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EMC

IEEE EMC Society Newsletter

INSIDE:

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EMC SOCIETY

Mutual Recognition Agreements for Conformity Assessment: What Are They?

by Dan Hoolihan, Hoolihan EMC Consulting

Introduction

In the world-wide marketplace, many manufacturers would like to have:

> "one standard to test their products to, one test only to that standard, acceptance of that test's results worldwide."

This acceptance worldwide would be for both general market distribution of the product and for specific regulatory compliance of various governments. The World Trade Organization encourages government recognition and acceptance of one anothers conformity assessment procedures. This government "recognition and acceptance" can be based on (1) Government-to-Government (G2G) Agreements and (2) Voluntary Agreements with limited Government Participation.

Mutual Recognition Agreements (MRAs) for Conformity Assessment are examples of these Agreements and several are being developed in the area of Electromagnetic Compatibility (EMC) and Telecommunications.

United States – European Union (US-EU) MRA

One of the most well-known MRAs in the EMC world is the US-EU MRA which was signed in December of 1998. The agreement is now in the midst of a two-year transition period which is scheduled to end in December of this year (2000).

The US-EU MRA is similar to other MRAs in that it relies on accreditation as a basis for establishing technical competence and building regulatory confidence. So, when a government "recognizes" another country's products as being acceptable for use in their country, it really means that they have accepted the accreditation bodies of that respective country or "union of countries." This is a result of a Designating Authority (evaluating entity that investigates the accreditation body) having determined that the accreditation body meets the requisite technical requirements of appropriate international standards and has been designated as being "competent and capable of assessing and subsequently accrediting organizations."

Conformity Assessment Bodies for EMC have been identified in both the United States and the European Union. In the United States, a CAB must have been accredited to ISO/IEC Guide 25 for specific test methods by either NVLAP or A2LA. (NVLAP is the National Voluntary Laboratory Accreditation Program run by the National Institute of Standards and Technology of the Department of Commerce of the United States Government and A2LA is the American Association for Laboratory Accreditation – a private organization.)

In addition to being accredited to Guide 25, the EMC Conformity Assessment Bodies (EMC CABs) have to also meet "EMC Competent Body" criteria; which are requirements in addition to Guide 25 rules. The EMC Competent Body criteria is focused on qualifying organizations which are capable of performing engineering evaluations including analysis of Technical Construction Files (TCFs). These TCFs are paper dossiers on manufactured products which must be examined thoroughly to determine if non-standard products meet the "intent" of the engineering standards for electromagnetic emissions and electromagnetic immunity.

In the European Union, some countries have detailed requirements for EMC Competent Bodies (for example, in Great Britain there is URN 99/627 –

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http://www.emcs.org
This newsletter is online! Visit the web page address above and click on the "Newsletter" button.

Art Wall represents the Federal Communications Commission (FCC) at the ANSI-ASC C63 committee meetings. Due to the increasing global activity with the MRA programs and others related to EMC, Mr. Wall may often be found during the meeting receiving up to date information via phone or e-mail for the Commission's report.

Mutual Recognition Agreements

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"Guidelines on the Appointment of Competent Bodies.") This document details the minimum requirements for appointment as an EMC Competent Body as well as additional details on the Technical Construction File Route as a Conformity Assessment Procedure.

In the United States, the detailed minimum requirements to be an EMC Competent Body are still being developed; but they will undoubtedly look very similar to the European EMC Competent Body requirements.

Asia Pacific Economic Cooperation (APEC) Mutual Recognition Arrangement

The Asia Pacific Economic Cooperation (APEC) Mutual Recognition Arrangement is different from the US-EU MRA in that it is an ARRANGEMENT (not an agreement) and it is Multilateral (between multiple economies.) The 21 economies involved include Australia, Brunei Darussaiam, Canada, Chile, China, Chinese Taipei, Hong Kong-China, Indonesia, Japan, Korea, New Zealand, Mexico, Malaysia, Papua New Guinea, Peru, Philippines, Russia, Singapore, Thailand, United States, and Vietnam.

The purpose of the APEC Telecommunications Equipment MRA is (1) to facilitate trade, (2) to promote market access, (3) to reduce or minimize non-tariff trade barriers, and (4) to arrive at a Mutual Recognition Arrangement of conformity assessment processes.

All the economies in the APEC Arrangement are already in Phase I (Phase I encompasses mutual recognition of test reports). Many economies are ready for Phase II; where Phase II is acceptance of product approvals from one another.

Workshops are being held with respect to this Arrangement (as well as the US-EU MRA) where all parties concerned can learn the intricacies of the acceptance process. These workshops are held in the geographical location of both sides of the agreement so that the educational process can be expedited for both parties.

The APEC Arrangement is similar to the US-EU MRA yet different because it is multilateral, between economies and because it details the designation and monitoring procedures for the accreditation bodies.

Author Dan Hoolihan of Hoolihan EMC Consulting (L) received much of the information for this article from attendance at the ANSI-ASC C63 committee meetings. Dr. Ralph Showers of the University of Pennsylvania (C) chairs the meetings while Bob Pritchard (R) acts as the IEEE Secretariat to the committee.

The text for an MRA was agreed to in November of 1999 for CITEL. The text is very close to the wording of the APEC Mutual Recognition Arrangement in that it is multilateral, sector specific, and contains Phase I and Phase II stages.

One difference is the concept of "homologation" which is a Product Distribution Requirement.

Conclusions

The world is changing with respect to trading goods and services. Most countries want trade with one another with a minimum of barriers while still protecting the health and safety of their citizens. Most manufacturers want to develop and manufacture products that are safe and useful and they want to market them widely with a minimum of tariffs and non-tariff trade barriers. MRAs are an increasingly popular mechanism for satisfying both sides of the manufacturer/buyer equation on a worldwide basis. **EMC**

Editor's Note: Much of the discussion on this topic occurs during the meetings of the American National Standards Institute (ANSI) Accredited Standards Committee (ASC) C63 (electromagnetic compatibility). For more information about ANSI-ASC C63 activities, visit their website at http://C63.IEEE.org. *To receive their newsletter electronically, contact Warren Kesselman at* w.kesselman@ieee.org. *Mr. Hoolihan, of Hoolihan EMC Consulting, is a member of ANSI-ASC C63. He may be reached at* hoolihan@cornernet.com, *phone 651-213-0966.*

MRAs are having a sweeping effect on commerce. Diverse representation of government, industry, and organizations may be found at the ANSI-ASC C63 meetings where up-to-date information on MRAs is reported. Shown seated (L-R) are Don Heirman of Don HEIRMAN Consultants, Herb Mertel of Mertel Associates, and Ed Bronaugh of Siemens Communications Devices. Standing in back (L-R) are Dennis Camell of NIST, Ken Hall of Hewlett-Packard, and James Thompson of Instrument Specialties. Seated in back (L-R) are Andy Griffin of Cisco Systems and Clark Vitek of CKC Labs.

Inter-American Commission on Telecommunications (CITEL)

CITEL is an agreement among 34 American countries including the United States and Canada. It is involved with EMC and Telecommunications. CITEL member states are striving to follow the CITEL Guidelines for Telecommunications Equipment Certification processes, adopted in 1996 by Senior Telecommunications Officials, with a view to facilitating trade in telecommunications goods and services.

President's Message

Joe Butler – President, EMC Society

Running on Electromagnetic Energy

The EMC Society Board of Directors is off and running into the new millennium.

In our efforts to act in a more global fashion, we are starting to initiate contact with various international EMC Conferences with the idea of establishing MOU's (Memoranda of Understanding) which would detail the co-operative agreements. These MOU's would cover such issues as the usage of the IEEE EMCS logo, technical paper reviews, EMCS booth space allotment, website links, advertising, exchange of symposium records, etc. At our March Board of Directors meeting in Phoenix, Henry Ott, Vice-President for Conferences, announced the appointment of Elya Joffe as Chairman, Global Conferences Committee. Elya will be responsible for these MOU's worldwide. This will compliment Elya's already busy agenda as he serves as Region 8 (Europe) Membership Chairman as well as Chair of the Standards Advisory and Coordination Committee (SACCom). The SACCom is the committee that serves as the EMC Society's technical liaison to other EMC Standards Development organizations.

In the Membership Services arena, our Vice-President for Member Services, Todd Hubing, is now worried about his budget for his stable of Distinguished Lecturers (DL's). It seems that even more chapters around the world have realized a DL can mean a larger than normal chapter meeting attendance. Lee Hill, Chair of the Distinguished Lecturers Committee, has been busy coordinating these activities.

Len Carlson, our Vice-President for Communications, and Janet O'Neil, Newsletter Editor, have made real progress on their plans to move this newsletter up to formal magazine status. At present we are looking at waiting to start up in 2002, so as to ensure we have lined up a reasonable number of sources for quality technical material. By the way, do you like the new look?

It's time to think about nominations for this year's election of positions on our EMCS Board of Directors. Dan Hoolihan, Chair of the Nominations Committee and Past President, is soliciting interest.

Hopefully, you are starting to make plans to attend this year's EMC Society Symposium in Washington, DC on August 21st through 25th. From all preliminary information I have seen as I write this column, the affair looks like another in our string of successful symposia. Speaking of symposia successes, Bill Gjertson, Chair of the 1999 Seattle EMCS Symposium and current IEEE Division IV Director, reported a surplus of $291K from symposia activities – a new record!

Andy Drozd, Membership Chair and Internet Committee Chair, AKA, webmaster, has been busy working on websites for the nine Technical Committees and our own *www.emcs.org* Society website. We will soon start to display commercial advertising on our website in the form of links to vendors who pay a $1,500 annual fee. Andy is finishing off the memorandum of understanding to document this type of arrangement. Steve Berger, Chair of the Standards Development Committee, has been working hard to bring online the EMC Standards website. By the time this newsletter is distributed, you should be able to access the site through either the IEEE or the EMCS websites.

You may be receiving an important survey in the mail from IEEE concerning our Society operations. Dick Ford, Chair of the Survey Committee and Society photographer, with help from Mark Montrose, and input from many others, has developed an important membership survey to provide the Board of Directors with the information they will need to guide the Society into the years ahead. If you are one of the few chosen to participate in the survey, please complete and return this in a timely fashion.

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Chapter Chatter

Todd Hubing, Associate Editor

Everything was going pretty well. I was on my way to the 2000 IEEE EMC Symposium in Washington, D.C. Although my students and others from Rolla had rented a van to make the trip, I had to be there a couple of days early, so I was flying. The weather was good, the food on the plane was good, and there was plenty of room to spread out the papers I had brought along to grade. Suddenly, a large hole opened in the floor of the aircraft and I was sucked out of the plane and found myself falling through the cold thin air toward the ground 30,000 feet below.

At first, I was in shock. What had just happened? Although I was freezing and couldn't breathe, I managed to turn and look back up at the plane. Despite a hole in its belly, the plane continued on its way. There were papers everywhere and I couldn't help but think about how disappointed my students would be when they learned that the papers they had invested several hours in were scattered across a hillside somewhere in Virginia. After reflecting on this for a second or two, another ominous thought came to mind. I too, was about to be scattered across a hillside somewhere in Virginia.

I managed to turn myself around so that I could view the landscape below. It was mostly hills and trees. I didn't see anyplace that looked like a good landing spot for a 160-pound man plummeting toward earth at 200 miles per hour.

Then, in the distance, I saw a small lake. Given the limited options available, it seemed like a good idea to try to land in the lake. (It's hard to think clearly when you're 2 miles above ground and closing rapidly.)

I spread my arms and bent my knees so that my body roughly approximated the shape of a glider. In this manner, I was able to steer myself in the general direction of the lake. I was still falling fast, but at least now, I had an objective.

As I got nearer to impact, I was able to see things a little more clearly and I became aware of two horrifying facts. First, the lake I had chosen was not a lake at all, but rather a giant mirror lying on a cement parking lot. Bad news? You bet. But what I saw in the mirror was even more frightening. I HAD A HAIRCUT JUST LIKE DON HEIRMAN'S!

I awoke in a cold sweat and ran my fingers through my hair. It was just a dream. What a relief. I guess I should have realized I was dreaming when the airline food tasted good.

How strange! That was my third Don Heirman haircut dream in as many weeks. I have to confess that I'm a little nervous about the possibility that 10 thousand dollars will be donated to the President's Memorial Award fund prior to the Washington symposium. So far, less than one-tenth of that has been raised, but who can say what might happen in the remaining time before the fourth week in August? After all, the President's Memorial Award is a very worthy cause. Money donated to this fund helps to educate tomorrow's EMC leaders while honoring the individuals who were pioneers in this field.

I've become rather comfortable with my current haircut, so in some ways it is reassuring to know that there are very few rich EMC philanthropists. On the other hand, the President's Memorial Award is the IEEE EMC Society's most important and prestigious award. In past years, this award has supported the graduate education of many individuals who are now leaders in our field. It would be sad to see this important program disappear due to a lack of financial support.

So, although I'm very comfortable with my current hairstyle, I have to admit that I would be delighted to see one or two companies that are leaders in the EMC industry accept this challenge. It would be wonderful to see the President's Memorial Award fund exceed the 10K goal before August. In fact, for me, it would be "a dream come true."

Central New England

John Clarke, chair of the Central New England chapter, reports that Marc DeKirmandjian was their featured speaker at the February meeting. Marc is a Senior Applications/Product Engineer at TDK Corporation in Mount Prospect, Illinois. His talk was titled "Ferrite Electrical Characterization and Applications for EMI Control." Marc discussed the effects of temperature and current on the performance of ferrites in a circuit. He also described the different packages available for application to various types of circuits, including desktop and notebook PC video, USB and IEEE 1394. Attenuation and impedance characteristics of different types of materials and component configurations were also discussed.

Israel

The Israel IEEE EMC Society chapter's first meeting of the year and the millennium was a workshop. The workshop was held on January 27, 2000. The motto of the workshop was "A New Millennium – but Old EMC Problems," and it was dedicated primarily to the very important issue of grounding, from circuits to systems. The workshop took place at the Holon Academic Technological Institute, and was hosted by Professor Jacob Gavan, a member of the chapter and a Fellow of the IEEE EMC Society.

In spite of a severe storm, participation was overwhelming at just under 100 participants. Approximately half the participants were IEEE members, and the others were guests (some of whom requested application forms to join the IEEE).

Nine presentations were given:

"Types of Grounds, Objectives, and Applications", by Moshe Netzer, RAFAEL/ADA

"Grounding of Lightning Protection Systems in a High Resistance Ground", Dr. Boris Vefrick, RAFAEL/ADA

"Analog and Digital Circuitry on PCBs", Dr. Moshe Merzer, RAFAEL/ADA

"The Knights' Castles and PCB Grounding...?", Elya B. Joffe, KTM Project Engineering

"Identification and Diagnostics of Excessive Emissions using an EM Scanner", Mr. Samuel Cohen, Tadiran, Communications Division

"Backplane to Enclosure Grounding Techniques", Mr. David Wright, Transelectric – ASIS

"Signal Integrity (SI) Process for High Speed (HS) Mixed Signal Analysis", Dr. Yoram Levi, Transelectric – ASIS

"Sources of Conducted Emissions in Switch Mode Power Supplies", Dr. Alex Axelrod, EMI Test

"Radiation from the Edge of a Rectangular Waveguide having a Flange", Dr. Haim Metzner, Holon Academic Technological Institute

A special occasion was celebrated in conjunction with the meeting: The dedication of the new anechoic chamber for EMC research purposes at the Institute. The ceremony included "cutting the tape" by Professor Gavan and Professor David Maron, President of the Institute. In addition, special greetings were brought by Chapter Chair, Elya B. Joffe, who stressed the importance of the study of EMC in academia (The Institute is the first academic institute in Israel to have an EMC course and an EMC test facility for research and study purposes). The entire event was a great success.

Mr. Moshe Netzer, Israel Chapter Vice-Chairman, reports that on February 21 the first conference on "Avoidance of Explosive Atmosphere and Control of Static Charges for Preclusion of Hazards" took place in Israel, in the auditorium of the Faculty of Chemical Engineering, in the Technion, Haifa.

ESD events generated by man, equipment and machines can act as an ignition source for hazardous materials. There are several documented cases of explosions that were almost certainly due to ESD. In some cases, people were severely wounded and even killed due to such unfortunate events. In one case, a worker was killed due to an explosion in a grain silo that was apparently due to an electrostatic discharge. It appears that static charges accumulated on the seeds processed in the facility, and the resulting discharge through the air ignited the agricultural dust atmosphere causing the explosion.

This accident and others prompted the organization of the Conference, which was co-sponsored by the Israel IEEE EMC Chapter. The topics covered included issues that were of general interest to people dealing with safety and fire avoidance. The keynote address was presented by Mr. Pieter Zeeuwen, from Chilworth Technology in the UK, and was entitled: "Prevention of Explosions, with particular attention to electrostatic ignition sources." Additional presentations included:

"Avoidance of Static Charges in Chemical Production Facilities", by Mr. Bob Gilmore, Bromide Industries

"Inherent Safety: A Necessity for Zero Accidents", by Yigal Rizel, The Oil Refineries

"Preclusion of Ignition and Detonation of Explosives in the Military Industry and Armed Services", by Moshe Netzer, RAFAEL/ADA

"Case Histories and Accidents with Hazardous Materials in the Process Industry and Lessons Learned", by Moshe Netzer, RAFAEL/ADA

"Avoidance of Pouders' Ignition in Industrial Work Processes", Eyal Zadok, Israel Laboratory for ESD Control

"ESD Control in Industry: Combining Safety with Productivity", Eyal Zadok, Israel Laboratory for ESD Control

150 participants, from all industry fields in Israel, attended this special event. The large number of attendees led to a decision to hold future such conferences in Israel. The Second Conference is planned for the First Quarter of April 2001.

