### Philips Site Yearly Performance Evaluation Philips Achieva - Gibbons 1.5T 1-Jun-08

#### **Table of Contents**

Summary and Signature Page	2						
Specific Comments							
Site Information							
Equipment Information							
Table Position Accuracy							
Magnetic Field Homogeneity	4						
Slice Thickness Accuracy	4						
Slice Crosstalk	5						
Soft Copy Displays	6						
<b>RF</b> Coil Performance Evaluation							
Coil Inventory List	7						
Body Integrated	8						
Body Synergy	9						
Breast Array (open)	10						
Breast Coil	11						
C1	13						
C3	14						
Carduac	15						
Flex Synergy - Medium	16						
Flex Synergy - Small	17						
Head - Quad	18						
Head Coil (T/R)	19						
Head SENSE - 8 ch	20						
Knee 8ch	21						
Knee/Foot Quad	24						
Neurovascular	26						
Spine Syn Coil	35						
Wrist	38						
Appendix A: Magnet Homgeneity Map	40						
Appendix B: Slice Thickness / Profiles / RF Crosstalk	45						
Appendix C: ACR Phantom Analysis							
Appendix D: Explanation of RF Coil Test Format	60						

Site Name:	Philips Site			MRAP #	
Address:				Survey Date:	6/1/08
City, State, Zip				Report Date:	6/19/08
MRI Mfg:	Philips	Model:	Gibbon	Field:	1.5T
MRI Scientist:	Moriel NessAiver, Ph.D.	Signature:	Moriel,	Ventiver, P.	h.O.
	Equipment Evalu	ation Tests		Pass Fail * N/A	
1.	Magnetic field homogeneit	v:			
2.	Slice position accuracy:				
3.	Table positioning reproduci	ibility:			
4.	Slice thickness accuracy:				
5.	RF coils' performance:				
	a. Volume QD Coils				
	b. Phase Array Coils				
	c. Surface Coils				
6.	Inter-slice RF interference	(Crosstalk):			
7.	Soft Copy Display				
				ass ail * A	
]	Evaluation of Site's Techno	ologist QC Prog	gram	Ĩ Ž Ž	
1.	Set up and positioning accu	racy: (daily)			
2.	Center frequency: (daily)	• /• •• \			
3.	Transmitter attenuation or g	gain: (daily)			
4.	Geometric accuracy measur	rments: (daily)			
5.	Spatial resolution measurer	nents: (daily)			
0. 7	Low contrast detectability:	(dally)			
7.	Head Coll SNK (daily)				
8.	Body Coll SNK (weekly)	ah a atin - 1 1	· (dail-)		
9.	Fast Spin Ecno (FSE/1SE)	gnosting levels	(dally)		
10.	Visual abachlist: (week	ту)			
11.	visual checklist. (weekly)				

Specific Comments and Recommendations
1. Magnet homogeneity is very good.
2. Your soft copy (display console) looks good and there is good agreement between the screen and film.
3. The NVA coil has one dead channel.
4. The Body synergy coil has one channel with very poor SNR.
5. Although all 5 channels of the spine coil are well balanced, the overal SNR is about 20% lower than what I have
come to expect from that coil.
6. I was unable to find the connector for the Breast Array Coil - no testing was performed.
7
8
9
10
11
12
13
NOTE: Please be sure to read appendix D for an explanation of the new format of this document.

Contact			Title Chief Te	ech	Phone		•	eMail				
Equipment	t Inform	ation										
MRI Manı	ufacturer:	Phi	lips	Model:	Achie	va		SN:	13020	_ Software: _	2.5.1.0	
amera Manu	utacturer:	Ag	gta	Model:	Drystar	5500		SN:	4176	_ Software: _		
PACS Manu	utacturer:		hontom Na	Model:	12496			SN:		Software:		
		ACK P	nantom Nul	moer used:	J3486	-						
. Tahle Pa	ositionin	g Reprod	ucibility:								Pass	
Toble motion out/in:			T G	Out/In	Out/In	Out	/In	Out/I	n		-	
	Table mot	ion out/in:	IsoCenter	Out/III		0						
Measur	Table mot ed Phanto	ion out/in: om Center	1.1	1.3	1.36	1.	1	0.82	2			
Measur Commo	Table mot red Phanto ent: ic Field 1	ion out/in: m Center Homogen	1.1	1.3       See append	1.36 lix A for fi	eld plot	1 ts.	0.82	2		PASS	
Measur Comm 2. Magnet	Table mot red Phanto ent: ic Field I CF in 2 15 cm	ion out/in: om Center Homogen 2005: <u>63</u> 20 cm	1:0Center 1.1 eity 8904109 25 cm	See append Thi GRE 5 mm	1.36 lix A for fi s Year CF TR: 500, T skip 5 mn	eld plot <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>63</b> <b>6</b> <b>6</b> <b>6</b> <b>6</b> <b>6</b> <b>6</b> <b>6</b> <b>6</b>	1 ts. 90032 & 15 H 9.3KH	0.82 26 Flip Ang Iz, 256x	CF Cl ;le: 45, F :128, 2ne	nange: <u>-37</u> OV: 40 x	PASS 83	
Measur Commo 2. Magnet	Table mot red Phanto ent: ic Field I CF in 2 15 cm 0.1	ion out/in: om Center Homogene 2005: <u>63</u> 20 cm 0.2	1:0Center 1.1 eity 8904109 25 cm 0.4	See append Thi GRE 5 mm Comm	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot 63 E: 10 &	1 ts. 90032 & 15 F 9.3KH	0.82 26 Flip Ang Iz, 256x	2 CF Cl (le: 45, F (128, 2ne	nange: <u>-37</u> OV: 40 x	PASS 83	
Measur Comm 2. Magnet Axial: Coronal:	Table mot red Phanto ent: ic Field I CF in 2 15 cm 0.1 0.2	tion out/in: om Center Homogene 2005: <u>63</u> 20 cm 0.2 0.2	IsoCenter         1.1         eity         9904109         25 cm         0.4         0.4         0.4	See append Thi GRE 5 mm Comn	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot <u>63</u> E: 10 &	1 ts. 90032 & 15 H 9.3KH	0.82 26 Flip Ang Iz, 256x	2 CF Cl ;le: 45, F :128, 2ne	nange: <u>-37</u> OV: 40 x	PASS 83	
Measur Commo 2. Magnet Axial: Coronal: Sagittal:	Table mot red Phanto ent: ic Field I CF in 2 15 cm 0.1 0.2 0.3	ion out/in: om Center Homogene 2005: <u>63</u> 20 cm 0.2 0.2 0.5	IsoCenter         1.1         eity         9904109         25 cm         0.4         0.4         0.6	See append Thi GRE 5 mm Comm	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot <b>63</b> <b>63</b> <b>E: 10 &amp;</b> <b>1.</b>	1 ts. 90032 2 15 H 9.3KH	0.82 26 Flip Ang Iz, 256x	2 CF Cl ;le: 45, F :128, 2ne	nange: <u>-37</u> OV: 40 x	PASS 83	
Axial: Coronal: Sagittal: Coronal: Coronal: Coronal: Sagittal:	Table mot red Phanto ent: ic Field I CF in 2 15 cm 0.1 0.2 0.3 iickness 2 OV: 250m	ion out/in: om Center Homogene 2005: <u>63</u> 20 cm 0.2 0.2 0.5 Accuracy m M	IsoCenter         1.1         eity         8904109         25 cm         0.4         0.4         0.6         atrix: 256x2	See append Thi GRE 5 mm Comn	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot 63 E: 10 & 5, BW: 9	1 ts. <b>9003</b> 2 <b>2 15 H</b> <b>9.3KH</b>	0.82 26 Flip Ang Iz, 256x	2 CF Cl (le: 45, F (128, 2ne	nange: <u>-37</u> 'OV: 40 x	PASS 83	
Axial: Coronal: Sagittal: Coronal: Sagittal:	Table mot         red Phanto         ent:	ion out/in: m Center Homogene 2005: <u>63</u> 20 cm 0.2 0.2 0.5 Accuracy m M ence	IsoCenter         1.1         eity         3904109         25 cm         0.4         0.4         0.4         0.6         atrix: 256x/         TR	See append Thi GRE 5 mm Comn	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot <b>63</b> <b>63</b> <b>E: 10 &amp;</b> <b>A</b> <b>BW: 9</b> <b>C</b> <b>C</b> <b>C</b> <b>C</b> <b>C</b> <b>C</b> <b>C</b> <b>C</b>	1 ts. <b>90032</b> <b>2 15 H</b> <b>9.3KH</b> om A	0.82	2 CF Cl (le: 45, F (128, 2ne (1128, 2ne) (1128, 2ne) (	ange: <u>-37</u> OV: 40 x All values in 1 % Error	<b>PASS</b> 83	
Axial: Coronal: Sagittal:	Table mot red Phanto ent: ic Field I CF in 2 15 cm 0.1 0.2 0.3 iickness 2 OV: 250m Sequ SE	ion out/in: m Center Homogene 2005: 63 20 cm 0.2 0.2 0.5 Accuracy m M ence E (ACR)	IsoCenter         1.1         eity         3904109         25 cm         0.4         0.4         0.4         0.6         atrix: 256x         TR         500	3           1.3           See append           Thi           GRE           5 mm           Comm	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot E: 10 & BW: 9 ee #1 fro NSA 1	1 ts. <b>9003</b> 2 & 15 H <b>9.3KH</b> <u>om A</u> Ca 5.2	0.82 26 Flip Ang Iz, 256x .CR Pha alc 22	2 CF Cl de: 45, F 128, 2ne (1128, 2ne (1128, 2ne (1128, 2ne) (1128, 2ne) (1128	hange: <u>-37</u> OV: 40 x All values in 1 <u>% Error</u> 4.4%	<b>PASS</b> 83	
Axial: Coronal: Sagittal:	Table mot         red Phanto         ent:         ic Field I         CF in 2         15 cm         0.1         0.2         0.3         sickness J         OV: 250m         SE         SE	ion out/in:         om Center         Homogene         2005:       63         20 cm         0.2         0.2         0.5         Accuracy         m       M         ence         2 (ACR)         (Site T1)	IsoCenter         1.1         eity         8904109         25 cm         0.4         0.4         0.4         0.6         atrix: 256x         TR         500         500	0007111           1.3           See append           Thi           GRE           5 mm           Comm	1.36 lix A for fi s Year CF <b>TR: 500, T</b> skip 5 mm nents:	eld plot <b>63</b> <b>63</b> <b>E: 10 &amp;</b> <b>A</b> <b>BW: 9</b> <b>C</b> <b>C</b> <b>NSA</b> 1 1 1	1 ts. 90032 & 15 I 9.3KH 0.3KH	0.82	2 CF Cl (le: 45, F 128, 2ne 128, 2ne 5 5	All values in 1 <b>% Error</b> 4.4% 3.8%	<b>PASS</b> 83	
Measur Commo 2. Magnet Axial: Coronal: Sagittal: 3. Slice Th FO	Table mot red Phanto ent: ic Field I CF in 2 15 cm 0.1 0.2 0.3 iickness J OV: 250m Sequ SE SE	ion out/in: m Center Homogene 2005: 63 20 cm 0.2 0.2 0.5 Accuracy m M ence E (ACR) (Site T1) (20/80)	IsoCenter         1.1         eity         3904109         25 cm         0.4         0.4         0.4         0.6         atrix: 256x?         TR         500         500         2000	3         3           1.3         3           See append         Thi           GRE         5 mm           Comm         3           256         TE           20         14           20         3	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot E: 10 & b, BW: 9	1 ts. <b>9003</b> 2 <b>2</b> 15 H <b>9.3KH</b> <b>0m A</b> <b>Ca</b> 5.2 5.1 5.2	0.82	2 CF Cl de: 45, F 128, 2ne 128, 2ne Target 5 5 5	All values in 1 <b>% Error</b> 4.4% 3.8% 5.2%	<b>PASS</b> 83	
Axial: Coronal: Sagittal: 3. Slice Th	Table mot red Phanto ent: ic Field I CF in 2 15 cm 0.1 0.2 0.3 iickness J OV: 250m Sequ SE SE SE SE	ion out/in:         om Center         Homogene         2005:       63         20 cm         0.2         0.2         0.2         0.5	IsoCenter         1.1         eity         8904109         25 cm         0.4         0.4         0.4         0.6         atrix: 256x         TR         500         500         2000         2000	Out/III           1.3           See append           Thi           GRE           5 mm           Comm	1.36 lix A for fi s Year CF TR: 500, T skip 5 mm nents:	eld plot 63 E: 10 & BW: 9 E: 10 & NSA 1 1 1 1 1 1 1 1	1 ts. 90032 2 15 H 9.3KH 0.3KH 5.2 5.2 5.2 5.2 5.2	0.82	2 CF Cl (le: 45, F 128, 2ne 128, 2ne 5 5 5 5 5 5 5 5 5	All values in 1 <b>% Error</b> <b>4.4%</b> <b>3.8%</b> <b>5.2%</b> <b>0.6%</b>	<b>PASS</b> <u>83</u> 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 T1 weighted sequences when the slice gap varies from 200% down to 0% (contiguous) using the Transmit/Receive head coil in the low PNS mode. 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 or 30% of the slice thickness, the measured slice profile begins to drop.

