It has been suggested that an AM radio placed inside a conductive container can be used to evaluate the effectiveness of that container as a shield. The assumption is made that if the radio continues to play, then the container is not capable of shielding static fields. This confuses electrostatic shielding with electromagnetic shielding. An effective static shield need not be an electromagnetic shield.

An electrostatic shield is principally a means to prevent the electric field from a static charged object from penetrating. The shield itself can be charged, but inside, no electric field will exist. A component inside an electrostatic shielding container is safe from the electrical fields associated with static. It is not necessarily shielded from EMI however. It has been shown that an effective electrostatic shield must have a surface resistivity of less than $10^4$ ohms/sq.\(^1\).

EMI is an acronym for electromagnetic interference. It is often called RFI for radio frequency interference because it commonly affects radios causing the familiar "crackling" or "static" noises.

Unlike typical static fields, an electromagnetic field oscillates at high frequency similar to that of radio and T.V. transmission. It is also generated when sparking occurs such as is associated with ESD, lightning, motor brushes, and even results from the operation of a typical battery operated pocket calculator or wristwatch. An EMI shield has to be capable of attenuating oscillating, high frequency electromagnetic disturbances. Typically, an EMI shield must be very conductive and fairly thick in order to respond adequately and be considered a reasonable EMI shield.

One way the EMI barrier properties of a material over a relatively small frequency range can be observed is by placing a small radio in a closed container made of the material. If the radio was tuned to a station prior to placing it in the container, and it is silenced by the container, the material from which the container is made provides some degree of EMI attenuation at the broadcast frequency of that station. If a radio is not silenced in a conductive container however, it cannot be assumed that electronic components housed in that container will be damaged by static electricity.

A radio is a high frequency detector which is designed to preamplify and then amplify a very weak time-varying electromagnetic field. An inexpensive AM radio is sensitive to electromagnetic fields of a few hundred microvolts per meter (10 v/m). The oxide layer of a typical MOS technology semiconductor requires about $10^9$ volts per meter for dielectric breakdown.\(^2\) The sensitivity of electronic devices to an electric field is therefore about $10^{13}$ times less than an AM radio.

Electromagnetic radiation also has a magnetic field component which will not be attenuated by a thin, purely electrostatic shield. If a radio has a ferrite loop antenna, it could respond to this magnetic field even though no electric field reaches it.

Work by Chubb\(^3\),\(^4\) has shown that the fields from a static spark are extremely small. This is because nearly all of the stored static energy is used to sustain the current in the spark rather than being wholly radiated. Thus, a radio might "crackle" due to nearby static discharge, since it has received and greatly amplified a high frequency although very weak signal.

In conclusion, an effective static shielding material may not silence a radio; therefore, the use of a radio to evaluate static shielding performance is not recommended.

References
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