Nanjing

The January meeting of the Nanjing chapter featured two presentations. The first presentation titled "MMIC Technology: Basic Concepts and Applications" was presented by Dr. Kwok-keung Michael Cheng of the Chinese University of Hong Kong. The second presentation was titled "An Efficient Frequency Domain Systematic approach to Model Extraction for Passive Microwave Circuits" by Dr. Ke-Li Wu. Dr. Wu is also from the Chinese University of Hong Kong. A total of 35 members and guests were in attendance.

On March 2nd, the Nanjing chapter sponsored a Workshop on Microstrip Antenna Theory and Technology featuring distinguished speakers from the Nanjing University of Science and Technology and the Nanjing Research Institute of Electronic Technology. A chapter meeting on March 10 featured Professor Yong-Ze Su, who spoke on the "RCS Calculation of Complicated Targets" and Associate Professor Chang-Qing Gu, who gave a presentation on "Iterative Physical Optics for RCS Analysis." Both speakers were from the Nanjing University of Aeronautics and Astronomy.

A meeting on March 24 featured Mo-Lin Gu of the Nanjing Research Institute of Electronic Technology, who spoke about "MIC Technology – Review and Prospects." 53 members and guests attended this presentation. Three days later, 42 members and guests were on hand for a "Technical Visit and Discussion on Microwave Power Application Technology" by Wei Chen and Cheng Mei from Sanlu Microwave Technology Company.

Orange County

Randall Flinders, chair of the Orange County chapter, reports that Mark Montrose was the featured speaker at the February meeting. Mark gave a great presentation on "Fundamental Concepts and PCB Design Techniques." The topic was very well received by the audience of over 20 people. The group enjoyed Mark's frank, tell it like it is style, and also got the chance to listen to well known guru Mike King get up and assist Mark in his presentation. Dining on Lasagna, Fettuccini, and Caesar salad, it's hard to say if the attendees came for the presentation or the food!

Rocky Mountain Chapter

The January meeting at the National Institute for Standards and Technology (NIST) in Boulder, Colorado had another strong turnout with 42 members and guests attending to participate in elections and enjoy the doubleheader technical program following pizza courtesy of EMC Integrity.

The following chapter officers were elected for a second term: Chairman - Lyle Luttrell, Vice Chairman - Charles Grasso, Secretary - Bob Reinert, Treasurer - John Stadille.

Barry Wallen presented "An Overview of C63 Standards." Barry currently sits on three of the C63 subcommittees and has been involved with C63 activities for the last 8 years. Barry's discussion covered a brief review of the structure of the C63 committee and its subcommittees as well as a look at their current activities. There was something here for everyone; including manufacturers, testing organizations, and designers. Barry also went into some detail about antenna calibration, alternate site calibration (no grandfather clause!) and test issues being addressed by the ANSI committee. One particular item is a proposal for conducted measurements on cables - currently in CISPR 22 3rd Edition and being examined closely by ITI TC5. This new requirement will dramatically increase test time and potentially add more cost to ITE equipment. These sorts of additions to standards exemplify why companies should participate in the standards making process.

TJ (Bill) Ritenour, of EMC Compliance LLC, closed off the meeting with "Where the Noise Starts - a Discussion on PWB Design," an excellent presentation on printed wiring board design as it pertains to EMC. The topics covered were board and board/cable resonances, ground plane inductance, the noisemakers, and finally mitigation techniques. Bill started the presentation rather differently, first with a list of references and then with a summary of old EMC theories as they pertained to board design. He covered switching transients, showed how the radiation from a printed wiring board changes with respect to its width, and compared the measured results with predicted results from a loop formula. Using some excellent hand-drawn pictures, Bill then described the concept of board and cable resonances as well as connector ground bounce. We were then presented with the four sources of common-mode current: IC switching induced CM current, capacitor decoupling induced CM current, transmission line induced CM current and connector induced CM current. Bill then covered decoupling capacitors discussing chip cross over current, rise time, capacitor lead inductance, parasitic resonance, series resonance and dynamic impedance. Finally, Bill detailed some printed wiring board practices that can cause EMI and presented mitigation techniques. All in all, it was a very well received presentation - Thanks Bill! You can download the presentation at *http://www.ewh.ieee.org/r5/denver/rockymountainemc/*.

On February 26 the Rocky Mountain Chapter joined other Technical Society Chapters in the Denver Section as part of the IEEE Denver Expo 2000 - a Professional Activities Conference in the Denver Tech Center. The Saturday conference had a total attendance of some 150 people, with over 25 attending the EMC session and receiving a CD-ROM including the presentation notes. The Chapter thanks Auspex Systems for enabling Doug Smith to speak at our meeting and Agilent Technologies for providing the measurement equipment used in Doug's demonstrations. Doug Smith presented "An Overview of High Frequency Measurement Techniques for Design Verification and Troubleshooting." Doug provided an in-depth study of signal and noise measuring techniques for characterizing and troubleshooting electronic circuits and designs in the frequency range of 20 MHz to 1 GHz and higher. As a bonus, he also covered techniques for finding and fixing signal integrity, noise and EMC problems.

Doug started the talk with an interesting demonstration using a homemade 50MHz oscillator driving a "Black Box". Doug attached a calibrated scope probe to each of the two outputs of the box. He then demonstrated that the outputs of the boxes were not identical. Not terribly strange - until he opened the box to reveal that the two outputs were actually attached together. The question he started the day with was - Why?

The talk started with an overview of basic theory on inductance, magnetic coupling, shielded cables and skin effect with an emphasis on measurement tools such as scope probes and differential measurement techniques. Doug then proceeded to show some examples of clock waveforms that were less than perfect and proved conclusively that there is a direct relationship between the cost of the measurement equipment and confidence in the result. We then covered a section on scope probe characteristics of various probe designs including Doug's favorite - the balanced coaxial probe. Using simple math and graphical displays, Doug showed how scope probes - even the expensive low capacitance ones - can dramatically change in characteristic as the frequency increases.

In the next section, Doug covered induced voltages and their effect on measurements. He reviewed basic theory on inductance, mutual inductance and shielded cable operation. Doug walked us through some simple concepts on mutual inductance and introduced the idea that a coaxial cable is really a 1:1 transformer between the shield and the center conductor. He also demonstrated that, by using inductance and mutual inductance as constants, one could design a probe that will give a qualitative analysis of the noise in a circuit in question. In this case the probe was square - a bent paper clip and a piece of 50-ohm coaxial cable. Doug also presented another method of visualizing a shielded cable, such as a coax cable in that a shielded cable often works by inducing noise on the center conductor rather than keeping noise out. Doug then introduced us to the "NULL" experiment, which amounts to validating the measurement.

The third section covered differential measurements. Doug first covered all the techniques that are used and reviewed some of the more common mistakes that can occur in such measurements. After looking at all other methods, Doug then went into some detail on the Balanced Coaxial Probe. He showed, using some ESD-induced waveforms, how the balanced coaxial probe was more immune to induced noise as it has a highly balanced common-mode rejection ratio.

The final section dealt with non-contact measurements. In this section, Doug covered exactly how the square loop worked and reviewed some of the more interesting aspects of the more ubiquitous round loops that we are all familiar with.

During the talk Doug punctuated his points with demonstrations and experiments. Overall, the presentation was well received and appreciated by all. Thank you, Doug. For more information on Doug, you can go to his website: *www.dsmith.org*

San Diego

Dave Bernardin, chair of the San Diego chapter, reports that they had a terrific meeting on March 15 featuring Mr. Doug Smith. The subject of Mr. Smith's talk was EFT Testing Per IEC 61000-4-

4. The audience participation was great and the presentation included a practical demonstration using an EFT generator, a small length of hook up wire and an Agilent Technologies Infinium oscilloscope. At the end of the lecture, Doug Smith handed everyone CD's which contained articles, papers and information from his web site at *http://www.dsmith.org*.

The San Diego chapter would like to thank Mr. David Badtorff, Field Engineer from Agilent Technologies, for the loan of the $30,000, four channel, 1.5 GHz, Infinium oscilloscope and his personal time.

Phoenix

Harry Gaul, secretary/treasurer of the Phoenix chapter, reports that their last meeting was held on March 23. This meeting was a regular "Who's Who in the EMC World" as it was held in conjunction with the EMC Society's Board of Directors meeting in Phoenix. Attendees included the new president of the EMC Society, Joe Butler, as well as the outgoing president, Dan Hoolihan. Also on hand were Dr. Todd Hubing, Mark Montrose, Doug Smith, Henry Benitez, Ghery Pettit, Janet O'Neil, Don Heirman and many other EMC "celebrities".

Some 60 attendees enjoyed a lavish Mexican dinner buffet followed by an enlightening talk by EMC Society Board of Directors member and EMC Society Distinguished Lecturer, Elya Joffe. The presentation was titled "Why Are People Really Scared of EM Fields - ElectroPhobia". In this talk, Elya outlined the reasons why we are scared of EM fields. In particular, the general

Photo by Steve Gerard

EMC Society Distinguished Lecturer Elya Joffe points out some of the scary headlines in Israeli newspapers concerning electromagnetic fields.

public gets their impressions from the media and scary headlines sell. The fact of the matter is that most studies conclude that there are no health problems, but the researchers always say that more studies are needed. Of course, they do this so that they can obtain more funding and stay gainfully employed. The sad part of this situation is that funding is diverted and researchers are distracted from finding the real cause of cancer. An exhaustive study and report was recently completed by the National Institute of Environmental Health Sciences. The study concluded, based on the evidence to date, that ELF and EMF exposure should not be included in a list of carcinogens.

Elya also shared with us some recent news from his homeland in Israel where a riot occurred in the village of Usfiya because of a protest over the location of a cell phone tower. This riot on March 15 resulted in 18 people suffering injuries. Although many, many people use cell phones in Israel, it is becoming increasingly difficult to get permits to locate cell phone towers. Of course, one could resort to hiding the antenna towers but then the activists would say that must indicate that we've got something to hide about the dangers of electromagnetic fields. As responsible scientists and engineers, we need to help dispel the rumors and scientific untruths concerning the safety of electromagnetic fields.

Oregon and SW Washington EMC Chapter

Chairman Henry Benitez reports that the chapter has continued its goal to provide IEEE activities each month. Michael J. Windler, Underwriters Laboratories, was our January distinguished speaker. Mr. Windler gave an excellent account of updates to the ANSI ASC C63 Subcommittee 1 site attenuation standard. He presided over a riveting discussion pertaining to site calibra-

Photo by Henry Benitez

Speaker Werner Schaefer drives home the point during his presentation to the Oregon and SW Washington EMC Chapter meeting in February.

Photo by Steve Gerard

Consultant Mark Montrose (L) and newly elected EMC Society President, Joe Butler, enjoy the social time before the buffet dinner in Phoenix.

Photo by Henry Benitez

There was a great turn out by chapter members to hear Werner Schaefer at the Tektronix facility in Beaverton. Some 40 people attended the meeting of the Oregon and SW Washington EMC Chapter.

tion, antenna calibration and the viability of alternate test sites.

Mr. Werner Schaefer of Agilent Technologies was our February distinguished speaker. He gave a well-attended audience an outstanding presentation on "Understanding Impulse Bandwidth Specifications of EMI Receivers". Mr. Pat Andre of CKC Laboratories provided a presentation called "EMC Follies and Foibles" in March. Once again we had excellent attendance. We know it was due to the subject matter and not the complimentary Buster's Barbecue! Mr. Andre had 10 EMC stories about EMC issues and their solutions. At the end of the presentation, we opened it up for "EMI War Story" contributions from the membership at large. Several excellent impromptu contributions were given. (Note: An "EMC War Stories" Session will be introduced at the Washington, DC EMC Symposium in August. It should be a great success if this meeting was any indication!)

We are looking forward to upcoming meetings this spring that include Maqsood Mohd on Lightning Effects and Doug Smith presenting an RF Probe Building Workshop. A summer social and contribution to the local IEEE Section Summer Social is anticipated as well.

Seattle

Vice-Chairman Janet O'Neil reports that the chapter started the new-year with a spirited presentation by Michael J. Windler of Underwriters Laboratories in Northbrook, Illinois. The presentation was entitled "Improvements to C63.4 Normalized Site Attenuation." This topic drew representatives from several EMC test labs in the area including CKC Labs, Acme Testing, and Northwest EMC. Mr. Windler presented an update on the new antenna calibration standard activities within the American National Standards Institute (ANSI) Accredited Standards Committee (ASC) C63 Subcommittee 1 (on EMC). Mr. Windler is an active member of ANSI-ASC C63 including Subcommittee 1 on Techniques and Developments and Subcommittee 6 on Laboratory Accreditation/Lab Assessment. An exciting discussion took place concerning different calibration methods, different test distances and usage in different types of test facilities. Mr. Windler provided extensive data to demonstrate results of experimentation. The data used will have immediate impact on future revisions to ANSI C63.5 as well as ANSI C63.4.

Photo by Janet O'Neil

Paul Slavens of Acme Testing (L) paused to speak with Len Carlson, EMCS Vice-President for Communications, at the January EMC Chapter meeting in Seattle. Paul drove 80 miles one way to hear the presentation by Mike Windler!

Mike Windler is the Associate Managing Engineer for International EMC Services with Underwriters Laboratories in Northbrook, Illinois. Having been the manager of UL's Northbrook EMC lab for four years, he had much in common with several chapter members present from the various local test labs.

In February, Werner Schaefer of Agilent Technologies (formerly Hewlett-Packard), in Santa Rosa, California visited the chapter. Mr. Schaefer is an IEEE EMC Society Distinguished Lecturer (DL). This was his first presentation under the DL program and the chapter was not disappointed! His topic was "Understanding Impulse Bandwidth Specifications of EMI Receivers" which was presented in a lively and very interactive way with the audience. Mr. Schaefer advised that when measuring emissions with an EMI receiver or spectrum analyzer, different signal types might be encountered. Their classification as narrowband or broadband is dependent upon the signal's spectral distribution relative to the receiver's resolution bandwidth used for the measurement. It is essential to know which type of signal is being measured to avoid erroneous test results and the wrong interpretation of data. In this context, the knowledge of the instrument's impulse bandwidth is necessary to correctly determine the absolute amplitude value of an emission. The determination of the receiver's impulse bandwidth can be done with a series of measurements, but not simply by multiplication of its 3dB or 6dB bandwidth value with a constant factor. Only the accurate knowledge of this parameter allows a meaningful comparison of the measured emission levels to a limit line and verification of a product's compliance with an EMI standard.

The presentation covered definitions of broadband signals, the impulse bandwidth of a filter, and the effect of filtering on a broadband signal. Plus, an easy method to

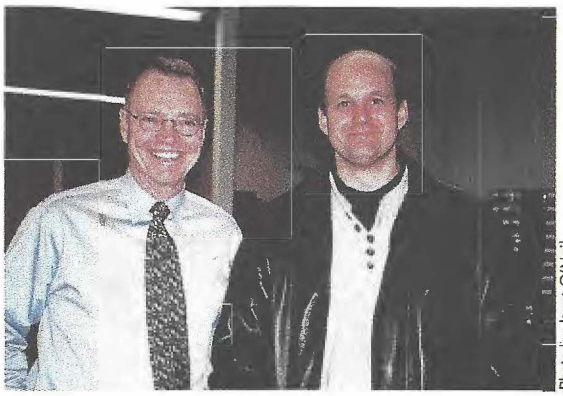
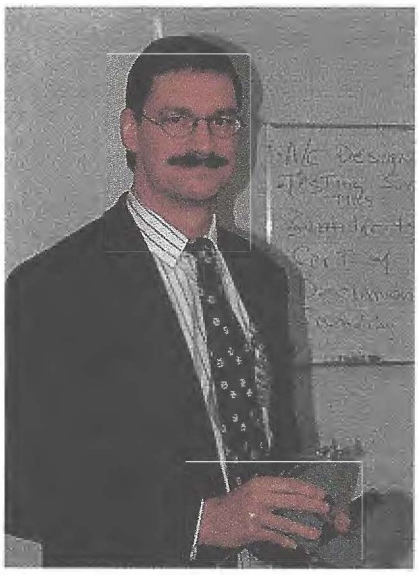


Photo by Janet O'Neil

During his visit to the Seattle EMC Chapter in January, speaker Mike Windler of UL (R) took some time to visit the Kalmus facility in neighboring Bothell. Leo Smale of Kalmus was pleased to take Mike on a tour of the manufacturing area.



Pat Andre of CKC Labs presented the lively and entertaining "EMC Follies and Foibles" at the March EMC Chapter meeting in Seattle.

