KIMMEL GERKE Bullets

MEMBER AMERICAN CONSULTING ENGINEERS COUNCIL

Summer, 1995

Welcome to KGB...

And to the second issue in 1995 of our "personal communications" to our friends, clients, and colleagues about EMI issues, problems and solutions.

This issue focuses on the European Union (EU), an area of critical interest for anyone selling electronic products in Europe. The door to Europe is rapidly closing, as the EMC Directive become mandatory in January 1996. Without the "CE" Mark, you'll be locked out of the European Union market.

Although most of you are well aware of these requirements, we still get calls from people asking about these "new European EMC laws." In any event, we'll take a quick look at the present rules, and we'll give our assessment of their design impact.

As always, give us a call if we can help you with your design or troubleshooting EMI problems.

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

MINNESOTA EMC EVENT...

Plan now to attend the **Tenth Annual Minnesota EMC EVENT**... again held at the Thunderbird Hotel in Bloomington, MN... Oct. 16-17-18, 1995 (Mon-Wed)

All Exhibits on Tuesday (October 17) are FREE... Trade Show Exhibits, **FREE LUNCH**, Technical Talks by Industry Experts, IEEE/EMC Meeting.

Join us Monday and Wednesday for in-depth seminars on *Grounding & Shielding, PCB Design, ESD, Power Disturbances, Medical EMC*, and more.

An excellent way to get some low cost EMC training.

This show is sponsored by Kimmel Gerke Associates, TUV Product Service, and the Paul Bunyan Chapter of the Electronics Representatives Association.

Shows and Conferences...

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

Tenth Annual Minnesota EMC Event...

Tuesday, October 17, 1995, at the Thunderbird Hotel in Bloomington, Minnesota. (Hard to believe it's been ten years since we put on the first EMC Event – a two hour affair at the Registry Hotel.) ***The Tuesday show... and the lunch... are free.*** Full day seminars on Monday and Wednesday for a nominal fee.

IEEE Engineering in Medicine&Biology Society...

September 19-23, 1995, at the Montreal Convention Center in Montreal, Quebec. Daryl has co-authored a paper with Joe Butler of Chomerics, titled *"High Frequency EMI vs Low Frequency Circuits in Medical Devices."* Joe Butler will present the paper as part of a special workshop on medical EMI issues.

Medical Design & Manufacturing West 95 Conference...

February 6-8, 1996, at the Anaheim Convention Center in Anaheim, California, and sponsored by *Medical Devices and Diagnostics Industry* magazine.

Daryl will present a tutorial paper on *"RFI and Circuit Boards: Assessing the Threat"*, and Bill will present a tutorial paper on *"ESD and Edge Triggered Circuits: Asking for Trouble."* This is part of a special half day session on medical EMC issues.

Portable By Design...

March 25-29, 1996, in Santa Clara, California. Bill will be doing a one day tutorial on *"ESD Design in Portable Electronics."* Sponsored by *Electronic Design* magazine.

Reprints... EDN Magazine's Designer's Guide to Electromagnetic Compatibility...
This popular EMC design guide (written entirely by us) is currently available as a reprint. Call Cahners Reprint Services at 1-800-523-9654. Cost is $19.95 + shipping. Quantity discounts available.

Kimmel Gerke Bullets is a newsletter on electromagnetic interference/compatibility (EMI/EMC).
Published by Kimmel Gerke Associates, Ltd., 1544 North Pascal, St. Paul, Minnesota 55108 • (612) 330-3728.

Focus on the European Union (EU)...

In January 1996, new EMC rules will apply to all electronic products in Europe. At that time, the "EMC Directives" are no longer voluntary, but become mandatory. Without the "CE" mark, product sales will be prohibited in the member nations of the European Union.

Although most of our readers are well aware of these rules, we still get calls asking about these "new EMC rules." And sadly, we've seen cases where the design team recognized the problem, but where management still isn't convinced. Well, whether we like it or not, the European rules are just about upon us.

We'll take a look at some of those rules, and their impact on the design.

Emissions vs Immunity... A key difference in the EU rules from earlier commercial EMC requirements is the inclusion of *immunity* tests. These demonstrate equipment will operate in the presence of external threats like static or power transients. In the past, commercial EMC rules focused on *emissions*, with limits aimed at protecting nearby radio and television receivers from undue interference.