All of the slice profiles can be seen in Appendix B.

Sequence Type	TR	TE	FOV (cm <sup>2</sup> )	Matrix	NSA	Thickness	# of slices	Slice Measured
SE	450	15	25	256x256	1	5	11	6

Skip	SE 15
0	4.70
0.2	4.84
0.5	4.92
1	5.07
1.5	5.11
2	5.13
2.5	5.12
5	5.14
10	5.12



# 5. Soft & Hard Copy Displays

 Luminance Meter Make/Model:
 Tektronix J16
 Digital Photometer
 Cal Expires:

Monitor Description: Philips LCD

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	58	45.8	47.8	56.3	52.7		

Uniformity							
MAX	MIN	Percent Delta					
58	45.8	24%					

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

Display looks very good. There is good agreement between film and display.



## **Coil and Other Hardware Inventory List**

Site Name Philips Site

ACR Magnet # \_\_\_\_\_

Nickname Gibbon 1.5T

ctive	Coil Description	Manufacturer	Model	Rev.	Mfg. Date	SN	Channels
<b>[</b> ], E	Body Integrated						1
D E	Body Synergy	Philips	4522 132 1985		Feb, 2005	0002	4
D E	Breast Array (open)	MRI Devices	102273		Aug, 2008	U24223	4
D E	Breast Coil	Philips	4522 131 7224				1
	21	MRI Devices ?	9896 030 02032		Jun, 2004	1897	1
	23	Philips	9896 030 05011		Jun, 2004	1763	1
	Cardiac	Philips	4522 131 5208			CRR80982/1	5
D F	lex Synergy - Medium	Philips	4522 131 31173		Jul, 2004	46826	2
D, F	Flex Synergy - Small	Philips	4522 132 31193		Jul, 2004	47015	2
□⊦	lead - Quad	Philips	4522 031 39009		Aug, 2006	00291	1
□⊦	lead Coil (T/R)	Philips	4522 1313 9529		Jul, 2005	CRR60328	1
□⊦	lead SENSE - 8 ch	Invivo	4522 132 14163		Aug, 2006	000678	8
L. K	Knee 8ch	MRI Devices	4522 132 31072		May, 2004	00015	8
	(nee/Foot Quad	Med Adances	4522 132 14021		Jul, 2005	46097	1
	leurovascular	Invivo	4522 132 31083		Jan, 2007	476	16
	Spine Syn Coil	Philips	4522 132 19874		May, 2007	00148	5
L V	Vrist	Invivo	105003		Sep, 2006	U29656	4

<u> </u>	RF C	oil Per	forman	ce Eval	uation					Test Date	6/	1/2008
	Coil: Body Integrated									Model		
	Mfg.:									Revision		
M	g. Date:			Coil ID:	1704	J				SN		
P	hantom:	32 cm sj	phere								# of Cha	annels <u>1</u>
	Seque SI	ence 1 E 3	R     TI       00     20	E Plane	FOV 53	Nx 256	Ny 256		BW 28.01	NSA T	hickness 5	Gap _
	Coil Mo	de: <u>Q-B</u>	ody									
					Anal	ysis of	Test Ima	age				
			IVI	easured	Back	Noise	Noise	-	C Mean	Normal-	Max	Uni-
	Label	Mean	Max	Min	ground	SD 21.09	Туре	1	SNR	ized	SNR	formity
	A	1,506	1,964	1,232	50.7	28.26	Air		34.9	9.0	45.6	76.8%
								•••••				
			Mean: 15	06	ROI M:	0.08 N	lean: 15	06	Air	M: 50.7	0	
				aller	ROIsd:	31.08			Air	sd: 28.2	6	
									0100			
				01	984				0190			
					012	32			(	1227		
			ROI Area	: 718.46		F	OI Area	: 718	3.46			
						Test Ima	iges					
l												

RF Coil Performance Evaluation         Coil:       Body Synergy         Mfg.:       Philips         Mfg. Date:       2/1/2005         Coil ID:       1702         Phantom:       Large Body Disk         Sequence       TR       TE         SE       300       20       T       53       256         Coil Mode:       SENSE-Body	Test Date:       6/1/2008         Model:       4522 132 1985         Revision:
Analysis of Co	omposite Image
Measured Data	Calculated Results
Back Noise	Noise Mean Normal- Max Uni-
Label         Mean         Max         Min         ground         SD           N         1.086         1.843         418         0.6         3.34	Type         SNR         Ized         SNR         Iommy           NEMA         230.0         59.3         390.2         37.0%
A 1,085 1,838 416 4.1 3.08	Air         230.8         59.5         391.1         36.9%
Analysis of Unc	ombined Images
Measured Data	Calculated Results
Ch         Mean         Max         Noise SD         Noise Type           1         854         1,771         3.82         Air           2         727         1,782         12.73         Air           3         1,142         1,709         4.20         Air           4         863         1,993         4.66         Air	Mean% of MeanMax SNR% of Max146.582%303.8100%37.421%91.730%178.2100%266.688%121.468%280.392%
Channel #2 has 1/4th the SNR of what I would expect. Overall S	SNR is more than 20% lower than other sites.

<b>RF Coil Performance Evaluation</b>	Test Date: 6/1/2008										
Coil: Breast Array (open)	Model: 102273										
Mfg.: MRI Devices											
Mfg. Date: 8/5/2008 Coil ID: 589	SN: U24223										
Phantom: MISSING CONNECTOR - UNABLE TO T	EST # of Channels _4_										
SequenceTRTEPlaneFOVSE30020T53	NxNyBWNSAThicknessGap25625628.0113-										
Coil Mode:											
Analysis o	f Composite Image										
Measured Data	Calculated Results										
Back Label Mean Max Min ground	loise Noise Mean Normal- Max Uni- SD Type SNR ized SNR formity										
	0.0										
Analysis of Uncombined Images											
Measured Data	Calculated Results										
Ch Mean Max SD Type	SNR Mean SNR Max										
	Channel 1 Channel 2										
Composites											
	Channel 3 Channel 4										

<b>RF Coil Performance Evaluation</b>	0.9	Test Date: 6/1/2008									
Coil: Breast Coil		Model: 4522 131 7224									
Mfg.: Philips		Revision:									
Mfg. Date: Coil ID: 552	-	SN:									
Phantom: Two 2 liter bottles		# of Channels1									
SequenceTRTEPlaneFOVSE30020T45	Nx         Ny           256         256	BWNSAThicknessGap28.0115-									
Coil Mode: Breast											
Analysis of Test Image											
Measured Data		Calculated Results									
Back Label Mean Max Min ground	Noise Noise SD Type	Mean Normal- Max Uni- SNR ized SNR formity									
N 1,310 1,996 437 -4.3	3.87 NEMA	239.4 85.5 364.8 35.9%									
A 1,315 2,006 441 2.7	1.82 Air	473.5 169.2 722.3 36.0%									
Mean: 1310 ROI M: -4.31 ROIsd: 3.87 Mean: 1315 Air M: 2.71 Airsd: 1.82 02006 0437 ROI Area: 123.39 BOI Area: 123.39											
	Test Images										
l											

<b>RF Coil Performance E</b>	valuation	0.9		Test Date:	<b>6</b> /1	1/2008					
Coil: Breast Coil	-	1	Lange (	Model:	4522	131 7224					
Mfg.: Philips			-	Revision:							
Mfg. Date: Coil	ID: 552			SN:							
Phantom: <u>Two 2 liter bottles</u>					# of Cha	nnels <u>1</u>					
SequenceTRTEPSE30020	IaneFOVC36	Nx Ny 256 256	BW 28.01	NSA TI	nickness 5	Gap _					
Coil Mode: Breast											
Analysis of Test Image											
Measu	red Data		0	Calculate	d Result	S					
Label Mean Max Mir	Back Noi ground SI	se Noise ) Type	Mean SNR	Normal- ized	Max SNR	Uni- formity					
N 1,742 1,933 1,60	3 -8.3 4.3	5 NEMA	283.2	158.1	314.3	90.7%					
A 1,750 1,943 1,61	1 4.9 2.9	7 Air	386.1	215.6	428.7	90.7%					
Mean: 1742	ROI M: -8.26 ROIsd: 4.35	ROI Area: 5	D Air Air 01611	r M: 4.93 rsd: 2.97							
	Test	Images									