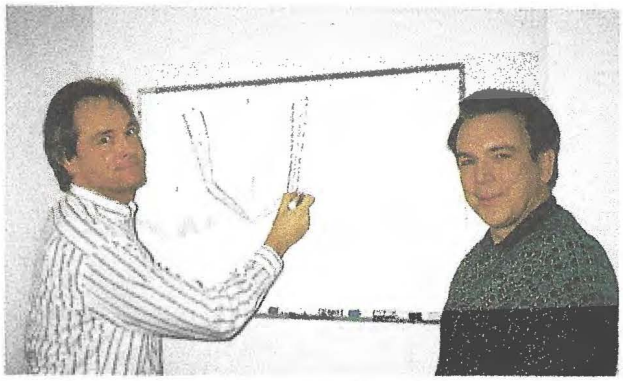


Photo by Janet O'Neil

At the February meeting of the Seattle EMC Chapter, speaker Werner Schaefer of Agilent Technologies (L), provided an in-depth explanation of a technical point to chapter member and EMC consultant Frederick Telewski.

determine the impulse bandwidth of a receiver was described. References were also made to the current status of bandwidth definitions in national and international standards.

The chapter took a different turn with its technical presentations in March when Pat Andre, Manager and Consulting Engineer with CKC Labs, presented the lighthearted and entertaining topic "EMC Follies and Foibles." Mr. Andre shared his top 10 favorite EMC design and engineering stories, including the famous "Talking House" story. By hearing some of the more humorous EMC design errors and consulting misdiagnosis's, chapter members learned how to correct common EMC problems or better yet, avoid them altogether. No names were shared to protect the innocent! It was a unique opportunity to learn while being entertained.

Please see the Seattle Section website *www.ieee-seattle.org/* for further, up-to-date information about the Seattle EMC chapter meetings. Or, contact Seattle EMC chapter Secretary Stephen Stimac via e-mail at *sastimac@home.com*, provide your e-mail address, and the Seattle EMC Chapter Newsletter will be e-mailed to you as a pdf file automatically prior to each meeting. If you're in the area, please join us at a chapter meeting! **EMC**

Chapter Coordinators Retreat Report

"Improving Chapter Relations: Key to Society Success"

By Henry Benitez

I had the pleasure to represent the EMC Society at a special conference sponsored by the IEEE Technical Activities Board (TAB) and IEEE Societies. The primary purpose was to get a status report of the current Society/Chapter relationships and share ideas on how we can improve them. The theme for the conference was *"Improving Chapter Relations: Key to Society Success."*

The key to the meeting was the sharing of individual Society best practices and the compilation of recommendations, conclusions and feedback. Reports were also given on Society/Chapter communications, Chapter technical activities, membership development and educational activities. Much of the information, including Society best practices presentations, is on the TAB IEEE Chapter Homepage at *Http://www.ieee.org/organizations/tab/ciaindex.html*.

The IEEE Chapter homepage objective is to use the pages as a focal point for communication about Chapters and to better inform you as to what services and support are available to you in your Chapter growth and development efforts. Chapter chairmen and members are encouraged to browse through all of the information on the site to learn about developing and maintaining healthy Chapters. Information includes the following:

- Membership Data
- Chapter Development and Rejuvenation
- Chapter Subsidy Support
- Chapter Meetings and Activities
- Guidelines for Developing a New Chapter
- Chapter Development Tools
- Frequently Asked Questions
- Distinguished Lecturer Program
- IEEE Society/Chapter Funding Guide
- Resources for Chapter Growth and Development: Society Chapter Coordinators
- Chapter Briefs Newsletter
- Globalization Project
- Chapter Coordinators Retreat 2000
- RAB/TAB White Paper: Recommendations for a closer relationship
- Regional Activities: Membership Development
- Technical Activities

It was very enlightening to see what IEEE Societies, in addition to the EMC Society, were doing. There were ideas worthy for the EMC Society to consider. However, for the most part, the EMC Society/Chapter practices were among the best in the IEEE. I was proud to be a representative for the EMC Society. I commend the efforts of our predecessor Chapter Chairmen and members. It is now the task of the present Board of Directors to continue to listen to the membership, acknowledge best practices within all Societies, and continue to improve Chapter relations as a key to the Society's success.

Each Society representative had 5 to 10 minutes to share Society/Chapter best practices. I listed the EMC Society/Chapter best practices as follows:

Photo by Henry Benitez

Henry Benitez is shown presenting some of the EMC Society's best chapter practices during the recent IEEE Chapter Coordinator's Retreat in New Orleans.

1. Local Chapter Support
   a. Distinguished Lecturer Program
   b. Haislmaier Angel Fund
   c. Chapter Angels
2. Communications
   a. EMC Society Newsletter
      1. Chapter Chatter Column
      2. EMC Book Reviews
      3. Special Issues – EMC Symposium, EMC in Academia
   b. Society and Chapter WebPages
   c. Local Chapter Newsletters
   d. EMC Transactions
3. Membership
   a. Growing Membership (~5000)
   b. Low EMC Society Fee
   c. Membership Coordinators in Regions 8, 9, & 10
4. Board of Directors
   a. Representation from All Regions
   b. Globalization Efforts
   c. Successful Symposium Sponsorship and Co-Sponsorships

Approximately 15 Society best practices were presented. The distinguished lecturer (DL) programs stood out as exceptionally useful to chapters. Some Societies had a large number of distinguished lecturers (10 to 20). In those cases, it appeared that they had longer terms and were less utilized than the EMC DL program. Some Societies made use of Regional DL programs for efficient use of funds.

Additional support for Chapters included lecture videotape lending programs. Some Societies provided videotapes to promote the Society and Society Officer training. Virtual meetings were also arranged for areas where members were geographically spread out.

Photo by Henry Benitez

No visit to New Orleans is complete without a visit to Jimmy Buffet's Margaritaville...

Society monetary support to the Chapters varied. Many were similar to the EMC Society Haislmaier Angel fund. One Society based a rebate amount dependent upon the number of Chapter meetings held. Also provided were new Chapter formation kits, Chapter leadership manuals and full day Chapter chair workshops. Regional Chapter chair workshops were also suggested. The EMC Society has a Chapter chairs luncheon at its annual symposium each year.

Society Chapter awards were common. One Society presents best Chapter awards twice a year. Another Society presents separate best Chapter awards to USA Chapters and non-USA Chapters. Awards vary from certificates, plaques, and banners. One Society suggested that the banner allowed the Chapters to proudly display their achievement year after year. One Society limited the receipt of best Chapter award to previous winners to once every seven years.

Interaction between Society executive members and Chapter meetings were promoted. Also Society/Chapter partner programs similar to the EMC Society Haislmaier Angel program were utilized. The Haislmaier Angel program provides each Chapter a point of contact on the Board of Directors. One Society was in the midst of beta testing a corporate relations project to increase IEEE awareness and corporate support for membership and participation.

Many Chapters have their own newsletters. Most Society magazines have Chapter columns. Societies are providing free web space for Chapters. One Society created websites for every Chapter whether they wanted it or not! Society WebSites provide a Chapter chairs database.

Some Societies had some issues to address to support Chapters. Some of those concerns included: dormant Chapter chairs, insufficient active Chapters and the need for more champions.

Overall the Society Chapter Coordinators Retreat was deemed a success. Over 50 people were in attendance. 16 people were from outside the USA. 26 Societies were represented and all 10 Regions were represented. The group was divided into 4 sections to compile a list of areas for improved Chapter support. The following is a consolidated list of recommendations in descending order of priority:

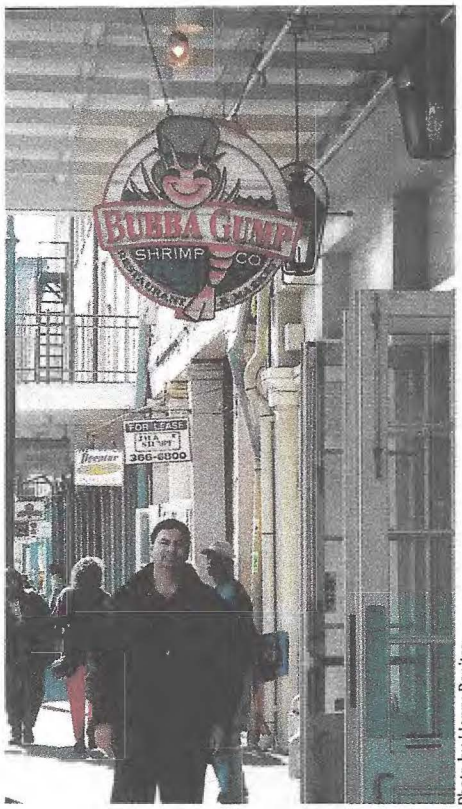


Photo by Henry Benitez

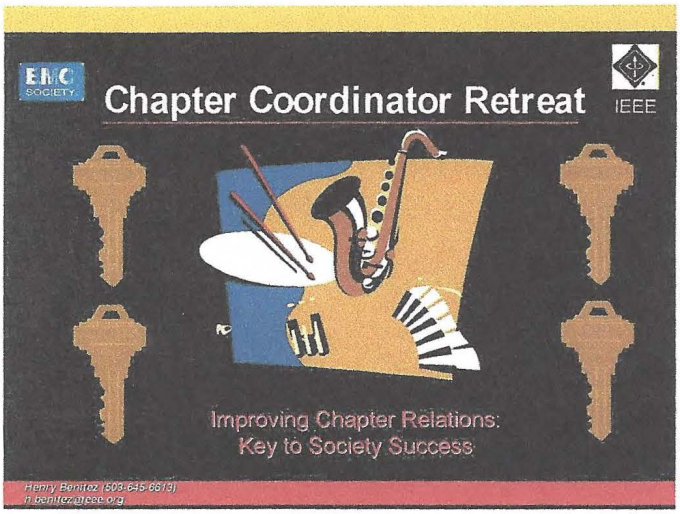
.....and a visit to the Bubba Gump Shrimp Company. Obviously, Henry Benitez combined a little pleasure with business during his visit to the IEEE meeting in New Orleans.

1. Hold Regional Chapter Chair meetings
2. Promote the Chapter Handbook/Development Guide
3. Piggyback Chapter Retreat with the Membership Development Retreat
4. Centralize a web-based database (Chapter coordinators and other volunteers contact info, DL info, awards, etc)
5. Tie: a) Implement "Worst Practices" sessions/solicitations (learn from mistakes made); b) Streamline and improve current reporting processes
6. Increase regional support for Chapter formations
7. Provide a matrix of Society (Chapter) support activities with

corresponding links posted on Technical Activities Department Chapter Home Page
8. Provide leadership training for Chapter interfaces (RAB/TAB)
9. Identify improved communications for Chapters/sections/region
10. Hold Chapter level technical meetings
11. Recognize Chapters at a prestigious event
12. Conduct Society promotional Distinguished Lecturer tours
13. Support Chapter e-mail aliases
14. Provide industry relations package
15. Simplify inquiries (initiate a "Help Desk", improved search engines)
16. Tie: a) Provide Society mentoring programs for chapters; b) Provide a listing of Chapter activities on Society WebSites
17. Provide a set of Life-Long Interest packets from Societies

We left the retreat with five final thoughts:

1. Focus on e-business
   a. Develop new and non-traditional products and services that enhance the value of membership
   b. Invest in people and technology which ultimately improves members' IEEE web experience
2. Become more nimble and responsive to opportunities
   a. Experiment more in order to compete
   b. Simplify business rules
3. Reinforce IEEE as a place where engineering technical communities can gather around emerging technologies
4. Promote engineering as a vital and desirable profession and career
5. Make volunteering fun! **EMC**



Henry Benitez gave a very professional presentation on the EMC Society's best chapter practices at the IEEE Chapter Coordinator's Retreat in New Orleans. In his first viewgraph, he used graphics to highlight the city's jazz theme.

Award Nominations Requested!

It's time to start thinking about nominations for awards to be presented at the Awards Luncheon to be held at the 2000 IEEE International Symposium on Electromagnetic Compatibility, August 21-25, 2000 in Washington, DC.

Consider nominating a fellow co-worker or others whose IEEE volunteer work deserves recognition! Visit the EMC Society web page at *www.emcs.org* to see the list of award categories and past recipients.

Nominations must be submitted by July 1, 2000 to Henry Benitiez, Awards Chairman, at phone 503-627-1217 or e-mail at *henry.w.benitez@tek.com*.

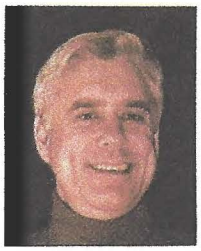
President's Message

continued from page 3

In the area of awards, the Board of Directors voted at our March meeting to participate in the financial support and selection process for the awarding of the annual IEEE Electromagnetics Field Award which includes a $10,000 honorarium to recognize significant accomplishments in the field of electromagnetics. Todd Hubing, VP Membership Services, will represent the EMC Society in this endeavor. Todd, or more properly our awards chair, Henry Benitez, is also seeking recommendations for awards of several types to recognize the many members who make our Society as successful as it is. Please take the time to think about those individuals at all levels in our Society who should be publicly thanked for their efforts. These awards will be presented at the symposium in Washington DC.

Future EMCS Board of Directors meetings will be held in Montreal, Canada (site of the 2001 EMC Symposium) on Friday, June 9th, in Washington, DC on Sunday, August 20th, and in Tampa, Florida on Thursday, November 16th. We have also tentatively chosen Friday, February 23, 2001 in Zurich, Switzerland for a Board meeting following the Zurich EMC Symposium.

If you have any questions, comments, or suggestions, please feel free to write or call me at my workplace: Chomerics, Division of Parker Hannifin Co., 77 Dragon Court, Woburn, MA 01801, telephone 781-939-4267 or e-mail me at *j.e.butler@ieee.org*. **EMC**



TC-9 Computational EMC

Annual Applied Computational Electromagnetics Society (ACES) Conference Draws Computational Electromagnetics Enthusiasts From Academia, Government and Industry

By Colin E. Brench

Each March the Applied Computational Electromagnetics Society (ACES) holds its annual conference at the Naval Postgraduate School in Monterey, California. ACES first began as a computer modeling/electromagnetics workshop with the goal of providing a forum for the discussion of computer modeling tools like the Numerical Electromagnetics Code (NEC). Today, members of the society are very active in a wide range of Computational Electromagnetics (CEM) research and development, all of which are well represented at the annual conference.

"ACES is an excellent resource for those wishing to learn more about the application and the underlying theory of computational EM."

The annual ACES conference provides an opportunity to gather together with a number of CEM enthusiasts. The goal of this conference is to bring together those wishing to share information and experiences about the practical application of computational methods to current EM challenges. Presentations, courses, and workshops are offered in areas such as the validation and performance of computer codes and the underlying solution techniques; the development of new algorithms, computational techniques, and code enhancements; and the application of these techniques to real problems. In addition, ACES also addresses model input/output data issues; the intention being to provide some standard input geometry file and output format to ease the application of meshing routines and data management.

The ACES conference runs for six days. This year it was held from March 20 to 25. While Monday, Friday, and Saturday were reserved for full and half day short courses, the remaining conference days each began with a plenary session of general interest. After the plenary session, the conference split into three or four parallel sessions and provided the almost two hundred attendees with papers on a wide range of topics. Many of those that attend this conference are from academia and government organizations; a much smaller percentage is from industry.

This year's short courses addressed theoretical and numerical topics, and different design issues including EMC modeling. The short course on EMC modeling was a full day course entitled "EMI/EMC Computational Modeling for Real World Engineering Problems", and presented an overview of numerical techniques relevant to EMC. More importantly it provided an in depth discussion on how to create and use effective models to solve EMI/EMC problems.

During the week, the major numerical techniques, their use, optimization and development were covered in a number of the sessions. For those actively involved in developing EMC modeling tools, these sessions provided good insight into the way that the field is developing. It was also revealing to see how EM tools are applied to non-EMC problems. Antenna behavior, radar cross-section and most other areas of CEM require great accuracy, while EMC modeling is somewhat less precise. It is encouraging to see that Computational Electromagnetic modeling can provide accurate answers to specific problems.

Two of the sessions were of particular interest to the EMC engineer: "Numerical Techniques for Packaging and Interconnects", and "EMC". In the first session, some of the papers addressed the difficulties associated with the creation of practical models for packages and transmission lines. The EMC session provided largely practical papers discussing how best numerical techniques can be applied to EMC problems. Topics covered ranged from modeling for a number of printed circuit module problems, to the analysis of shielded enclosures.

Having a full session dedicated to EMC is a frequent though not a constant item at the ACES conference. It is anticipated that as EMC issues become more complex, the need for CEM to address these issues will also grow. As a result, ACES is strongly encouraging participation from those who work in this area. There is little doubt that EMC engineers can benefit greatly from the wide range of information available and from the insights that can be obtained by those working in fields so closely related to our own.

ACES is an excellent resource for those wishing to learn more about the application and the underlying theory of computational EM. Further information on ACES, including membership information, the call for papers for next year's conference, and contact information for ACES officers can be found at *http://aces.ee.olemiss.edu/*. This page also provides additional links to other computational electromagnetics pages that may be of use to the reader. **EMC**

Practical Papers, Articles and Application Notes

Bob Rothenberg, Associate Editor

Following are two papers which should be of interest to members of the EMC community. Stephane Laik, a French doctoral candidate with a research interest in EMC testing, offers a paper on measurement uncertainties related to European Community (EC) radiated emission tests. George Kunkel describes a demonstration of field penetration through shields which he presented at the 1999 IEEE International EMC Symposium in Seattle. (An interactive CD describing the theory and results of this demonstration can be obtained from Spira Mfg. Corp., e-mail: *sales@spira-emi.com*).

