Gremlins in Your Medical Equipment

By Dr. Margot Stock

RF radiation is everywhere. We can't smell it, see it, hear it or touch it, yet we know it is out there. Medical diagnostic equipment provides unreliable results. Weird audio can be heard through testing equipment. Rock and roll music accompanies a medical diagnostic test. These gremlins are caused by high-power RF installations several miles away, such as AM, FM and shortwave radio, TV, microwave links and other such sources. Even local sources such as: EMT trucks, WLANs, MRI, and linear accelerators can have an impact.

Case Study: Several years ago a local neurologist was testing his new neuro conduction/EMG machine. When applying the concentric needle to his wrist, he noted that his arm was dancing to clearly heard rock music. As an amateur radio operator, he was quite conversant with radio frequency and understood that this behavior by the machine was connected in some way. This particular interference was traced by LBA engineers to an AM radio station a mile away. A telephone call to the builder leading to the installation of custom architectural shielding, by LBA, of the exam room solved the problem. On a further, interesting note, the engineer detected a signal of approximately 1 V/m emanating from the radio station. Federal Communications Commission (FCC) guidelines suggest that RF interference problems with electrical medical equipment can be elicited within the 1 V/m field. This case study was an obvious instance of RF interference, but not all interference is so easily detected.

Diagnostic tests are an invaluable tool in identifying patient problems. The results must be accurate if the diagnosis is to be correct. The tests are too expensive to be repeated, particularly if they are due to outside RF interference which can be prevented.

The handsome fellow in the title box is a Texas Air Pollution Board Gremlin.

Case Study: Several years ago, an incident occurred in the local hospital when an ultrasound machine used for tracking fetal growth developed noise in the display which obscured the picture. This problem was traced to a nearby radio station. Fortunately, the station went out of business before shielding was applied. The old adage that "an ounce of prevention is worth a pound of cure" is definitely true in the case of RF emissions and medical technology. It is never too early in the specifications or the design to plan for effective RF interference abatement.

Medical offices are, by virtue of their focus, usually clustered in specific areas in any urban setting. Frequently, this cluster of medical facilities includes a hospital with its abundance of medical technology. Urban areas are a hotbed of constantly evolving RF sources both local and ephemeral. This provides a distinct possibility of higher RF interference which will have an increasingly greater impact on the medical equipment within the area. In addition to the cases outlined above, RF interference might manifest itself as false positive or negative readings, transient, undesirable audio-on signals, aberrant readings on ECG from unshielded leads to name but a few. A convenient and free computer tool to provide an alert to local sources of high power radio interference may be found in the LBA Toolbox, http://Lbagroup/toolbox.php.

Conclusion

Obviously, the answer to RF interference is appropriate shielding of equipment pieces or exam rooms containing diagnostic and recording equipment. The trick is to ensure that the passage of unwanted RF signals are small enough to cause no harm to medical equipment. New innovations in shielding make it possible to lower unwanted RF interference to manageable levels at a reasonable cost. Using architectural shielding such as fiber attenuation composites and conduction coatings can achieve attenuations of 40dB or more in existing facilities. While not to CIA specifications, such installations are often a cost-effective way to prevent RF ingress into your medical equipment. For small pieces of equipment, stand-alone Faraday cages such as LBA Technology's EMFaracage™ can be employed to block virtually all RF signals from entering. In addition to protecting your investment in expensive medical

equipment, a Faraday cage reduces maintenance costs, increases reliability and delivers more satisfaction to the patient.

If possible, shielding for specific spaces should be part of the original architectural design. If a potential source of interference is introduced into the area then a competent consulting engineer with experience in RF compatibility should be retained immediately. His role will be to study the electromagnetic environment and provide expert guidance in achieving compatibility between the new potential source of interference and the medical office with its diagnostic equipment. Prompt attention to this will prevent surprises in medical equipment behavior and reassure the owners that RF interference is not an angry gremlin sent to make life untenable.

LBA Group provides analysis of radio frequency interference problems, and, with its strategic partner The East Group, is involved in the design and commissioning of archectural shielding solutions.

Contact www.LBAgroup.com or www.East group.com.

Is Your Facility RF Green?

By Lawrence Behr, CEO

Electromagnetic energy is an environmental issue that is often overlooked. This invisible environmental factor should be considered as carefully as air and water quality.

Standards have been set for acceptable electromagnetic energy levels in the environment. Organizations, such as the American National Standards Institute (ANSI) and the Institute of Electrical and Electronics Engineers (IEEE), have studied and identified levels and time limits above which human exposure should be restricted.

As required by the National Environmental Policy Act (NEPA) of 1969, the Federal Communications Commission (FCC) has established standards and guidelines for evaluating the level of potential human exposure to emissions from licensed transmitters. OSHA's website states "…there are national consensus standards which OSHA could consider referencing in a general duty clause citation." Policies and procedures should be put in place to reduce the potential for being challenged on these issues and for properly responding if you are challenged.

Electromagnetic energy is generated over a wide spectrum of frequencies from many different sources. The frequencies addressed in this article include extremely low frequency (ELF), radiofrequency (RF) and microwave (MW) radiation. The term "EME/RF" will be used here to refer to these frequencies.

ELF fields are produced by power lines, electrical wiring, and electrical equipment. RF and MW radiation is generated from many sources, including radios, cellular phones, the processing and cooking of foods, heat sealers, vinyl welders, high frequency welders, induction heaters, flow solder machines, communications transmitters, radar transmitters, ion implant equipment, and microwave drying equipment. These frequencies, along with visible and ultraviolet light, are known as non-ionizing radiation to distinguish them from the more dangerous X-rays, gamma rays and other higher energy level rays known as ionizing radiation. Ionizing radiation is not addressed in this article.

Establishing a policy and implementing procedures to consider, identify and document the factors that influence the electromagnetic environment will help ensure that workers and the general public are appropriately protected from any potential adverse effects resulting from excessive exposure. While most devices typically would not result in levels of exposure high enough to cause injury, it is nevertheless important to ensure that human exposures are maintained well below levels that are suspected to be potentially harmful.

Electromagnetic environment evaluation procedures should be consistent and complete. The FCC has established maximum permissible exposure (MPE) levels for human exposure to RF. They have published guidelines and procedures for evaluating RF exposure for the general public and for personnel performing occupational tasks in a controlled area.

While the focus of the FCC is strictly on transmitters that they license, OSHA is very much concerned with the workplace. OSHA has published their own guidelines, which state that they agree with those of the FCC and other standards organizations. In the area of occupational protection against EME/RF exposure, the OSHA guidelines are a very clear blueprint for the responsibilities of building facilities man-