

AbstractID: 4592 Title: Some Issues With Image Intensity Uniformity Test Performed on 3T MRI Scanners

Purpose: To investigate why Image Intensity Uniformity (IIU) tests performed on commercial 3T MRI systems according to the ACR MR Accreditation Program (MRAP) instructions are subject to frequent failures.

Method and Materials: The phantom scanning instructions for ACR MRAP tests specify that a dedicated phantom (ACR phantom) must be used to assess the MRI scanners performance. As a part of required test, an assessment of IIU is performed by measuring the Percent Image Uniformity (PIU) according to the specified formula. The data used in calculation of PIU must be acquired for a rigidly defined scanning protocols, and the process of data collection is also precisely specified. For the 3T MRI scanner to pass the test, the measured PIU must be equal or greater than 82%.

PIU tests were performed using the same ACR phantom on five different 3T MR scanners from two different vendors, following the ACR MRAP acquisition and measurement protocol exactly. The scanners tested were installed in routine clinical settings and all head coils, available on site, were tested independently. In addition, if scanner offered multiple gradient performance modes, all modes were tested. Finally, effects of image post-processing routines, designed to improve the image uniformity and installed on the scanners were investigated as well.

Results:

A vast majority of PIU tests using non-postprocessed images failed (more than 95%). All tests that used postprocessed images passed. Upon closer investigation, the likely cause of failures was linked to RF properties of the ACR phantom.

Conclusion:

The IIU test needs to be carefully reassessed to ensure that it provides a meaningful characterization of MRI scanner's performance, and is not hampered by the limitations imposed by the electromagnetic physics of scanning at 127 MHz, the resonant RF frequency of 3T MRI systems.

Conflict of Interest (only if applicable):