Readers wishing to share experience-based knowledge or measurement results with colleagues in the EMC community are encouraged to submit original papers or application notes for this section of the Newsletter. See page 3 for my e-mail, fax and real mail addresses. Unlike Transactions and Symposium papers, the selection process is simple and editorial support is offered.

Comments from readers concerning these papers are welcome, either as a letter (or e-mail) to the editor or directly to the authors.

Radio Disturbance Measurement and its Uncertainties

By Stephane Laik

Introduction

The EC labelling of electronic equipment to be made available on the European market makes it necessary to carry out EMC tests with a view to satisfying the basic requirements of directive 89/336/EEC. In particular, this directive imposes the determination of the level of emission of disturbances radiated by the equipment and its comparison with a limit which must not be exceeded. To respect these requirements, it is important to know the measuring method used and the uncertainties associated with it.

Mathematical model

When making measurements on an equipment item, it is necessary to know all the characteristics of the measuring system used. For example, to measure the electric field radiated by a device, the setup used is similar to that described in figure 1.

In this case, the electrical field measured can be expressed as:

$$E(\mu V/m)=V(\mu V).k(m^{-1}).P.(1+D) \text{ or}$$
$$E(dB\mu V/m)=V(dB\mu V)+K(dB/m)+P(dB)+D(dB)$$

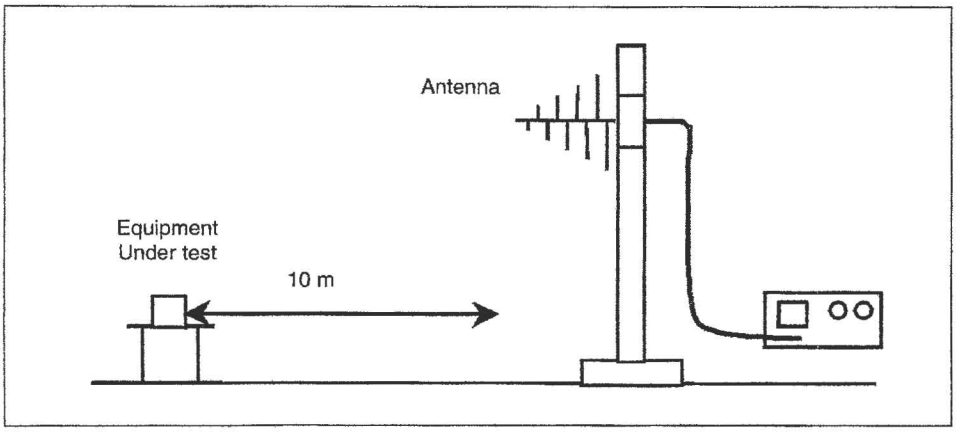


Figure 1 : Measurement setup

with: V, the measurement given by the apparatus
k, the antenna factor
P, cable losses
D, uncertainties connected with impedance mismatches.

In the 30 – 1000 MHz frequency band, two types of antennas are often used: a biconical one between 30 and 200 MHz and a log-periodic one between 200MHz and 1000 MHz.

Parameters influencing measurement

The measurement recorded is influenced by elements inside and outside the measuring system. [NIS81] proposes a non-exhaustive list of these parameters : Ambient signal, Antenna factor calibration, Cable loss calibration, Receiver specification, Antenna directivity, Antenna factor variation with height, Antenna phase centre variation, Antenna factor frequency interpolation, Measurement distance variation, Site imperfection, Mismatch impedance, System repeatability.

It is possible to put a numerical value on these uncertainties in most cases. The simplest method is to calculate the overall uncertainty on the bandwidth under consideration by taking the maximum value of all the partial uncertainties. But this method has the disadvantage of giving a result that does not really reflect the measurement. It is wiser to calculate the uncertainty per frequency band, dividing up the bands as fixed by the calibration certificates. In this case we obtain:

- Antenna factor calibration uncertainty (Probability distribution : normal, k=2)
  - 30 to 100 MHz ⇒ ± 1.1 dB
  - 100 to 200 MHz ⇒ ± 0.9 dB
  - 200 to 600 MHz ⇒ ± 1.0 dB
  - 0.6 to 1 GHz ⇒ ± 1.2 dB
- Antenna reflection coefficient uncertainty (Probability distribution : normal, k=2)
  - 0 to 0.2 ⇒ ± 1.1 dB
  - 0.2 to 0.4 ⇒ ± 0.9 dB
  - 0,4 to 0.6 ⇒ ± 1.0 dB
  - 0.6 to 0.8 ⇒ ± 1.2 dB
  - 0.8 to 1 ⇒ ± 1.2 dB

Comparing these data with the calibration results (Figure 2 to Figure 5) we obtain the following six divisions:

30 to 45 MHz (Biconical antenna, $\Gamma > 0.8$)

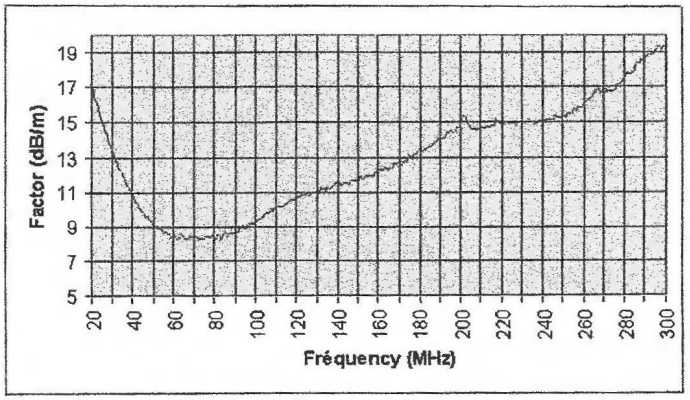


Figure 2: Biconical antenna factor

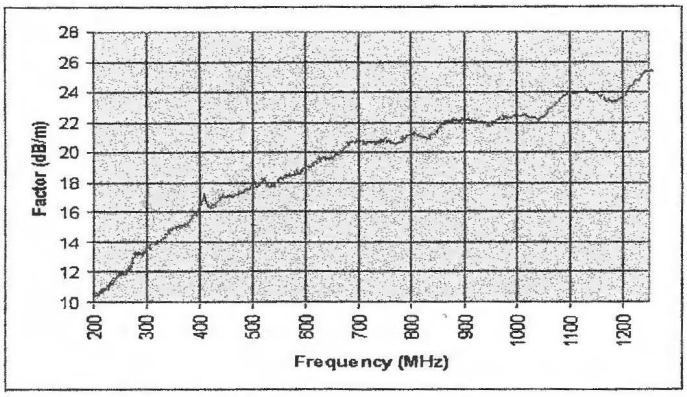


Figure 3: Log-periodic antenna factor

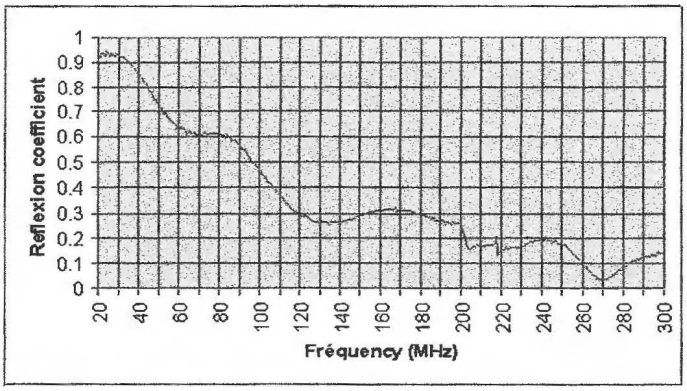


Figure 4: Biconical antenna reflexion coefficient

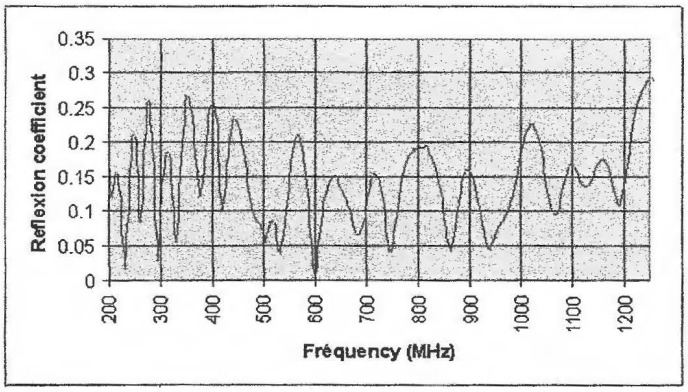


Figure 5: Log-periodic antenna reflexion coefficient

45 to 85 MHz ($0.8 > \Gamma > 0.6$)
85 to 100 MHz ($0.6 > \Gamma > 0.4$)
107 to 200 MHz ($0.4 > \Gamma > 0.2$)
200 to 600 MHz (Log-periodic antenna, $0.4 > \Gamma > 0.2$)
600 to 1000 MHz ($\Gamma < 0.2$)

Table 2 lists all the uncertainties per frequency band. From these uncertainties it is possible to calculate the standard uncertainty on the measurement of radiated disturbances. In the first band we obtain:

$$U_c = \sqrt{\left(\frac{1.1}{2}\right)^2 + \left(\frac{0.5}{2}\right)^2 + \left(\frac{1.5}{\sqrt{3}}\right)^2 + \left(\frac{2}{\sqrt{3}}\right)^2 + \left(\frac{0.25}{\sqrt{3}}\right)^2 + \left(\frac{0.4}{\sqrt{3}}\right)^2 + \left(\frac{2}{\sqrt{3}}\right)^2 + \left(\frac{2.27}{\sqrt{2}}\right)^2 + 0.7^2 + \left(\frac{0.13}{2}\right)^2} = 2.63dB$$

The expanded uncertainty for a 95 % confidence level in the measurement is: $U = 2U_c = 5.26$ dB.

The uncertainty calculation on mismatches is given by: $U=20\log(1\pm\Gamma_l\,\Gamma_g)$ where Γ_g, is the reflection coefficient of the antenna and $\Gamma_l = 0.3$ is the reflection coefficient of the measuring receiver.

Interpretation of calculations

Once the characteristics of the measuring system are known, it only remains to take the measurements on the equipment item and compare them with the upper limit fixed. The four possible cases are shown in table 1.

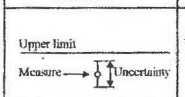
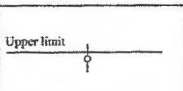
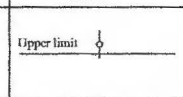
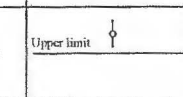
Case A	Case B	Case C	Case D
			
The product complies.	The measured result is below the specification limit by a margin less than the measurement uncertainty. It is not therefore possible to determine compliance at a level of confidence of 95 %. However, the measured result indicates a higher probability that the product tested complies with the specification limit.	The measured result is above the specification limit by a margin less than the measurement uncertainty It is not therefore possible to determine compliance at a level of confidence of 95 %. However, the measured result indicates a higher probability that the product tested does not comply with the specification limit.	The product does not comply.

Table 1: Compliance Criteria (NIS 81)

Application to measurement on free field site

In the case of free field site measurements on a class B equipment item, standard NF EN 55022 (CISPR 22) sets the upper limits at 30 dBµV/m between 30 and 230 MHz, and 37 dBµV/m between 230 and 1000 MHz. Figure 6 compares the noise levels of the measuring system over the whole frequency spectrum.

It can be seen that around 1 GHz the difference between the standard and the noise level of the measuring system is 15 dB (Figure 6). For compliance at a level of confidence of 95%, the maximum radiation must be 3.69 dB below the limit in order to fall into case A of Table 1, i.e. its radiation level must be 33.31 dBµV/m. In these conditions, the signal/noise ratio is 11.31 dB and the measurement indicated suffers from additional error. Figure 7 shows how the error on the measurement indicated by

Contribution	Fréquency (MHz)					
	30 to 45	45 to 85	85 to 107	107 to 200	200 to 600	600 to 1000
	Uncertainty (dB)					
Antenna factor calibration	1.1	1.1	1.1	0.9	1	1.2
	-1.1	-1.1	-1.1	-0.9	-1	-1.2
Cable loss calibration	0.5	0.5	0.5	0.5	0.5	0.5
	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Receiver specification	1.5	1.5	1.5	1.5	1.5	1.5
	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
Antenna factor variation with heigth	2	2	2	2	0.5	0.5
	-2	-2	-2	-2	-0.5	-0.5
Directivity	0	0	0	0	0.5	0.5
	0	0	0	0	0	0
Antenna phase centre variation	0	0	0	0	0.2	0.2
	0	0	0	0	-0.2	-0.2
Antenna factor frequency interpolation	0.25	0.25	0.25	0.25	0.25	0.25
	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25
Measurement distance variation	0.4	0.4	0.4	0.4	0.4	0.4
	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Site imperfections	2	2	2	2	2	2
	-2	-2	-2	-2	-2	-2
Mismatch	2.27	2.05	1.58	1.08	1.08	0.56
	-3.09	-2.69	-1.93	-1.24	-1.24	-0.6
System repeatability	0.7	0.7	0.7	0.7	0.7	0.7
	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
Mismatch calibration	0.13	0.1	0.07	0.05	0.05	0.05
	-0.13	-0.1	-0.07	-0.05	-0.05	-0.04
Combined standard uncertainty	2.63	2.54	2.36	2.20	1.93	1.84
	3.02	2.82	2.49	2.24	1.95	1.83
Expanded uncertainty (k=2)	5.26	5.08	4.72	4.40	3.86	3.68
	6.04	5.64	4.98	4.48	3.90	3.66

Table 2: Uncertainty budget

the receiver increases with the signal/noise ratio. With a signal/noise ratio of 11 dB, the uncertainty on the measurement rises from 3.69 to 4.93 dB and we find ourselves in case B of Table 1.

It is, however, possible to remove the ambiguity for sine-wave signals while respecting the spirit of the standard by reducing the pass band of the filter (fixed at 120 kHz). With a 9 kHz filter, the noise level drops 20 dB or so and the signal/noise ratio increases in consequence. This only gives correct results if one and the same signal is present in the pass band of the 120 kHz and 9 kHz filters. If this is not the case, the total energy of all the signals included in the 120 kHz pass band will be higher than the total energy of all the signals included in the 9 kHz pass band and the bandwidth reduction will result in a reduction of the radiated disturbance measurement, thus giving a rather over optimistic ruling on the compliance of the product.

Conclusion

In this article we have highlighted the importance of knowing and qualifying all the elements of a measuring system perfectly if false conclusions as to the acceptability of the equipment under study are to be avoided. We have pointed out the influence of the pass band of the filters on the quality of the measurement intended to determine whether the equipment complies with standard NF EN 55022 but only for cases of emission of isolated sine-wave signals. For wideband pulse signals there are no methods for giving so simple a ruling without completely distorting the spirit of the standard since other parameters such as the signal repetition frequency and the quasi-peak detector response must be taken into account.

References

NF EN 55022 : Limits and methods of measurement of radio disturbance characteristics of information technology equipment – January 1999.

NIS 81 : The treatment of uncertainty in EMC measurements – 1st edition May 1994

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Jean Louis Boizard *received a Ph. D. degree in Automatic Control from the Universite Paul Sabatier in Toulouse, France in 1985. His research was on three dimensional vision systems based on the use of CCD cameras for robotic applications. He has worked as a project manager on the design of electronic systems for spatial, aeronautic and automotive applications, and is currently an assistant professor at the Institut Universitaire de Formation des Maitres (IUFM) in Toulouse. His present research activities, with the Laboratoire d'Acoustique de Metrologie et d'Instrumentation (LAMI) of Toulouse, include signal processing architectures for wide band acoustic antennas and EMC modeling for CAD tools. Dr. Boizard can be contacted via e-mail at* boizard@cict.fr. **EMC**

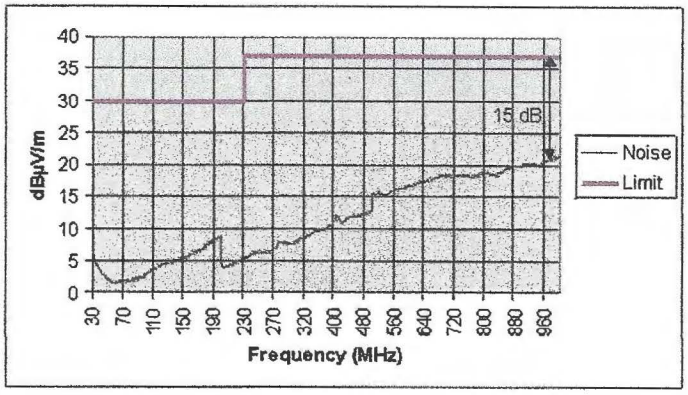

Figure 6: Noise level of the measurement method

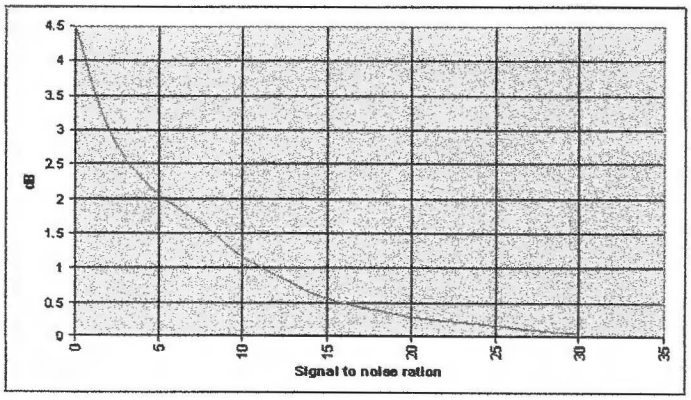

Figure 7: Error indication

Penetration of Electromagnetic Fields Through Shielding Barrier Material

By George Kunkel

Introduction

The industry uses "shielding effectiveness" as a "figure of merit" for gauging the attenuation of an electromagnetic field through shielding barrier material. The concept of shielding effectiveness is based on wave theory, where the math associated with the theory is abstract and does not lend itself to understanding the physics associated with the penetration of the field through the barrier material.