RF Co Coil: Mfg.: Mfg. Date: Phantom: Sequer SE Coil Mod	Il Perf           C1           MRI Devi           6/1/2004           PIQT           nce         TR           300           e:         C1	ormanc ices ?	Coil ID:	544           FOV           45	Nx 256	Ny 256		BW 28.04	Test Date: Model: Revision: SN: NSA TI	  # of Ch hickness 5	'1/2008         030 02032         1897         annels       1         Gap         -		
				Anal	ysis of	Test Ima	ige						
		Me	easured	Data			_	Calculated Results					
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type		Mean SNR	Normal- ized	Max SNR	Uni- formity		
Ν	1,632	1,980	1,096	14.1	4.39	NEMA		262.9	94.0	319.0	71.3%		
A	1,618	1,964	1,086	4.6	2.72	Air		389.8	139.4	473.2	71.2%		
	M	ean: 163 Ol Area:	32 0 1) 257.78	ROI M: ROIsd:	14.11 4.39	Mean: 16 ROI Area	18	Air Air 1086 0 1964	M: 4.55 sd: 2.72				
						uges							

RF Coil P	erforman	ce Eval	uation	- 24	- AND	1	6.	Fact Data:	6/	1/2008
Coil: C3				9	P		as a	Model	9896	
Mfg.: Philip	s			1	1	7		Revision:		
Mfg. Date: 6/1/2	04	Coil ID:	548			1		SN:		1763
Phantom: PIQT									# of Cha	annels <u>1</u>
Sequence	TR TE	E Plane	e FOV	Nx	Ny		BW	NSA T	hickness	Gap
SE	300 20	C	45	256	256		28.04	1	5	
Coil Mode: C	3									
_			Δnal		Tost Ima	ano				
	М	easured	Data	y 515 01	10011110	<u></u>	С	alculate	d Resul	ts
Labol Moa	n Max	Min	Back	Noise	Noise	-	Mean	Normal-	Max	Uni-
N 1,25	6 1,990	650	6.4	3.41	NEMA		260.5	93.1	412.7	49.2%
A 1,24	9 1,981	646	3.8	2.35	Air		348.3	124.5	552.4	49.2%
	Mean: 12 ROI Area	56 01 66 : 256.13	ROI M: ROIsd:	6.38 3.41	Mean: 12 ROI Area	49	Air Air: 0 1981 0 646	M: 3.83 sd: 2.35		
					ages					

RF C	oil Perf	ormand	ce Eval	uation				1	Teet Det		(1/2008
Coil:	: Cardiac				C	BY			Test Dat	e: <u> </u>	2 131 5208
Mfg.:	: Philips	~						~	Revisio	on:	2 101 3200
Mfg. Date:	:		Coil ID:	549					S	N: CR	R80982/1
Phantom	: Body Dis	k		,					_	# of Ch	nannels <u>5</u>
Sequ	ence TF	R TE	Plane	FOV	Nx	Ny		BW	NSA	Thickness	Gap
S	E 30	0 20	Т	53	256	256		28.04	1	5	-
Coil Mode: Cardiac											
Analysis of Composite Image											
		M	easured	Data	Noisa	Noiso	Calculated Results Mean Normal- Max Uni-				
Label	Mean	Max	Min	ground	SD	Туре	Г	SNR	ized	SNR	formity
N A	1,261	1,778	<u>524</u> 521	1.3	2.39	NEMA Air	ŀ	373.1	96.2	526.1	45.5%
A 1,200 1,770 521 2.8 2.01 Air 410.8 105.9 579.0 45.4%											
	84	o o o u ro d	A	nalysis o	of Unco	mbined	Imag	ges (		d Beault	
		easured	Noise	Noise	-		Me	an C	% of		5 % of
Ch	Mean	Max	SD	Type	1		SN		Mean	SNR 120.7	Max
	<u>593</u> 670	1,567	2.39	Air			16	2.6	96%	429.7	93%
3	586	1,765	2.51	Air			153	3.0	91%	460.8	100%
4	726	1,718	3.00	Air			158	8.6	94%	375.3	81%
5	714	1,676	2.94	Air			15	9.1	94%	373.6	81%
Mean: 120	61 ROI M ROIst 0 1778	M: 1.31 Mean d: 2.39	521 0-17	Air M: 2.79 Airsd: 2.01	( Mean: 59 ROI Area Mean: 72	Channel 1 3 Air M: 2 Airsd: 2 1507 C : 294.86 6 Air M: 3 Airsd: 3	2.56 M 2.39 G 67 F 3.23 M 3.00 M	Cł Aean: 670 199 301 Area: : Aean: 714	Air M: 2.7 Airsd: 2.6 O:1697 294.86 Air M: 3.2 Airsd: 2.9	Cha <sup>79</sup> Mean: 586 <sup>777</sup> ROI Area: 2: <sup>28</sup>	annel 3 Air M: 2.69 Airsd: 2.51
HUI Area:	(	Composites	6		ROI Area	01718 : 294.86 Channel 4	109 F	94 ROI Area: : Ch	01878 294.86 nannel 5		

<b>RF Coil Performance Evaluation</b>		Tost Date: 6/1/2008
Coil: Flex Synergy - Medium	off the	Model: 4522 131 31173
Mfg.: Philips		Revision:
Mfg. Date: 7/1/2004 Coil ID: 547		SN: 46826
Phantom: 5 liter bottle		# of Channels 2
Sequence TR TE Plane FOV	Nx Ny	BW NSA Thickness Gap
SE         300         20         T         36	256 256	28.04 1 5 -
Coil Mode: SENSE-Flex-M	_	
Analysis	of Composite Imag	ge
Measured Data	-	Calculated Results
	Noise Noise SD Type	Mean Normal- Max Uni- SNR ized SNR formity
N         1,305         1,590         880         0.6	5.88 NEMA	157.0 87.7 191.2 71.3%
A 1,305 1,592 880 4.6	3.95 Air	216.5 120.9 264.1 71.2%
Analysis o	of Uncombined Ima	ges
Measured Data		Calculated Results
Noise Noise Ch Mean Max SD Type	M( S	ean % of Max % of NR Mean SNR Max
1 608 1,481 2.67 Air	14	9.2 100% 363.5 100%
2 604 1,468 2.68 Air	14	7.7 99% 359.0 99%
Mean: 1305 ROI M: 0.57 Mean: 1305 Air M: ROled: 5.88 Aired	4.59 Mean: 608	Air M: 2.82 Mean: 604 Air M: 2.83
Alisu.	3.95	Airsa: 2.67 Airsa: 2.68
01590 01592	018	36 O 1488
<b>9880</b>		) ( )
		9/481 9/17
ROI Area: 154.07 ROI Area: 154.07	ROI Area: 154.	07 ROI Area: 154.07
Composites	Chai	nnel 1 Channel 2

RF Coil Performance Evaluation         Coil: Flex Synergy - Small         Mfg.:       Philips         Mfg. Date:       7/1/2004       Coil ID: 546         Phantom:       5 liter bottle         Sequence TR TE Plane FOV         SE       300       20         T       36         Coil Mode:       SENSE - Flex- S	Test Date:       6/1/2008         Model:       4522 132 31193         Revision:
	Coloulated Deculta
Measured Data	Laisa Noisa Mean Normal Max Uni
Label Mean Max Min ground	SD Type SNR ized SNR formity
N 1,074 1,561 602 2.4	4.38         NEMA         173.4         96.9         252.0         55.7%           2.27         A:         209.2         116.2         203.2         55.5%
A 1,0/1 1,559 599 3.9	3.37         Air         208.3         116.3         303.2         55.5%
Analysis of Measured Data	Uncombined Images Calculated Results
Noise Noise	Mean % of Max % of
Ch Mean Max SD Type	SNR         Mean         SNR         Max           152.9         94%         509.3         96%
1         120         1305         1100         111           2         458         1,505         1.85         Air	162.2         100%         50%         50%           162.2         100%         533.1         100%
Mean: 1074 BOI M: 2.35 Mean: 1071 Air M: 3	87 Mean: 420 Air M: 1.92 Mean: 459 Air M: 1.95
ROIsd: 4.38       Airsd: 3.3         Image: state of the	37       Airsd: 1.80       Airsd: 1.80         Airsd: 1.80       Airsd: 1.85         074       01595         097       99         ROI Area: 153.81       ROI Area: 153.81
Composites	Channel 1 Channel 2

RF C	oil Perf	orman	ce Eval	uation			6		Test Date:	. 6/	/1/2008
Coil	Head -	Quad					<b>a</b> -	Te	Model	4522	031 39009
Mfg.	Philips								Revision	:	
Mfg. Date	8/1/2006		Coil ID:	545			DE		SN	:	00291
Phantom	ACRPha	ntom								# of Ch	annels <u>1</u>
Sequ SI	ence TF E 30	R TE 00 20	Plane	e FOV 40	Nx 256	Ny 256		BW 28.01	NSA T	hickness 5	Gap _
Coil Mo	ode: Head										
				Anal	ysis of	Test Ima	ige				
		М	easured	Data				C	alculate	ed Resul	ts
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type	-	Mean SNR	Normal- ized	Max SNR	Uni- formity
N	1,880	1,991	1,801	1.2	5.03	NEMA		264.3	119.5	279.9	95.0%
A	1,879	1,989	1,801	8.0	4.52	Air		272.4	123.2	288.4	95.0%
	Mean: 1880 ROI M: 1.23 ROIsd: 5.03 0 1991 0 1991										
					Test Im	ages					
l											

RF Coil Performance Evalu         Coil:       Head Coil (T/R)         Mfg.:       Philips         Mfg. Date:       7/1/2005         Coil ID:       Coil ID:         Phantom:       ACR Phantom         Sequence       TR       TE       Plane         SE       300       20       T         Coil Mode:       Head-H       E       E	uation         Image: Constraint of the second	Ny           256	Test Date:         Model:         Revision:         SN:         BW       NSA         28.04       1	6/1/2008 4522 1313 9529 CRR60328 # of Channels 1 ickness Gap 5 -						
Analysis of Test Image										
Measured	Data		Calculated	I Results						
Label Mean Max Min	Back Noise ground SD	Noise Type	Mean Normal- SNR ized	Max Uni- SNR formity						
N 1,908 1,993 1,829	-0.9 6.13	NEMA	220.1 99.6	229.9 95.7%						
A 1,909 1,993 1,832	8./ 4.88	Air	256.3 116.0	267.6 95.8%						
Mean: 1908         Ø      Ø	ROI M: -0.85 ROIsd: 6.13	lean: 1909 Ol Area: 237 ges	Air M: 8.71 Airsd: 4.88							

