KIMMEL GERKE Bullets

Winter, 2000

Welcome to KGB...

And to another issue of our "personal communications" to our friends, clients, and colleagues about EMI issues, problems and solutions.

This issue discusses "wireless EMI," a rapidly emerging problem. And thanks to new wireless technologies like Bluetooth, things should get even more interesting.

The catalyst for this focus article was Daryl's recent participation in a conference on "Wireless EMI in Hospitals." Users and industry representatives discussed the effects of a wide range of wireless devices, including cell phones, walkie-talkies, patient telemetry, wireless LANS, paging systems, and more. Technical conflicts are arising due to HDTV transmissions and spread spectrum devices, as well as the "regular" EMI problems.

As always, give us a call if we can help you with any of your EMI problems, from circuit boards to full systems.

Best Regards, Daryl Gerke, PE, and Bill Kimmel, PE

Seasons Greetings...

Our sincere best wishes to you and your families this holiday season, and all the best to you in the year 2001... *Bill & Daryl.*

EMC Winter Workshops 2001

Orlando, FL - February 5-8, 2001
San Diego, CA - February 13-16, 2001

Need a winter break, and some fun in the sun? Want to learn more about EMC design, systems, or troubleshooting? Then join us in San Diego or Orlando in February for our "once a year" expanded seminar series, sponsored by Tektronix.

Once again, we year we have one day on systems, two days on design, and one day on troubleshooting. Take only what you need to get up to speed on EMC issues.

For more details, visit our website (*www.emiguru.com*) or call us toll free at 1-888-EMI-GURU. *(Inquire about special hotel rates if you reserve by January 1.)*

EMC Calendar...

Here are some shows and classes we are involved with that may be of interest. Call us if you'd like more details.

Portable Design 2001... January 29-31, 2001, at the Santa Clara Mariott in Santa Clara, CA. Bill will be doing a one day session on "EMI Issues in Portable Design." This will be a concentrated "nuts and bolts" session focused on portable electronics.

As an ADDED BONUS — the show people are offering a discount to friends of KGA. *Simply enter the Priority Code (PD01MU) and get a $150 discount off the full price.*

IEEE International EMC Symposium... August 21-25, 2001, in Montreal, Quebec. Although specialized, this show has good stuff for newcomers as well — tutorials, demonstrations, and more. More details in a future issue.

Sixteenth Annual Minnesota EMC Event... Fall of 2001, exact date to be determined. A combined day of EMC training and exhibitions in the Twin Cities.

EMC Courses...

Here is the tentative schedule of the popular seminars sponsored by Tektronix and presented by Kimmel Gerke Associates, Ltd.

-Orlando, FL - February 2001
-San Diego, CA - February 2001
-Dallas, TX - February 2001
-Atlanta, GA - March 2001
-Rochester, NY - April 2001
-Newark, NJ - April 2001
-Boston, MA - April 2001
-Chicago, IL - April 2001
-Detroit, MI - May 2001
-Minneapolis, MN - May 2001

For more details, visit our web site, *www.emiguru.com*. Please note that you can now register on-line.

emicatalog.com... Although we sold this web site to Canon Communications (publisher of *Compliance Engineering* magazine), we are still involved. If you haven't done so, we invite you to visit. It is an on-line database with ENHANCED SEARCH CAPABILITIES for finding special EMC components or EMC test labs. Best of all, it is FREE to users.

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Focus on Wireless EMI...

In our last issue, we discussed "Microwave EMI," written mainly from a design view. In this issue, we'll look at "Wireless EMI," written from a systems view. With the advent of wireless microwave devices like Bluetooth, we expect to see more EMI problems in both areas in the next few years.

The catalyst for this article was Daryl's recent participation in a small conference on "Wireless EMI in Hospitals." About 50 biomedical engineers and industry personnel discussed the effects of a wide range of wireless devices in hospitals -- including cell phones, walkie-talkies, patient telemetry, wireless LANS, paging systems, and more. Held at one of the leading medical centers in the US, this was an eye-opener, even for a crusty old EMI engineer.

Most of us are well aware of the potential problems in hospitals due to cell phone or hand held radios used near sensitive medical devices. Other technical problems are arising, however, due to HDTV transmissions and spread spectrum devices, which can also adversely affect patient telemetry and information systems.

