

KIMMEL GERKE



Bullets

Winter
2015

Welcome to KGB... And to the now annual issue of our "personal communications" to our friends, clients, and colleagues about EMI issues, problems and solutions.

This issue focuses on "Prepping for Testing." While most of our efforts at Kimmel Gerke Associates are aimed at EMC design (rather than test), sooner or later you will need to go to the EMC test lab. For a first timer, this can be particularly confusing – perhaps even a bit frightening.

But not to worry. We'll share some ideas and give some advice on how to survive your trip to the lab.

Hope you find this article useful. But from *design to test to troubleshooting*, give us a call if you need EMI help.

– Bill Kimmel, PE, and Daryl Gerke, PE
– Full Time EMC Consulting Engineers since 1987

Note - This material was taken from a longer article we did for *InCompliance* magazine in August 2014.

EMC Winter Workshops 2015 **San Diego, CA - February 9-10-11, 2015** **Orlando, FL - February 17-18-19, 2015**

Need a winter break, and some fun in the sun? Want to learn more about EMC design or troubleshooting? Then join us in San Diego or Orlando for our annual *EMC Winter Workshops*.

In addition to our regular *Design for EMC* class (2 days), you can attend our *EMC Troubleshooting* class (1 day).

The troubleshooting class is offered ONLY at these locations, as an optional extension to the two day class. We recommend attending the two day class *Design* prior to attending the *Troubleshooting* class.

For more details, visit our website (www.emiguru.com) or call us toll free at 1-888-EMI-GURU. (Inquire about our special hotel rates in Orlando.)

Season's Greetings... Happy Holidays from our families to yours. Wishing you the peace and the joy of the season, and all the best in 2015!

Upcoming Events.. Here are some places we'll be in 2015. Hope to see you at one or more of these events.

EMC Winter Workshop-San Diego CA-February 9-11. Daryl will be teaching this class. Combine this with a mini-vacation to see the San Diego Zoo, Sea World, or (like Daryl does) the wine country of Temecula. www.emiguru.com

EMC Winter Workshop-Orlando FL-February 17-19. Bill will be teaching this class. Take a mini-vacation to Disney World (like Bill does) before or after this class. www.emiguru.com

IEEE EMC Symposium-Santa Clara CA-March 15-20. The annual rendezvous for those interested in EMI/EMC. Meet old friends, learn new ideas, see new products, and more. If you are new to EMC, this is a great show to attend., as it is a friendly bunch that welcomes newcomers. <http://www.emc2015usa.emcss.org>

IEEE International EMC Symposium - Dresden, Germany - August 16-22. Note that the US show in Santa Clara was moved from August to March to avoid a conflict with this show. www.emc2015.org

Please Join our E-Mail List... About half of you are already on our electronic list, and we invite the rest of you to join us. *Multiple benefits - you will learn about:*

- On line EMC events, like webinars.
- Local public EMC events, like our classes.
- Other EMC issues/events that may be of interest

You will also receive a notice/link for the latest KGB.

We won't spam you, and you can opt-out at any time. Our E-mail list is private, and we do not sell or rent names. Join us – keep up to date on EMC – and save a tree!

EDN Designer's Guided to EMC...

Now available in PDF. Written entirely by Kimmel Gerke Associates. First published in 1994, and updated in 2001 (three new chapters.) Order this still timely classic on-line at www.emiguru.com, for \$29, and download immediately.

Hard copies still available for \$39, which includes US shipping. Call for details, or special pricing on multiple copies. *Attend a class and get a FREE hard copy.*



Focus on Prepping for the Test Lab...

Like it or not, most electronic designs today are subject to formal EMI testing.

So even if you are new to EMI/EMC (electromagnetic interference/compatibility), you need to understand what is involved and how to best prepare for a trip to the EMI test lab. Like any trip, good preparations are key.

Before we begin, however, a little philosophy. Too often designers take EMI failures personally. So change your mind set — think *verification*, not testing.

The goal is not to criticize your designs, but rather to assure your designs will work in the field. Make it a positive experience. As we learn, we improve — even us grumpy old EMC consultants.

Make a plan... The first step is to write a plan. If you are working in the defense industry, a test plan is usually a contract requirement.

But even if not required, a written test plan is still a good idea as it forces one to address critical issues ahead of time. Here is a summary, which you can even use as a checklist.

Define failure criteria... With emissions, this is easy. Are the levels above or below the limits?

But with immunity/susceptibility, however, you may need to define failures. For example, is a reset with recovery acceptable? How much perturbation can you withstand in an analog sensor?