RF C	oil Perf	orman	<u>ce Eval</u>	uation		and in	1	1	Test Date:	6/	1/2008
Coil	: Head S	ENSE - 8	8 ch		(	AT	5		Model:	4522	132 14163
Mfg.	: Invivo						11-		Revision:		
Mfg. Date	e: <u>8/1/2006</u>		_ Coil ID:	543	~		1	-	SN:	0	00678
Phantom	: ACR Pha	antom								# of Cha	annels <u>8</u>
Sequ	ence TF	R TE	E Plane	FOV	Nx	Ny		BW	NSA T	hickness	Gap
S	E 30	0 20	) T	40	256	256		28.01	1	5	
Coil Mo	de: SENS	E-Head-8									
				Analysis	— s of Cor	nposite	Imac	Ie			
		Μ	easured	Data				C	alculate	d Resul	ts
L abol	Moan	Max	Min	Back	Noise	Noise		Mean	Normal-	Max	Uni- formity
N	1,171	1,522	872	-0.4	2.35	NEMA	1 [	352.4	159.4	458.0	72.8%
Α	1,171	1,524	871	3.5	2.19	Air	] [	350.4	158.5	456.0	72.7%
Analysis of Uncombined Images											
	M	easured	Data		_			Ca	culated	Results	
Ch	Mean	Мах	Noise SD	Noise Type			Me	an <sup>o</sup>	% of Apan	Max	% of Max
	583	1,538	2.57	Air	]		14	8.7	98%	392.2	89%
2	569	1,563	2.47	Air			15	1.0 1	00%	414.7	94%
3	502	1,512	2.63	Air			12	5.1	83%	376.7	86%
4	552	1,650	2.46	Air			14	7.0	97%	439.5	100%
5	504	1,500	2.68	Air	_		12.	3.2	82%	366.8	83%
6	557	1,608	2.76	Air			13	2.2	88%	381.8	87%
7	512	1,553	2.49	Air	-		13	4.7	89%	408.7	93%
8	543	1,630					13	1.8	87%	395.6	90%
					Cha	nnel 1	Char	nel 2	Channel 3	3 Char	nnel 4
	74 001	M: 0.40 M		A: NA 0 47	Mean: 583	Air M: 2.72 M Airsd: 2.57	lean: 569	Air M: 2.60 N Airsd: 2.47	Mean: 502 Air M Airse	M: 2.79 Mean: 552 d: 2.63	Air M: 2.60 Airsd: 2.46
Mean: 11	ROI	sd: 2.35	an: 1171	Airsd: 2.19		2	6173	0 563	- OHI	6	140
					015	38 9211			9/0	12	91850
	0878	1522	007	01524	BOI Area: 23	5 18 B	OI Area: 235	18 5	OI Area: 235 18	BOI Area: 2	235 18
					Mean: 504	Air M: 2.84 M	lean: 557	Air M: 2.93 N	Mean: 512 Air M	M: 2.64 Mean: 543	Air M: 2.86
					6	Airsa: 2.68	1	Airsd: 2.76	Airs	0: 2.49	Airsa: 2.70
<b>BOI</b> Area	: 235.18	BO	Area: 235.18						01553	71	
						0157		<b>P2</b> 31			0.1530
		Composite	es		ROI Area: 23	5.18 R	OI Area: 235	.18 F	ROI Area: 235.18	ROI Area: 2	235.18
					Cha	nnel 5	Char	inel 6	Channel	7 Char	nnel 8

RF Coil Performance Evaluation         Coil:       Knee 8ch         Mfg.:       MRI Devices         Mfg. Date:       5/1/2004       Coil ID: 553         Phantom:       Bottle         Sequence       TR       TE       Plane       FOV         SE       300       20       T       25         Coil Mode:       SENSE-Knee-8 Port A	Test Date: _ Model: _ Revision: _ SN: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	6/1/2008         4522 132 31072         00015         # of Channels       8         ckness       Gap         5       -								
Measured Data	or composit		Calaulatad	Desults						
			Calculated	Results						
Label Mean Max Min ground	Noise Noise SD Type	SNR	ized	SNR formity						
N 1,140 1,470 797 0.2	3.66 NEM	A 220.3	190.3	284.0 70.3%						
A 1,140 1,470 796 4.5	3.41 Air	219.1	189.3	282.5 70.3%						
Analysis of Uncombined Images										
Measured Data		C	alculated R	lesults						
Noise Noise Ch Mean May SD Type		Mean	% of Moon	Max % of						
			-							
	Channel 1	Channel 2	Channel 3	Channel 4						
Mean: 1140 ROI M: 0.18 Mean: 1140 Air M: 4.51										
O 797										
01:170										
ROI Area: 92.65 ROI Area: 92.65										
Composites										
	Channel 5	Channel 6	Channel 7	Channel 8						

RF Coil Performance Evaluation         Coil: Knee 8ch         Mfg.:       MRI Devices         Mfg. Date:       5/1/2004       Coil ID: 553         Phantom:       Bottle         Sequence       TR       TE       Plane       FOV         SE       300       20       T       30         Coil Mode:       SENSE-Knee-8 Port A&B	Nx         Ny         BW         NSA         Thickness         Gap           1         5         -							
Analysis o	of Composite Image							
Measured Data	Calculated Results							
Back I Label Mean Max Min ground	Noise Noise Mean Normal- Max Uni- SD Type SNR ized SNR formity							
N         1,152         1,413         812         0.9	2.47         NEMA         329.8         197.9         404.6         73.0%           2.46         124.6<							
A 1,151 1,412 812 4.0	2.46 Air 306.6 184.0 376.1 73.0%							
Analysis of	Uncombined Images							
Measured Data         Ch       Mean       Max       SD       Noise         SD       Type         SD       SD       SD         SD       SD <td< td=""><td>Mean       % of       Max       % of         SNR       Mean       SNR       Max         Image: SNR       Image: SNR       Image: SNR       Image: SNR         Image: SNR       Image: SNR       Image: SNR       Image: SNR       Image: SNR         Image: SNR       Image: SNR       Image: SNR       Image: SNR       Image: SNR       Image: SNR         Image: SNR</td></td<>	Mean       % of       Max       % of         SNR       Mean       SNR       Max         Image: SNR       Image: SNR       Image: SNR       Image: SNR         Image: SNR       Image: SNR       Image: SNR       Image: SNR       Image: SNR         Image: SNR       Image: SNR       Image: SNR       Image: SNR       Image: SNR       Image: SNR         Image: SNR							
balanced.								
Mean: 1152       FOI M: 0.88 ROIsd: 2.47       Mean: 1151       Air M: 4.00 Airsd: 2.46         Image: Composites       Image: Composites       Image: Composites         Composites       Channel 5       Channel 6       Channel 7								
	Channel 5 Channel 6 Channel 7 Channel 8							

RF Coil Performance	Evaluation		Con la	-	Test Date:	6/1	/2008		
Coil: Knee 8ch	61	Test Date:	Model: 4522 132 31072						
Mfg.: MRI Devices	Mfg.: MRI Devices								
Mfg. Date: 5/1/2004 Co	FIL	SN:	00	0015					
Phantom: Bottle					-	# of Cha	nnels <u>8</u>		
Sequence TR TE	Plane FOV	Nx	Ny	BW		hickness	Gap		
SE 300 20	T 30	256	256	15.6	1	5	-		
Coil Mode: <u>SENSE-Knee-8 Port</u>	A&B								
	Analy	vsis of	Test Ima	ae					
Meas	ured Data			J-	Calculate	d Result	s		
lahel Mean Max M	Back Bin ground	Noise	Noise	Mean	Normal- ized	Max SNR	Uni- formity		
N ptA         1,152         1,413         8	12 0.9	2.47	NEMA	329.8	197.9	404.6	73.0%		
A ptA 1,151 1,412 8	12 4.0	2.46	Air	306.6	184.0	376.1	73.0%		
N ptB 1,149 1,406 8	10 0.3	2.51	NEMA	323.7	194.2	396.2	73.1%		
A ptB 1,148 1,406 8		2.43	Air	309.6	185.8	379.2	73.1%		
······		Test In	nanes						
Mean	: 1152 ROI ROIs	M: 0.88 sd: 2.47	Mean: 115	1 Air M Airs	M: 4.00 d: 2.46				
	0812			0812					
	01416			0:1412					
ROLA	rea: 89.24		ROI Area:	89.24					
Mean	: 1149 ROI ROIs	M: 0.28 sd: 2.51	Mean: 114	8 Air M Airs	M: 3.98 d: 2.43				
ROIsd: 2.51 Airsd: 2.43									

RF Co Coil: Mfg. Date: Phantom: Seque SI Coil Mo	RF Coil Performance Evaluation         Coil:       Knee/Foot Quad         Mfg.:       Med Adances         Mfg. Date:       7/1/2005         Coil ID:       551         Phantom:       Breast Bottle in Knee, Wrist Bottle in foot         Sequence       TR         TE       Plane         FOV       Nx         Ny       BW         SE       300         20       T         40       256         256       28.04         1       5         -         Coil Mode:         Knee-Foot										
				Anal	ysis of	Test Ima	ige				
		Μ	easured	Data				(	Calculate	ed Result	s
Label	Mean	Max	Min	Back ground	Noise SD	Noise Type		Mean SNR	Normal- ized	Max SNR	Uni- formity
N ft	1,754	2,001	1,671	-1.9	2.82	NEMA	Γ	439.9	199.0	501.8	91.0%
N kn	1,255	1,351	1,148	-1.3	3.00	NEMA		295.9	133.9	318.5	91.9%
A ft	1,756	2,003	1,673	4.6	2.73	Air		421.5	190.7	480.8	91.0%
A kn	1,256	1,351	1,149	4.6	2.73	Air		301.5	136.4	324.3	91.9%
					Test Ir	nages					
	Mean: 1754 ROI M: -1.93 ROIsd: 2.82 02001 01671 01671 01351 0148 ROI M: -1.32 ROIsd: 3.00										
	ROI Area: 35.68 Mean: 1756 Air M: 4 Airsd: 2. 02003 01673 ROI Area: 35.68						81.51	Air M: Airsd: 01351 01149	4.59 2.73		