By using circuit theory to calculate the attenuation associated with the penetration of an electromagnetic field into and through shielding barrier material, the physics associated with the penetration can be realized. It can also be used to approximate the value of the E and H fields at any given distance from the barrier as a function of the H field impinged on the incident side of the barrier.

A demonstration was presented at the 1999 IEEE International symposium on EMC in Seattle. An explanation of the presentation and results is contained herein.

Overview

A radiated electromagnetic field is generated by the action of driving a current through a wire. The EMC community typically uses a dipole (electric and magnetic) antenna to generate the field of interest.

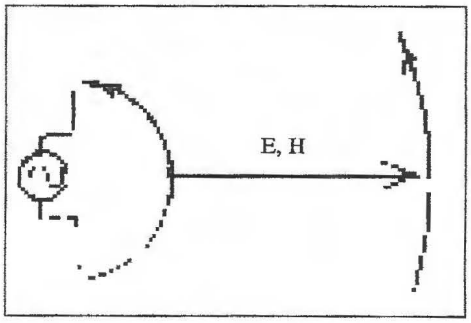

Figure 1. Generation of EM Field

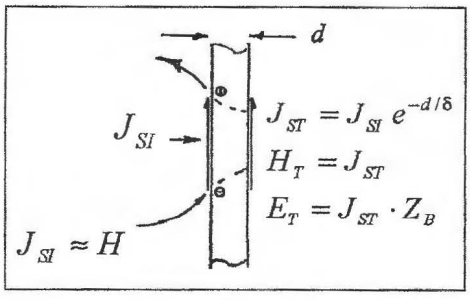

Figure 2. EM Field Penetrating Barrier

Figure 1 illustrates a typical electric dipole antenna, which is being driven by an ac voltage source.

What is illustrated is the generation of a radiated force field created by a differential of voltage potential from the energy source. This force field consists of an electric "E" field, which is a function of the difference in voltage between the ends of the antenna, and current, which is a function of the capacitive reactance between the ends of the antenna. There is also a magnetic "H" field, which is at right angles to the force field. The current, which is parallel to the E field, is measured in units of amperes/meter and is equivalent to the value of the H field.

The field moves away from the antenna, with the power in the field decreasing as the square of the distance. Figure 2 illustrates the field (or wave) impinging on a shielding barrier.

Current is induced into the barrier material. Its value is approximately equal to the value of the H field incident on the barrier. This current is reduced in value by a force called skin effect as the field penetrates the material. The value of the E and H fields as the wave leaves the barrier is equal to the value of the fields on the surface and is as illustrated in Figure 3. Since the current (H field) lags the voltage (E field) by 45°, the power of the transmitted field is as follows:

$$P_T = E_T H_T \cos 45°$$

The power of the field decreases as the square of the distance from the original source of energy (i.e., dipole antenna). The value of the power and the value of the E and H fields at a distance R_2 can be approximated using the equations of Figure 3.

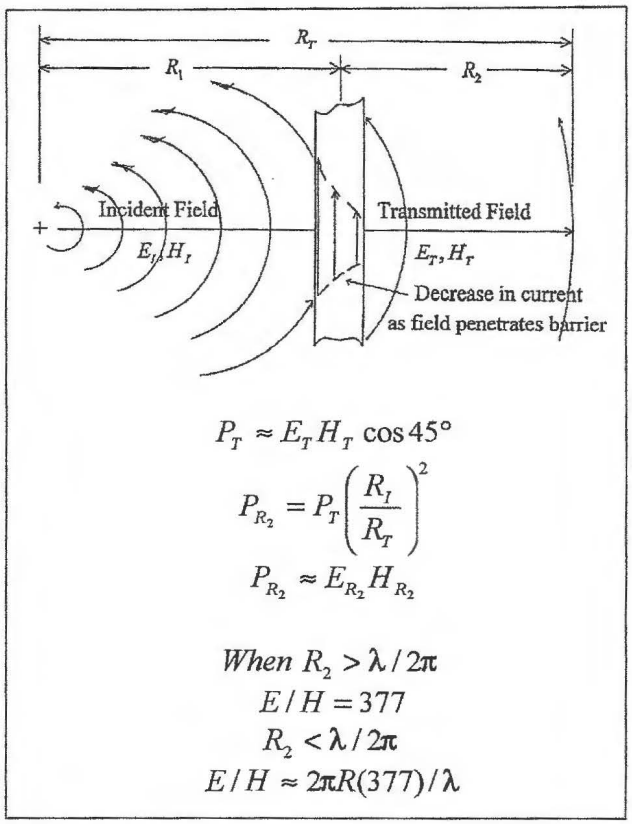

Figure 3.

Demonstration

In the demonstration, the H field generated by an electric dipole antenna situated in a shielded box (with the face open), as illustrated in Figure 4 is measured over the frequency range of 100 kHz to 1 MHz. A shield consisting of aluminized mylar measuring 1.4 ohms is then attached to the face of the box. The strength of the E and H field with the shield over the opening of the box, as illustrated in Figures 5 and 6, is then

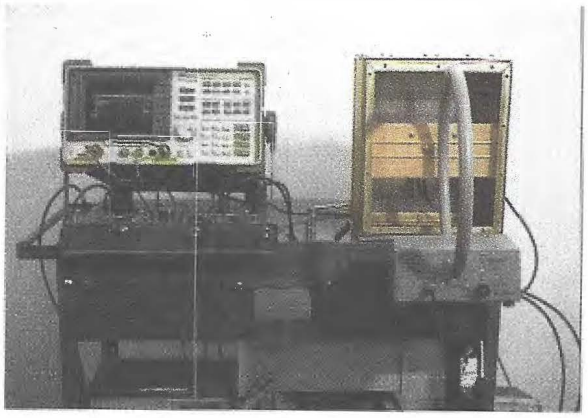

Figure 4. Configuration for Testing H Field with Cover Off

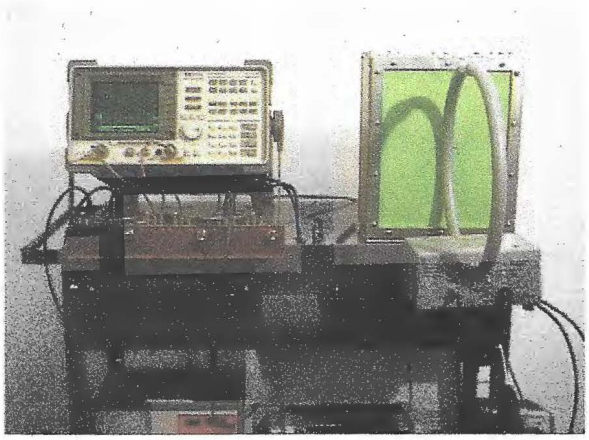

Figure 5. Test Configuration for Measuring H Field with Shield Material Over Face of Box

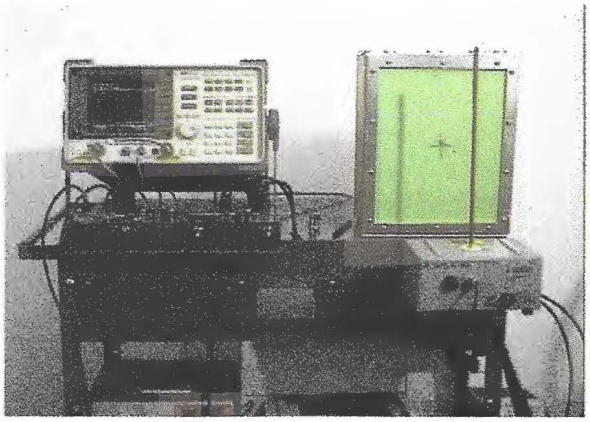

Figure 6. Test Configuration for Measuring E Field with Shield Material Over Face of Box

measured. The measured values are compared with the predicted values for the H field without the shield in place. The shielding effectiveness for the E field is also measured.

Figures 7, 8, and 9 illustrate the measured field strength before and after the placement of the shield on the face of the box. Figure 10 illustrates the measured field strength of the E field prior to and after the placement of the shield material on the face of the box. The shielding effectiveness to the E field is the difference between the two readings.

Summary of Results

1. The H field before and after the placement of the shield material on the face of the box is the same (as illustrated in Figures 7 and 8). This is as one would predict based upon the conditions described in Figure 2, i.e.,

$$J_{ST}=J_{SI}e^{-d/\delta}$$

$$\text{where } e^{-d/\delta}=.9998@1MHz$$

$$\therefore J_{ST}\approx J_{SI}$$

$$\& H_T\approx H_I$$

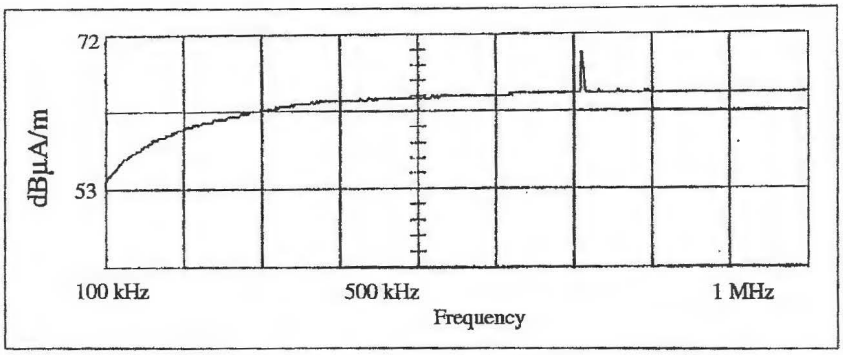

Figure 7. H Field Test Data with Face of Shielded Box Open

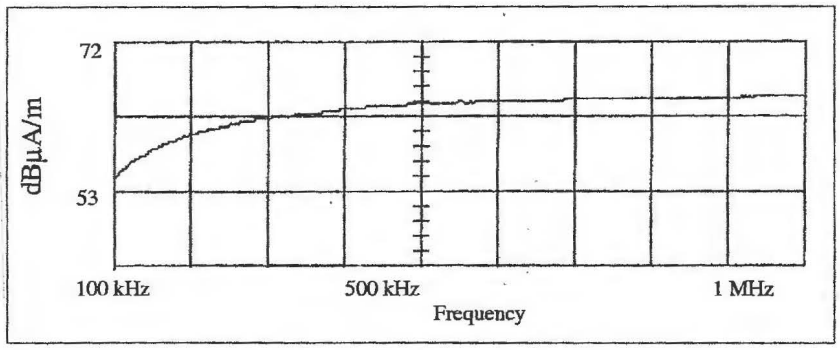

Figure 8. H Field Test Data with Shield Attached to Face of Box

2. The measured transmitted E field over the frequency range of interest is as illustrated in Figure 9. The predicted field strength is equal to measured H field (dBμA/m), the attenuation due to skin effect (dB) plus 20 log 2.4 (dB). The measured and predicted electric (E) field strengths in dBμV/m are as follows:

Frequency	66 kHz	500 kHz	1 MHz
Measured	63 dB	69 dB	69 dB
Predicted	66 dB	72 dB	73 dB

3. The measured E-field shielding effectiveness is illustrated in Figure 10, and is as follows:

Frequency	100 kHz	500 kHz	1 MHz
Shielding Effectiveness	42 dB	46 dB	46 dB

Sample Calculations

To obtain the results illustrated in the demonstration, the following calculations had to be performed: (1) the thickness of the aluminum shield material; (2) the impedance of the aluminum shield material over the frequency range of 100 kHz to 1 MHz; (3) the skin depth of aluminum shield material from 100 kHz to 1 MHz; and (4) the normalized values of the recorded E and H fields as a function of the antenna correction factors.

The dc resistance of the aluminum foil was measured to be 1.4 ohms per square. The definition for the dc resistance of a material is

$$R=\frac{1}{\sigma d}\ \text{(ohms)}$$

$$\text{where } \sigma = conductivity\ (mohs/meter)$$

$$\sigma\ for\ aluminum = 3.55\times10^{7}$$

$$d = thickness\ of\ barrier\ (meters)$$

$$\therefore d = 1.66\times10^{-8}\ meters$$

The skin depth (δ) is equal to the following:

$$\delta=(2/\omega\mu\sigma)^{1/2}\ \text{(meters)}$$

$$\text{where } \omega = 2\pi f$$

$$\mu = 4\pi\times10^{-7}\ H/m$$

$$\therefore \delta = 2.67\times10^{-4}\ meters@100kHz$$

$$= 8.45\times10^{-5}\ meters@1MHz$$

The impedance of a metallic barrier material is:

$$Z_B=\frac{1+j}{\sigma\delta(1-e^{-d/\delta})}$$

$$\therefore Z_B = 2.40\ ohms@100kHz\ \&\ 1MHz$$

The correction factors to be added to the recorded trace from the spectrum analyzer in dB μV are as follows:

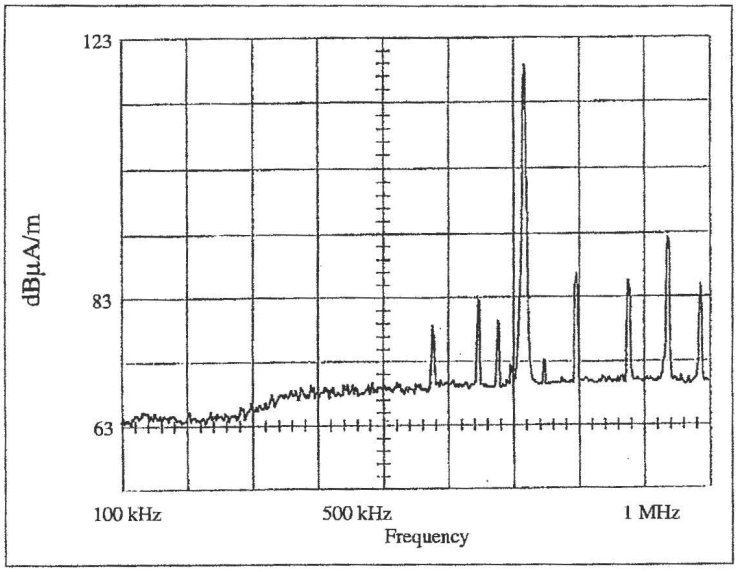

Figure 9. E Field Test Data with Shield Attached to Face of Box

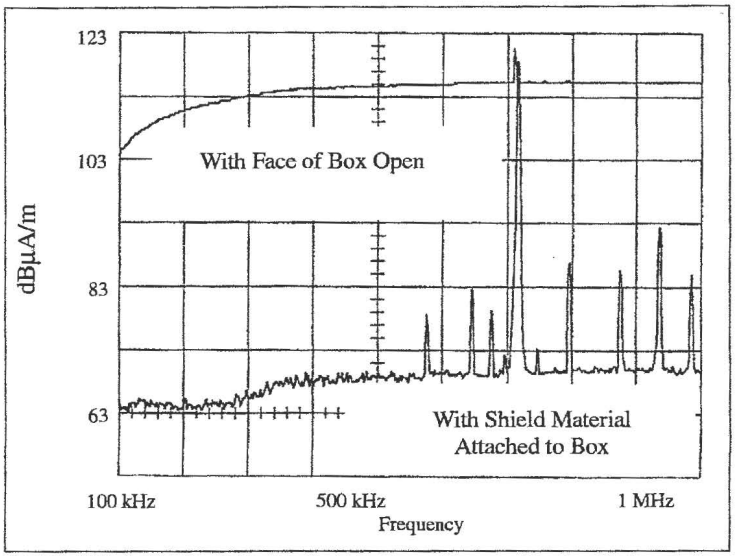

Figure 10. E FieldTest Data

Loop antenna -35 dB to obtain dB μ A/m
Rod antenna +16 dB to obtain dB μ V/m

The reading at the top line of the spectrum analyzer plot was 107 dB μ V. Therefore the values of the top line of the plots presented herein are:

E field 107 + 16 = 123 dB μ V/m
H field 107 - 35 = 72 dB μ A/m

George Kunkel *received his Bachelor of Science and Master of Science degrees in engineering from the University of California at Los Angeles (UCLA). After graduation he taught courses on applied electromagnetic theory in the UCLA extension department. He is presently a member of the Deans Council, College of Engineering at UCLA, and president of Spira Manufacturing Corporation.*

Mr Kunkel has nearly 50 years experience as a design engineer, primarily in electromagnetic effects (i.e., EMI/EMC, TEMPEST, EMP, lightning and RADHAZ). He is a senior member of the IEEE and was chairman of the Technical Committee on Interface Control for the EMC Society from 1969 through 1987. He has published numerous papers on grounding, bonding, shielding and filtering.

