Eliminating Interference with Shielded Enclosures

 By Janine E. Mooney, Editor

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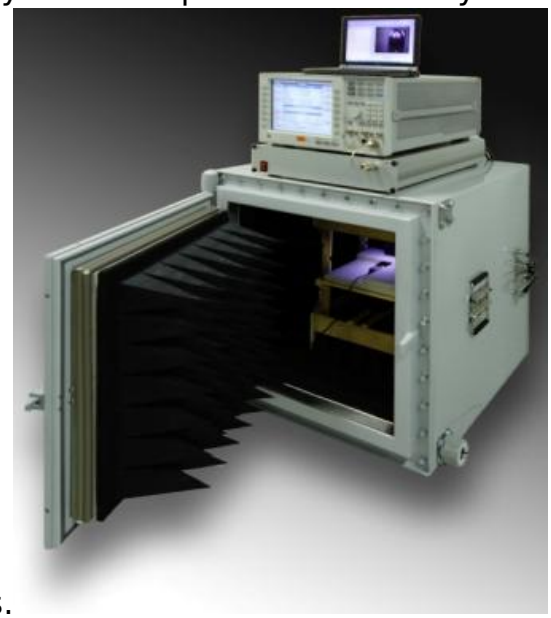
What's more important than protecting your valuable electronics from potential threats? Not much. Especially with regards to military electronics, which are growing more and more prevalent every day. Protecting electronics from the elements – dirt, sand, rain, high/low temperatures – is essential, but one threat in particular is extremely important in today's world: Electromagnetic interference (EMI). EMI has the ability to interrupt or even destroy the functionality of

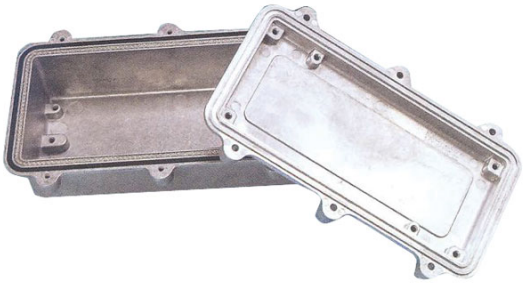


unprotected electronics.

Today's society is more dependent on wireless communications than ever. Cell phones and Wi-Fi, for example, are just a few of the widespread technologies, which beam data through the air, instead of over a wire. With so many signals, each new device designed must ensure that it does not emit any signals that will interfere with other transmissions. In addition, a new device must be free of interference from existing EMI/RFI radiation, or the device will not work as anticipated.

In military applications, you must have proper shielding in place in order to prevent

unwanted signals that could potentially put military personnel at risk. With the use of proper shielding, you can greatly reduce the risk of these threats, increasing military security. Often custom shielding is more effective in these situations, as you know you are getting ample protection for each individual enclosure, and of course – you'd rather be safe than sorry. However off-the-shelf products are still very effective in many applications.



What's That Made Of?

There are many methods available for making an enclosure shielded against EMI/RFI. For a Faraday Cage, you need a metal enclosure, which will absorb/reflect the electromagnetic energy. Nonmagnetic metals, such as aluminum, will not work at very low frequencies. Magnetic material, such as iron or nickel is required. At high frequencies, the conductivity of the material dictates its effectiveness. The first choice for a shielded enclosure should be a metallic enclosure, such as an aluminum box. In order to achieve proper shielding at high frequencies, the conductivity between the lid and the box must be zero, and the joint between the lid and box should have a baffle to prevent leakage.

If a metallic box is not feasible, the use of a conductive plastic enclosure may be a good fit. A couple options are conductive paint or conductive plastic. The conductive paint is an older technology in which the interior of the enclosure is coated with a nickel filled acrylic paint. The plastic is compounded with stainless steel fibers, forming a 3-dimensional conductive matrix inside the base material. This method provides a consistent enclosure, with no secondary coating quality issues.

Taking Proper Precautions

Eliminating EMI means the design engineer must reduce the currents or voltages exiting the antennas, eliminate the transmitting antennas and block the radiated fields. These pose a lot of possibilities for interruption if not shielded properly. The best way to ensure you are preventing interference is not only to use proper shielded enclosures, but also understand and minimize high-frequency sources and provide a clean PCB layout. The military, aware of the effects of EMI, have taken great precautions to ensure their electronics are appropriately shielded. In fact, for large electronics like their network equipment, bases often keep them in fully shielded rooms.

Meeting the Standards

For mobile applications, shielded enclosures have been used for over 80 years. The first military standard governing EMI shielding was introduced in the 1930's and since then new standards – both commercial and military – have been implemented. Today, the list of standards governing EMI shielding requirements is endless. In addition to the military, organizations such as the Federal Communications Commission ,the American National Standards Institute, the International Electrotechnical Commission, the National Security Agency and the Institute of Electrical and Electronics Engineers (unless you're going to repeat them in the article you don't need the abbrieves.) have all created their own standards. As technologies have evolved, "shielded" and "military-grade" have taken on new meanings. What was considered "shielded" ten years ago, would not prevent all of today's interference and interruptions.

Testing for Effectiveness

This brings us to the final step – testing the EMI shielded enclosure for each individual application. Necessary testing requirements for compliance are often specified by the person procuring the enclosure, and are very application-specific. The goal of any shielding is to protect from two things—emitted EMI and susceptibility to outside, or incoming, EMI. EMI can be conducted through materials, or it can be radiated from a source and distributed through the air. The ultimate goal of testing shielded enclosures is to measure its ability to shield from all four scenarios: conducted emissions (CE), conducted susceptibility (CS), radiated emissions (RE) and radiated susceptibility (RS).

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