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Acoustic Noise Measurement Procedure for Magnetic Resonance Equipment

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Preamble

This is one of a series of test standards developed by the medical diagnostic industry for the measurement of performance parameters related to the safety of magnetic resonance imaging systems. These test standards are intended for the use of equipment manufacturers, prospective purchasers, and users alike.

Manufacturers are permitted to use these standards for the determination of system performance specifications. This standardization of performance specifications is of benefit to the prospective equipment purchaser, and the parameters supplied with each NEMA measurement serve as a guide to those factors that can influence the measurement. These standards can also serve as reference procedures for acceptance testing and periodic quality assurance.

It must be recognized, however, that not all test standards lend themselves to measurement at the installation site. Some test standards require instrumentation better suited to factory measurements, while others require the facilities of an instrumentation laboratory to ensure the stable test conditions necessary for reliable measurements.

For historical reasons, the use of an independent signal source to drive the gradient amplifiers (i.e., a demand waveform that does not pass through all elements of system control) remains supported in this version of the standard.

In the next edition of this standard, the waveforms driving the gradients must pass through all elements of system control (e.g., pre-emphasis).

Scope

This standard specifies all the information necessary to determine, declare, and verify airborne emission sound pressure level characteristics of MR EQUIPMENT under standardized conditions in the MR EXAMINATION ROOM. It specifies minimum requirements for measurement methods and operating conditions that shall be used for the test. This standard measures the maximum exposure the PATIENT may experience and the representative average MR EQUIPMENT output at the position for an MR WORKER standing beside the PATIENT table.

The use of this standard ensures the reproducibility of the measured airborne noise-emission characteristics within specified limits determined by the grade of accuracy of the basic airborne noise measurement methods used. Noise measurement methods according to this standard are engineering methods (grade 2). All measurements as defined in this standard are acceptable for ISO 4871 declarations. Translation to sound power levels is not required for the purpose of this standard.

This standard is a type C standard as stated in ISO 12001, also known as a noise test code. MR EQUIPMENT is considered PERMANENTLY INSTALLED EQUIPMENT, and this standard provides type test methodologies for the scanner as installed. All PERMANENTLY INSTALLED MR EQUIPMENT is considered to be large for the purposes of ISO Acoustic Noise standards. This *in situ* determination of the airborne emission sound pressure level at a specified PATIENT and MR WORKER position is necessary for:

- Demonstrating compliance with requirements in IEC 60601-2-33
- A harmonized and consistent method to measure acoustic emissions
- Declaring a noise emission value, such as required by the EU Machinery Directive 2006/42/EC

This standard may also be useful for design and verification of noise control provisions.