George can be reached at (818) 764-8222 or via e-mail at george@spira-emi.com. **EMC**

Call for Raconteurs

There will be a special session on EMC War Stories at the Y2K IEEE EMC Society Symposium in Washington, D.C. in August of 2000. The best and second best stories will be recognized at the awards banquet - assuming we get as many as two responses. They may even be published in the Society newsletter (no pseudonyms allowed).

Please submit a written version of your proposed war story - 500 to 2000 words - to the panel of judges (tom@7ms.com) on or before 4 July 2000. (How's that for independent thinking?)

The story should be about an EMC project in which you were involved. Like any good story, embellishments and exaggerations are expected, in fact encouraged. Oh yes. The story should have a kernel of truth. The chosen stories will be presented verbally at the symposium session by the authors (or their designee) and should be at least 10 minutes but not more than 20 minutes long. An overhead projector will be available for cartoons and notes so that you needn't write on your shirt cuffs. **EMC**

Book Review

Reviewed by Norm Violette, Associate Editor

Wireless Communications Design Handbook Aspects of Noise, Interference, and Environmental Concerns Volume 3: Interference into Circuits

Author: Reinaldo Perez, Ph.D.
Spacecraft Design
Jet Propulsion Laboratory
California Institute of Technology

Academic Press, San Diego, CA 1998

Preface and Introduction

These two introductory sections set the tone for the flow of the book's five main chapters. This book is essentially a companion to Volumes 1 and 2 which were reviewed in two previous EMC Society Newsletters.

Chapter 1 - Noise Interactions in High-Speed Digital Circuits

This chapter presents basic concepts. Goals are defined that should be achieved to minimize interconnect noise interactions in high-speed digital printed circuit boards (PCBs). The **transmission line (T-line) behavior** of PCB traces at digital high-speed and high frequency performance is described. The dependence of performance on the PCB relative dielectric constant (relative permittivity) is described along with other transmission line parameters.

Specific applications to the microstrip configuration are illustrated. Capacitive effects in loads and T-lines are described to determine minimum load separation.

The chapter also addresses crosstalk, power distribution, decoupling capacitor applications, power dissipation in TTL and CMOS devices, thermal conduction, heat radiation, and control. Lossy T-lines and propagation delays are described.

VLSI failures and electromigration, topology-related and material-related problems are addressed and electromigration mechanisms are described. Other topics include interference concerns with connectors, including crosstalk; ground loops and radiated interference; solving interference problems in connectors; filtering; shielding; and the issue of vias.

Chapter 2 - Noise and Interference Issues in Analog Circuits

The basic characteristics of noise in op-amps are presented and classified as either *white noise* or *color noise, random* or *repetitive*, of *voltage* or *current* form, and can be found at any frequency. An example of a noise density spectrum is illustrated. *Thermal noise* is described with sample calculations presented including the determination of noise figure.

Op-amp fundamental specifications are explained including the feedback concept. The characteristics of shot noise, flicker noise, and popcorn noise are described. The need for an input offset voltage is described. Op-amp noise gain, slew rate, power bandwidth, and gain-bandwidth product are defined. An analysis of op-amp internal noise is provided along with noise issues in high-speed ADC applications.

Power supply decoupling, the application of decoupling capacitors, and the design of power bus rails in power/ground planes for noise control are described. The effect of trace resistance and resulting power loss are analyzed. Signal integrity and the effects of ground bounce and crosstalk are described.

A discussion is presented of considerations and difficulties encountered in the use of EDA tools for ASICs in the design and delivery of submicron (mm) components and circuits. The main problems occur because parasitic effects such as parasitic (distributed) capacitance, inductance, and resistance become significant due to close proximities and affect circuit performance. The current EDA state-of-the-art can handle 0.5 mm and often deal with 0.35 mm, but the deep submicron area at 0.25 mm presents problems for current (1998) EDA design techniques.

Chapter 3 - Noise Issues in High Performance Mixed Signal ICs and Other Communications Components

The problem of providing a clear analog input signal into an analog-to-digital converter (ADC) arises because an ADC has several possible inputs, to wit: ground pins, power supply pins, and reference pins which can also act as inputs. These must be treated so as to prevent inherent noise and interfering signals from coupling into these paths and thereby corrupt the analog output. This "meaty" chapter provides detailed analyses and many illustrations that describe techniques for identifying and mitigating these problems. Generally, analog circuits are much more sensitive and can be corrupted more easily than digital circuits.

The *grounding* of ADCs is presented as critical. Proper *bypassing* and *circuit layout* are also described as essential. The use of RC filters in the driving input of ADCs is described. Filtering the switched-mode power supply (SMPS) and the choices of capacitors for filtering are described. The use of inductors, ferrites, and ferrite cores in SMPSs are presented.

The *shielding* of cables in op-amp inputs is discussed and illustrated. The troublesome *RFI rectification* in analog circuits is illustrated. Op-amps driving capacitor loads, including load capacitance from cabling, are presented in detail.

Intermodulation distortion, phase-locked loops (PLLs), and *voltage-controlled oscillators (VCOs)* are described including *VCO phase noise* and *Phase Detectors*.

Some types of capacitors and carbon resistors can generate a substantial amount of 1/f type noise and thereby contribute to noise in low-pass filters. The design of low-noise circuits there-

fore requires the selection of low-noise capacitors and resistors. The noise power density is described.

Phase noise is described in DC amplifiers, high-frequency amplifiers, phase detection circuits, digital frequency dividers, frequency multipliers, oscillators, and reference frequency generators.

RF interference at the transistor level is described along with rectification in PN junctions. Illustrations and models are provided of the mechanisms of RF interference. RFI effects in op-amps and crystal oscillators are described.

Chapter 4 - Computational Methods in the Analysis of Noise Interference

A general introduction addresses the impact of Maxwell's formulations governing "... the electrical nature of matter and the fields associated with the currents involved." He (Maxwell) probably could not have imagined the application of computers and computational techniques used to solve his complex equations under a variety of boundary conditions and provide results that can be experimentally proven. The purpose of this chapter is to: "...discuss briefly the profound effect that computational techniques have had in solving electromagnetic field problems, especially those problems related to the area of electromagnetic compatibility (electromagnetic interference)."

Approaches to solving problems in electromagnetics include analysis and synthesis techniques, concepts of input-output, transfer functions, field propagators, and coupling mechanisms.

The selection of a *field propagator* is the first step in the development of a computer model. Basic categories of field propagators discussed include (1) integral equations, (2) differential equations, (3) optical equations, (4) network equations, and (5) multiple field equations. Details are presented that describe the different types of field propagators for each of these categories.

Computational Electromagnetic: Techniques presented and described briefly for constructing mathematical models and algorithms for solving problems in electromagnetics include the **Method of Moments (MOM)**, with developments on the mathematical theory of the MOM, modeling problems using wire geometries, choosing basis and weighting functions, modeling problems using surface geometries, hybrid MOM for wire and surface currents, the aperture problem in the MOM, the two-media problem, slot apertures, and the hybrid MOM for apertures.

High frequency methods in computational electromagnetics are presented including geometrical optics, geometric theory of diffraction (GTD), the uniform geometric theory of diffraction, the physical theory of diffraction, and the hybrid MOM/GTD methods in EMC.

The **Finite Difference Time Domain (FDTD)** techniques are developed including structural modeling in FDTD, Yee's implementation of FDTD, and boundary conditions, with illustrations.

The **Finite Element Method (FEM)** and the **Transmission Line Method (TLM)** are presented, including **Scattering** concepts for 2D and 3D geometries.

A section is included on **Computational Methods at Work: Getting Numbers from Your Models.** Five worked examples are studied to illustrate the application of electromagnetic models based on MOM (three examples) and FDTD (one example) methods. The fifth example is an overview of several techniques applied to a single PCB. Several references are listed to complete this basic but comprehensive chapter.

Chapter 5 - Antennas for Wireless Personal Communications

A summary review is presented for determining the electric (E) and magnetic (H) fields due to currents in a radiating structure. The procedure illustrates the determination of the fields from vector potentials which, in turn, are derived from the structure currents. Radiated fields from thin wire antennas are then determined.

The characteristics of the linear dipole are derived and the radiated fields from dipoles are determined due to simple and sinusoidal current distributions. Radiated fields are then derived for thin wire loop antennas (circular and square loop geometry).

Models are derived and illustrated for microstrip antennas, antenna arrays, reflector antennas, and helix antennas.

Numerical methods (MOM, FDTD) are discussed in the design of loop antennas and cylindrical arrays for personal communication services (PCS). A brief outline is provided of antennas that can be modeled by the MOM. Radiation pattern models are illustrated of monopole and helix antennas mounted on a conducting box.

General Review

This book is highly recommended for engineers who work in fields related to modern wireless communications. It can also serve as a useful reference for undergraduate and graduate students in electrical engineering that have an interest in this field. **EMC**

EMC Standards Activitiy

by Don Heirman, Associate Editor

IEEE Standards Activity within the EMC Society continues unabated. Following are contributions to the Newsletter from the chairmen of the Standards Advisory and Coordination Committee (SACCom) and the Standards Education and Training Committee (SETCom). Together with the Standards Development Committee (SDCom), these three committees constitute the nucleus of the Vice-Presidency for Standards Activity on the EMC Society Board of Directors.

Volunteers Needed! *by Elya Joffe, SACCom Chairman*

The EMC Society Standards Advisory and Coordination Committee (SACCom) is looking for persons willing to act as liaisons between the EMC Society and several organizations that are involved in developing, preparing, and/or approving EMC-related standards. Duties are to keep the IEEE EMC Society appraised of standards work in these organizations through e-mail and other means, passing the information to the chairman of the SACCom, and passing information on the standards interests of the EMC Society to the relevant organization. The interface with the EMC Society is Elya Joffe, chairman of the SACCom.

There are currently openings for representatives to the following five organizations:

- ❑ Electronic Industries Alliance (EIA) R1/R2 committee
- ❑ Electronic Industries Alliance (EIA) G46 committee
- ❑ CENELEC 210A (European Organization for Electrotechnical Standardization) committee
- ❑ ASTM D09.12.14 (Shielding Effectiveness)
- ❑ ASTM E06.53 (Reusable Structures)

We have representatives identified to act as liaisons to the following organizations:

- ❑ CISPR SC A (Measurements and Statistical Techniques)
- ❑ CISPR SC B (Industrial, Scientific and Medical Devices)
- ❑ CISPR SC E (TV and Broadcast Receivers)
- ❑ CISPR SC G (Information Technology Equipment)
- ❑ SAE AE-4 (Aerospace EMC)
- ❑ SAE AE-4 (Automotive)
- ❑ ANSI ASC C63 (EMC)
- ❑ Radio Technical Committee on Aeronautics (RTCA) SC 135
- ❑ Radio Technical Committee on Aeronautics (RTCA) SC 177
- ❑ Electrostatic Discharge Association
- ❑ European Telecom Standards Institute (ETSI) TC-EMC/Radio Matters (ERM)
- ❑ ISO TC22/SC3 WG3 (Interference to Motor Vehicle Electrical and Electronic Equipment)
- ❑ Tri-Service Mil-Specs/Defense Department
- ❑ Information Technology Industry Council (ITIC) committee on EMC matters (ITI TC5)
- ❑ European Computer Manufacturers Association (ECMA) TC-20 on EMC
- ❑ IEC TC-66/SC66A (EMC of Measurement, Control, and Laboratory Equipment)
- ❑ IEC-TC-77

Please contact Elya B. Joffe via fax (+972)-9 7657065 or e-mail (*eb.joffe@ieee.org*) if you are interested in serving as liaison to one of the five committees listed above, or if you know of any other organization that is involved in standards activities that is not listed above.

Please respond by July 1 so that we can make an official appointment and invite you to the annual SACCom meeting and luncheon during the EMC Symposium in Washington, DC this August.

Standards Education and Training Committee (SETCom) *by Hugh Denny, Committee Chairman*

The purposes of SETCom are to develop Working Group processes to assure that IEEE EMC standards are prepared in accordance with IEEE policies and procedures; to develop procedures to facilitate the development of EMC standards; and to increase the awareness and understanding of EMC standards, both IEEE and non-IEEE in origin. To these ends, two major activities are being pursued: (1) the presentation of seminars for working groups on the development, coordination, balloting and support of IEEE EMC standards; and (2) enhancing awareness of EMC standards throughout the EMC community and demonstrating how these standards can be effectively applied to the development, production and use of equipment and systems. The first of these efforts is being initiated through a special workshop session at the 2000 IEEE International Symposium on EMC on Monday, August 21 in Washington, DC. Special presentations will be given on IEEE requirements on standards development, computer-based tools now available to support working groups and others working on the development of new standards or on the revision of existing standards, suggestions for managing working group meetings and activities, and unique perspectives of current and recent working group chairs. All persons who are currently members of IEEE EMC standards working groups or anyone who is interested in learning more about standards development activities, whether IEEE or not, are invited to attend. Check the final program of the Washington DC Symposium for the time and location of this Workshop Session. **EMC**

Inter-Society Activities

David A. Case, Associate Editor

Representative Advisory Committee Report

For those of us in the wireless and telecommunications field, several key events will affect how we approach certification of our products both in Europe and here in the United States.

The first two events involve Europe and the implementation of the Mutual Recognition Agreements (MRAs) and the Radio and Telecommunications Terminal (R&TTE) Directive. Both of these will significantly effect not only how fast products can get to market, but also even where they are tested.

Those interested in the TCB program might want to consider the newest group to join the IEEE EMC Society's Representative Advisory Committee (RAC): the TCB Council. This work group is open to anyone interested in the TCB program.

Under the R&TTE Directive, it will be possible for a manufacturer to test and self-declare compliance of his telecom or radio based equipment in the United States for sale in Europe. This will cut both time and cost to non European based companies who now must have their products tested in Europe to obtain type approval.

Under the R&TTE directive, based upon using harmonized standards, telecom and radio equipment will only need to be reviewed by one Notified Body lab which will issue a approval number that will be accepted by all the European Union (EU) countries. The MRA will allow for the establishment of Notified Bodies to be located in the United States. Under this new directive, the EU countries have one year to implement this directive into national law. The effective date of the R&TTE Directive was April 8, 2000.

In the US, the FCC's Telecommunications Certified Body (TCB) program is progressing. The TCB program is spelled out under FCC ET Docket 98-68. The basic concept is to qualify competent private sector entities as reviewers of the FCC telecommunication and radio submittals. Thus, helping offload some of the workload of the FCC and speeding up the approval process. Domestic TCBs must be designated by the FCC once they have been accredited by the American National Standards Institute (ANSI), who in turn will be accredited by the National Institute of Standards and Technology (NIST).

NIST has been tasked with establishing a subprogram under NVCASE to recognize bodies that accredit certification bodies to certify products related to telecommunications equipment. This accreditation of the accreditors is being done at the request of the FCC.

In a Public Notice, DA-1640, dated August 17, 1999, the Commission gave additional clarification on various aspect of the TCB programs, which included the scope of accreditation, sub-contracting, retention of records, etc. The accreditation will be available for several different scopes of equipment certification. A TCB can choose to obtain their accreditation for any or all of the categories within each scope.

The FCC has divided the accreditation into three major categories, unlicensed transmitter, licensed radio services, and telephone terminal equipment. Under the first two of these there are four subcategories for which a TCB can be certified. As stated earlier, a TCB is required to be accredited for only one category or subcategory.

A TCB must be accredited to the general requirements of ISO Guide 65 and ISO Guide 25 as well as be capable of performing a core set of equipment tests for each scope of accreditation as spelled out in the public notice.

However, a manufacturer or a manufacturer's laboratory cannot be designated as a TCB, since a TCB must be totally impartial. According to the public notice, a TCB can be located outside the US in accordance with the terms of an effective bilateral mutual recognition agreement.

The FCC conducted the first round of training for the TCB trainers, assessors, and hopeful TCB designates in December 1999. Future training is being conducted by private industry using the FCC trained trainers. Future TCB training is planned for later this year both in the US and Europe.

Those interested in the TCB program might want to consider the newest group to join the IEEE EMC Society's Representative Advisory Committee (RAC): the TCB Council. This work group is open to anyone interested in the TCB program. Please contact Dave Case at phone 330-665-7396 or e-mail *davecase@cisco.com*. Please contact the ACIL for further information on the TCB program, phone 202-887-5872. **EMC**

Personality Profile

Bill Duff, Associate Editor

Marcello D'Amore was born in Mesagne (South Italy) in 1942. He received the degree in Electrical Engineering in 1966 and the post-graduate degree in nuclear engineering in 1970, from the University of Rome "La Sapienza". From 1967 until 1969, he served the army in aeronautics and then was a researcher at the Center for Nuclear Studies (CNEN) in Rome. He was appointed assistant at the University of Rome in 1970, assistant professor in 1974 and full professor of Electrotechnics in 1980. He was the first head of the Electrical Engineering Department at "La Sapienza" from 1983 to 1985 and from 1989 to 1995, and Director of the Ph.D. course of Electrical Engineering from 1984 until 1985. He presently teaches the courses of electrotechnics and electromagnetic compatibility for the degree in electrical engineering. He is President of the Electrical Engineering Degree Committee and is Director of the EMC Master since 1999.

