A Power Supply Can't Fix All EMC Woes, Yet Partnering With The Right Power Supply Experts Early Can

by Kevin Parmenter, Chair, and James Spangler, Co-chair, PSMA Safety and Compliance Committee

About 30 years ago I attended a key supplier conference for a very large OEM for which I was the FAE assigned to the account. One of the activities at this conference involved an exercise conducted by a consultant. The consultant split the attendees into small groups and gave them all the assignment of getting a house painted. The groups would need to determine all requirements and considerations associated with painting a house. But there was a catch: One half of the groups would do so while planning to paint the house themselves. But the other groups would outsource the task to a painter or painting company.

After 30 minutes or so we compared our lists. The teams which presented on painting the house ourselves had much shorter lists of requirements which were not overly demanding. For example, if we spilled some paint, "we would just wait till the grass or bushes regrew and cut the paint splattered part out". On the other hand, the groups that "outsourced" the painting had much stiffer requirements such as "if paint is spilled or gets on the bushes, the painter must re-sod and replace the bushes at the painter's expense, no questions asked."

This exercise taught a simple lesson: if you do a job yourself the expectations will be a lot lower than if you outsource it.

Now, fast-forward to the present. For many companies in the electronics design and supply chain, the business has not changed much except that the margins everyone is making are much lower and the expectations are probably even higher. But does the lesson learned all those years ago still apply?

Recently I was called by one of our customers who was failing EMC in the test lab. They were using one of our competitor's power supplies and we had been talking with them about using ours because of its superior value and performance. It was hard to ascertain if our pitch was falling on deaf ears or not.

But now, with their product failing compliance testing, suddenly we were important to them as evidenced by them calling me after hours. The discussion went something like "does your power supply have lower EMC than the one I'm now using?" Of course they were talking about radiated EMC as I already had helped them with selecting a line filter, which was sufficient to make sure either power supply would pass conducted EMC. With their product in the test lab there was real urgency as—chah–ching, chah–ching—the money meter was running with the test lab charging them by the hour as the customer tried to get their product to pass EMC (Fig. 1).

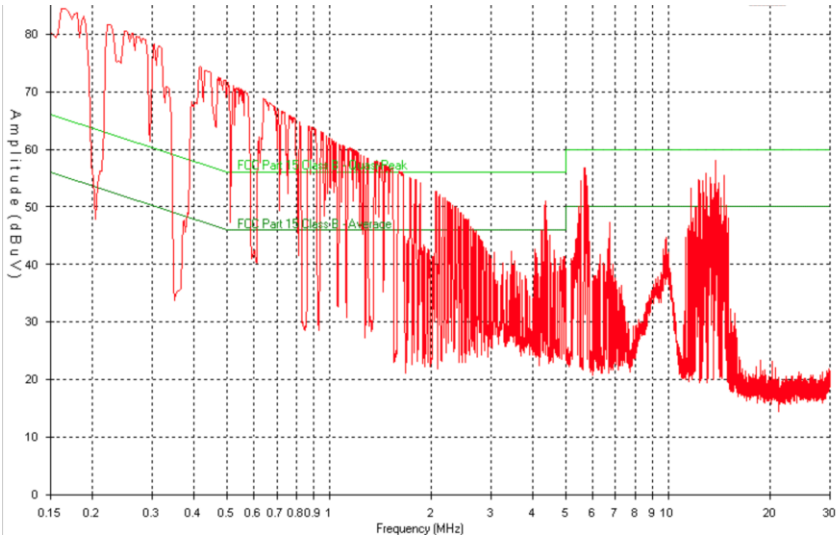

Fig. 1. A product failing EMC testing. When this happened to one of my prospective customers, they assumed that the power supply was at fault and tried swapping power supplies to no avail.

I mentioned that I was going to be in their area the very next week and I offered to work with them in the test lab. When I arrived at the designated time, this would-be customer showed me what they had done thus far. Their product was in an RF anechoic chamber like the one shown in Fig. 2. They took the covers off and showed me the product and power supply location. Our competitor's product was buried inside the device with little shielding or attention to wire dress or filtering. Meanwhile our power supply was on the bench with an IEC cord feeding it ac from an outlet and twisted pair wires connecting the power supply's outputs to the product's electrical connections.

As I surveyed the scene, they asked "if your power supply can't pass, can you recommend one that will?" Like a gambler playing a slot machine, they were more than happy to keep pulling the power supply "handle" in hopes a better power supply would pay off and make them a compliance winner. They thought it's like picking resistors off a catalog distributor's website or something similar.

However, both power supplies were running and every test was failing. I knew from experience that neither power supply was probably having much of an effect. The rails in the product were 12 V and 24 V at about 1 kW total.

With those voltages in mind, I advised the customer to go to the auto parts store and buy a couple of car batteries. They could then run shielded cables from the batteries into their product's chassis to power it, and re-run all the tests from the 12 and 24 V dc. Batteries after all, produce no EMI. So can we agree at that point power supplies would have nothing to do with the test? They agreed and set the test up.

As I expected, they failed radiated emissions again with very little change in the emission profile. Whoops! The customer realized it was the house they painted themselves, so what now? "Oh, we will just get the CE mark and ship it out to beta customers," they decided, bypassing the requirement for an EMC test lab certification. And the unspoken parting message to me was "when I need more free consulting work without actually using any of your products, we will call you again."

Besides confirming that the painting-the-house lesson still holds true, this story also has a moral: The power supply does not cause all radiated emissions problems in the end product. But the customer will call the power supply company anyway because it's easy to blame the problem on what they think is the noisiest part of the system.