Depending on the equipment under test, the failure criteria are already specified. Other times you may have more flexibility in your definition of a failure.

The different failure levels prescribed in the European Union EMI specifications are a useful place to start. Be sure to include this in your plan, and to get advance agreement on the failure criteria from your customer.

Determine failure monitors... Again, with emissions this is easy — just watch the spectrum analyzer.

Immunity/susceptibility are not as easy. How will you determine a failure? Special software? Or special hardware, such as a blinking “heartbeat” detector? Or maybe just indicators on the EUT via a video camera.

KGB Bullet... An old rule of thumb...

- If the cost to prevent an EMI problem is \$1...
- The cost to fix it at EMI testing can be \$1K and up...
- The cost to fix it in the field can be \$100K and up...

For want of a the nail the shoe was lost... for want of a shoe the horse was lost... for want of a horse, the battle was lost... for the want of a battle the kingdom was lost... all for the want of a horseshoe nail. — An Old Proverb

Determine equipment hardware... What specific equipment will you test? Are peripherals needed? What about memory or I/O configurations?

It is probably best to test a “worst case” configuration, which assumes that lesser equipment configurations will have lesser EMI issues.

Determine equipment software... Will you need special test software? Some software may even be prescribed.

For example, the prescribed *emissions* test software for personal computers includes reading/writing to hard drives and peripherals, along with a “scrolling H” test pattern for monitors. Not fair to let the system idle — you need to exercise the hardware.

For *immunity/susceptibility*, how will you monitor, recognize, and report failures? Will the standard software do it, or do you need additional special software? Will that software run on the EUT, or on remote equipment?

Determine support hardware... Passive peripherals, or active exercisers? Will you need to develop special hardware (and associated software?) Are there special power or cooling needs?

Don’t forget about cables and connectors. If shielded, make sure they are properly terminated. If necessary, how will the cables penetrate the test chamber? You may need to develop a special test fixture for this.

Incidentally, we’ve see too many problems with cables — check them out before going to the lab. We still recall one engineer admonishing his colleague with, “*I thought we brought the GOOD cables.*”

Put together a tool kit and spares... As a minimum, you should bring spare circuit boards. Better yet, bring an extra system or two. There is nothing worse than having equipment break during the tests, with no backup. Bring backup software too.

You may also want to include some spare parts — ferrites, small caps, EMI copper tape, and even a roll of heavy duty aluminum foil.

A soldering station can be useful too if you need any minor board modifications. Much of this may be available at the lab, but better to be prepared.

Consider multiple configurations... For cost sensitive designs, we often recommend three test samples (we call this the A-B-C method.)

The *A-unit* has minimal modifications (management’s dream); the *C-unit* has all the EMI fixes you can think of (the EMI engineer’s dream); and the *B-unit* is somewhere in between (the designer’s dream.)

If you’re an optimist, start with A. If you pass, life is great! If you are a pessimist, start with C. If you fail, you’re still

in trouble. In most cases, you'll be somewhere in between, which is where the B unit comes into play. But this approach lets you quickly bracket things. It also means you have spares on hand that can be modified as needed.

Schedule your tests... Finally, with all this preparation, don't forget to call your test lab for scheduling.

Test labs can get pretty busy, so don't expect to get in right away. The more advance time you can give the lab, the better. They will appreciate your courtesy.

But for emergencies, most labs will do their best to accommodate you. Just don't make every test a panic.

In Conclusion... We hope this makes your next trip to the EMI test lab both easier and more enjoyable. EMI testing is an important step to assure our equipment will work properly in its intended environment. The ultimate goal is a better design, which is what we all want as engineers.

This material was condensed from our recent article at *InCompliance* magazine. To read the full article, go to incompliancemag.com/article/prepping-for-emi-testing

An ounce of prevention...
Is worth a pound of shielding or ferrite...
- A Kimmel-Gerke EMC Proverb

Some engineering humor... Daryl's brother (Jim) is a retired Civil Engineer. Many years ago at Thanksgiving, they were discussing work. Jim mentioned he was working on a "waste water treatment" project.

Deciding to needle him, Daryl said, "What is this? Why don't you civil engineers just call it what it is?"

Without missing a beat, Jim responded, "It may be sewage to you, but it's my bread and butter." (He actually used another term for sewage, but this is a family publication.)

Lesson learned – never mess with a Civil Engineer. Given the opportunity, they can be wickedly non-civil.

A KGB Bullet... **EMI/EMC in Military Systems** **(Includes MIL-STD-461/464 & Troubleshooting)**

We now partner with the *Applied Technology Institute* to offer our *EMC Military Systems* course on both a PUBLIC and IN-HOUSE basis.