Initially, the EU decided to focus on three key threats: electrostatic discharge (ESD) from humans, radio frequency interference (RFI) from nearby transmitters, and a special power transient known as the "electrical fast transient" (EFT). (They retained commercial emission limits, of course.) Future requirements are planned for lightning transients, RF induced on power lines, and power sag/surge levels.

Directives vs Standards... Although sounding like bureaucratic alphabet soup, there is a method and a hierarchy to the various EU regulations.

First, the *directives* are the legal mechanism, and include such items as the EMC Directive, the Medical Device Directive, the Machinery Directive, etc. Most of us are interested in the EMC Directive, as it affects virtually all electronic devices. The EMC Directive has been voluntary since 1992, but becomes mandatory in January 1996. The Medical Directive becomes mandatory in June 1998.

The *standards* are the rules, and provide both test procedures and test limits. To further confuse things, standards exist at several levels. The *basic standards* provide test procedures, and simply make test limit recommendations. Examples are CISPR 22 or the IEC 1000-4-X (formerly the IEC 801.X) series. The *generic standards* are one level up, and apply to general classes of equipment. They cite the test requirements in the *generic standards*. Examples are IEC 50081-1 and -2. *Product specific standards* are a level higher, and apply to specific equipment. An example is IEC 60101 for medical electrical devices.

The bottom line on all of this legalese is that the manufacturer must demonstrate compliance to the appropriate standards before affixing the "CE" mark to the equipment. This is the magic mark that the European customs inspectors look for before allowing equipment into the EU. No sticker, no sale. And just in case anyone decides to cheat, the fines can be hefty, and can even include jail sentences.

Design Impact... So what does this mean to the equipment designer? Well, if you haven't designed EMC in, you are probably in trouble. And if you are trying to qualify older equipment that only met the existing emission limits (VDE or FCC), you may be in trouble too. But don't despair too much, because the problems are preventable or solvable.

The *emission levels* of CISPR 22 (or CISPR 11 for ISM equipment) are similar to the FCC and VDE limits. As such, if you are already meeting these levels, you are probably in good shape here. These requirements do have impact across the design -circuit boards, cables, shielding, I/O filtering, and even the power supply.

The *ESD immunity levels* of IEC 1000-4-2 (IEC 801.2) can be brutal on digital equipment. Typical failure points are resets, interrupts, memories, and digital control lines. Careful attention to these circuits will pay big dividends. Simple I/O filtering can also help, since ESD often enters the system via the I/O. Other areas of ESD impact are shielding, cables and connectors, and grounding. Finally, if you are still using 2-layer boards, consider multi-layer boards - they are typically 10 times better for ESD.

The *RF immunity levels* of IEC 1000-4-3 (IEC 801.3) can be brutal on sensitive analog equipment. (Fortunately, most digital equipment today can withstand 3 volts/meter, particularly if multi-layer PCBs are used.) Typical failure points are low level analog circuits, followed by voltage regulators. High frequency I/O filtering, combined with high frequency decoupling is usually needed.

A KGB BULLET...

Here is a *Rule of Thumb* we've found useful: "Test experience indicates that equipment will exceed the specified limits [FCC, CISPR 22] when the common mode current in one of the connecting cables exceeds 5 microamps".

Electromagnetic Compatibility (page 37), by Dr. Jaspar Goedbloed. (See the Spring 1994 KGB for a book review).

RF immunity impacts circuit boards, shielding, and cables and connectors.

The *EFT immunity levels* of IEC 1000-4-4 (IEC 801.4) can affect both the power supply as well as internal electronics. The EFT speeds are similar to ESD speeds, so ESD precautions for resets and control lines apply here as well. The primary impact from EFT is to the power and signal interfaces, since that is how the energy is injected into the system.

A comment for medical designers... We've run into some medical folks who incorrectly (or hopefully perhaps) believe that they do not need to meet any requirements until 1998, when the Medical Directive becomes mandatory. No, there isn't a loophole. If you don't elect to meet the Medical Directive in 1996 (voluntary until mid-1998), then you must meet the EMC Directive after 1995. We usually recommend meeting the Medical Directive anyway, just to be safe.