RF Coil Performance Evaluation         Coil:       Knee/Foot Quad         Mfg.:       Med Adances         Mfg. Date:       7/1/2005         Coil ID:       551         Phantom:       Breast Bottle in Knee, Wrist Bottle in foot         Sequence       TR         TE       Plane         FOV       Nx         Ny       BW         NSA       Thickness         Gap         SE       300         20       S         40       256         256       28.04         2       5         -								
	Analy	 ysis of 1	Fest Ima	ge				
м	easured Data			<u> </u>	Calculate	ed Results		
	Back	Noise	Noise	Mear	Normal-	Max Uni-		
Label Mean Max	Min ground	SD	Туре	SNR 564 A		SNR formity		
N kn 1,056 1,336	619 -1.6	2.05	NEMA	317.8		402 1 63 3%		
A ft 1.639 1.956	1.550 2.7	1.81	Air	593.4	189.9	708.2 88.4%		
A kn 1,058 1,338	620 2.6	1.79	Air	387.3	123.9	489.8 63.3%		
		Test Im	ages					
M	lean: 1636 ROI ROI	M: -2.42   sd: 2.05	Mean: 105	6 RO RO	l M: -1.64 Isd: 2.35			
ROIsd: 2.05 0 19531 548								
	OI Area: 37.79		ROI Area:	197.28				
Mean: 1639       Air M: 2.69       Mean: 1058       Air M: 2.64         Airsd: 1.81       Airsd: 1.79         Image: Original 550       Image: Original 550         ROI Area: 37.79       ROI Area: 197.28								

RF Coil Performance Evaluation	Test Date: 6/1/2008							
Coil: Neurovascular	Model: 4522 132 31083							
Mfg.: Invivo	Revision:							
Mfg. Date: 1/1/2007 Coil ID: 555	SN: 476							
Phantom: Invivo NVA Phantom	# of Channels 16							
SequenceTRTEPlaneFOVNxNSE30020T362562	byBWNSAThicknessGap5628.0115-							
Coil Mode: <u>a SENSE-NV-16 Head 1,2,3,4,5,6</u>	to Imaga							
Measured Data	Calculated Results							
Back Noise Noise Ture	e Mean Normal- Max Uni- SNR ized SNR formity							
N         1,729         1,861         1,530         -0.5         4.41         NEM	A         277.3         154.8         298.4         90.2%							
A         1,729         1,861         1,530         5.0         3.04         Air	372.7 208.1 401.2 90.2%							
Analysis of Uncombine	ed Images							
Measured Data	Calculated Results							
Noise Noise Ch Mean Max SD Type	Mean % of Max % of SNR Mean SNR Max							
1 743 1,731 5.06 Air	96.2 61% 224.2 62%							
2 784 1,784 3.25 Air	158.1         100%         359.7         100%           106.3         679/         253.7         719/							
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
5 755 1,724 3.29 Air	150.4 95% 343.4 95%							
6 731 1,660 5.47 Air	87.6 55% 198.9 55%							
I believe this coil actually has 8 elements. Two are combined to make channel 2 and two are combined to make channel 5 which is why these two channels are higher than the other 4.								
	Channel 1 Channel 2 Channel 3							
Mean: 1729 ROI M: -0.53 Mean: 1729 Air M: 5.00 ROIsd: 4.41 Airsd: 3.04	Mean: 743 Air M: 5.40 Mean: 784 Air M: 3.45 Mean: 691 Air M: 4.53 Airsd: 5.06 Airsd: 3.25 Airsd: 4.26							
	250 Ct784							
	0,649							
01530	HOI Area: 182.48         FIOI Area: 182.48         FIOI Area: 182.48           Mean: 716         Air M: 4.56         Mean: 755         Air M: 5.57           Air M: 4.90         Aired: 5.47         Aired: 5.47							
Nicht, 78       Nicht, 78       Nicht, 73       Nicht, 73								
Composites	Channel 4 Channel 5 Channel 6							

<b>RF Coil Performance Evaluation</b>	Test Date: 6/1/2008							
Coil: Neurovascular	Model: 4522 132 31083							
Mfg.: Invivo	Revision:							
Mfg. Date: <u>1/1/2007</u> Coil ID: <u>555</u>	SN: 476							
Phantom: Invivo NVA Phantom	# of Channels 16							
Sequence TR TE Plane FOV	Nx Ny BW NSA Thickness Gap							
SE         300         20         S         53	<u>256</u> <u>256</u> <u>28.01</u> <u>1</u> <u>5</u> <u>-</u>							
Coil Mode: b SENSE-NV-16 All Channels 1-8 PtA	<u>A</u>							
Analvsis	of Composite Image							
Measured Data	Calculated Results							
Back Label Mean Max Min ground	Noise Noise Mean Normal- Max Uni- SD Type SNR ized SNR formity							
N         1,172         1,714         314         -0.4	2.00         NEMA         414.4         106.8         606.1         31.0%							
A 1,172 1,714 313 3.5	2.44         Air         314.8         81.1         460.3         30.9%							
Analysis o	of Uncombined Images							
Measured Data	Calculated Results							
Noise Noise Ch Mean Max SD Type	Mean % of Max % of SNR Mean SNR Max							
1 487 1,635 2.53 Air	126.1         77%         423.5         86%							
2 662 1,818 2.64 Air	<u>164.3</u> <u>100%</u> <u>451.3</u> <u>92%</u>							
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
6 539 1.659 3.35 Air	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
7 458 1,723 3.35 Air	89.6 55% 337.0 69%							
8 649 1,998 5.22 Air	81.5 50% 250.8 51%							
This is a 16 channel coil. Here are channels 1-8 and the.	composites while attached to Port A							
	Channel 1         Channel 2         Channel 3         Channel 4           Mean: 487         Air M: 2.70         Mean: 662         Air M: 2.83         Mean: 475         Air M: 2.71         Mean: 427         Air M: 2.31							
Mean: 1172 ROI M: -0.37 Mean: 1172 Air M: 3.54	Airsd: 2.53         OTB/gsd: 2.64         Airsd: 2.53         Airsd: 2.14							
	Image:							
ROI Area: 359.59 Composites	Mean: 610         Air M: 2.93         Mean: 539         Air M: 3.58         Mean: 458         Air M: 3.58         Mean: 649         Air M: 5.61           Or Airpd: 2.73         Or Airpd: 2.73         Or Bib         Aird: 3.35         Or 1723         Or 998         Or 998           ROI Area: 359.59							
	Channel 5 Channel 6 Channel 7 Channel 8							

<b>RF Coil Performance Evaluation</b>	15 L								
Coil: Neurovascular	1 SLAC	Model:							
Mfg.: Invivo		Revision:							
Mfg. Date: <u>1/1/2007</u> Coil ID: 555		SN: 476							
Phantom: Invivo NVA Phantom		# of Channels 16							
SE         300         20         S         53	SE     300     20     S     53     256     28.01     1     5     -								
Coil Mode: <u>c SENSE-NV-16 All</u> Channels 9-16 PtA	-								
Analysis	of Composite Image								
Measured Data		Calculated Results							
Label Mean Max Min ground	Noise Noise Mea SD Type SNF	n Normal- Max Uni- R ized SNR formity							
		0.0							
	Uncombined Images								
Measured Data	U U	Calculated Results							
Noise Noise Ch Mean Max SD Type	Mean	% of Max % of							
9 542 1,667 3.71 Air	95.7	Intern         Strik         Max           100%         294.4         98%							
10         628         1,992         4.85         Air	84.9	89% 269.1 89%							
11 516 1,540 9.47 Air	35.7	37% 106.6 35%							
12 706 1,610 115.68 Air	4.0								
13 433 1,563 8.39 Air	33.8								
14 60/ 1,652 8.95 Air	44.4	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	<u>69.5</u>	$\frac{12\%}{530/}$ $\frac{301.7}{155.2}$ $\frac{100\%}{510/}$							
10 309 1,010 7.07 All	30.3	55 % 155.5 51 %							
This is a 16 channel coil. Here are channels 9-16 while a	tached to Port A. Channel 12 is	DEAD							
	Channel 1 Channel 2	Channel 3 Channel 4							
Mean: 542       Air M: 5.38         Airsd: 3.71         Airsd: 3.71         01667         01992         628         ROI Area: 359.59									
	Mean: 433 Air M: 6.98 Mean: 607 Air M: 5 Airsd: 8.39 C145 ROI Area: 359.59 ROI Area: 359.59	.59         Mean: 364         Air M: 3.65         Mean: 589         Air M: 8.20           .95         Airsd: 3.44         Airsd: 3.44         Airsd: 7.67           62         6109         B18           ROI Area: 359.59         ROI Area: 359.59         ROI Area: 359.59							
Composite	Channel 5 Channel 6	Channel 7 Channel 8							

RF Coil Performance Evaluation         Coil: Neurovascular         Mfg.:       Invivo         Mfg. Date:       1/1/2007       Coil ID: 555         Phantom:       Invivo NVA Phantom         Sequence       TR       TE       Plane       FOV         SE       300       20       C       53         Coil Mode:       d SENSE-NV-16 All Channels 1-8 PtA	Image: Nx       Ny       BW       NSA       Thickness       Gap         1       5       -	  <u>16</u> ]						
Analysis	of Composite Image							
Measured Data	Calculated Results							
Back Label Mean Max Min ground	Noise Noise Mean Normal- Max Uni- SD Type SNR ized SNR formity							
N 1,163 1,591 504 0.0	1.96 NEMA 419.6 108.1 574.1 48.1%	]						
A         1,163         1,590         504         3.3	2.49         Air         306.1         78.8         418.4         48.1%							
Analysis of								
Measured Data	Calculated Results							
Ch         Mean         Max         SD         Noise Type           1         668         1,803         4.08         Air           2         448         1,597         1.82         Air           3         664         1,839         3.75         Air           4         691         1,810         3.83         Air	Mean         % of SNR         Max Mean         % of SNR         Max Max         % of Max           107.3         67%         289.6         50%           161.3         100%         575.0         100%           116.0         72%         321.4         56%           118.2         73%         309.7         54%							
5         449         1,587         1.89         Air           6         707         1,796         4.33         Air           7         898         2,001         (.51)         Air	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$							
7         888         2,001         6.51         Air           8         321         1.370         2.04         Air	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	-						
This is a 16 channel coil. Here are channels 1-8 and the composites.								
	Channel 1 Channel 2 Channel 3 Channel 4	7						
Mean: 1163       ROI M: 0.01       Mean: 1163       Air M: 3.28         POlsd: 1.96       01591         01591       01590         0504       0107         ROI Area: 345.67       ROI Area: 345.67         ROI Area: 345.67       ROI Area: 345.67         ROI Area: 345.67       ROI Area: 345.67         Mean: 449       Air M: 2.14         Mean: 707       Air M: 4.65         Mean: 388       Air M: 6.98         Airsd: 1.88       Mean: 707         Or Mean: 888       Air M: 6.91         Airsd: 1.89       Mean: 707         Or Mean: 888       Air M: 6.98         Airsd: 1.89       Mean: 707								
ROI Area: 345.67 ROI Area: 345.67 Composites	O1 Area: 345.67         ROI Area: 345.67         ROI Area: 345.67         ROI Area: 345.67           Channel 5         Channel 6         Channel 7         Channel 8							

