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International MRI Accreditation Resources, LLC

ACR MRI Accreditation Phantom Data Report

SITE NAME:
MAGNET MANUFACTURER:
MODEL:
SERIAL NUMBER:
FIELD STRENGTH:
SOFTWARE VERSION:
DATE TESTED:
PERFORMED BY:

This MRI scanner was tested according to standards established by the American College of Radiology (ACR) MRI Accreditation Program and using the ACR test phantom. The positioning and scanning procedures are described below.

1. The phantom was positioned in the head coil using the manufacturer's standard head cushion and some wedges to achieve parallel alignment in the axial direction. The phantom was centered so that the laser positioning light cut through the centerline of the phantom in the HF direction and through the center of the square grid structure in the RL direction. A three-axis scout scan was used to confirm proper positioning.
2. The ACR sagittal locator scan was performed. See the table below for scan parameters.
3. The ACR T1 and ACR T2 axial scans were performed. Both scans were prescribed on the ACR sagittal locator scan so that the first slice and the last (11th) slice of the axial scans each bisected the crossed wedges apparent in the sagittal locator.
4. The site's T1 and T2 protocols used for a routine head exam were performed in the axial plane using the same positioning, slice thickness and spacing as for the ACR protocols.
5. The data were backed up onto magneto optical disk and analyzed according to ACR procedure.

Protocols used:

1. Sagittal Locator Scan:

	Sequence	TR (ms)	TE (ms)	FOV (cm)	Slices	Thickness (mm)	Gap (mm)	NEX	Matrix		Band	Time
ACR	SE	200	20	25x25	1	20	-	1	256	256		0:56
Used	same											

2. ACR T1 protocol:

	Sequence	TR (ms)	TE (ms)	FOV (cm)	Slices	Thickness (mm)	Gap (mm)	NEX	Matrix		Band	Time
ACR	SE	500	20	25x25	1	5	5	1	256	256		2:16
Used	same											

3. ACR T2 protocol:

	Sequence	TR (ms)	TE (ms)	FOV (cm)	Slices	Thickness (mm)	Gap (mm)	NEX	Matrix		Band	Time
ACR	SE	2000	20/8	25x25	11	5	5	1	256	256		8:56
Used	same											

4. Site Routine Head T1 protocol:

	Sequence	TR (ms)	TE (ms)	FOV (cm)	Slices	Thickness (mm)	Gap (mm)	NEX	Matrix		Band	Time
Site												
Used												

5. Site Routine Head T2 protocol:

	Sequence	TR (ms)	TE (ms)	FOV (cm)	Slices	Thickness (mm)	Gap (mm)	NEX	Matrix		Band	Time
Site												
Used												

Test Results:

1. Geometric Accuracy

Series	Slice #	Direction	Distance	PASS	FAIL
Localizer	1	Vertical	149	X	
ACR T1	1	Vertical	192	X	
	1	Horizontal	192		
	5	Vertical	191	X	
	5	Horizontal	191		
	5	Diagonal 1	191		
	5	Diagonal 2	191		

Performed on slices #1 & 5

Criteria: Distance for localizer should be 148mm±2mm; for ACR images 190mm±2mm

2. High Contrast Spatial Resolution

Series	Resolution mm	Resolved for		PASS	FAIL
		UL Array	LR Array		
ACR T1	1.1			X	
	1.0	X	X		
	0.9				
ACR T2	1.1			X	
	1.0	X	X		
	0.9				

Performed on slice #1

Criteria: Should be resolved for both UL and LR arrays for resolution of 1.0mm or better

2. Slice Position Accuracy

Series	Slice #	□1	PASS	FAIL
ACR T1	1	1	X	
	11	0		
ACR T2	1	1	X	
	11	0		

Performed on slices #1 & 11

Criteria: □1 □ 5mm (4mm better)

4. Slice Thickness

Series	ROI	Measurements	Slice Thick	PASS	FAIL
ACR T1	ROI 1	323	5.19	X	
	ROI 2	320			
	ROI mean	321.5			
	L1	54			
	L2	50			
ACR T2	ROI 1	214	4.70	X	
	ROI 2	207			
	ROI mean	210.5			
	L1	47			
	L2	47			

Performed on slice #1

Slice Thickness = $0.2 \times (L1 \times L2) / (L1 + L2)$

Criteria: Slice Thickness 5.0mm \pm 0.7mm

5. Image Intensity Uniformity

Series	Low Signal	High Signal	PIU	PASS	FAIL
ACR T1	1328	1612	90.3	X	
ACR T2	751	924	89.6	X	

Performed on slice #7

PIU = $100 \times [1 - \{(high - low) / (high + low)\}]$

Criteria: PIU \square 87.5%

6. Percent Signal Ghosting

Series	ROI					Ghosting Ratio	PASS	FAIL
	Large	Top	Btm	Left	Right			
ACR T1	1459	19	16	11	11	0.004	X	

Performed on slice #7

Ghosting Ratio = $[(top + btm) - (left + right)] / (2 \times (large ROI))$

Criteria: Ghosting Ratio \square 0.025

7. Low Contrast Object Detectability

Series	Number of Resolved Spokes for Slice				Total	PASS	FAIL
	#11	#10	#9	#8			
ACR T1	10					X	
ACR T2	10					X	
SITE T1	10					X	
SITE T2	10					X	

Performed on Slices #11,10,9 & 8

Criteria: Total 9

8. Image Artifact Evaluation

Series	Excessive Ghosting		Excessive Truncation		RF noise Leak		DC Offset Artifact		Aliasing Artifact		Reconstr. Artifact		Geometric Distortion	
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
ACR Loc	X		X		X		X		X		X		X	
ACR T1	X		X		X		X		X		X		X	
ACR T2	X		X		X		X		X		X		X	
SITE T1	X		X		X		X		X		X		X	
SITE T2	X		X		X		X		X		X		X	

There is a slight ghosting artifact noticed in the AP direction of axial slices, and a small amount of non-uniformity in the lower portion of the phantom. We believe both these artifacts fall within allowable limits.

9. Magnet Visual Inspection

Visual Inspection	Pass	Fail	N/A
RF door flange is present and door lock works properly			
Patient alarm works properly			
Magnet bore lights are working properly			
Patient fan is working properly			
Positioning lights are working properly			
Patient table works properly			
RF coils stored properly, cables are insulated, no visual defects			
Patient/operator intercom system works properly			
System emergency acquisition shutdown works properly			
Daily QA system implemented			
Operator's monitor is calibrated properly (SMPTE pattern tested)			
Images on film match display images (SMPTE image)			

Phantom Test Results Summary

	Pass	Fail
Geometric Accuracy	X	
High Contrast Spatial Resolution	X	
Slice Position Accuracy	X	
Slice Thickness	X	
Image Intensity Uniformity	X	
Percent Signal Ghosting	X	
Low Contrast Object Detectability	X	
Image Artifacts Evaluation	X	
Magnet Visual Inspection	X	
Overall Phantom Test Result	X	

Comments and Recommendations:

In our opinion, on the date tested, this magnet met the acceptance criteria established for phantom scanning by the ACR MRI Accreditation Program.

Performed by:
