deviation. If the NEMA method was used, then the top right corner will list the mean and SD of the large ROI (labeled ROI M and ROIsd) applied to the subtraction image. If the noise was measured in the background air the the numbers are labeled Air M and AirSD.

Data Tables

The meaning of most of the entries in the data table are should be self evident with a few exceptions. The first column in each table is labeled "Label". In the composite analysis, this field may be empty or contain some sort of abbreviation to identify some aspect of the testing. Some possibilities are the letter N for NEMA, A for Air, L for Left, R for Right, C for CLEAR, NoC for No CLEAR. In the Uncombined Image table, the label usually contains the channel number or similar descriptor. The column labeled "Noise Type" will be either Air or SubSig which stands for Subtracted Signal, *i.e.* the NEMA method. Both tables contain a column for Mean SNR and Max SNR which are the Mean or Max signal divided by the SD of the noise scaled by either 1.526 (Air) or 0.7071 (NEMA).

Composite Image Table: The final two columns in this table are "Normalized" and "Uniformity". It can be rather difficult to compare the performance of different coils particularly if different scan parameters are used. (Of course, it's even more difficult from one scanner to another.) I have standardized most of my testing to use a spin echo with a TR/TE of 300/20msec and a thickness of 3 mm. The FOV changes to depending on the size of the phantom used although I try to use a FOV that is at least twice the diameter of the phantom as measured in the PE direction. For one reason or another, a change may be made in the scan parameters (either accidentally or intentionally such as turning on No Phase Wrap to eliminate aliasing, etc.). In order to make it easier to compare SNR values I calculate a "Normalized" SNR value. This value is theoretically what the SNR would be if a FOV of 30cm, 256x256 matrix, 1 average, receiver BW of 15.6 KHz and slice thickness of 3mm had been used. Obviously, the final number is affected by the T1/T2 values of the phantoms used as well as details of the coil and magnet field strength but it can be useful in certain situations.

The "Uniformity" value is defined by the ACR as 1 - (max-min)/(max+min). This is most important when looking at volume coils or for evaluating the effectiveness of surface coil intensity correction algorithms (such as PURE, CLEAR or SCIC).

Uncombined Image Table: This table has two columns labeled "% of Mean" and "% of Max". When analyzing multi-channel coils it is important to understand the relationship between the different channels, the inherent symmetry that usually exists between channels. In a 8 channel head or 4 channel torso phased array coil, all of the channels are usually have about the same SNR. These two columns list how the SNR (either Mean or Max) of each channel compares to the SNR of the channel with the maximum value.