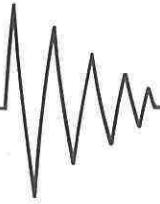


# KIMMEL GERKE



## Bullets

Fall, 1989  
Vol. 1, No. 1

### Welcome to KGB. . .

Sounds ominous, doesn't it? Sure, we know it's a play on words, and probably a bad one at that. . . but we just couldn't resist. Besides, we don't believe one should take EMC issues, or life for that matter, too seriously. . . and sometimes it's hard to find *anything* humorous about EMC.

KGB, or Kimmel Gerke Bullets, is more than a newsletter. . . it's a personal communication to our friends and clients containing news, ideas, and "bullets" of information on EMI/EMC issues.

We plan to print this quarterly, and we'll cover topics in several major areas: *regulations and compliance* (FCC, VDE, MIL-STD), *electrostatic discharge* (ESD), *power disturbances*, *radio frequency interference* (RFI) to/from radio and television equipment, and *high speed digital systems*. Not surprisingly, these are all areas where we practice as consulting engineers.

We'll also give you our impressions on the trade shows we attend, relevant magazine articles, and new products and equipment for solving EMC problems. Oh, yes. . . we'll sprinkle several "bullets" in each issue, too.

We're looking forward to communicating with each of you through this letter. But to be truly successful, communications must occur in two directions. . . so please call or write and let us know your "news and views" on EMI/EMC. We're particularly interested in any "helpful hints" or novel solutions to problems. We'll give you credit, too. . . your chance to see your name in print.

We hope you find KGB useful. Thanks to all of you for your business, your friendship, and your support.

Best regards,

Daryl Gerke, PE and Bill Kimmel, PE

### Twin Cities EMC Society Hosts Distinguished Lecturer. . .

On October 12, the Twin Cities IEEE EMC Society heard from Don Heirman of AT&T Information Systems in New Jersey. Don is a longtime leader in the EMC community, and is an EMC Society Distinguished Lecturer. His talk was titled "The Push Towards Emission Limits and Test Technique International Harmonization." Lots of up to date information regarding international compliance issues.

### A KGB Bullet. . .

The bandwidth of digital circuits or transients can be approximated using the following formula:

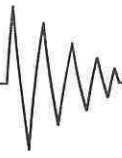
$BW = 1/\pi tr$ , where  
BW = bandwidth in hertz  
tr = rise or fall time in seconds.

This can be derived using Fourier analysis, and is the same relationship used for oscilloscopes and other instrumentation. For example, 10 nsecs has a bandwidth of about 30 MHz, while 1 nsec has a bandwidth of over 300 MHz. It's no wonder EMI problems increase as system speeds increase.

### Join the IEEE EMC Society. . .

If you are interested in EMC issues, please consider joining the IEEE EMC Society. The local chapter meets four or five times a year for relevant technical presentations. We've already heard from Don Heirman of AT&T, and have Bill Kimmel of Kimmel Gerke Associates and Scott Bennett of Hewlett Packard scheduled for future events.

The next meeting of the Twin Cities chapter is scheduled for Tuesday, November 21, at 11:30 A.M. It's a lunch meeting, and Bill Kimmel will talk. For more information, call either Daryl Gerke at 330-3728 or Dan Hoolihan at 462-7001.



## NEWS AND VIEWS...

### **Regulations and Compliance**

Several changes are underway that will affect EMC regulations in the future. . . given design cycles of a year or more, it's not too soon to consider these changes now. . .

**MIL-STD-461/462/463 revisions.** . . The EMC regulations for most government and military products, are currently being reviewed by a special Tri-Service committee. The goal is to bring these standards in line with current technology.

The first meeting of a technical working group was held in April, 1989, and was attended by representatives from the American Standards Institute, the IEEE EMC Society, the Society of Automotive Engineers, and the Electronics Industry Association. The working group will meet four to six times per year, and the goal is to complete the revisions within two years.

Since MIL-STD-461 is used as a guideline for many commercial EMC specifications, the entire design engineering community will be affected by these changes.

**European Community Update.** . . The 1992 deadline for a common set of EMI regulations for the 12 members of the European Communities (EC) is rapidly approaching. In May, 1989, the Directive on EMC was released, and includes both emissions and immunity requirements.