At the beginning of his research activity, his main interests focused on the study of electromagnetic interference radiated from the corona phenomenon on high-voltage lines; he also developed procedures for the simulation and analysis of the propagation phenomena of impulsive currents on multiconductor transmission lines above a dissipative ground. The developed models have been used successively for the analysis of wide-spectrum signal propagation on power line networks. During this period, he has been in touch with members of the IEEE Power Society Sub-Committee "Corona and Field Effects", and in particular with Professor Janischewskyi, against whom he played a very strenuous table-tennis match at the University of Toronto, similar to the one he played against a young Chinese researcher during the '92 IEEE EMC Symposium in Beijing.

He has been coordinator of numerous research programs supported by the Ministry of the University, the National Research Council (CNR), ENEL, ENEA and several Industries. He has been the first President of the National Group of Electrotechnics, from 1984 until 1990, a scientific referee of the European Commission for the evaluation of scientific projects within the "Science" Program from 1985 until 1991, and within the "Training and Mobility of Researchers" Plan in 1995. He has been member of the National Committee nos.35 and 36 of CIGRE, and of the IEEE Sub-Committee "Corona and Field Effects" from 1980 until 1990.

Marcello D'Amore

The acquired expertise about the transmission line theory was the basis of numerous research projects on EMC topics concerning in particular the susceptibility of complex electrical networks, with non linear loads, excited by EMP sources. The interest aroused in the EMC community by the studies developed in both the frequency- and time-domains is demonstrated by the Best Paper Award that he received in 1993 and 1997 at the IEEE International Symposium on EMC.

He has also devoted strong effort to research concerning the shielding of low and radio-frequency EM fields. The paper concerning the shielding of power frequency magnetic field received the Best Paper Award during the 1997 International Symposium on High Voltage Engineering in Montreal. The research studies concerning the shielding have also been focused on the characterization of the EM performances of composite materials for aircraft applications. Presently he is involved in a research program concerning the certification by EM simulation of an aircraft made of metallic and composite material, stricken by a direct lightning.

Marcello has been Chairman of the International Symposia, EMC ROMA '94, '96, '98. The first international symposium on EMC was organized successfully in Rome in 1994, thanks to the great development of the EMC industry in the early 90s, to the experience that he acquired in the management of the EMC European Project, and to the encouragement coming from numerous EMC research groups. The success allowed the organization of the symposia in 1996 and 1998. The obtained results have also been reached thanks to the collaboration of the Professors participating in the European Project, and to Dr. Motohisa Kanda, Dr. Fred Tesche and Professor James Wait. From Dr. Kanda, Marcello has also received useful suggestions in order to improve his tennis game. Successively, after the third conference, EMC ROMA became EMC EUROPE in order to move around in Europe.

He participates with Professors Marvin and Catrysse on the European Project Erasmus, which supports student stages at the Universities of Rome, York and Oostenda. He is has been Chairman of the EMC Group of the National Association of Electrical and Electronics Engineers (AEI) since 1992, and of the CEI Committee "Human Exposure to High Frequency EM Fields" since 1993. He founded the Inter-Universities Center of EMC Research, in which the Universities of Rome "La Sapienza", Ancona, and L'Aquila, together with the Polytechnic of Turin and the Naples Naval Institute participate.

He joined the IEEE in 1972 and was elected IEEE Fellow in 1990 "for the development of simulation and analysis models to evaluate transmission line corona on communication channel performance." He is an associate editor of the IEEE Transactions on EMC; he was guest editor and co-editor of the Special Issues of the IEEE Transactions on EMC entitled, respectively, "EMC Research in Italy" (1996) and "Lightning" (1998). He is the author of more than one hundred scientific papers published in international journals or in the proceedings of international symposia, and of a two-volume book of electrotechnics.

Marcello is married and has two daughters; his wife and the eldest daughter are judges, the youngest one is a lawyer. This explains the reason why Marcello at home is always in the minority. According to Marcello, he is "a good tennis player, a slow down-hill skier, a discrete dancer, and a mediocre singer." **EMC**

Board of Directors Activities

Phoenix, Arizona
Friday, March 24, 2000

Call to Order

President Butler called the March 24, 2000 meeting of the EMC Society Board of Directors to order at 8:30 am. A round of introductions was made. Board members present included H. Benitez, D. Bush, J. Butler, L. Carlson, T. Chesworth, L. Cohen, A. Drozd, W. Duff, W. Gjertson, D. Heirman, D. Hoolihan, T. Hubing, E. Joffe, W. Kesselman, D. Millard, M. Montrose, J. O'Neil, H. Ott, G. Pettit, D. Smith, D. Sweeney, and T. Yoshino. Board members absent included F. Heather, M. Kanda, F. Mayer, J. Perini, N. Violette, and K. Williams (who was available during the meeting via speaker phone). Guests present included D. Awerkamp, H. Shein (IEEE), R. Carstensen, and R. Ford.

President's Report

In order to increase public relations for the EMC Society Board of Directors, President Butler requested a digital photo of each Board member and some information about them. He would like to know the names and addresses of newspapers, publications, etc. regionally for each Board member so he can submit press releases during his next two years as President. He discussed the TAB meetings and the branding issues as well as the status of the new financial model. Board members were encouraged to subscribe to the IEEE's Centennial e-mail publication. Contracts for hotels, restaurants, etc. need to be reviewed by the IEEE prior to signing these. The IEEE is concerned about being financially at risk for contracts that are signed by local chapter members, etc. on behalf of the IEEE.

Todd Hubing discussed the IEEE EMC Field Award. The EMC Society and the Magnetic Society have been asked to financially co-sponsor the IEEE Electromagnetics Field Award along with the Antennas and Propagation, Geoscience and Remote Sensing, and Microwave Theory and Techniques Societies. The prize for the award is $10,000. The Board approved contributing an amount not to exceed $2,500 to the IEEE Electromagnetics Field Award.

Treasurer's Report

Treasurer Warren Kesselman distributed his report and noted that EMC Society reserves are in excess of $1M, due largely to good investment returns and good surpluses from the annual EMC Society symposia. In looking at the 1999 income chart, approximately 38% of total income was derived from sales of the Transactions on EMC and non-periodicals, 27% from investments, 24% from conferences and 11% from membership fees. For 1999 expenses, approximately 53% of expenses were for administrative and committee functions, 33% for Transactions and 14% for the Newsletter. Mr. Kesselman summarized that the EMC Society is very sound financially. The Board approved the critical input parameters for the 2001 budget for the EMC Society.

Photo by Janet O'Neil

Phoenix EMC Chapter members gather at the reception hosted by the EMC Society Board of Directors following the Board meeting on March 24. Shown left to right are Jeff Tripp and Steve Deppen of Honeywell, Patrick Richardson of Motorola and Jack Rubin.

Secretary's Report

Secretary Janet O'Neil presented the minutes from the last Board meetings on November 19 and 20, 1999. Changes were required. The minutes were approved as amended.

Membership Services Report

Todd Hubing, Vice-President for Membership Services, presented his report. Tom Chesworth discussed the special session at the Washington DC symposium on "EMC War Stories." He has received a few submissions as a result of the recent "Call for Raconteurs" ad in the EMC Society Newsletter. Henry Benitez reported on Awards. The Society is now soliciting nominations for awards to be presented at the Washington, DC symposium. The nominations will be voted upon at the June Board meeting. Mr. Drozd suggested that corporations that contribute to the success of the EMC Society be recognized in some way at the Awards Luncheon. Mr. Benitez spoke about the February 7-9, 2000 Chapter Coordinator Retreat that he attended in New Orleans. Representatives from all 10 IEEE regions were represented at the retreat. The IEEE chapter home page is http://www.ieee.org/organizations/tab/ciaindex.html. This home page contains a wealth of information for starting chapters, maintaining chapters, etc. Overall, he was satisfied that the EMC Society is doing a good job with its chapters. Regarding EMC Chapter Activities, Ghery Pettit advised that there has been little chapter activity since the Seattle symposium. There was one chapter Haislmaier Angel disbursement of $500 made in 1999 (to the Israeli chapter). It was suggested that a list server be created in order to communicate to all chapter chairmen. Dick Ford of the Survey Committee introduced Henry Shein of the IEEE Survey Department. Mr. Shein advised that the survey effort will require 12 weeks, the bulk of which will be devoted to developing the questionnaire. They expect 40-50% response rate based upon recent data from IEEE surveys. He advised that they will be looking at the delta from the 1995 EMC Society scientific survey with the 2000 EMC Society scientific survey. The goal of the survey is to determine the relevance, quality and timeliness of what the EMC Society is currently doing. The survey should also determine member needs and preferences with current product offerings. The survey will be completed by the August

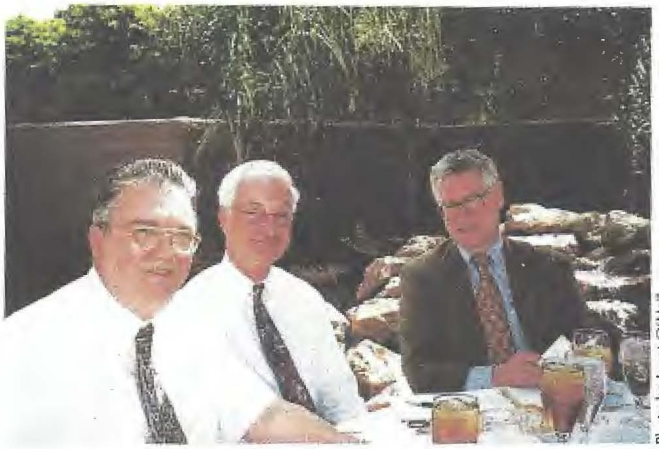

Photo by Janet O'Neil

During the Board meeting in Phoenix, Dick Ford of the Survey Committee (L) chatted with Henry Shein of the IEEE (C) and Past EMCS President Dan Hoolihan (R). The trio gathered at lunch to discuss the scientific survey of EMCS members that will be conducted in 2001.

2000 symposium in Washington, DC. Results will be presented at the November 2000 Board meeting. Reporting for the Membership Committee, Andy Drozd advised that he attended an IEEE membership development retreat in Newark, New Jersey recently. IEEE membership has increased 5% in 1999 from the previous year. There has been a slight decline in US membership which has been offset by the increase in membership internationally. The number of women members is at an all-time high. Elya Joffe reported as EMC Region 8 Membership Committee Chairman. He has the EMCS membership booth and will take this to various Region 8 EMC conferences this year. Mr. Joffe will extend the $15 membership in the EMC Society for one year for free to those who join the IEEE at all EMC conferences where the IEEE EMC Society is represented. Mr. Hubing requested that if any Board members are attending international EMC conferences, that they let Mr. Joffe know so that outreach efforts may be coordinated. Bill Gjertson, Division IV Director, requested that Mr. Joffe be invited to attend the Division I-IV conference in Paris later this year. Regarding Region 9, he attended their conference in Puerto Rico recently and obtained several contacts for potential new members. Regarding the Fellows Search Committee, Bill Duff reported that he has received three Fellow Award applications this year. He received eight applications last year. The awards will be presented at the Washington, DC symposium. Todd Hubing reported for Lee Hill, chair of the Distinguished Lecturer (DL) program. DL activity is at an all-time high and the budget for the year 2000 is close to being fully allocated now in March. Dan Hoolihan, Chair of the Nominations and Bylaws Committee, advised that the changes in the bylaws which were advertised in the Winter 2000 EMC Society Newsletter have been made. Regarding nominations, Mr. Hoolihan advised that the call for Board nominations was printed in the Winter 2000 EMC Society Newsletter. The Board approved Mr. Hoolihan's recommendation to change the Board of Directors 2000 election schedule in order to provide for increased participation by members in Regions 8, 9 and 10 in the ballot return cycle.

Standards Services

Don Heirman, Vice-President for Standards Services, gave his report. His area of responsibility covers three major areas: The Standards Education and Training Committee (SETCom) chaired by Hugh Denny, the Standards Advisory Committee (SACCom) chaired by Elya Joffe and the Standards Development Committee (SDCom) chaired by Steve Berger. Each committee met prior to the Board meeting. New technologies, such as DVD television, and the development of new standards, were discussed. For example, the use of filters for high currents entering commercial buildings is now being addressed. This involves the use of current technology (filters) for a new application (commercial buildings). The Standards operations manual was approved and now can be used by the committee. The Standards website is being created and will be soon available for public viewing. This website will show the status of all IEEE EMC Standards and will contain a wealth of up to date information on Standards activities. The website address for IEEE standards is *http://standards.ieee.org*. Mr. Heirman discussed audits of test laboratories. For more information on this, consult the website address for NACLA at *http://www.nist.gov/nacla*. Elya Joffe reported as chair of the SACCom. He showed the current list of representatives on his committee. He has confirmed that all representatives wish to remain active on the committee except for Ron Storrs.

Conference Services

Henry Ott, Vice-President for Conference Services, presented his report. The Board approved budgeting for a 20% surplus with each EMC Society Symposia. Mr. Ott discussed the issue of material included in tote bags that are distributed at the EMC Society Symposia, and the labor provided to "stuff" the tote bags. Mr. Ott would like to formalize the informal practices with

Photo by Dick Ford

Photo by Dick Ford

EMCS Board Member Elya Joffe was recruited to speak at the Phoenix EMC Chapter meeting while he was in town for the Board meeting. Phoenix EMC Chapter Chairman Terry Donohoe thus wisely saved on the travel costs to bring Elya to Phoenix from Israel. The chapter enjoyed Elya's rousing presentation on "Electrophobia."

Photo by Dick Ford

EMC Society President Joe Butler (L), chatted with speaker Elya Joffe (C) and Daryl Gerke (R), Vice-Chairman of the Phoenix EMC Chapter, following the March meeting.

respect to the tote bags. The Board approved the recommendation that only promotional items such as calculators, key chains, etc. are permitted to be included in the tote bags. Items such as commercial product literature, catalogues, etc. may not be included in the tote bags. No charge shall be made for those wishing to place promotional items in the tote bags. Those wishing to place items in the tote bags must provide the labor for stuffing these items. Before items are placed in the tote bags, they must be pre-approved by the registration chairman of the symposium committee. Mr. Ott then summarized activity of recent symposia including the 1998 Denver symposium. The financial books are not closed to date; they should be closed in June pending completion of the IEEE audit currently underway. Regarding the 1999 Seattle symposium, Bill Gjertson, Chairman of this symposium, reported that the expected surplus is approximately $291K. The IEEE audit of the symposium is now underway. Bill Duff, Chairman of the 2000 Washington DC symposium, presented a report on recent activity. They have received 250 papers in response to the call for papers. 200 were accepted; subsequently 20 papers were withdrawn. There will be six parallel technical sessions. There are a total of 260 booths sold with 40 exhibit spaces left for sale to date. Tuesday during the symposium week is the reception at the Air and Space Museum. Wednesday is a reception at the Hilton Hotel, host facility for the symposium. The experiments will again be placed in a prominent position. Regarding the 2001 Montreal symposium, Mr. Ott advised that Benoit Nadeau is the new chairman of the committee. Board member Andrew Podgorski is the new treasurer. Janet O'Neil reported on regional EMC chapter conferences. Mr. Pettit stressed the fact that these chapter conference committees are responsible for reporting their activities to their respective IEEE Sections as it is the Sections, not the EMC Society, who are financially responsible for these regional conferences. It was suggested that an MOU be created for these regional chapter conferences which wish to use the EMC Society logo and endorsement. The Board approved Mr. Ott's suggestion to create a new committee, entitled the Global Conferences Committee, to address the global conferences related to EMC. Mr. Ott announced that Elya Joffe will chair this new committee which will report to the Vice-President of Conference Services. The Board approved the request for the EMC Society to be a technical co-sponsor with "The International Conference on Electromagnetics in Advanced Applications" in Torino, Italy, September 10 through 14, 2001.

Photo by Dick Ford

A full house enjoyed the presentation by EMC Society Distinguished Lecturer Elya Joffe at the Phoenix EMC chapter meeting in March. The chapter met while the Board was in town for their spring Board meeting. Several Board members attended the chapter meeting.

Communication Services

Len Carlson, Vice-President for Communication Services, distributed his report. Transactions Editor Moto Kanda was not present to report. Newsletter Editor Janet O'Neil reported on the new "look" for the Newsletter. The first issue published in 2000 featured all color photos and graphs throughout. New graphics were used. The layout was changed. Reader response has been very favorable. Board members and others were encouraged to submit practical papers for inclusion in the Newsletter. Mr. Carlson noted that Hugh Denny has resigned as the EMCS liaison to the IEEE Press. Mark Montrose has volunteered to be the new liaison. He presented a report. Royalty information will be provided at the June Board meeting (it was not available for this meeting due to a computer glitch with IEEE). Public Relations Chair Henry Benitez reported that he will submit articles to EMC publications regarding solicitations for year 2000 awards and to publicize last year's award winners. EMCS Webmaster Andy Drozd reported that work is required to complete the web information on the Technical Committees. He is working with Dave Case to make these TC pages more dynamic. Links still need to be established with related EMC committees. There are three vendors who have signed up for advertising on the EMC Society website.

