RF Shielding Issues in Wireless, Cellular, and Electronics Product Companies

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RF / EMI interference during testing can be an enormous problem for electronic and wireless parts manufacturers. During the production process, wireless devices often need to be activated without external interference for quality and process control checks. To ensure that radio frequency signals are solely from the individual unit being tested, RF isolation is required on assembly lines or in test areas. And when multiple adjacent manufacturing cells are building electronic and wireless products, RF isolation is essential to allow quality control or activation testing of the similar components on adjacent lines. RF isolation prevents RF/EMI noise from equipment in other parts of the factory interfering with production testing.

Additionally, RF sensors and process controls that are critical to automation can be susceptible to interference and may require isolation from other radio frequency sources.

When trouble-shooting process control issues, portable shielding that is movable on the assembly line or between cells may be essential in finding problems. Additionally, automation controls and sensors require calibration and will benefit from temporary RF isolation.

In re-manufacturing, wireless units often need to be activated to assure functionality, again requiring the RF signal to be isolated and traced to the individual unit being tested.

RFID is used more and more in manufacturing on individual products or on pallets for electronic labeling and scanning. RF shielding may be required to assure accurate counts as product moves from location to location in order to segment distinct manufacturing operations, the warehouse from the factory, or the dock from the truck.

RF / EMI shielding in manufacturing can be accomplished a number of ways. Curtains can segment operations. Portable lightweight RF shielded test boxes can house equipment as it travels along the line. And portable RF shielding tents can be erected for temporary isolation.

Product development for wireless and electronics encounters a number of RF / EMI Shielding challenges for products and parts of all sizes and applications.

RF isolation is key to test and calibrate the product and components at various stages of development, free from RF interference. RF interference comes from external sources like cell towers or airports, and internally from RF emitting prototypes in the lab.

RF / EMI compliance testing is a key step in product development. This testing is designed for two major purposes, RF susceptibility and RF radiated emissions. RF susceptibility testing is important to assure the product is fully functional in actual use when subjected to RF signals of varying strengths in a various locations and situations in the real world. Testing for radiated emissions is key as the FCC requires all products be properly shielded and certified by independent labs to prove that they do not transmit radiated emissions.

Pre-scan testing of the product in the R&D lab is critical prior to sending it out for independent certification testing. This pre-scan testing should be performed at various development stages to allow quick corrective action. This is critical to maintain product launch schedules and reduce redesign costs, which escalate as the product progresses through development.
Pre-scan testing can also avoid significant costs and delays by preventing the product from failing during external compliance testing. This will save retesting costs, logistics back and forth to the independent test lab, and expediting costs to maintain launch schedules.

RF isolation is critical in pre-scan testing for accuracy and to assure the testing process itself does not emit signals in violation of FCC guidelines. RF isolation can be achieved in the lab with RF shielded boxes, pouches, or tabletop enclosures. Curtains between racks of equipment are also common. Tests of large products are done in shielded rooms or very large RF shielded enclosures.

RF shielded enclosures can be permanent hard-walled or made from lightweight high attenuation fabrics. RF fabric boxes, pouches, tabletop enclosures, and tents allow portability and collapsibility for use in the field or to save space in the lab.

Hard-walled rooms with non-reflective foam and tiles can do a myriad of testing. High attenuation tents can range from room sized to hangers for vehicles and aircraft. These tent systems can also use reflectivity dampening foam, and are fitted with sophisticated RF filtering systems and air conditioning.

The choice of an RF isolation solution must consider the nature of the testing required and the total cost of ownership, including the cost of the enclosure, the cost of the space utilized, the cost of external testing, and the cost of moving for reuse. Major permanent product development facilities may be best served by a common multi-use RF shielded chamber. With shorter product development times, a portable, storable, reusable fabric solution may be an option to consider.

RF interference, the need for RF isolation, and RF signal compliance are common challenges for companies developing and manufacturing wireless and electronic products. RF shielding is inherent in the design of the product itself to be compliant with FCC regulations, but RF Shielding is also critical to process effectiveness in key business functions including product development, manufacturing, quality control, field service, supply chain logistics, re-manufacturing, IT, Corporate Security, and other functional areas.

