Understanding EMC Inside and Out

The best practices and board level hardware needed to deal with EMI effects

In our modern world, we are surrounded by electronic and electrical equipment with wireless communication becoming increasingly pervasive. Mitigating the impact of electro-magnetic interference (EMI) is, as we will see, therefore essential.

When designing electronic systems, engineers must address the presence of EMI. There are two key reasons for this:

- To make certain that it won't impinge on the operation of other electronic equipment nearby,

- To prevent EMI from other sources impinging on its operation.

Though engineers often worry that the work needed to achieve electro-magnetic compatibility (EMC) is complicated, if the correct process is followed, it can be very straightforward.

The Principles Of EMC

EMC draws on a few basic principles of electrical engineering, so by just applying these it is relatively easy to get a grasp of the subject. These principles are:

- In any electrical circuit, electrons will always return to their source using whatever route is available to them. So EMC is about managing that return path.

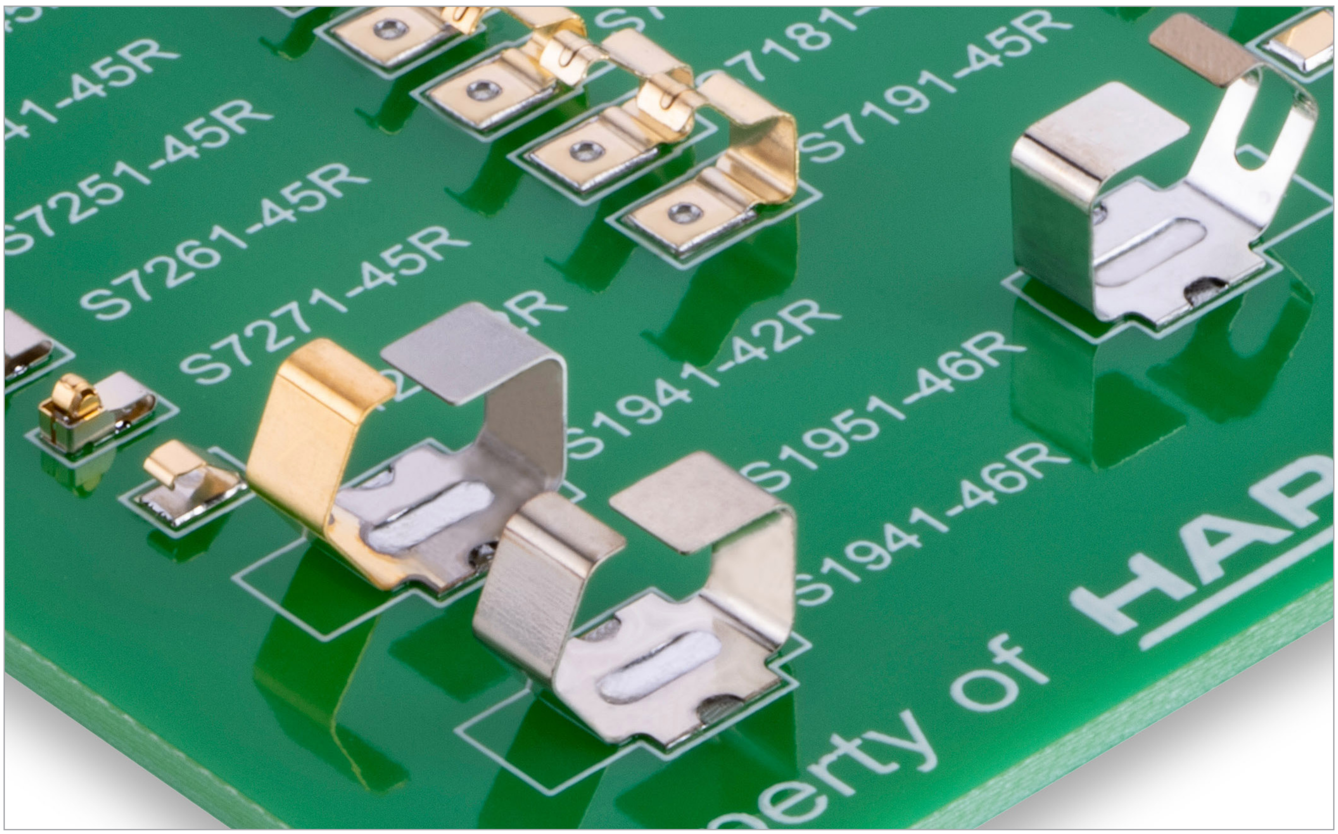
- Any two pieces of metal connected to a source can constitute an antenna, whether intentionally or not. Though antennae will normally be purposely designed for that function, there are plenty of situations where one can be created by accident.

Any two pieces of metal can be an antenna and today's electronic systems present ample opportunities. Here you will find plenty of metallic items including wiring, PCB traces, the leads on through-hole components, etc. Any of these could provide the means for either transmitting or receiving EMI.