ATI is an industry leader in technical training, with hundreds of classes in their catalogue. Our EMC classes through ATI have been well received.

For more information, contact ATCourses.com. Or contact us at emiguru.com, or at 888-EMI-GURU.

Consider In House EMC Training...

You may have noticed our public class schedule has shrunk in the past few years.

Due to the economy, revenues are down as companies tighten training and travel budgets. At the same time, the expenses (promotion, hotels, catering, etc.) continue to go up. Thus, we've had to cut back the classes.

Simply stated, the old public model no longer works as well for us. While we enjoy the teaching, we still run a business, and our classes must carry their own weight.

NO, we are NOT getting out of the training business!!!

We remain as committed as ever to helping our clients prevent EMI problems through EMI education. We will continue with our public classes, but at a lower level.

Our NEW EMPHASIS, however, is on IN-HOUSE CLASSES... So if you want to take advantage of over 90 years of industry experience combined with teaching over 10,000 students, call us to get on our schedule.

But don't wait too long. We won't be doing this forever. After all, we just celebrated 27 years in full-time practice. We also just celebrated 22 years of our *Design for EMC* classes. We won't be doing this 20 years more.

Not to sound immodest, but we're at the top of our game. As such, it is a great time for you to tap into our collective EMI/EMC experience. After all, the problems are not going away anytime soon.

BREAK-EVEN is about 12 students... We train up to 30 students at a fixed fee (no per-seat fees). You provide the training space, A/V, and refreshments. We provide the materials and instructor (either Bill or Daryl) .

An added advantage is that we can tailor material to focus on your particular problems. We can also add design reviews.

Don't have 12 students? Share a "hybrid" class with other local companies. Similar to an in-house class, but we request only one payment (you work out the money split.) We've done several such classes with good success.

The PAYBACK for EMC training is there... Save one trip to the test lab, and you have probably recovered ALL the class fees. Any savings after that are 100% profit.

But it is not just test savings. One client told us that preventing just one equipment shutdown saved \$50K. Another client told us that getting to market one month early was - as the credit card people say - priceless!

Interested? Call us at 888-EMI-GURU... or drop a line to dgerke@emiguru.com or bkimmel@emiguru.com. We can usually schedule your class within 8 weeks or less.

Schedule by 4/1/15 and get a FREE DESIGN REVIEW day worth \$1600 (class of two days or more.)

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Kimmel Gerke Associates, Ltd.

Winter 2015

About Kimmel Gerke Associates...

We are often asked to give a quick description of what we do and who we are. If you are asked by someone needing EMI help, here are several key points about KGA...

Point I... We are a two-man **electrical engineering firm that specializes in consulting & training on EMI/EMC (electromagnetic interference and compatibility) issues.** These include five key areas:

- Regulatory Compliance** (Emissions, immunity, FCC, CISPR, IEC, CE, FDA, MIL-STD, RTCA, SAE, etc.)
- Radio Frequency Interference** - (RFI)
- Electrostatic Discharge** -(ESD)
- Power Disturbances** - (Transients, magnetic fields, etc.)
- Self Compatibility** - (Signal Integrity, Analog, etc.)

KIMMEL GERKE ASSOCIATES, LTD.
EMC Consulting Engineers

DESIGN & TROUBLESHOOTING ELECTRONIC INTERFERENCE CONTROL

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Point II... We are Registered Professional Engineers (PE) and iNARTE Certified EMC engineers. **Between us, we have over 90 years of industry experience.**

Point III... We are not a test lab - **our emphasis is on EMC design, troubleshooting, and training.** While we are knowledgeable on EMC tests and regulations (and regularly witness EMC testing for our clients), our primary focus is on design/systems issues, and how to **IDENTIFY, PREVENT, and FIX EMI problems.**

Point IV... We serve many industries, and **our support ranges from circuit boards to complete systems.**

- **Military/Aero** (MIL-STD-461, TEMPEST, EMP, etc.)
- **Avionics** (DO-160, MIL-STD-461, etc.)
- **Computers** (FCC, EU, PCs to supercomputers)
- **Industrial Controls** (Individual controls to full systems)
- **Vehicular** (SAE, automobiles, farm machinery, etc.)
- **Medical** (FDA, diagnostic, clinical, patient connected)
- **Telecommunications** (GR-1089, etc.)
- **Facilities** (Shielded rooms, lightning, power)
- **Site Surveys** (RF, magnetic fields, mitigation help)
- **Legal Support** (Patent help, expert witness)

Point V... We are an independent consulting firm. **Our advice and recommendations are always free from any bias or other business concerns.**