Interference can come from external sources including nearby cell towers or airports. Interference can also come from your own products, sub-assemblies, and projects side by side in product development, product testing, manufacturing, or field service.

Companies engineering, manufacturing, distributing, servicing, and refurbishing wireless and electronic component parts and end products all need to effectively manage RF shielding issues.

Wireless and electronic components are pervasive in a wide array of products ranging from the obvious—cell phones, tablets, and laptop to refrigerators, vehicles, industrial process controls, aerospace, military weaponry, and many more. RFID is a growing tool more and more common in these products and in packaging and bulk packing.

Companies manage these RF Shielding issues with a wide variety of solutions ranging in size and configuration from RF shielded boxes and pouches, to tabletop enclosures and curtains, to hanger sized shielded tents and multimillion-dollar RF Shielded Rooms. Shielded vehicles can provide mobile solutions.

In addition to the size and configuration needed, these solutions must consider the frequency range in the spectrum encountered, the strength of signals, internal reflectivity, and the dB shielding required.

Product and business life cycles, total cost of ownership, and return on investment impact solution choice. Short to medium duration projects may warrant different approaches than a multi-project facility designed to serve ten or more years.

In short, RF Shielding is a problem in a wide range of industries and throughout the organization touching most functional areas in varying applications. Solutions must be chosen carefully to address these differing business environments to provide the optimum financial and technical outcomes.
It is critical that RF / EMI shielding enclosures actually function per your own specific requirements, whether you are protecting sensitive data from foreign and commercial espionage, or assuring the chain of evidence for data on seized mobile devices, or testing for EMI in time critical major product launches.

So how can buyers of these enclosures assure they will perform? Product literature supplied by vendors often provides test data, but that must be carefully scrutinized to assure that the specific test used will predict the functionality of the enclosure in actual operation.

Different tests offer different insight as to effectiveness. Tests of the enclosure’s material may give a clue as to shielding effectiveness, but this is insufficient to predict functionality in use. The fully assembled enclosure needs standardized testing to ascertain shielding effectiveness. As leakage may come from seams, vents, filters, IO plates, or doors, shielding effectiveness should be measured through the wall at multiple locations. Shielding effectiveness can also vary greatly by frequency.

Select Fabricators tests their RF shielding tents with a third party independent IEEE-299 standardized test of the entire assembled enclosure. This standardized test measures dB shielding effectiveness at different frequencies. It also measures attenuation through the tent wall at a variety of locations, by the door, by the vents, etc.

The minimum shielding effectiveness that is recorded anywhere throughout the enclosure is the critical measure for security applications. Select Fabricators’ IEEE-299 test of their high attenuation tent plotted on the chart below shows shielding effectiveness of at least 85.7 dB from 400 MHz to 18 GHz throughout this portable chamber. Peak shielding performance of 98.7 dB was recorded at 1 GHz on the side with the door.

Your specific application may have unique shielding effectiveness requirements. dB measurements are logarithmic, a 60 dB rating is ten times higher than a 50 dB rating. Shielding effectiveness needs vary greatly with the signal intensity encountered, which drops exponentially with the distance to the source. Critical security applications to prevent electronic eavesdropping in hotels and office buildings may need to shield computer and cellular equipment’s RF emissions from reaching the next room or floors above and below.

**Proactively managing your RF shielding enclosure’s procurement process is critical to assure the buyer gets the results they need for their specific application.** Specifying shielding requirements in the request for quotation is important. For highly critical applications, you may need to assure that the specific enclosure you purchase, as manufactured and delivered, will actually work for you on the site where and how it will be ultimately used. In these sensitive situations, the request for quotation may possibly include a receiving verification process to assure that the specific enclosure as configured and delivered performs in the field as used. This may require third party testing of the enclosure on the site where it will be used, perhaps requiring the supplier to make field modifications to adjust for any shielding issues. Select Fabricators will work with customers with highly sensitive requirements to facilitate this verification process.

To assure your RF / EMI Shielding Enclosure will work for your application, be sure to include a written request for quotation including your minimum shielding requirements for the frequencies important to your needs. If your application is highly critical, consider specifying onsite 3rd party testing to assure the enclosure you receive meets your specifications. Most importantly, be sure to choose a supplier who will stand by their product. Here at Saelig Company, we are committed to delivering an isolation product that meets your needs.