<b><u>RF Coil Performance Evaluation</u></b>									
Coil: Neurovascular	Test Date: 0/1/2008								
Mfg.: Invivo	Model: 4322 132 31063								
Mfg. Date: 1/1/2007 Coil ID: 555	SN: 476								
Phantom: Invivo NVA Phantom	Phantom: Invivo NVA Phantom # of Channels 16								
Sequence         IX         IZ         Plane         IOV         IX         IV         IV           SE         300         20         C         53         256         256         28.01	SequenceIRIEPlanePOVNXNyBWNSAInicknessGapSE $300$ $20$ C $53$ $256$ $256$ $28.01$ 1 $5$ $-$								
Coil Mode: <u>e SENSE-NV-16 All</u> Channels 9-16 PtA									
Analysis of Composite Image									
Measured Data	Calculated Results								
Back Noise Noise Mea Label Mean Max Min ground SD Type SNF	n Normal- Max Uni- ized SNR formity								
	0.0								
Measured Data	Calculated Results								
Noise Noise Mean	% of Max % of								
ChMeanMaxSDTypeSNR998719976.88Air94.0	Mean SNR Max								
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$								
11 528 1,627 10.02 Air 34.5	37% 106.4 33%								
12 747 1,625 125.74 Air 3.9	<b>4% 8.5 3%</b>								
13 489 1,655 11.04 Air 29.0	31% 98.2 30%								
14         415         1,770         4.85         Air         56.1	60% 239.2 73%								
15 790 1,992 11.58 Air 44.7	48% 112.7 34%								
16         430         1,853         5.05         Air         55.8	59%         240.5         73%								
This is a 10 channel coll. Here are channels 9-10. Channel 12 is DEAD									
Channel 1 Channel 2	Channel 3 Channel 4								
Mean: 997 Air M 7.39 Mean: 344 Air M 3	Of         Mean: 528         Air M: 10.74         Mean: 747         Air M: 135.44           06         Minuti 10.074         Mean: 747         Air M: 135.44								
9208     Airsd: 6.88     Airsd: 2.70     Airsd: 10.02     9192/listsd: 125.7-       997     91348     91348     912/listsb     11389									
ROI Area: 345.67 ROI Area: 345.67	ROI Area: 345.67 ROI Area: 345.67								
Mean: 489         Air M: 11.79         Mean: 415         Air M: 5.19         Mean: 790         Air M: 12.38         Mean: 430         Air M: 5.42           Airsd: 11.04         Airsd: 11.04         Airsd: 4.85         Airsd: 11.58         C1111         C30           C1022         C1022         C1022         C1022         C1022         C1022         C1022         C1022         C1022         C1022									
ROI Area: 345.67 ROI Area: 345.67	ROI Area: 345.67 ROI Area: 345.67								
Composite Channel 5 Channel 6	Channel 7 Channel 8								

E	RF Co	<u>oil Perf</u>	ormano	ce Eva	<u>luation</u>		17-			Test Date:	6/	1/2008
	Coil	Neurov	ascular			7	TK	6	T	Model:	4522	132 31083
	Mfg.	Invivo							7	Revision:		
Mf	g. Date	1/1/2007		Coil ID	: 555		7	Y	1	SN:		476
Ph	antom	: <u>Invivo N</u>	VA Phanto	m	, <u> </u>						# of Cha	annels <u>16</u>
Ιг	Sogur		) те	Blon		Ny	Nhz		D\\/		hiaknaaa	Gan
	Seque		$\begin{array}{c c} \hline \\ \hline \\ 0 \end{array}$ 20			256	256	ר	28.01		5	
L											<b>_</b>	
0	Coil Mo	de: <u>f SEN</u>	SE-NV-16	All Chan	nels 1-8 Ptl	3						
					Analysis	s of Coi	mposite	Ima	ge			
			M	easurec	l Data				(	Calculate	d Resul	ts
	Label	Mean	Max	Min	Back ground	Noise SD	Noise Type		Mean SNR	Normal- ized	Max SNR	Uni- formity
[	N	1,175	1,712	316	-0.0	2.09	NEMA		397.6	102.4	579.3	31.2%
	Α	1,175	1,712	316	3.8	2.42	Air		318.2	82.0	463.6	31.2%
	Analysis of Uncombined Images											
		M	easured	Data					Ca	lculated	Results	
-	Ch	Maan	Max	Noise	Noise	-		M	ean	% of	Max	% of
	1	488	1,638	2.50	Air	1		12	7.9	80%	429.4	<b>Max</b> 89%
	2	664	1,824	2.73	Air			15	9.4	100%	437.8	91%
	3	476	1,581	2.54	Air			12	2.8	77%	407.9	85%
	4	427	1,595	2.17	Air			12	8.9	81%	481.7	100%
	5	612	1,762	2.71	Air			14	8.0	93%	426.1	88%
	6	540	1,655	3.34	Air			10	5.9	66%	324.7	67%
	7	455	1,710	3.40	Air			8	7.7	55%	329.6	68%
	8	648	1,994	5.16	Air			8	2.3	52%	253.2	53%
Th	uis is a 1	6 channel	coil. Here a	ire channel	s 1-8 and the	composit	tes while att	ached	to Port B.			
								<u>.</u> .		<u>.</u>		
						Cha Mean: 488	Air M: 2.69 M	Chai ean: 664	nnel 2 Air M: 2.97	Channel 3 Mean: 476 Air M	3 Char M: 2.71 Mean: 427	Air M: 2.36
	Mean: 11	75 ROI	M: -0.04 Mea	n: 1175	Air M: 3.84	6	Airsd: 2.50		OTBOTSd: 2.73	Airso 0158	d: 2.54 31	Airsd: 2.17 01595
		07701	sd: 2.09	0	Aigsd: 2.42			)				
					/	1	013	- 70	20	5	(	- A
	U         U <thu< th=""> <thu< th=""> <thu< th=""> <thu< th=""></thu<></thu<></thu<></thu<>											
						Mean: 612	Air M: 2.90 M	ean: 540	Air M: 3.58 Airsd: 3.34	Mean: 455 Air M	M: 3.61 Mean: 648 d: 3.40	Air M: 5.56 Airsd: 5.16
		0316		0316		(		0	1655	()	(	$\langle \rangle$
	ROI Area	: 359.85	ROI	Area: 359.85			012			01710		0 994
_			Composite			(	J	ſ		$\bigcirc$	6	$\bigcirc$
				-		ROI Area: 35	annel 5	Ol Area: 35 Chai	nnel 6	Rol Area: 359.85	ROLArea: 3	359.85 Anel 8
1						016		Und				

<b>RF Coil Performance Evaluation</b>	1	Test Date: 6/1/2008							
Coil: Neurovascular	15KA	Model: 4522 132 31083							
Mfg.: Invivo		Revision:							
Mfg. Date: 1/1/2007 Coil ID: 555		SN: 476							
Phantom: Invivo NVA Phantom		# of Channels6							
Sequence TR TE Plane FOV Nx Ny BW NSA Thickness Gap									
SE         300         20         S         53	256 256 28.0	1 5 -							
Coil Mode: g SENSE-NV-16 All Channels 9-16 Pr	Coll Modo: a SENSE NV 16 All Channels 0 16 DtP								
Analysis	of Composite Image								
Measured Data		Calculated Results							
Back Label Mean Max Min ground	Noise Noise Me SD Type SM	an Normal- Max Uni- IR ized SNR formity							
		0.0							
LAnalysis of	of Uncombined Images								
Measured Data		Calculated Results							
Noise Noise Ch Mean Max SD Type	Mean	% of Max % of Max							
9 543 1,667 3.73 Air	95.4	100% 292.9 99%							
10         629         1,994         4.90         Air	84.1	88% 266.7 90%							
11 517 1,541 9.44 Air	35.9	38% 107.0 36%							
12 746 1,598 117.18 Air	4.2	<b>4% 8.9 3%</b>							
13 434 1,565 8.47 Air	33.6	35% 121.1 41%							
14 606 1,651 8.99 Air	44.2	46% 120.3 41%							
15 364 1,581 3.49 Air	68.3	72% 296.9 100%							
16 585 1,809 7.69 Air	49.9	52% 154.2 52%							
This is a 16 channel coil. Here are channels 9-16 while There is no difference between port A and B.	attached to Port B. Channel 12.	is DEAD							
	Channel 1 Channel	2 Channel 3 Channel 4							
	Mean: 543         Air M: 4.00         Mean: 629         Air M           Airsd: 3.73         Airsd: 3.73         Airsd: 3.73         Airsd: 3.73           0         1667         0         1994           533         ROI Area: 359.85         ROI Area: 359.85         ROI Area: 359.85           Mean: 434         Air M: 9.05         Mean: 606         Air M	E 3.26 Mean: 517 Air M: 10.07 Mean: 746 Air M: 126.3- Airsd: 9.44 Airsd: 17.18 Airsd: 17.7 Airsd: 17.6 Airsd: 17.							
Composite	ROI Area: 359.85         ROI Area: 359.85           Channel 5         Channel	61         62         61           ROI Area: 359.85         ROI Area: 359.85           6         Channel 7         Channel 8							

