## **ACR MRI Accreditation Update** www.acr.org Whole Body System Extremity (MSK Ron Price Dedicated Breas Vanderbilt University Medical Center Nashville, TN

#### ACR MRI Accreditation Update

- 1. ACR MRI Accreditation Program (Purpose, Status and Role of the Medical Physicist)
- 2. Impact of CMS/MIPPA and JC Requirements
- 3. ACR MRI Application Specifics (Whole-body modular, Extremity and Breast)
- 5. 2015 ACR MRI Quality Control Manual (Technologist and Medical Physicist Responsibilities)
- 6. MRI Safety Requirements: ACR/Joint Commission

#### **ACR MRI** Accreditation Program

- for "best
- practice" and to help continuously improve the quality of patient care. Primary components of the ACR program are the evaluation of:
- Qualifications of all personnel (Physicians, Physicists and Technologists)
- Equipment performance Effectiveness of quality control and patient safety measures
- Quality of clinical images

#### Accreditation Milestones

- 1996: Voluntary Whole-body/Cardiac MRI accreditation with "Large" QA phantom
- 2008: Modular program (Head, Spine, MSK, Body, MR 2008: "Small" phantom for dedicated extremity systems
- 2010: Breast MRI Accreditation
- 2015: Joint Commission Revised Requirements for Diagnostic Imaging Services

#### ACR Status (6/29/15)

- ~20% Fully Electronic Submissions



#### Impact of CMS/MIPPA Requirements

The Centers for Medicare and Medicaid Services (CMS/MIPPA\*) requires that all facilities providing Advanced Diagnostic Imaging (ADI)\*\*\* services that are billed under Part B of the Medicare Physician Fee Schedule by one of the (4) CMS approved accreditation organizations by January 1, 2012

- American College of Radiology (ACR)
- Joint Commission (JC)
- Intersocietal Accreditation Commission (IAC)
- RadSite (RS) (2013)

MIPPA: Medicare Improvements for Patients and Providers Act ADI: MRI, CT and Nuclear Medicine/PET



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#### **ACR** Accreditation Application Specifics

https://acredit.acr.org/

The accreditation process consists of two phases:

Phase 1: Account Activation (Must be completed online.)

Phase 2: <u>Application</u> (Image submission either online or mailed CDs.)

Modular whole-body and extremity magnets the application requirements: • Planton and Clinical Images

Physicist's Equipment Performance Report for each magnet (< 1 year), <u>documentation</u> of corrective actions and most recent quarter of technologist's weekly QC documents

Breast MRI application requirements. Note: currently no phantom images.

Physicist's Equipment Performance Report for each magnet (< 1 year), <u>documentation</u> o orrective actions and most recent quarter of technologist's weekly QC documents











Lar	ge Phantom ACR Limits: Unchanged
(FOV = 25 cm, 25	56X256)
Dimensional accuracy (Sagittal)	148 ± 2 mm
Dimensional accuracy (Axial)	190 ± 2 mm
Slice Thickness	5 ± 0.7 mm
Slice Position	<u>≤ 5mm</u>
Image Uniformity (PIU)	≥ 87.5% (< 3T)
	≥ <u>82.0% (3T)</u>
Percent Signal Ghosting	≤ 2.5%
High-contrast Resolution	1 mm
Low-contrast Detectability Score	≥9 (<3T)
	≥ 37 (3T)
Sn	nall Phantom ACR Limits: Unchanged
(FOV = 12 cm, 1	(52X192)
Dimensional accuracy (Sagittal)	100 ± 2 mm
Dimensional accuracy (Axial)	100 ± 2 mm
Slice Thickness	5 ± 0.7 mm
Slice Position	≤ 5mm
Image Uniformity (PIU)	≥ 87.5% (< 3T)
Percent Signal Ghosting	≤ 2.5%
High-contrast Resolution	<u>0.8 mm</u>



Medical Physicist	Assistance with Cli	nical Images
Examination choices for MR Accr	editation by module (specialty examin	ations denoted by asterisk*)
Head/Neck Brain for transient ischemic attack (TIA) Internal auditory canal (IAC/temporal bone) for hearing loss Brain for suspected demyelinating disease* Pitultary with dynamic contrast enhancement* Orbits for vision loss*	Spine - Lumbat Spine - Thoracic Spine - Cervical Spine " - Cervical Spine with contrast for intramedullary disease"	MSK Knee such as for internal derangement Shoulder such as for internal derangement Wrist such as for internal derangement <sup>*</sup> Elibow such as for internal derangement <sup>*</sup> Forefoot for Morton's neuroma <sup>*</sup>
Body	MRA	Cardiac
Male pelvis such as for prostate cancer     Renal     Hepatobiliary to Include MRCP*     Female pelvis such as for uterine or adnexal disease*	Brain     Carotid     Thoracic aorta     Distal peripheral runoff     High resolution arch and carotid*     Abdomen for renal artery stenosis*	Black blood     Basic     Delayed enhanced cine 1     Delayed enhanced cine 2     Delayed enhanced cine + black blood*
The physicist should confirm t clinical sequences meet the re parameters defined in the ACP Typical requiremen	hat the submitted squired acquisition R Quality Guide. hts: 4-6 exams per scanner depend	Accreditation Program cal Image Quality Guide

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ACR Breast Accreditation Clinical Images (review DICOM beader)