Sensitive electronic circuitry can be prevented from picking up EMI from external sources by being housed in a metal enclosure (a Faraday cage will shield whatever is placed inside it as long as the mesh spacing is substantially less than the wavelength of the radiation). It is crucial that this is done correctly to avoid the metal enclosure itself becoming an antenna. The enclosure must be properly connected to the same ground as the PCB via a number of low-impedance paths. Include metal pillars within the enclosure structure and ground-connected holes in the PCB. The enclosure is then attached by screwing the PCB onto the pillars.

Using surface mount spring contacts

Although this will prevent EMI, it is not a completely practical methodology since costs can be relatively high. These costs include time and labour as well as extra hardware. A more economical method is using **spring contacts** supplied by Harwin. These surface mount components can be positioned on the PCB edge using pick-and-place machinery. They offer an effective ground connection once the board is pushed into place without costly amendments to the assembly process. Harwin offers over 30 different spring contact variants and these are complemented by 3D CAD models to assist with the design process.



Once your electronic system is shielded from external EMI, and is not emitting EMI, now you will need to address what is happening at the board level. Here, there is the risk of individual components or devices within the system interfering with one another. The close proximity of analogue/mixed signal, RF and digital devices can cause noise coupling. Here the EMI produced by a component which has capacitive or inductive properties can affect the signal passing through neighbouring devices.

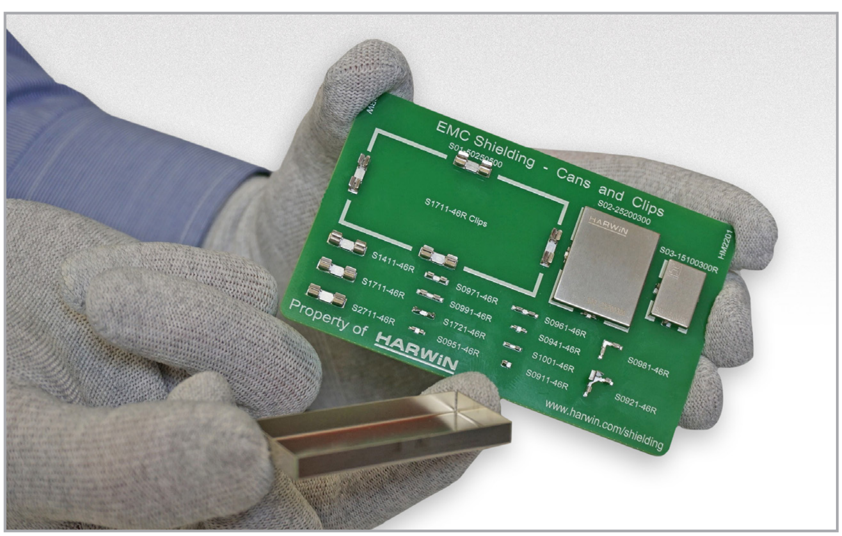
Avoiding noise coupling

Noise coupling can either be conducted (through PCB traces) or radiated (over the air). Radiated noise coupling can be addressed by putting metal covers (known as shield cans) over certain devices, or areas of the circuit. Cans with through-hole terminations are readily available in standard shapes and sizes, or custom-made to specific requirements. Once the right can is found, the PCB must be designed with corresponding mounting holes, electrically connected to the ground plane.

By using a throughboard shielding can, you are adding greater complexity to the assembly process. If all the other devices populating the PCB are surface mount, then soldering a through-hole shield requires a separate process, using either wave or hand soldering. This extra operation adds extra costs. Not only that, but you may also add more EMI issues elsewhere. Any termination pins relating to these through-hole cans can also act as antennae.

Using surface mount clips

At Harwin, we've developed a range of **surface mount clips** which hold metal cans onto your PCB. As there are no termination pins, there is no risk of creating an antenna by accident. The surface mount clips do not add an extra operation to your assembly, as they support automated pick-and-place operations. Watch the video to see how easy it is to use the shield clips with EMC cans.



Click here
to view the video

A variety of clips are available in different sizes and styles, and you can choose the level of retention force according to your application. If the metal can needs to be removed on a regular basis to access the circuitry inside, it is best to select clips with the lower retention force. For systems that are likely to be exposed to more extreme conditions involving heavy shocks and vibrational forces, the higher retention level is recommended.

Using an EMC shield can kit

Harwin offers a custom can service for metal cans for volume manufacturing of your product. While still in the prototyping phase, or if production will only be a small number, the investment in tooling is not practical. This is where Harwin's **EMC shield can kit** is a great alternative. The kit includes scored metal sheets which are easy to cut/fold into the required can size. SMT clips are also included for attaching the can to the PCB. Engineers can quickly create cans of different sizes while developing the right board-level shielding to solve the EMC issues.

Whatever your EMC challenges, Harwin is able to provide the products and technical support needed to help you overcome them.