RF Coil Performance Evaluation         Coil:       Neurovascular         Mfg.:       Invivo         Mfg. Date:       1/1/2007         Coil ID:       555         Phantom:       Invivo NVA Phantom         Sequence       TR       TE       Plane       F         SE       300       20       C       55	ON     Image: Second state s	Ny 256	BW         28.01	Test Date: Model: Revision: SN: - NSA TI	6/ 4522 # of Cha hickness 5	1/2008 132 31083 476 annels <u>16</u> Gap -		
Coil Mode: <u>h SENSE-NV-16 All Channels 1-</u> Anal Measured Data Label Mean Max Min grou N 1,157 1,581 502 0.2 A 1,157 1,582 502 3.2	8 PtB ysis of Co k Noise nd Sp 1.96 2.45	Noise Type NEMA Air	Mean SNR 417.5 309.5	Calculate Normal- ized 107.5 79.7	d Result Max SNR 570.5 423.1	Uni- formity 48.2%		
Analys           Measured Data           Ch         Mean         Max         SD         No           1         669         1,805         4.07         A           2         447         1,595         1.91         A           3         664         1,838         3.84         A           4         691         1,810         3.96         A           5         450         1,588         1.96         A           6         704         1,790         4.30         A           7         886         1,997         6.56         A           8         321         1,368         1.95         A	sis of Unco	ombined I	Mean         C.           Mean         NR           107.7         153.4           113.3         114.3           150.5         107.3           88.5         107.9	alculated % of Mean 70% 100% 74% 75% 98% 70% 58% 70%	Max           SNR           290.6           547.2           313.7           299.5           530.9           272.8           199.5           459.7	% of Max 53% 100% 57% 55% 97% 50% 36% 84%		
Men: 1157 FOIM: 0.21 FOISI 1.50 FOISI 2.50 FOISI 2.50 FOISI 2.50Men: 1157 FOIM: 0.21 FOISI 2.50 FOISI 2.50Men: 1157 FOIM: 0.21 FOISI 2.50Men: 1157 FOIM: 0.21 FOISI 2.50Channel 1Channel 2 FOIM: 0.21 FOIDI 2.50Channel 4Men: 1157 FOIM: 0.21 FOISI 2.50Men: 1157 FOIM: 0.21 FOIDI 2.50Men: 1157 FOIM: 0.21 FOIDI 2.50Men: 1157 FOIM: 0.21 FOIDI 2.50Channel 3Channel 4Men: 1157 FOIM: 0.21 FOIDI 2.50Men: 1157 FOI FOIDI 2.50 FOIDI 2.50Men: 1157 FOIDI 2.50 								

RF C Coil: Mfg.: Mfg. Date: Phantom: Seque Si Coil Mc	Oil Perf         Neurov:         Invivo         Invivo         1/1/2007         Invivo NV         ence         F         30         ode:         i SEN	Ormano ascular VA Phanto R TE 0 20 SE-NV-16	Coil ID: m Plane C All Chann	555 555 FOV 53 els 9-16 Pt Analysis	Nx       I         256       2         B       s of Composition	Ay BW 256 28.01	Test Date: Model: Revision: SN: 	6/1/2008 4522 132 31083 476 # of Channels <u>16</u> hickness Gap 5
		M	easured	Data	Noice Noic			d Results
Label	Mean	Max	Min	ground	SD Typ			SNR formity
							0.0	
			Α	nalysis	of Uncombin	ed Images		
	M	easured	Data		_		Calculated I	Results
Ch 1 2 3 4 5 6 7 8	Mean 987 347 527 777 490 417 793 429	Max 2,000 1,357 1,614 1,644 1,661 1,773 1,997 1,856	Noise SD 6.89 2.87 9.91 132.28 10.97 4.77 11.71 5.04	Noise Type Air Air Air Air Air Air Air Air		Mean SNR 93.9 79.2 34.8 38 29.3 57.3 44.4 55.8	% of Mean 100% 84% 37% 4% 31% 61% 47% 59%	Max         % of           SNR         Max           190.2         61%           309.8         100%           106.7         34%           8.1         3%           99.2         32%           243.6         79%           111.8         36%           241.3         78%
	Com	posite			Channel 1 Mean: 997 Air M: 7.4 210 Area: 345.66 Mean: 490 Air M: 111 Air M: 124 Air M	Channel 2 Mean: 347 Air M: 3 Air M: 3 10 10 10 10 10 10 10 10 10 10	Channel 3 44 87 Air M: Air M: Air M: Air M: Col Area: 345.66 10 Air M: Air M	Channel 4 10.64 Mean: 777 Air M: 142.8 19.91 Mean: 777 Air M: 142.8 19.91 Air M: 14.91 Air M:

RF Coil Performance Evaluation         Coil Spine Syn Coil         Mfg.       Philips         Mfg. Date:       5/1/2007       Coil ID:       550         Phantom:       Body Disk         Sequence       TR       TE       Plane       FOV         SE       300       20       S       53         Coil Mode: SENSE-Spine 1.2	Nx         Ny         BW           256         256         28.04	Test Date:       6/1/2008         Model:       4522 132 19874         Revision:					
Analysis	- of Composite Image						
Measured Data		Calculated Results					
Back	Noise Noise Mean	Normal- Max Uni-					
Label         Mean         Max         Min         ground           N         663         1.189         285         0.2	3.07 NEMA 152.7	39.4 273.9 38.7%					
A 663 1,180 284 1.8	1.49 Air 291.6	75.2 519.0 38.8%					
Analysis of	f Uncombined Images						
Measured Data	C C	alculated Results					
Noise Noise Ch Mean Max SD Type	Mean	% of Max % of Moan SNR Max					
1 425 1,244 1.50 Air	185.7	Intern         Strik         Max           100%         543.5         100%					
2 394 1,289 1.61 Air	160.4	86% 524.7 97%					
The NEMA method did not produce good results due to s	wirling of fluid in the phantom						
The overall SNR of this coil (all channels) is roughly 209	6 than the last two systems I tested	•					
Mean: 663 ROI M: 0.23 ROIsd: 3.07 ROIsd: 3.07 ROI Area: 257.39 Composites ROI Area: 257.39 ROI Area: 257.39							
Composites	Channer	Gridiniei z					

RF Coil Performance Evaluation       Test Date:	6/1/2008 4522 132 19874 00148 f of Channels 5 cness Gap 5 -
Analysis of Composite Image	
Measured Data Calculated R	Results
Back Noise Noise Mean Normal- Mean Normal- SD Type SNR ized S	Max Uni- SNR formity
N         800         1,467         326         -0.8         2.20         NEMA         257.2         66.3         47	71.6 36.4%
A         801         1,475         326         2.1         1.77         Air         296.6         76.4         54	36.2%
Analysis of Uncombined Images	
Measured Data Calculated Res	sults
Noise Noise Mean % of M Ch Mean Max SD Type SNR Mean Si	Max % of SNR Max
1         509         1,494         1.86         Air         179.3         100%         52           1         509         1,494         1.86         Air         175.2         099/         55	26.4 96%
2 484 1,520 1.81 AIr 1/5.2 98% 55	50.5
Mean: 800 ROI M: -0.83 Mean: 801 Air M: 2.08 Mean: 509 Air M: 2.06 Mean: 484 ROIsd: 2.20 Airsd: 1.77 Airsd: 1.86	4 Air M: 2.07 Airsd: 1.81
• 32 <sup>6</sup> • 32 <sup>6</sup>	04
<b>O</b> 1494	
	01520
ROI Area: 269.88 ROI Area: 269.88 ROI Area: 269.88 ROI Area: 269.88	: 269.88
Composites Channel 1 C	Channel 2
l	

RF Coil Performance Evaluation       Test Date: 6/1/2008         Coil: Spine Syn Coil       Model: 4522 132 1987         Mfg.: Philips       Model: 4522 132 1987         Mfg. Date: 5/1/2007       Coil ID: 550         Phantom: Body Disk       SN: 00148         Sequence TR       TE         SE       300         20       S										
SE         SUU         20         5         250         250         28.04         1         5         -           Coil Mode:         SENSE-Spine 4,5         Sense 4,5										
Measured Data Calculat	ed Results									
Back Noise Noise Mean Normal Label Mean Max Min ground SD Type SNR ized	- Max Uni- SNR formity									
N         860         1,472         424         -0.5         2.71         NEMA         224.4         57.8	384.1 44.7%									
A         861         1,476         422         2.2         1.87         Air         301.7         77.8	517.2 44.5%									
Analysis of Uncombined Images										
Measured Data Calculate	d Results									
Noise Noise Mean % of	Max % of									
Cn         Mean         Max         SD         Type         SNR         Mean           1         526         1.520         1.83         Air         1.88.4         1.00%	SNR Max									
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	543.5 100%									
$\underbrace{I = 100.4  97/6  343.3  1007/6}_{I = 100.4  97/6  343.3  1007/6}_{I = 1007/6  1007$										

RF Coil Performance Evaluation         Coil:       Wrist         Mfg.:       Invivo         Mfg. Date:       9/1/2006       Coil ID:       1703         Phantom:       Wrist Phantom         Sequence       TR       TE       Plane       FOV       Nx         SE       300       20       S       20       256       2         Coil Mode:       SENSE-Wrist-4	Test Date:       6/1/2008         Model:       105003         Revision:								
Analysis of Compos	ite Image								
Measured Data	Calculated Results								
Back Noise Noise Label Mean Max Min ground SD Typ	Se Mean Normal- Max Uni- e SNR ized SNR formity								
N 1,154 2,000 156 -1.2 2.28 NEW	IA 357.9 647.9 620.4 14.5%								
A 1,155 2,002 156 2.0 1.48 Ai	r 511.4 925.6 886.4 14.5%								
Analysis of Uncombin	ed Images								
Measured Data	Calculated Results								
Ch Mean Max SD Type	SNR Mean SNR Max								
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								
3         1,106         1,994         3.51         Air           4         900         1,996         2,75         Air	206.5         95%         372.3         77%           214.5         99%         475.6         98%								
<b>4</b> 700 <b>1</b> ,770 <b>2</b> .75 <b>A</b> II									
$\frac{4}{900}$ $1,996$ $2.75$ Air $214.5$ $99\%$ $475.6$ $98\%$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{214.5}$ $\frac{1}{214.5}$ $\frac{1}{214.5}$ $\frac{1}{29\%}$ $\frac{1}{214.5}$ $\frac{1}{$									

