An Alternative EMI/RFI Shielding Solution to Crosstalk

In multi-frequency, Bluetooth, wireless networking, and other wireless design applications, eliminating crosstalk is a constant design challenge.

MICHAEL BIGGAR
Leader Tech, Inc.
Tampa, FL

PCB designers who design in Bluetooth wireless networking technology, and other networking applications recognize the importance of designing preventative technology into their circuit board designs. Exercising these preventative measures should thwart both crosstalk and the dB (decibel) gain inherent in crosstalk which is a serious cause of EMI/RFI problems. For those who aren't familiar with Bluetooth technology, the name "Bluetooth" is derived from "Harald Bluetooth," the Danish king who was instrumental in the unification of Denmark and Norway in the 10th century. It's a specification providing unification between portable computers, phones, and other portable and handheld devices, as well as a link to the Internet. Leaders in computing, telecommunications, and networking are pushing the development of this technology—companies such as 3Com, Lucent, Ericsson, IBM, Intel, Motorola, Microsoft, Nokia and Toshiba, and others. Bluetooth wireless technology is poised to transform the personal connective marketplace by providing freedom from all wired connections.

WHAT IS CROSSTALK?

To illustrate the extent of the crosstalk problem, imagine yourself as an avid radio listener who enjoys jazz at home or when traveling. Whether you're in Chicago, New York or LA, you enjoy listening to the local jazz stations. The clarity of their reception is one of the important features of each station that you enjoy—good jazz, static-free. Now, imagine that all three jazz stations move to your hometown with all three residing on the same block. The enormous static generated by the three stations broadcasting three different frequencies in such close proximity would make it impossible to listen to any of them effectively. The same can be said for circuit boards. When components emitting different frequencies are carefully isolated on different boards, each frequency is safely contained. But bring them together in the same area on the board and the result—EMI/RFI problems. These different radio frequencies, the "talk," cross over and emit different radio waves. When mixed together with other frequencies, this effect, crosstalk, causes transmission interference and ultimately poor performance.

CROSSTALK PREVENTION DESIGN TECHNIQUES

The preferred way to design out this problem is to isolate the different frequencies on the same board or on different boards in the same unit. In order to achieve this, the usual procedure is to design an aluminum casting block, which is designed and manufactured to surround and isolate each of the

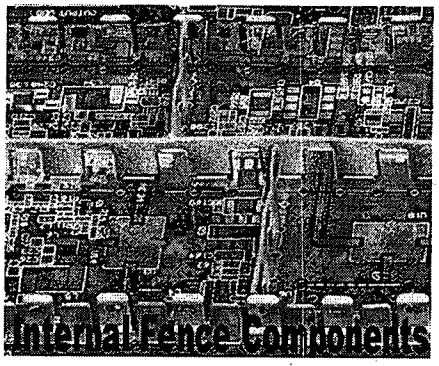

Figure 1. Internal fence components.

spurious frequencies on the printed circuit board. Casting blocks can be one-cavity or multicavity and come in a variety of shapes and sizes. Each cavity houses a separate frequency functioning independently and totally isolated from the frequencies in the other cavities next to it.

However, inherent in this typical design solution are several critical factors or problems the designer should be aware of:

- *Weight*. An aluminum casting block can make the board extremely heavy and cumbersome, especially when alterations need to be made.
- *Size*. Walls must be a certain thickness which typically limits the amount of space available on the rest of the board.
- *Cost*. A milled aluminum unit can be quite costly in tooling and machining.
- *Heat*. Aluminum cavities containing high frequency components generate an extravagant amount of heat.
- *Inflexibility of design*. Once the casting block has been designed, changes or retooling become very costly and time-consuming, creating potentially serious delivery delays.

Flexibility of design, often overlooked, is one of the most important considerations in these applications. Remember, the new technology of today quickly becomes the outdated technology of tomorrow. Designers are faced with constant demands/changes that evolve into challenges that demand resourcefulness; therefore, having the flexibility to make changes to an existing design "on-the-fly" quickly and efficiently to meet tight deadlines is an important consideration for every PCB designer.

Some innovative companies have adopted an alternative design solution by using a multicavity CBS shield instead of the aluminum casting block. The CBS shield is a two-part solution comprised of (1) a fence, specifically designed to isolate all of the multiple portions of the board housing the different frequencies, and soldered to the circuit board, and (2) a single cover/lid which creates a metal-to-metal ground between all exterior

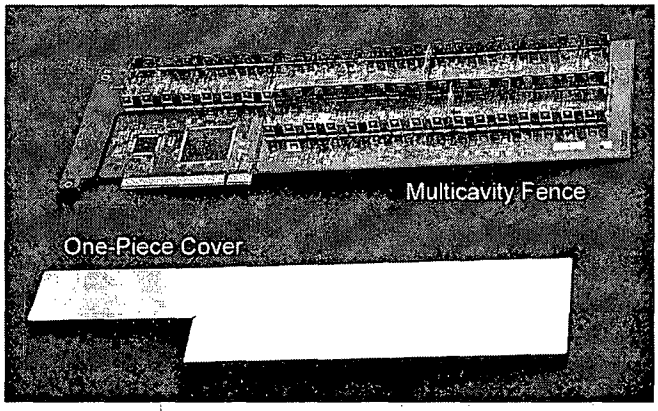

Figure 2. Multicavity fence with one-piece cover.

and interior fences. The CBS product works by creating a multicavity Faraday cage where the four fences and lid provide 5 of the 6 sides, and the printed circuit board provides the 6th side. This isolates the component from external interference and prevents the internal components from interfering with other parts of the board.

An alternative solution like the CBS shield has allowed companies to develop more efficient and economical PCB designs by reducing their weight, size, heat output, and cost. The flexibility in design accommodates changes and retooling at a fraction of the cost and time needed to remanufacture an aluminum casting block.

The beauty of using flexible off-the-shelf technology like the CBS shield is that it can be modified to the customer's specifications, including added features like special notches, access points, ventilation points, and different heights. Therefore, any changes in layout can be easily and inexpensively incorporated into the design at any stage, without lengthy lead-time.

One additional concern in typical CBS solutions is the inner members of fencing that require a continuous reliable metal-to-metal contact to the lid without the cost of additional fastening methods. One of the key features of the new CBS shielding product is a unique solution combining standard shielding with the flexibility of cloth-over-foam, also off-the-shelf technology. The soft shield is fitted to the top of the metal fencing to create a tight fit between the fence and the lid which ensures reliable metal-to-metal contact.

The new CBS shielding technology accommodates both the individual PCB designer who needs a few pieces to prove his design and the contract manufacturer who requires high volume including automated packaging methods such as tape and reel.

MICHAEL BIGGAR is responsible for Marketing, New Business Development, at Leader Tech, Inc. in Tampa, FL. He can be reached at 813-855-6921; Fax: 813-855-3291; or www.leadertechinc.com. ■