

Cost, Compliance, and EMC Layout Shape EMI Future

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WDD readers identify the key specifications, challenges, and obstacles in the design of EMI/RFI filters.

Electromagnetic interference (EMI) is everywhere. According to Electronics.ca Publications¹ [1], the global market for EMI materials and technologies is expected to reach \$5.2 billion in 2016, for a compound annual growth rate (CGR) of 2.8 percent. Wireless communication, broadcast radio, television, and medical devices are just a few of the industries that are affected by interference. Electronic equipment is used throughout many industries like automotive and alternative energy systems, where precise power processing is necessary. All power electronics produced today include EMI filtering circuits; all switch-mode power supplies have internal EMI filters. Additionally, every electrical product has to pass the Federal Communications Commission (FCC) emissions standards before it can be released to consumers, and the problem, says Guy de Burgh with RTC magazine, is “Design experts do not focus on EMI while designing the schematic.”² [2] The products are assembled and given to the electromagnetic compatibility (EMC) expert too late in the game, and the fix is expensive, difficult, and time consuming. EMI is essential in the early stages of design to help eliminate this costly problem.

Mel Berman with TDK-Lambda Americas posits that “many specs and ratings must be considered when selecting EMI filters”³ [3] and indicates several important features: case size, safety agency approvals, operating voltage, current, temperature range, and insertion loss. Results from a recent survey on EMI filters suggest how *Wireless Design and Development (WDD)* readers believe cost, design/test compliance, and EMC layout play the most significant roles in the future development of filters. The survey also presents readers’ thoughts on important specifications, challenges, design obstacles, and popular trends.

Specifications

The results suggest that readers and professionals in the industry agree with what Berman considered to be most important when implementing EMI/RFI filters into designs. Insertion loss was the most popular (61 percent). Others reported the following:

- Rated current – 55%.
- Rated voltage – 52%.
- Operating temperature – 38%.

While insertion loss, operating current, voltage, and temperature are considered

most important overall, 16 percent chose:

- Noise.
- Miniature size and weight.
- Frequency range.
- Rugged design for vibration/shock.

Insertion loss is used to analyze installation and performance quality. In wireless communication, insertion loss measurements are used to “help troubleshoot the network by verifying the cable installation and cable performance. High insertion loss in the feedline or jumpers can contribute to poor system performance and loss of coverage”⁴ [4]. Experiencing a dropped call is a minor irritant, but system failures in aerospace or the medical field can be serious. Moreover, rated current, rated voltage, and operating temperature are essential to design, because of the necessity to operate continuously over temperature ranges without incurring damages.

Challenges

Designers who are integrating EMI filters into products face various challenges. More than half (52 percent) surveyed agree that size considerations were a problem. Others reported the following:

- Standards/certifications – 35%.
- Ratio of noise – 39%.
- Environmental conditions – 31%.
- Temperature range – 28%.

Electrical devices are getting sleeker and slimmer, and the probability for interference increases as more circuits are being crowded into less space. EMI filters reject signals and harmonics generated by data lines and clock signals that cause interference, but it is important to consider size, especially if a given application has limited space. The effectiveness of EMI filters can be reduced if they are unable to fit comfortably in an application.

Design Obstacles

The results varied with design obstacles. While 37 percent agree that cost is the biggest design obstacle, others reported the following:

- Design/test compliance requirements – 20%.
- Energy efficiency/stability – 18%.
- Time-to-market – 9%.

The global market for EMI materials and technologies is growing. Integration of power and electronic circuits is the market demand. Advances in semiconductor technology brought fast power switches in the market to improve system efficiency

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and performance, but it necessitates complying with EMC requirements. According to Dr. Firuz Zare with the IEEE, it is challenging to determine “switching frequency and switching time of power switches [...] which requires breadth and depth of knowledge of EMC and power electronics in order to optimize a system at the beginning stage of design.”⁵ [5]

Trends & Future Developments

According to the survey results, the most popular trends occurring in EMI filters are size and cost, with the future developments of EMI filters depending on cost, design/test compliance, and EMC layout. Professionals in the technology industry have stressed the importance of implementing EMI considerations into the beginning phases of design in order to meet emission standards and avoid costly overhauls. Size has been noted by the readers to be a challenge in implementing EMI into design, but ultimately, the size of the EMI filter is controlled by the product requirements.

References

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