# Technologist's Quality Control Testing (Action Limits Determined by the Medical Physicist)

A. Quality Control Testing Frequency

The technologist's QC testing procedure frequencies given in Table 1 and in the rel of this manual are the minimum recommended frequencies. However, we stronger recommend that the tests be done on a duly basis. If problems are detected often, if the equipment is unstable, or if the system has just been subject to a significant repair or upgrade, then it may be necessary to carry out some of the procedures more frequently. Table 1. Minimum Frequencies of Performing Technologist's QC Tests Procedure Weekly Table Position Accuracy \* 3 Center Frequency/Transmitter Gain or Attenuation Geometric Accuracy Measurements Weekly Weekly High

High-Contrast Spatial Resolution	Weekly	1
Low-Contrast Detectability	Weekly	2
Artifact Evaluation	Weekly	1
Film Printer Quality Control (if applicable)	Weekly	10
Visual Checklist	Weekly	5



#### **Medical Physicist's Annual Performance Testing**

ACR

2015

Magnetic Resonance Imaging

- Annual Physics Report must include <u>verification of</u> technologist weekly QC measurements (repeated at 1 annual visit)
- <u>Annual Physics Report</u> must include evaluation of all pulse sequences required for accreditation submission 3 Additional methods for field homogeneity:

Spectral Peak Phase-angle Difference

- Additional methods (NEMA) for SNR, PIU and PSG
- 6 Additional information on testing multi-element coils

dical Physics Annual Performance Report Must Include Field homogeneity assessment

- Acquisition monitor assessment Assessment of coil performance (comparison to prior year or reference)

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#### **Field Homogeneity**

- Spectral FWHM with large sphere (Only global sensitivity)
- Phase-Difference Method (2D or 3D homogeneity maps)

(Chen, et al Med. Phys. 33 (11), 2006. Note: only sensitive along frequency axis.)



Spherical phantoms are recommended for all methods. Homogeneity should be specified for largest spherical volume (DSV) available.



Alternative: For systems that do not allow any of these methods. One may use the service engineer's most recent shim report (< 6 month).

### **Phase-Map Method**

Gradient Echo Sequence: TE ~ 1/resonance frequency (ppm) (e.g. 1 ppm @ 1.5T = 1/63 Hz = 15.6 ms)





TE = 20 ms ~ 0.4 ppm/transition

The field homogeneity  $(\Delta B_0)$  is determined by counting the number of transitions and then multiplying by the ppm/transition for the specific TE.





For single-image SNR methods, to improve reproducibility image intensity correction should be **off** e.g. SCIC, CLEAR and PURE. Algorithms can significantly affect the background noise  $(\sigma_{air})$  estimate and thus the calculated SNR.



With intensity correction



#### Surface Coil SNR Measurements: (Annual Testing)

Original manual recommendation was to use phantom geometry that best matched the coil and to measure the . In order to y, recommendation is to measure improve year-to-year and to use the largest RC the



#### **Testing Coil Arrays (Annual Performance Testing)**

The 2015 ACR MRI Manual recommends that the images from each coil element be reconstructed and evaluated individually (if possible) to check for malfunctioning elements.





Dead Coil Element in 8-channel array

Images Courtesy of Ed Jackson

#### **MRI** Safety

- Site Access Restrictions (MR Zones\*)
- Documented MR Safety Education/Training for all personnel\*
- Patient and non MR Personnel Screening
   MRI Safety policies as recommended by ACR guidance documents

### (contrast, quench, pregnancy, RF burns, ...) <u>ACR Guidance Document for Safe MR Practices</u>: E. Kanal, et al, <u>JMRI</u> 37:501–530 (2013)

the ACR requirements.

- Written policies are present, available to staff and reviewed on regular basis
   Facility has appropriate signage and methods of controlled access.
   Documentation of regular MR safety training for all MR personnel

#### Standard EC.02.01.01 The (critical access) hospit **Revised Requirements for** as estatu and security **Diagnostic Imaging Services** Note: The Joint Commission revised requirements for MRI safety are similar to

 Benents of Performance for EC.02.01.01
 A 14. For [critical access] hospitals that provide magnetic resonance imaging LNRU services. The [critical access] hospital magnets after yrisis in the NIR environment hospital magnets after yrisis in the NIR environment - Posting signage at the entrance to the MRI scanner • etc.



	1 MRI Safety Program Assessment Checklist
ACR MRI Safety Checklist Excel Form	MRI Safety Program Assessment Checklist     MRI Safety Program Assessment Checklist     Ster     Teadury and the model of addresses the billowing:     YeuflickLi     Descrimeted KRI Safety Academic Safety and     Descrimeted KRI Safety Academic Safety     Descrimeted KRI Safety
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	2 Vitters pictores are prevent and ready anaload resident states.     2 Vitters pictores are interest and pictores (an insight basis)     3 Factly tas appropriate UR safety saming signage and methods of     controlled access.     Overall Pass/Fall     Comments
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#### **Conclusion and Comments**

- The 2015 ACR MRI Quality Control Manual has relatively minor changes from the 2004 version. Specific tests are basically the same but with more options and additional testing detail. Compliance required one year from publication date: 7/1/2016.
- The 2015 QC manual includes several NEMA testing methods as options and is intended to be consistent with new Joint Commission recommendations and with AAPM Report 100.
- The 2015 manual does not identify a specific method for testing parallel imaging. However, it is recommended that images from each coil element be reconstructed and evaluated individually in order to confirm that all elements are functional.
- There is an increased emphasis on MRI safety to minimize patient risk.