



Standard Test Method for Measurement of Radio Frequency Induced Heating Near Passive Implants During Magnetic Resonance Imaging¹

This standard is issued under the fixed designation F 2182; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers measurement of Radio Frequency (RF) induced heating near a passive medical implant and its surroundings during Magnetic Resonance Imaging (MRI).

1.2 This test method is one of those required to determine if the presence of a passive implant may cause injury to the person with the implant during an MRI procedure. Other safety issues that should be addressed include magnetically induced displacement force and torque.

1.3 The amount of RF-induced temperature rise for a given specific absorption rate (SAR) will depend on the RF frequency, which is proportional to the static magnetic field strength. Because of possible additional heating, particularly when device dimensions exceed a quarter wavelength, conclusions from measurements made at one frequency may not apply to other frequencies. While the focus in this test method is on 1.5 T cylindrical bore imagers, the RF-induced temperature rise in the open MRI systems can be evaluated by suitable modification of the methods described here.

1.4 This test method assumes that testing is done on devices that will be entirely inside the body.

1.5 This test method applies to whole body magnetic resonance equipment, as defined in section 2.2.103 of the IEC Standard 60601-2-33, Ed. 2.0, with a whole body RF transmit coil as defined in section 2.2.100. The RF coil is assumed to have quadrature excitation.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

A 340 Terminology of Symbols and Definitions Relating to Magnetic Testing²

F 2052 Test Method for Measurement of Magnetically Induced Displacement Force on Medical Devices in the Magnetic Resonance Environment³

F 2119 Test Method for Evaluation of MR Image Artifacts from Passive Implants³

2.2 IEC Standard:⁴

60601-2-33, Ed. 2.0 Medical Electrical Equipment—Part 2: Particular Requirements for the Safety of Magnetic Resonance Equipment for Medical Diagnosis, 2002

3. Terminology

3.1 *Definitions*—For the purposes of this test method, the definitions in 3.1.1-3.1.10 shall apply.

3.1.1 *isocenter*—geometric center of the gradient coil system, which generally is the geometric center of a scanner with a cylindrical bore.

3.1.2 *magnetic resonance imaging (MRI)*—diagnostic imaging technique that uses static and time varying magnetic fields to provide images of tissue by the magnetic resonance of nuclei.

3.1.3 *magnetic resonance (MR) environment*—area within the 5 G line of an MR system.

3.1.4 *magnetic resonance system (MR System)*—ensemble of MR equipment, accessories including means for display, control, energy supplies, and the MR environment.

3.1.5 *medical implant*—a structure or device that is placed within the body of the patient for medical diagnostic or therapeutic purposes.

3.1.6 *MR safe*—the device, when used in the MR environment, has been demonstrated to present no additional risk to

¹ This test method is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.15 on Material Test Methods.

Current edition approved Nov. 10, 2002. Published December 2002. Originally approved in 2002. Last previous edition approved in 2002 as F 2182 – 02.

² *Annual Book of ASTM Standards*, Vol 03.04.

³ *Annual Book of ASTM Standards*, Vol 13.01.

⁴ Available from the International Electrotechnical Commission (IEC), 3 rue de Varembe, Case postale 131, CH-1211 Geneva 20, Switzerland.