<b>RF Coil Performance Evaluation</b>										
Coil: Wrist	Test Date:         0/1/2008           Madalu         105003									
Mfg.: Invivo	Revision:									
Mfg. Date: 9/1/2006 Coil ID: 1703	SN: U29656									
Phantom: Wrist Phantom	# of Channels									
Sequence         TR         TE         Plane         FOV         Nx         Ny         BW         NSA         Thickness         Gap										
SE     300     20     C     20     256     28.04     1     5     -										
Coil Mode: SENSE-Wrist-4										
Analysis of Comp	osite Image									
Measured Data	Calculated Results									
Back Noise Back Noise	Noise Mean Normal- Max Uni-									
N         1,010         1,778         169         5.2         5.80         N	EMA         123.2         222.9         216.8         17.4%									
A         1,005         1,770         169         1.5         1.21	Air         544.3         985.1         958.6         17.4%									
Analysis of Uncomb	bined Images									
Measured Data	Calculated Results									
Noise Noise Ch Mean Max SD Type	Mean % of Max % of SNR Mean SNR Max									
1 910 1,771 2.87 Air	207.8         90%         404.4         73%									
2 901 1,750 2.65 Air 3 690 1,691 1,99 Air	222.8         97%         432.8         78%           227.2         99%         556.8         100%									
3         600         1,501         1.55         1.11           4         678         1,596         1.93         Air	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$									
	Channel 1 Channel 2 Mean: 910 Air M: 3.10 Mean: 901 Air M: 2.88									
Mean: 1010 BOLM: 5.24 Mean: 1005 Air M: 1.47	Airsd: 2.87 Airsd: 2.65									
ROIsd: 5.80 Airsd: 1.21										
<b>01</b> 69 <b>01</b> 69										
	Q179 Q110									
	ROI Area: 40.92         ROI Area: 40.92           Mean: 630         Air M: 2.11         Mean: 678         Air M: 2.06									
01//8	Airsd: 1.99 Airsd: 1.93									
ROI Area: 40.92 ROI Area: 40.92										
Composites										
	ROI Area: 40.92 Channel 3 Channel 4									
	Graniero Granieri -									

### Appendix A: Magnet Homogeneity Field Maps Philips Achieva - 3 central planes Measured June 1st, 2008



Inferior

Axial											
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV					
10	-3	0	4	0.1	-0.8	0.9					
15	-7	0	8	0.1	-2.0	1.7					
20	-13	0	14	0.2	-3.6	2.9					
25	-23	0	24	0.4	-5.8	4.7					
28	-32	0	33	0.5	-7.4	6.2					
30	-40	0	41	0.7	-8.7	7.4					

Coronal										
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV				
10	-1	3	5	0.1	0.6	1.0				
15	-2	7	9	0.2	1.2	1.9				
20	-4	10	15	0.2	1.8	2.9				
25	-7	16	23	0.4	2.6	4.3				
28	-9	23	32	0.5	3.2	5.5				
30	-12	29	41	0.7	3.7	6.4				

Sagittal										
DIAMETER	MIN	MAX	RANGE	PPM	MEAN	STDEV				
10	-3	6	9	0.2	0.2	1.7				
15	-6	11	18	0.3	0.6	3.3				
20	-11	18	29	0.5	1.3	5.3				
25	-16	24	41	0.6	2.2	7.6				
28	-20	30	51	0.8	2.7	9.0				
30	-23	35	58	0.9	3.0	9.9				

#### Appendix A: Magnet Homogeneity Field Maps Philips Achieva Measured June 1st, 2008







# **Axial Field Plots**



# **Coronal Field Plots**





#### **Appendix B: RF Slice Profiles and Crosstalk**





## **Philips Site**

#### Coil Used: Head SENSE - 8 ch

Gibbon 1.5T

6/2/2008

Test Date:

	Sagittal Locator							
1	Length of phantom, end to	d (mn 148±2)		149.4		=	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	•	0.9		0.9	0.9	0.9	0.9
3	(1.10, 1.00, 0.90 mm)		0.9		0.9	0.9	0.9	0.9
4	Slice Thickness To	op	49.3		48.6	46.7	47.9	50.0
5	(fwhm in mm) Botto	m	53.9		54.1	51.5	56.0	58.2
6	Calculated value 5.0±0.7		5.15		5.12	4.90	5.16	5.38
7	Wedge (mm) = + =	-	2.9		2.9	2.9	2.9	2.8
8	Diamatar $(mm)$ $(100+2)$	d	190.9	]	90.9	190.9	190.9	190.7
9	Diameter (mm) (190 $\pm 2$ )	$\ni$	190.1	1	90.1	190.1	190.2	190.1
	Slice Location #5							
10	(	D	190.8	]	90.8	190.8	191.1	190.9
11	Diameter (mm) (190+2)	ΞĨ	190.0	]	90.0	190.0	190.2	190.1
12	(1111) (170 <u>-</u> )	øГ	190.0	]	90.0	190.1	191.0	190.8
13	(	9[	190.1	]	90.1	190.1	190.8	190.8
	Slice Location #7					•		
14	Signal Big RC	JI	1932		1926	1152	1883	1852
15	(mean only) Hig	gh	2002		1985	1182	1971	1940
16	Lo	w	1746		1769	1055	1718	1690
17	Uniformity (>87.5%	5)	93.2%	9	4.2%	94.3%	93.1%	93.1%
18	Background Noise To	op	4.2 ± 4.52	4.2	± 4.43	$3.3 \pm 3.07$	$6.3 \pm 6.41$	8.5 ± 7.47
19	Botto	om	4.3 ± 4.57	4.3	± 4.59	$3.4 \pm 2.97$	$4.9 \pm 5.08$	$6.0 \pm 6.18$
20	(mean ±std dev) Le	eft	$4.5 \pm 5.69$	5.1	± 6.14	$5.5 \pm 4.69$	$6.4 \pm 6.26$	$5.8 \pm 5.67$
21	Rig	ht	4.6 ± 5.62	4.5	± 5.59	$4.3 \pm 3.40$	$5.9 \pm 6.29$	$5.2 \pm 5.47$
22	Ghosting Ratio (<2.5%)		0.0%		0.0%	0.1%	0.0%	0.1%
23	SNR (no spec)		425		427	381	328	332
	Low Con Detectability							
24	Slice Location #8 1.4	%	9		9	2	7	2
25	Slice Location #9 2.5	%	10		10	10	10	8
26	Slice Location #10 3.6	5%	10		10	10	10	9
27	Slice Location #11 5.1	%	10		10	10	10	10
28	Total # of Spokes (>=9)		39		39	32	37	29
	Slice Location #11							
29	Wedge (mm) = + =	- †	-1.0		-0.9	-0 9	-11	-0.8
30	Slice Position Error		-3.9		-3.8	-3.8	-4.0	-3.6

46

## **Philips Site**

### Sequence parameters

#### Coil Used:Head SENSE - 8 ch

Test Date: 6/2/2008

Test ID **287** 

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	13.99	2:09
ACR PD	Dual Echo SE	2000	20	25	1	11	5	5	1	256	256	13.99	8:32
ACR T2	Dual Echo SE	2000	80	25	1	11	5	5	1	256	256	13.99	8:32
Site T1	SE	500	14	24	1	11	5	5	1	256	255	17.55	1:55
										r			
Site T2	TSE(15)	3000	100	24	1	11	5	5	2	256	255	17.1	1:42

Magnet ID: 44

Coil ID: 543

TestID: 287

### Gibbon 1.5T



#### ACR PD



#### ACR T2







## **Philips Site**

#### Coil Used: Head Coil (T/R)

# Gibbon 1.5T

Test Date:

6/2/2008

	Sagittal Locator					
1	Length of phantom, end to e	nd (mn 148± 2)	14	9.3	=	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	0.9	0.9	0.9	0.9
3	(1.10, 1.00, 0.90 mm)	0.9	0.9	0.9	0.9	0.9
4	Slice Thickness Top	55.1	55.5	53.2	54.1	56.7
5	(fwhm in mm) Bottom	49.6	50.0	47.7	49.9	53.7
6	Calculated value 5.0±0.7	5.22	5.26	5.03	5.19	5.52
7	Wedge (mm) = + = -	3.4	3.4	3.4	3.3	3.2
8	Diamator(mm) (100+2)	191.0	190.9	190.9	191.0	190.8
9	Diameter (mm) (190±2) $\ominus$	189.9	189.9	189.9	190.0	189.9
	Slice Location #5	]				
10	Œ	190.9	190.9	190.9	191.2	191.0
11	Diameter (mm) (190 $\pm$ 2)	189.9	189.8	189.9	190.1	190.0
12	Q	190.0	190.0	189.9	191.0	190.7
13	0	190.2	190.1	190.2	190.9	190.9
	Slice Location #7	7				
14	Signal Big ROI	1935	1937	1151	1922	1908
15	(mean only) High	1999 I	1990	1187	1981	2011
16	Low	1796	1801	1083	1777	1773
17	Uniformity (>87.5%)	94.7%	95.0%	95.4%	94.6%	93.7%
18	Background Noise Top	$13.4 \pm 7.81$	$13.4 \pm 7.93$	$11.9 \pm 7.07$	$18.1 \pm 10.4$	$24.2 \pm 14.0$
19	Botton	$12.9 \pm 7.50$	$12.9 \pm 7.79$	$11.6 \pm 6.94$	$18.2 \pm 10.9$	$23.6 \pm 12.9$
20	(mean ±std dev) Lef	$14.2 \pm 8.38$	$14.9 \pm 9.35$	$13.6 \pm 7.48$	$21.5 \pm 11.9$	$21.5 \pm 12.0$
21	Righ	$14.7 \pm 9.81$	$15.8 \pm 9.44$	$13.3 \pm 7.48$	$22.0 \pm 12.0$	$21.9 \pm 12.1$
22	Ghosting Ratio (<2.5%)	0.1%	0.1%	0.1%	0.2%	0.1%
23	SNR (no spec)	253	246	164	180	158
	Low Con Detectability	]				
24	Slice Location #8 1.4%	4	8	0	3	2
25	Slice Location #9 2.5%	10	10	9	9	5
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)	34	38	29	32	27
	Slice Location #11	7				
29	Wedge (mm) = + = -	-0.5	-0.5	-0.5	-0.5	-0.3
30	Slice Position Error	-3.9	-3.9	-3.9	-3.8	-3.5

# **Philips Site**

### Sequence parameters

#### Coil Used:Head Coil (T/R)

Test Date: 6/2/2008

Test ID **288** 

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	13.99	2:09
ACR PD	Dual Echo SE	2000	20	25	1	11	5	5	1	256	256	13.99	8:32
					-								
ACR T2	Dual Echo SE	2000	80	25	1	11	5	5	1	256	256	13.99	8:32
Site T1	SE	450	15	24	1	11	5	5	1	256	255	17.55	1:55
r			r		1	·				1			
Site T2	TSE(15)	3000	100	24	1	11	5	5	2	256	255	17.1	1:42

Magnet ID: 44

Coil ID: 554

TestID: 288

#### Gibbon 1.5T



#### ACR PD



**High Contrast Resolution** 



![](_page_56_Picture_3.jpeg)

![](_page_56_Picture_4.jpeg)

Slice Thickness

![](_page_56_Picture_5.jpeg)

57

ACR T2

Slice Position - Inferior

![](_page_57_Figure_1.jpeg)

![](_page_58_Figure_1.jpeg)

# 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 28.1 KHz (a 1 pixel fat/water chemical shift). 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 mm<sup>2</sup>). 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.