Hospitals are also quickly moving to "wireless Internet" applications for the medical staff. Doctors can be alerted when lab results are ready, which they can then view on- line. Full patient histories can be made available to further assist diagnosis and treatment. And the list goes on. (Next fall, all incoming medical students at the Harvard Medical school will be furnished wireless Palm devices — "wireless medicine" is here today.)

Let's look at just a few of these potential "wireless EMI problems" and what they mean.

High Power Fixed Transmitters - Nearby radio, television, or radar transmitters can play havoc with sensitive electronic equipment. Low level analog circuits are particularly vulnerable, such as thermocouples, physical sensors, or medical instrumentation.

If you are more than a mile away from these sources, they are often not a problem. Buildings offer some attenuation to low frequency sources, such as AM broadcast transmitters, but little attenuation against VHF/UHF sources such as TV or FM broadcast transmitters. Systems solutions include special shielded rooms, extra shielding on cables and sensors, and high frequency filtering of power and signal lines. Design solutions include equipment shielding, filtering, or additional components right at the most vulnerable circuits.

Low Powered Mobile Transmitters - Although devices like "walkie-talkies" and cellular phones use low power, they can also interfere with nearby electronics equipment. The most likely "victims" are sensitive analog circuits.

These transmitters may cause problems at distances of 10 feet or less. In fact, the European Union RF immunity limits of 3-10 Volts/meter are based on mobile transmitters located within a few feet of sensitive equipment. Since the transmitters are local, no additional building shielding can be assumed.

Systems solutions may include establishing a "protective perimeter" around sensitive devices, or even banning walkie talkies and cell phones in a facility. This approach has become popular in hospitals, and control centers in power plants, oil refineries, etc. The medical community even has a new "ad hoc" testing specification to help determine the protective perimeter distances. Design solutions are similar to those for high powered transmitters.

Telemetry - Low power telemetry has become very popular in hospitals, particularly for monitoring ambulatory patients. The typical range is a few hundred feet at most, and often use existing television frequencies on a "secondary" basis. The advent of HDTV has played havoc with this approach, which has higher level signals within the TV channel bandwidth. As a result, a number of "old" hospital telemetry systems are no longer functional. Due to this problem, the FCC recently dedicated a former TV channel for exclusive hospital telemetry use.

Solutions here include frequency management, changing telemetry frequencies as needed, or moving to new dedicated telemetry frequencies.

Wireless LANs - Similar to telemetry, wireless LANS have also become very popular in many areas, and also may have a limited range of several hundred feet. These often rely on "spread spectrum" frequencies in the 900 MHz or 2 GHz range.

An emerging problem here is incompatibility between the two popular spread spectrum techniques — "direct sequencing" and "frequency hopping." When both techniques are used in the same vicinity, serious interference problems can occur, greatly reducing data throughput. As Bluetooth and similar technologies proliferate, these problems are expected to increase.

Solutions here include coordination frequencies, locations, and modulation methods. (One speaker at the hospital conference even advocated a "RF Coordinator" be appointed in each hospital to address these new issues.)

A KGB Bullet...

Here are some web sites that may be of interest:

-*www.emiguru.com* - our favorite, of course. - www.emicatalog.com - an excellent resource for finding products and services. FREE, and easy to use.

-*www.fcc.gov* - download FCC documents

-*www.ieee.org* - IEEE publications.

-*www.dsp.dla.mil* - downloadable military specs.

-*www.iec.ch*, *www.iso.ch*, and *www.ansi.org* - these web sites list documents from respective organizations. Actual documents are copyrighted must be purchased.

Unintentional Radiators - Computer systems and radio receivers often referred to "unintentional radiators," since they do radiate small amounts of RF energy, even though there is no benefit as there is in a "wireless" application.

Both types of unintentional radiation can jam licensed and intended communications systems. Computer clocks can generate harmonics well into the GHz range, and superhetrodyne receivers can leak energy from their local oscillators. The FCC and other agencies regulate these levels with their "emissions" limits.

Unfortunately, even these limits may not be good enough for very sensitive receivers or with very close equipment proximity. For example, since the FCC/CISPR limits for computers are designed to protect television receivers, they are often woefully inadequate to protect nearby VHF/UHF radio receivers. This is why the FAA insists that computers be turned off during aircraft takeoff/landings, and that radio/television receivers not be used at anytime during a flight.

Summary: We hope this quick overview has given you some insights into these important new "wireless EMI" issues. As with any new technology, there is often a price to be paid. Since the RF spectrum is limited, we all need to take steps to prevent the pollution of this resource. Please call us if we can help you with any of your EMI problems — wireless or otherwise.

