

A Highly Valuable Guide To EMC Troubleshooting And Pre-Compliance Testing

Workbench Troubleshooting EMC Emissions (Volume 2): Simple Techniques for Radiated and Conducted Emissions Troubleshooting and Pre-Compliance Testing (EMC Troubleshooting Trilogy), Kenneth Wyatt, available from [Amazon](#) in US, Canada, Europe, Australia and Japan. Published 2021, 240 pages.

Reviewed by Kevin Parmenter, Chair, PSMA Safety and Compliance Committee

Anyone who is aware of EMC topics knows Ken Wyatt. He is one of the top talents in the field after acquiring over 35 years of experience. He has shared this experience in several books and numerous technical articles and videos. Besides being a consultant and author, he is also a well-known lecturer. I have had the pleasure of arranging for Ken to be a presenter and teach classes at conferences and his efforts always resulted in rave reviews from the attendees.

Ken's latest book, "Workbench Troubleshooting EMC Emissions," is a follow-up to his earlier work in volume 1, "Create Your Own EMC Troubleshooting Kit". Here in volume 2, which of course builds on volume 1, the goal is to give the reader simple techniques for mitigating conducted and radiated emissions, and troubleshooting the same.

Now, there are certain books which are written with practical methods and useful information so that every engineer should have them on their shelf. Anything written by Ken Wyatt fits into that category. These books need to be distinguished from the thousands of books written by theoretical types. Naturally, those books serve a purpose too. But if your job is to get a product through regulatory testing and into volume production and shipping in a manner so that nothing fails in the field or comes back, then this book—along with volume 1—is for you.

This latest work is useful for any engineer at any level of expertise. That even includes the co-op student or the new engineer whose boss has instructed them to get a product ready so it can pass regulatory and compliance testing. It is also useful to the seasoned veteran who will learn some new tricks and techniques.

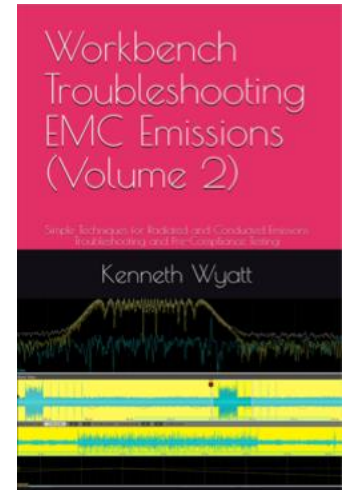
Ken has arranged his book in very logical progressions with a great overview and introduction to emissions, definitions of what they are and why they need to be mitigated. Basic EMC concepts are also explained. After the groundwork is set, the author dives into practical troubleshooting for conducted emissions and how to assess and then reduce them in your product under test. This of course logically transitions into troubleshooting radiated emissions with the same tenacity and expert guidance on how to measure and then reduce these emissions so that compliance can be achieved.

After reading both the conducted and radiated emissions troubleshooting sections I cannot think of anything in my experience which has been left out. What's more, many new techniques are presented that will be of use to the practicing engineer.

For example, in the conducted emissions section, the author outlines some simple yet cost effective ways to measure both differential- as well as common-mode currents. These methods employ some test instruments which won't break the bank such as a very cost effective LISN you can put to use immediately in the lab. So you won't have to scrape your engineering management off the ceiling when you ask to buy the gear.

In the area of radiated emissions the author explains a proven three-step process for tracking down the sources and mitigating them. He also has an interesting technique using near-field probes to track down the root causes of the interference.

His techniques do not require you to build a screen room in your building. But if you have one, his methodologies and approaches certainly apply. Moreover, they can be used by engineers with any level of expertise. There is something in here for everyone as Ken has done a great job of imparting wisdom and translating his knowledge from decades of work in the field into practical methods we all can perform in the engineering lab without huge monetary investments.



It also warmed my heart to see an entire chapter on pre-compliance testing. Beating the drum on pre-compliance testing is always an important thing as I continue to encounter good people paying big money in the EMC lab flailing helplessly while the test lab's spend-o-meter keeps racking up invoices. That is the last place—and possibly the most expensive place—to learn that you do not pass EMI compliance requirements. I regularly implore engineering managers to let their teams set up pre-compliance testing before they go to the certification labs. Make sure it passes in your lab first.

However the chapter on pre-compliance testing was not just promoting the fact that engineering managers need to enable their engineers to perform pre-compliance testing at their facility and pass these tests before ever heading over to the lab. Ken outlines the important how-to specifics of pre-compliance testing for both conducted and radiated emissions. That includes how to set up a low-cost temporary lab to make the measurements.

The next chapters cover other EMC measurements even those relating to the new wide-bandgap devices such as GaN power transistors. The author discusses what that these new devices mean in terms of the EMC considerations. This is especially relevant for us in the power electronics world as we are seeing the fast adoption of these parts. Also helpful is a chapter on troubleshooting wireless self-interference, which is the ability of a product (especially one that contains RF links or aspects of them) to interfere with itself. The author then outlines tips on how to mitigate the effects of self-interference.

Another chapter provides case studies to help engineers learn from others' experiences as to what works and what does not. These cover both radiated and conducted examples, and how the problems were solved. Moreover, there is an excellent section of summary and references that contains a plethora of useful information and resources which will come in very handy.

Additionally, the appendices offer examples of industry-standard test setups for typical measurements and known-to-work test setups as well as several do-it-yourself constructions to save time and money. There is also a notable section on using LTspice to evaluate filters which is a big-time saver.

The only subjects not discussed are topics such as ESD and surge protection, which are sometimes treated as EMI-EMC topics. But by no means does this take anything away from Ken's excellent work as the transient and surge topics are subjects unto themselves that deserve their own texts. For example, an excellent work on that subject, "Design of Transient Protection Systems Including Supercapacitor Based Design Approaches for Surge Protection" by Nihal Kuluratna was reviewed last month in this column.

Similarly, I recently obtained a copy of "Lightning Protection and Grounding Solutions for Communications Sites" by Ken Rand. It's an outstanding work covering lightning protection which of course is an extreme version of transient and surge protection.

But for help with EMI and EMC issues, particularly in power electronics, I recommend having Ken's books including this one, on any practicing engineer's bookshelf. It will not sit there gathering dust as you will likely consult it whenever EMI issues arise or you need to plan ahead for compliance.

Ken knows what he is doing, and we are fortunate that he has chosen to pass on his decades of knowledge and expertise through his books and fine presentations. Do not hesitate to order your copy of this excellent and practical book. You will be glad you did.

About the Author



Kevin Parmenter is an IEEE Senior Member and has over 20 years of experience in the electronics and semiconductor industry. Kevin is currently director of Field Applications Engineering North America for Taiwan Semiconductor. Previously he was vice president of applications engineering in the U.S.A. for Excelsys, an Advanced Energy company; 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.

Prior to that, Kevin 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. 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.

For further reading on power supply-related safety and compliance issues, see How2Power's special section on [Power Supply Safety and Compliance](#).