Technology is like a steamroller.... If you are not on it, you become part of the road.

Thanks to an old friend,
Don Backys of Motorola

EMI Winter Getaway...

Need a winter break? Want to learn more about EMI design and troubleshooting? Then join us for one of our expanded three day seminars with Tektronix. Back by popular demand, two seminars will be held in *warm locations* (very important) with an optional third day on EMI troubleshooting. More details in the next KGB, or call 612-330-3728 for details.

What Does EMC Stand For?

This is a question some friends at Fisher-Rosemount recently posed in an "engineering" discussion. Here are several of the printable answers:

European Marketing Catastrophe
Every Megahertz Counts
Even Men Cry
End My Career
Extreme Migraine Club
Electro Magnetic Corruption
Electro Magnetic Crap
Engineering Masochist Club

Send us your ideas, and we'll print them (assuming they pass the censors) in a future copy of the KGB.

Call, or drop an EMAIL at dgerke@aol.com.

New Book on Medical EMC...

We're pleased to announce the impending release of our new book, ***Electromagnetic Compatibility in Medical Equipment***, published jointly by IEEE Press and Interpharm Press Inc. Twelve chapters plus several Appendices of reference material.

We think the book will be of primary interest to electronic medical device designers, engineers, technicians, and managers. Medical equipment installers and facility engineers may also find this book useful. Contact Interpharm Press at 708-459-8480, or IEEE Press at 800-678-IEEE.

Newsletter on Lightning...

For the past several years, we've been receiving ***Striking News*** from PolyPhaser, a company that specializes in lightning protection. They also publish a useful book on the subject: *Grounds for Lightning and EMP Protection*. Call 1-800-325-7170.

Book Review... *Hot Off the Press!*

Printed Circuit Board Design Techniques for EMC Compliance, Mark Montrose, published by the IEEE Press. Just released, this design guide is full of practical ideas and guidelines, from an author who has done a lot of high speed designs. Recommended for anyone designing printed circuit boards.

E-Mail Addresses...

You can reach us via Internet E-Mail at the following addresses:
dgerke@aol.com
bkimmel@primenet.com

Still working on getting back issues of the KGB on the Internet. We'll keep you posted.

A KGB Bullet...

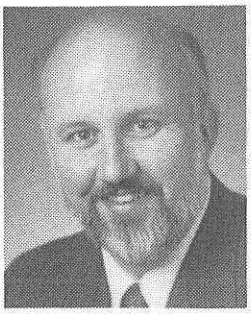
Here is an application note that may be of interest from the automotive group at Intel:

EMI Design Techniques for Microcontrollers in Automotive Applications - AP-711

Call Intel Literature at 1-800-879-4683, and order Document 272-673-001.

This summarizes a research project we did with Intel last year on PCB layout. Also documented in an SAE paper (950836) "Designing with Microcontrollers and Low EMI" by Chris Banyai.

About Kimmel Gerke Associates, Ltd.



DARYL GERKE, PE

We're a professional engineering consulting firm that specializes in ELECTROMAGNETIC COMPATABILITY, a broad area of electrical engineering that deals with electronic noise. We share almost fifty years of experience in the electronics industry. We're both degreed Electrical Engineers, Registered Professional Engineers, and NARTE Certified EMC Engineers.

WILLIAM KIMMEL, PE

We both have experience with the design, applications, and installation of electronic systems subject to government EMC (FCC, VDE, MIL-STD-461) and TEMPEST requirements. We both have experience solving operational EMC problems with a wide range of equipment. We'd be glad to help you with your EMC problems, fixes, design support, test support or training needs.

EMI-Toolkit® Software...

We continue to deliver copies of our unique EMI software, and we've had good comments from users. Thanks again to all of you who have ordered it.

EMI-Toolkit® is a collection of over thirty of our favorite EMI formulas, graphs, and tables that we use on a regular basis as EMI consulting engineers. It's like having an EMI reference book (or perhaps even an EMI consultant) right at your fingertips.

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Daryl Gerke, PE — William Kimmel, PE
1544 N Pascal • St. Paul, MN 55108 • 612/330-3728

Kimmel Gerke Associates, Ltd.
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