The immunity requirement is key. Since present US commercial standards do not include immunity, additional design and testing will be needed to market products in Europe. Now is the time to consider these changes if you are designing products for the international market.

**FCC Update.** . . By now, most of you are aware of the changes in the FCC Part 15 regulations, which went into effect in June, 1989. Some confusion remains, however, on the test procedures.

The old test procedures, MP4, still remain in effect. . . the new test procedures, TP5, are still under review and remain in a proposed status. Your EMC test lab can help you with this issue.

### **Electrostatic Discharge**

With winter approaching, and the associated "dry air", you should anticipate ESD problems. It's well known that as the humidity drops, ESD events increase in occurrence and amplitude.

Keep in mind there are two ways to handle ESD events. . . *prevention* and *mitigation*. Most "factory" ESD programs use prevention, since even a single ESD event can cause damage to sensitive components. At the "systems level," however, mitigation must be considered. . . you can not always prevent ESD from occurring at the user level.

When ESD occurs, it becomes an "EMI" problem. The rapid risetimes, typically in the 1-3 nsec range, contain significant energy well into the 100-300 MHz range. (See the *bullet* on rise times and bandwidth.)

Furthermore, two failure modes exist. . . those due to "direct discharge" of the ESD currents into circuits, and those due to "indirect discharge", due to the accompanying electromagnetic fields due to the rapid discharge. The first requires filtering or diverting the currents, while the second calls for shielding.

For more information, see our articles in "RF Design" (11/88) or *Electromagnetic News Report* (9/89).

### **Power Disturbances**

We believe this issue is increasing as an EMC problem. For years, the main EMC concerns with power have been adequate voltage to power equipment, spikes and transients, and perhaps "hum" coupled into sensitive analog circuits.

With the advent of "smart power" devices, such as switching mode power supplies and variable speed drives, the "sources" of power line noise have drastically increased. Combine this with the proliferation of ever more sensitive digital controls as "victims", and the problem is no longer small.

A side issue we've been faced with recently is the electric and magnetic *fields* due to nearby power lines and transformers. Video displays are routinely upset by nearby magnetic fields, and of course, there is the ongoing controversy on health issues related to electromagnetic fields.

We plan some research into the video display problem, which we'll publish next year. We'll also have an article in ITEM on power disturbances. In the meantime, see our chapter in "Filters and Power Conditioning" by Interference Control Technologies.

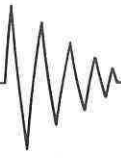
### **Radio Frequency Interference**

Not too long ago, almost all EMI problems were referred to as "RFI", or radio frequency interference. That's because most problems were with radio or communications systems. As the problems became more widespread, the more general term EMI, or electromagnetic interference, came into wide use. Thus, RFI became a dated term.

Nevertheless, the radio frequency problems did not diminish. In fact, we see an increasing number of "RFI" problems in our practice. See the *bullet* on how to predict electric field strengths. Remember, anything over 1 volt/meter should be suspect for digital systems.

A big source of these problems is interference between computers and radios, in both directions. As digital systems increase in speed, clock harmonics can easily disturb VHF and even UHF communications systems. At the same time, the proliferation of hand held radios, cellular phones, and microwave links

(continued on next page)



## News and Views. . . (continued)

create a hostile electromagnetic environment for these same digital systems. The issue has become particularly acute for the automotive and vehicular applications.

We've done several articles and papers on this subject in *RF Design*, *EMC Technology*, and *EMC Expo*. (At EXPO, we did two papers, back to back, titled "Computers and VHF Radios — Mutual Antagonists.") Call us — we can help you.

### High Speed Digital Design

Although not specifically an EMC problem, the higher the speeds (both *clock* rates and *edge* rates), the higher the frequency content. See the *bullet* on this. . . and remember, a 3 nsec edge has a bandwidth of over 100 MHz, and a 1 nsec edge rate has a bandwidth of over 300 MHz.

These increasing edge and clock rates can cause both external EMC problems (such as failure of FCC or VDE regulations), or internal EMC problems (such as crosstalk or ground bounce). With our many years in the computer industry, we can help you both prevent and solve these problems. And remember the old saying, "An ounce of prevention. . ."

Two ways of preventing problems are "EMC design reviews" and "EMC engineering tests". We've been able to help numerous clients with both approaches. Through brief EMC engineering efforts throughout the design phase, we've been able to head off "disasters" at test time.