EDN Supplement Delayed...

We just learned that the updated *EDN Magazine Designer's Guide to Electromagnetic Compatibility* has been delayed by the publisher. No specific date yet, but it is now targeted for printing in early 2001.

We apologize to those who contacted us — we are as anxious as you to again see this in print. EDN did run one of the new chapters on *EMI in Components* in a recent issue. We'll keep you posted.

Some Technology Humor...

In the 1960s, so it is said, the CIA built a computer to translate English and Russian. To test the machine, the programmers decided to translate a phrase into Russian and then translate the results back into English. The CIA director, when invited to do the honors, typed "Out of sight, out of mind." The computer ground through its calculations for several hours. Finally, the printer gave this result, "Invisible Insanity."

(–Stephen Budiansky, in the *Atlantic Monthly*)

"In America, anyone can become president. That's one of the risks we take." —*Adlai Stevenson*

(Note - We included this quote while the election was up in the air -- and it may still be when you read this.)

On-Site EMC Classes...

Our in-house EMC classes continue to be very popular. Here are several standard classes we offer:

-Design for EMC (2 days)
-Systems Grounding Shielding (1 days)
-Medical Design for EMC (2 days)
-EMC in Telecommunications (2 days)
-EMC in Vehicular Electronics (2 days)

We can also custom tailor classes to your needs. For example, we've recently done several "hybrid classes" that were "half design/ half systems" that also included a "mini-workshop" on EMI troubleshooting.

Another possibility is "sharing" a class with another company. One client recently even formed a consortium with several other local companies. In addition to our seminar, they have hosted several other technical seminars.

We can handle up to 30 attendees, but even if you have a dozen, an in-house class may make sense.

Book Review...

We just ran across this old "classic" at the University of Minnesota bookstore. Reprinted in paperback, this is a steal at only $8.95.

Lightning... by Martin Ulman. Originally published in 1969 by McGraw-Hill, and reprinted by the Dover Press. A very thorough treatment of the subject, written at the advanced undergraduate level of engineering. A good addition to any EMI library. ISBN 0-486-64575-4.

A KGB Bullet...

You can often improve the shielding effectiveness of openings with "waveguide beyond cutoff" techniques. These apply to both single openings , and arrays of openings (such as honeycomb ventilation materials.)

SE (dB) = 32 d/D for round openings

d= depth of hole, and D= diameter of hole.

This formula works when D is less than 1/10 of the wavelength, and the ratio of d/D is 3 or more. Furthermore, nothing conductive can penetrate the hole.

Design Reviews...

Many of our clients now include *EMI Design Reviews* as part of their design process. They know that the earlier you address the problem, the more options you have, and the lower the costs.

A typical design review examines the circuit boards, interconnect, power supplies, cable I/O, and the mechanical packaging. Typical costs are $2000-$3000 plus travel expenses.

How to Contact Us...

Here are several ways:

—Answering Service - 888-EMI-GURU (Toll Free)

—Bill Kimmel - 651-457-3715 (Minnesota Office)

—Daryl Gerke - 480-755-0080 (Arizona Office)

E-Mail ... A preferred way of reaching us if you don't need a "real time" answer. We both check our mail boxes regularly, and it works out well. Addresses are:

—Bill Kimmel - *bkimmel@emiguru.com*

—Daryl Gerke - *dgerke@emiguru.com*

Web Site... Please visit our web site (*www.emiguru.com*) for class schedules, back issues of the KGB, and other useful EMI stuff. We've also included detailed information on our firm, such as our consulting and training brochures.

EMI Suppression Handbook...

The little red book with the great EMI war stories is still available. Written by us, and edited by our good friend, Dr. Tom Chesworth (publisher of *Electromagnetic News Report*). Only $25 plus shipping. To order, contact Seven Mountains Scientific at 814-466-6559, or visit their web site at *www.7ms.com*.

EMI-Toolkit ® 2.0...

Immediate availability for the updated version of our popular EMI-Toolkit® software. The new version includes many useful features, plus an improved format. Comes on CD, and runs under Windows 95/98/NT/2000. $150 single user, $750 for site license. Discounts apply for V1.0 users.

We are also shipping EMI-Toolkit ® Plus, which includes additional information on most relevant EMI standards (MIL-STD-461, DO-160, FCC, CISPR, and more). For more information on either version, call us at 1-888-EMI-GURU, or e-mail bkimmel@emiguru.com.

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