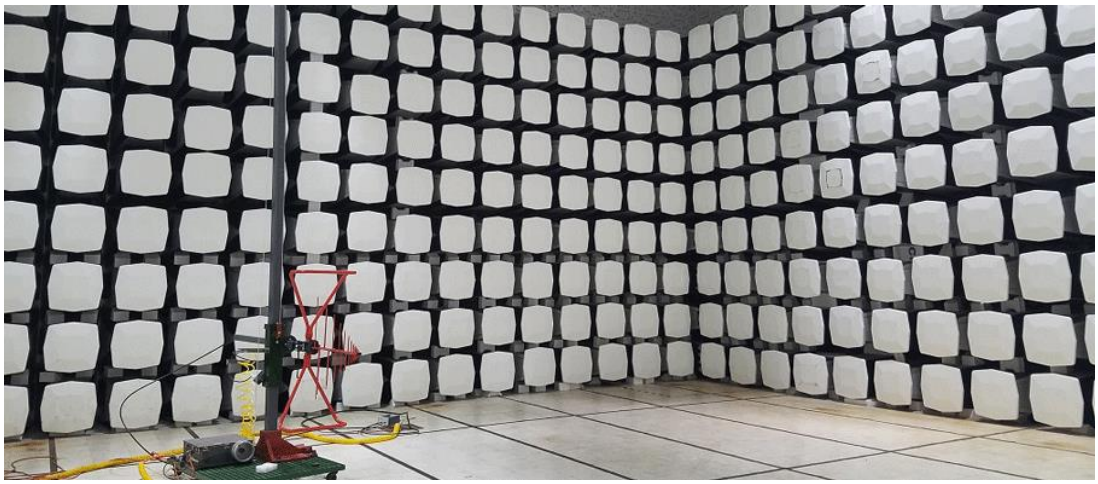

Fig. 2. An example of an RF anechoic chamber used for radiated EMC testing. (Photo courtesy of NST)

What Did We Learn?

Several mistakes were made by the customer in the above story:

1. EMC was an afterthought—if they had called me earlier we would have had more options and fixed it properly.

2. The power supply selection, particularly the choice of the power supply vendor, was given as much consideration as the selection of paper towels and the power towel maker, for the towels used in the company restrooms. They thought the power supply was just another commodity item—it's all generic. So when a problem that *might be* power supply related occurred, they just kept trying anything and everything in the hopes that something would work.

3. They waited until the end of the process to test the product for EMC with no pre-compliance testing.

4. They didn't build a relationship with the power supply company or bother to select one that actually has field applications staff that can come and help. They waited until they had an emergency and when no support was available from the default supplier they asked us for help. Their alternatives would have been to suffer in silence or deal with phone support from a far off land.

5. They didn't design for EMC all during the design process from concept to finish.

6. They thought that a power supply is always the main culprit in radiated emissions regardless of its integration in the end product with no consideration of their system impact or how the power supply is integrated in the system.

7. They kicked the compliance can down the road for later. CE won't accept other EMC approvals and other EMC agencies won't accept CE since all you have to do is pay a CE consultant to pass. This problem will surface another day. Probably when time to market is critical.

I offered to help the customer with a re-design of their product so they would pass EMC. I also mentioned that, in general, it's best to pick a power supply up front and then work closely with the supplier on the design of the product's I/O to the power supply, system design, filtering and such so that the test lab experience will be a good one.

Power supply selection is much more important than most engineers realize. It's not just picking a part from the Internet. It's a system selection and partnership commitment. Beyond that, power electronics is a partnership relationship. It's a collaborative commitment to making sure your product passes all safety, compliance and regulatory testing on the first pass.

Reference

"When Invaluable Kills Business" by Frederic Leens, 12-11-2017.

About The Authors

Kevin Parmenter is an IEEE Senior Member and has over 20 years of experience in the electronics and semiconductor industry. Kevin is currently vice president of applications engineering in the U.S.A. for Excelsys, an Advanced Energy company. Previously, Kevin has served as director of Advanced Technical Marketing for Digital Power Products at Exar, and led global product applications engineering and new product definition for Freescale Semiconductors AMPD - Analog, Mixed Signal and Power Division based in Tempe, Arizona.

Prior to that, he worked for Fairchild Semiconductor in the Americas as senior director of field applications engineering and held various technical and management positions with increasing responsibility at ON Semiconductor and in the Motorola Semiconductor Products Sector. Kevin also led an applications engineering team for the start-up Primarion where he worked on high-speed electro-optical communications and digital power supply semiconductors.

Kevin serves on the board of directors of the PSMA (Power Sources Manufacturers Association) and was the general chair of APEC 2009 (the IEEE Applied Power Electronics Conference.) Kevin has also had design engineering experience in the medical electronics and military electronics fields. He holds a BSEE and BS in Business Administration, is a member of the IEEE, and holds an Amateur Extra class FCC license (call sign KG5Q) as well as an FCC Commercial Radiotelephone License.

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For many years, he worked as a field applications engineer (FAE) for Motorola Semiconductor, On Semiconductor, Cirrus Logic, and Active Semiconductor, assisting customers in using semiconductors. He published numerous application notes and conference papers at a variety of conferences: APEC, ECCE, IAS, and PCIM. Topics included power factor correction, lighting, and automotive applications. As an FAE, he traveled internationally giving switch-mode power supply seminars in Australia, Hong Kong, Taiwan, Korea, Japan, Mexico, and Canada.

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