### A KGB Bullet . . .

A quick rule of thumb for electric field levels that cause failures in digital electronics is 1-10 volts/meter. A first approximation for field levels can be made using the following formula.:

$$E = \sqrt{30 P/d}, \text{ where}$$

E = volts/meter

P = transmitter power in watts

d = distance from transmitter in meters

For example, at 100,000 watts and 1 mile, (typical of a radio or television broadcast transmitter) the predicted field is about 1 volt/meter. At 3 watts and 1 meter (typical of a hand held radio) the field intensity is almost 10 volts/meter.

### A History of the EMC-EVENT. . .

Since this newsletter is being distributed at the *Fourth Annual Minnesota EMC EVENT*, we thought a brief history of this local show would be of interest.

The *First Annual EMC EVENT* took place in May 1986, and had about 75 attendees and 6 vendors. It was conceived and sponsored by Kimmel Gerke Associates in conjunction with a course on EMC being taught by Daryl in the Twin Cities.

The First Event only lasted about three hours, and was strictly a vendor show with no technical sessions. It was held after work from 4:00-7:00 P.M. at the Registry Hotel in Bloomington. Publicity was low key, primarily through the vendors and through the local IEEE EMC Society Chapter.

The overall response to this "mini-show" was quite positive, so it was decided to offer the show again in 1987. When AMADOR Corporation, the local EMC test laboratory, offered to co-sponsor the 1987 show, the format was expanded to a full day with technical sessions.

The *Second Annual EMC EVENT* was held in October 1987 at the Sheraton Hotel in Bloomington, and had over 200 attendees, and over 15 exhibitors. Three tracks of technical sessions were offered — testing, design, and new products.

The Second Event exceeded all of our expectations, and the overall response was again very positive. As a result, plans were immediately made for the 1988 Event.

The *Third Annual EMC EVENT* was held in October 1988 at the Hilton Inn Metrodome in Minneapolis, and had over 300 attendees and 20 exhibitors. The technical sessions were grouped into focus sessions on compliance, instrumentation, electrostatic discharge, shielding, and power.

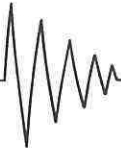
A special feature of the Third Event was a lunch talk by U.S. Senator David Durenberger. Spurred on by the encouragement of both attendees and vendors, we began work on the 1989 event.

The *Fourth Annual Minnesota EMC-EVENT* is again being held at in late October at the Hilton Inn Metrodome, with over 25 exhibitors. As KGB went to press prior to the show, we don't have a count, but we are optimistic that this year's turnout will grow as well.

This year's event features technical sessions on compliance, electrostatic discharge, instrumentation, power, shielding, and automotive electronics. This last area is receiving a lot of attention with the proliferation of vehicle electronics and new limits from the automotive companies.

We hope you've enjoyed the EMC EVENTS to date. It's been a lot of work, but it's been very rewarding to see the show grow each year. Let us know if you'd like to contribute to next year's technical program.

The *Fifth Annual Minnesota EMC EVENT* will be held October 25, 1990. Mark your calendars to attend.



## Happy Fifth Birthday, AMADOR...

Our best wishes to AMADOR, the local Minnesota EMC Test Laboratory, on celebrating five years in business.

AMADOR was originally the captive EMC Laboratory of Control Data. In 1984, Jim Johnson and Dan Hoolihan bought the facility from CDC, and offered EMC testing services at the "Wild River Test Site" in Almelund, Minnesota. That has now grown to three test sites, including a full general purpose EMC test facility in New Brighton.

It's been our pleasure to work with AMADOR on the EMC-EVENT (they have been a co-sponsor since 1987) as well as other projects of mutual interest.

Congratulations, AMADOR.

### *That's About It For This Issue...*

We hoped you enjoyed this, and found it of use. If you have any questions or comments, please give us a call at 612-330-3728, or drop us a line at Kimmel Gerke Associates, Ltd., 1544 North Pascal, St. Paul, MN 55108.

## **Expert Witness Help Available...**

Although we hope you and your products don't end up in court, we might be able to help if they do. We've both had experience as "expert witnesses", and although it's not a central part of our business, we do offer that as part of our services as consulting engineers.

We are both Registered Professional Engineers, which is almost mandatory in this area. In addition, Daryl holds a Master Electrician's License and an FCC Commercial License, two additional credentials useful in this area.

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