Pre-installation Site Surveys for MRI, NMR and Electron Microscope

Objectives

To assess the suitability of a site for installation of magnetic resonance imaging (MRI), nuclear magnetic resonance (NMR), or electron microscope equipment, and determine the requirement for mitigation steps to be taken with regards to magnetics or vibrations.

Instrumentation

- Mag-03MS1000 or Mag690-1000 three-axis magnetic field sensor
- Spectramag-6 data acquisition unit

Background

MRI and NMR scanners, and electron microscopes, rely on the use of magnetic fields to help image a sample or person. In the case of electron microscopy, the electron beam is directed using magnets within the beam column. For MRI and NMR, ambient field variations superimposed as the gradient field applied can lead to a change in response and a degraded response.

Vibration acts in the same way as an AC field, by moving the equipment in a static field. Shielding and active cancellation systems can be used around electron microscopes, MRI and NMR scanners (see Bartington Instruments case study related to electron microscope1) but it is still important to install them in the quietest locations possible.

Magnetic and vibration surveys are carried out to test the suitability of proposed sites before the equipment is installed.

Method

The Spectramag-6 unit is an A/D converter and a power supply data acquisition unit. It is designed for site survey investigations, and has the facility to connect accelerometers and acoustic sensors as well as magnetometers, such as the Mag-03 or Mag690. A typical site survey set-up would include a Mag-03MS1000 for the magnetic survey and an accelerometer for the vibration survey.

The magnetic survey is used to determine the levels of magnetic disturbance and vibration, which are generated by events such as vehicle traffic, elevators, or mains supply EM field. It is therefore important to perform the measurements in conditions similar to that which will be encountered at the time the equipment is used. The results are tested against tolerances provided by the equipment manufacturer. Site survey parameters may also be provided by the equipment manufacturer but, as a general rule, multiple surveys will take place.

For DC and low frequency magnetic field measurements, a survey over a longer period of time is required, so that typical variations that are to be expected will be encountered.

For AC magnetic measurements (for mains power interference), the survey time is usually a few minutes. Note that any electrical installation should be completed and running as normal.

An AC vibration survey will also take place, to determine vibrations levels in normal circumstances.

Using the manufacturer’s specified limits, these can be entered in the specification window during the Spectramag-6 set-up procedure (in time and frequency domain) to

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1 www.bartington.com/Literaturepdf/CaseStudies/magnetic field cancellation.pdf
generate a pass/fail message at the end of the survey.

The pass/fail limit is displayed as a green banner or a red banner if limits in either domain are breached.

If the survey records a failure, multiple options for mitigation will be available, from shielding to active compensation.

To assess the performance of the shielding method, it may be necessary to perform an additional site survey after installation of the shielding.