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EMI Shielding with Coated Plastics

Effective shielding using conductively coated plastics

by

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EMI SHIELDING WITH COATED PLASTICS

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Two factors are combining to create EMI shielding problems: increasing clock frequencies and the shift to plastic housings.

The trend to higher clock frequencies continues. Modern laptop and desktop computers run in the GHz range, a thousand times faster than the early personal computers, but even modest applications are running clocks in the 20 to 100 MHz range. CISPR 22 calls for emission testing up to six GHz, depending on maximum clock frequency.

For shielding effectiveness, you need to keep openings in your enclosure less than 1/20 wavelength of the highest applicable frequency, typically to the tenth harmonic of the fastest clock. If you have a 100 MHz clock, you will be testing to 1 GHz, so expect to limit openings to about 2 cm - even less if you have higher clock frequencies. It has now reached the point where continuous closure is necessary - occasional contact is not sufficient.

The second aspect is the increasing use of plastic enclosures. As we know, plastic provides no shielding unless provided with a conductive coating. The conductivity of the coating is not the driving factor in high frequency shielding effectiveness - it's the longest dimension of the opening, which almost always occurs at the mating seams. So select your coating for critera other than EMI - availability, cost, durability, ease of application, etc.

Herein lies the problem - it's difficult to get conductive closure at the seams, and the problem lies with the design of the mold. Done right, the shield works very well. Unfortunately, most of the molded plastics are poorly designed to contain EMI. Radiated emissions failure is almost a foregone conclusion, if the plastic enclosure is not properly designed.

<u>How to make the shield work</u>

You need to bring the conductive coating right up to the mating seams, then ensure the surfaces conductively mate pretty much continuously along the entire seam. This requires the plastic enclosure be designed so as to facilitate proper coating. A reliable method is to use tongue and groove, making sure the mating surfaces are stiff enough to ensure continuous contact. Better, yet, the groove can provide a nesting place for conductive EMI gasketing. This is shown in figure 1.

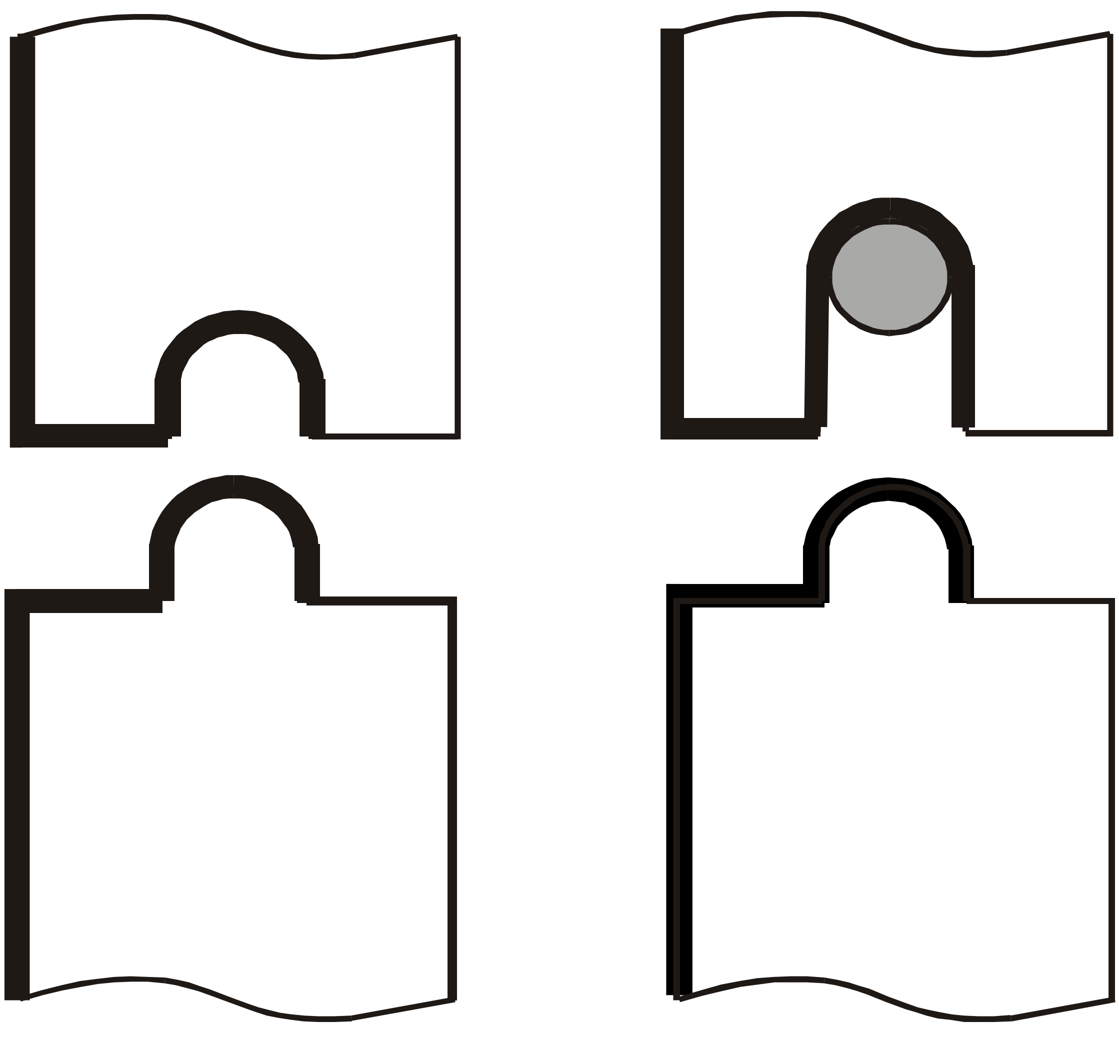
When discussing this with the mechanical designers, we encounter strong resistance. The issue is, they want to mask off the coating back from the seem to ensure the coating doesn't show on the outside. The fact is, if the coating doesn't get into the seams and close the gaps, the shield WILL NOT WORK.

In fact, if you don't close the gaps, the measured emissions may well increase - the shield may well collimate the available RF energy, resulting in emission hot spots.

You also need to make provision to terminate cable shields and filters. In most cases, these need to be grounded firmly to the shield - casual contact will not do. The worst case is to run the cable shield without terminating it to the enclosure shield - guaranteed test failure.

Summary

Don't fool yourself. If you want the shield to work, design the enclosure to close the seams - tongue and groove works well, preferably with EMI gasketing. And make sure your cable shields and cable filters are well terminated to the coating.



A **B**

Figure 1. A, Conductive coating brought up to the mating surfaces, B, Conductive coating brought up to the EMI gasket

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William Kimmel, PE, is a principal in the engineering consulting firm of Kimmel Gerke Associates, Ltd, specializing in electromagnetic interference. The company works in a wide range of business areas, including military, avionics, medical, industrial and commercial electronics. They do troubleshooting, design reviews and EMI seminars. For more information, go to **www.emiguru.com**