Technical Services

Kimball Williams, Vice-President for Technical Services, presented his report via speaker phone. Technical Activities Committee (TAC) Chairman Andrew Podgorski presented the TAC report. Issues related to TC-8 (Product Safety) and their request to become an independent technical council of the IEEE were discussed. Russ Carstensen discussed the draft NARTE MOU that he has prepared. Mr. Carstensen expects the document to be fully reviewed by NARTE, with comments incorporated, by the June Board meeting. The final document will be presented for approval at the June Board meeting. Mark Montrose discussed the formation of a new technical committee, TC-10, on the topic of Signal Integrity. Preliminary discussion about the necessity for a separate engineering entity on this topic ensued. The President thanked

Photo by Dick Ford

Jim Garrett, President of SENTEL (center left), welcomes Bill Duff (center right) both as a new SENTEL employee and as Chair of the 2000 IEEE International Symposium on EMC to be held in Washington, DC August 21 through 25. SENTEL hosted the recent symposium planning meeting at their Alexandria Facility. Also attending the meeting were Sandi Duff, Hospitality Chair (seated left), Claire Wyatt, Registration Chair (seated right), Ted Harwood, Publications Chair (far left), and Ernie Freeman, Committee Vice-Chair (far right). Mr. Duff reported on the symposium committee activities at the March 24 Board of Directors meeting.

Mr. Montrose for his work on this proposal, and suggested that the Board consider this matter further. Regarding the Representative Advisory Committee, Chair Dave Case has organized a special session for the Washington, DC symposium. Mr. Williams recommends that everyone attend this session.

Long Range Planning Committee

Joe Butler distributed a summary of the long range planning sessions held in conjunction with the last Board meeting. He discussed succession planning for all committee chairmen in particular. Mr. Butler advised that Warren Kesselman will be soliciting 2001 budget inputs for new initiatives in April. Thus, in reviewing the long-range plan, Board members need to think about which new initiatives we should pursue and the associated costs thereof.

Old Business

The Board reviewed the 2000/2001 Board meeting schedule. (The scheduled Board meetings are posted in the Calendar Section of this Newsletter.) In 2001, the Board agreed to meet on Friday, February 23, in Zurich, Switzerland in conjunction with the EMC conference held there. Kimball Williams reported that the IEEE does not have enough information to provide on Nano Technology to date. He asked that his report on this topic be deferred until the next meeting. Larry Cohen, Technical Program Chair for the 2000 IEEE International Symposium on EMC, discussed the requirement for a 20% rejection rate of the papers submitted to each symposia technical program. The Board agreed to drop the 20% rejection requirement.

New Business

Bill Gjertson reported on the Seattle EMC symposium and working with the IEEE's International Travel and Conference Management Services department. The final symposium report, which compliments the viewgraph report, is available from Mr. Gjertson upon request. Bill Gjertson provided cost information on the use of electronic balloting versus regular mail balloting for the Board of Directors elections. At this date, it is still very expensive to use electronic balloting.

Action Item Review

Secretary Janet O'Neil reviewed the action items assigned during the meeting and those open from previous meetings.

There being no further business, the meeting adjourned at 4:40 pm.

Janet O'Neil
Secretary,
EMC Society Board of Directors

EMC

2000 IEEE International Symposium on Electromagnetic Compatibility

A Spectrum of Challenges for the New Millennium

by Ted Harwood

Expecting a Record Breaking Turnout

The 2000 IEEE International Symposium on Electromagnetic Compatibility will be held at the Washington DC Hilton Hotel on 21-25 August 2000. Our Society's annual international event is generally recognized at the world's meeting place for EMC technologists. Dozens of international committees and organizations involved with EMC will hold key meetings at this event. Attendance estimated at 3000 people is expected to exceed the previous record attendance of 2640 set in 1998 at the Denver Symposium. This year's program will also be record breaking with thirty-six technical sessions (well over 200 papers) in addition to a three day, special parallel session specifically addressing the Symposium theme, *A Spectrum of Challenges for the New Millennium.** As well, 125 exhibitors will occupy nearly 300 exhibit booths. Among topics that should pique interest include papers on private sector Spectrum needs, EMI to pacemakers from cell phones, Instantaneous Frequency Distribution measuring equipment, and many others.

Seminars and Workshops are First-Rate

Outstanding seminars and workshops will be presented, beginning on August 18 with the Measurement of Radio Noise Emissions, instructed by Don Heirman, H. Robert Hoffman and Art Wall. There are 11 workshops, seven on Monday and four on Friday that address issues from Reverberation Chamber Designs, to Composite Material EM Properties, to EM Modeling, to Wireless EMC in the Medical Environment. All will be lead by internationally known individuals in the EMC community. The widely popular EMC experiment/demonstrations will run virtually continuously from Tuesday through Thursday of the Symposium week.

Welcome Reception: An Affair to Remember

The Tuesday evening reception will be held at the Smithsonian National Air and Space Museum. Our Symposium attendees and guests will have virtually unlimited and exclusive access to one of the most visited museums in the world for the entire evening. There are 23 galleries of displays to see. All of the aircraft and most of the spacecraft on display in the galleries were actually flown or used as backup vehicles. Both young and old will experience a strong sense of the fruits of human endeavor seeing the suspended Wright brothers' 1903 Flyer and Charles Lindbergh's Spirit of St. Louis, touching the Moon rock collected by the Apollo astronauts from the lunar surface, and walking through Skylab. The IMAX film "To Fly" will be shown in the Langley Theater during the evening.

Night Monuments Tour the Talk of the Town

On Wednesday night you will see the US Capital's premier national monuments and federal buildings flooded in lights, from the illuminated dome of the US Capitol to the breathtaking view from the roof of the Kennedy Center. You will step off the catered motor-coach with the assistance of tuxedo attired waiters and visit the Jefferson Memorial, Kennedy Center, Lincoln, Korean, Vietnam Veterans and FDR Memorials. You will experience views from the air conditioned coach, views of the US Capitol, Library of Congress, Supreme Court, House and Senate Office Buildings, Federal Triangle, Pennsylvania Avenue, the White House, Capitol Reflecting Pool, Georgetown and Marine Corps Memorial (Imo Jima).

Other Events Show Off Washington at its Finest

Many additional daily tour events are scheduled through out the entire week. Each day will feature a tour that starts at 0900 and will last all day. You will be able to experience most of what Washington D.C. has to offer from visiting the Newseum - "the interactive Museum of News", to visiting the Colonial past in Mount Vernon and Historic Old Town, to enjoying a whirlwind city tour of all the DC highlights, to a visit back in times to Georgetown, Washington's oldest neighborhood, and finally a shopping trip to one of the world's largest discount/outlet shopping centers - Potomac Mills.

One for the Ages

Bill Duff, Symposium Chair, and his committee have worked hard to assure that this symposium will set the standard for the next decade's EMC International Symposia. First-and-foremost, attendees will leave with both top-notch technical presentations and records. As well, they'll have had a first class experience in a fascinating, beautiful, and culturally exhilarating Capital City.

** Editor's Note: For details on this special session, see either the last Newsletter issue, page 33, or the Symposium Advance Program (which, at this time, should be in the possession of all EMCS members).* **EMC**

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EMC SOCIETY

EMCABS

EMC Abstracts

Osamu Fujiwara,
Associate Editor

Following are abstracts of papers from previous EMC symposia, related conferences, meetings and publications.

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Engineering college/university libraries, public libraries, company or corporate libraries, National Technical Information Services (NTIS), or the Defense Technical Information Center (DTIC) are all possible sources for copies of abstracted articles of papers. If the library you visit does not own the source document, the librarian can probably request the material or a copy from another library through interlibrary loan, or for a small fee, order it from NTIS or DTIC. Recently it became clear that EMCABs were more timely than publications which were being listed in data files. Therefore, additional information will be included, when available, to assist in obtaining desired articles or papers. Examples are: IEEE, SAE, ISBN, and Library of Congress identification numbers.

Also, the steering staffs of the Japan Technical Group and the EMC Japan Tokyo Chapter have offered to act as a central point for requests of papers abstracted here. Most of the papers will be available in Japanese only. Abstracts of papers from EMC Japan will be clearly identified. As a member of the steering staff, I will assist in routing your request to the author(s) but will not translate the papers.

Some of the Chinese papers are not available in English. Professor Sha Fei, EMC Research Section, Northern Jiatong University, has offered his time and assistance in routing requests for papers to appropriate author(s). He is not furnishing a translation service.

As the EMC Society becomes more international, we will be adding additional worldwide abstractors who will be reviewing articles and papers in many languages. We will continue to set up these informal cooperation networks to assist members in getting the information or contacting the author(s). We are particularly interested in symposium proceedings which have not been available for review in the past. Thank you for any assistance you can give to expand the EMCS knowledge base. **EMC**

EMCABS: 01-5-2000

POWER FACTOR IMPROVEMENT USING DCM CUK CONVERTER WITH COUPLED INDUCTOR

G. Ranganathan and L. Umanand
Electrical and Computer Engineering, PO Box 3055, University of Victoria, Victoria V8W 3P6, Canada and Centre for Electronics Design and Technology, Indian Institute of Science, Bangalore 560012, India
IEE Proceedings, Electric Power Applications, March 1999, pp. 231-236 (Vol. 146, No. 2).

Abstract: Most Power Factor Regulators (PFRs) in Continuous Conduction Mode (CCM) require bulky magnetics, PFRs in Discontinuous Conduction Mode (DCM) have high harmonic production. A modified Cuk converter, in the DCM, uses a coupled inductor to transfer ripple from the input to the output, thus reducing switching harmonics in the line current. The technique is compared with the boost converter and the flyback converter. Design details and results of a 500W prototype are presented.

Index terms: Modified Cuk converter, power factor improvement, reduction of line harmonics.

EMCABS: 02-5-2000

THREE-PHASE BUCK ACTIVE RECTIFIER WITH POWER FACTOR CORRECTION AND LOW EMI

Th.Gro Dfen+, E. Menzel ++ and J.H.R.Enslin+++
+ INSTA Elektro, LFCdensheid, Germany
++ Fachhochschule Dortmund, Germany
+++ The University of Stellenbosch, Republic of South Africa
IEE Proceedings, Electric Power Applications, November 1999, pp. 591-596 (Vol. 146, No. 6)

Abstract: A 3-phase rectifier is presented which has a high power factor, low harmonics (complying with IEC 1000-3-2 and 1000-3-4) requirements, and a low radiated EMI. Two single-phase buck circuits are connected to the neutral conductor. The active rectifier is controlled by a low-cost microprocessor to shift the current phasors so as to maintain a 120-degree separation. The relatively slow microprocessor, running at 16 MHz, is able, by using data from an EPROM lookup table and a specially developed algorithm, to control the active rectifier. A 12kW prototype, operated from 400Vac, has an output voltage that is continuously variable from 0-420V, loaded or unloaded.

Index terms: 3-phase buck active rectifier, power factor improvement, reduction of line harmonics, microprocessor controlled rectifier, radiated emission reduction in 3-phase rectifier.

EMCABS: 03-5-2000

MITIGATION OF RADIO INTERFERENCE IN XDSL* TRANSMISSION

Luc de Clercq; Miguel Peeters; Sigurd Schelstraete and Thierry Pollet
Alcatel Corporate Research Center, Antwerp, Belgium
IEEE Communications Magazine, March 2000, pp. 168-173
* XDSL is an abbreviation for several families of Digital Subscriber.

Abstract: Loops that include Asymmetric Digital Subscribe Loops (ADSL) and Very-high Speed Digital Subscriber Loops (VSDL) as members. This paper reviews the EMC issues of the copper parts of XDSL subscriber loops and the amateur radio bands. Several techniques for dealing with emissions (egress) by spectral shaping via windowing and dummy tones in Discrete Multitone (DMT) are described. On the immunity (ingress) side, analog RFI canceling using an adaptive algorithm is described. Digital RFI canceling, using Fast Fourier Transform (FFT) and similar techniques is also covered. The measured performance of an Alcatel RFI canceller is presented.

Index terms: Digital subscriber loop/amateur radio EMC, spectrum management, ham radio EMC, spectral shaping, analog RFI cancellation, digital RFI cancellation.

EMCABS: 04-5-2000

ON THE NON-UNIQUENESS OF THE TRANSIENT SOLUTIONS OF MAXWELL'S EQUATIONS IN LOSSY MEDIUM

Huang Binke and Gang Wang
Xiían Jiaotong University, Xiían 710049, China
Proceedings of the China-Japan Joint Symposium on Antennas and Propagation, Xiían, China, March 16-17, 2000, pp.25-29.

Abstract: It was once reported that the two solutions of Maxwell's equations in Lossy medium derived with two commonly used techniques were different, which implies a non-unique solution of the wave equation in Lossy medium. Computer plots at the same computation accuracy demonstrate the consistency between the solutions of electric field strength solved in different methods. The discrepancy between the solutions can be viewed as rhe results of Gibbs phenomenon caused by cutting off the high frequency components in computing the integral of Harmuth's solution.

Index terms: Maxwell's equations, transient solution, non-uniqueness, Gibbs phenomenon.

EMCABS: 05-5-2000

ELECTROMAGNETIC SCATTERING BY MULTIPLE CONDUCTING OBJECTS

Jin Mouping, Liang Changhong and Shi Xiaowei
Xidian University, Xiían 710071, China
Proceedings of the China-Japan Joint Symposium on Antennas and Propagation, Xiían, China, March 16-17, 2000, pp.45-48.

Abstract: The electric field integral equarion (EFIE) is used with the moment method to treat problems of scattering by multiple conducting objects. The objects are modeled using planar surface patches. A block-iterative algorithm is proposed to solve the matrix equation. Numerical results for surface current density and scattered fields are given for conducting objects. The conclusion is obtained that generalized resonance (a very strong scattered field at some frequency) occurs in scattering by multiple conducting objects. The phenomenon is noticeable in EMC design.

Index terms: Electromagnetic scattering, multiple conducting objects, generalized resonance, moment method, iterative method.

EMCABS: 06-5-2000

DESIGN OF ARRAY ANTENNA WITH HIGH RADIATION EFFICIENCY FOR PORTABLE TELEPHONE

Kenji Sato, Qiang Chen and Kunio Sawaya
Faculty of Engineering, Tohoku University, Sendai 980-8579, Japan
Proceedings of the China-Japan Joint Symposium on Antennas and Propagation, Xiían, China, March 16-17, 2000, pp.133-138.

Abstract: A 1/4-wavelength monopole Yagi-Uda array antenna with a parasitic monopole element is developed for portable telephones to improve the radiation efficiency. The antenna has a broad bandwidth and the power absorbed by the user's head is lower than that of the 1/4-wavelength monopole antenna. Numerical analyses are performed by using the finite-difference time-domain method, and the validity of the numerical results is confirmed by measurement.

Index terms: Array antenna, portable telephone, radiation efficiency, electromagnetic absorption.

EMCABS: 07-5-2000

A POLE-TYPE DISTRIBITION TRANSFORMER MODEL FOR ELECTROMAGNETIC TRANSIENT STUDIES

Taku Noda+, Hiroshi Nakamoto++ and Shigeru Yokoyama+
+ Komae Research Laboratory, Central Research Institute of Electric Power Industry, 2-11-1, Iwado Kita, Komae-shi, Tokyo 201-8511, Japan, takunoda@criepi.denken.or.jp
++Kyushu Electric Power Co., 2-1-82 Watanabe-dori, Chuo-ku, Fukuoka-shi, 810-8720, Japan
EMC-Japan meeting at Tokyo University of Agriculture and Technology, Tokyo, January 18, 2000, EMCJ99-121

Abstract: This paper proposes a transient simulation model of pole-type distribution transformers for electromagnetic transient studies. The proposed model takes into account the following effects: (1) capacitance between windings and an enclosure and also between primary and secondary windings, (2) skin effects of winding conductors and an iron core, and (3) multiple resonance due to the combination of winding inductance and turn-to-turn capacitance. Thus, the model accurately reproduces the frequency characteristics of a pole-type distribution transformer in a wide range of frequency. The parameters of the models can easily be determined by frequency-characteristic measurements using an impedance analyzer. Because of the above capability, the proposed model enables the accutate evaluation of over-voltages on distribution lines including consumer-side over-voltages. In this paper, a 10-kVA pole-type distribution transformer is modeled, and the proposed model is validated by comparisons between simulated and laboratory-test results.

Index terms: Pole-type distribution transformer, transient studies, EMTP, consumer-side over-voltages.

EMCABS: 08-5-2000

ENVIRONMENTAL MAGNETIC FIELD IN OFFICE BUILDING AND DEVELOPMENT OF MAGNETIC SHIELDINGS FOR CRT

Kiyotomi Miyajima, Kenichi Yamazaki and Seietsu Tomita
miyajima@criepi.denken.or.jp
Central Research Institute of Electric Power Industry, 2-11-1, Iwado Kita, Komae-shi, Tokyo 201-8511, Japan
EMC-Japan meeting at Tokyo University of Agriculture and Technology, Tokyo, January 18, 2000, EMCJ99-122

Abstract: Personal computer monitors and televisions with cathode ray tube (CRT) may have jitters in the alternating magnetic field. We measured magnetic fields in the office building that had jitters problems. In this report, a diurnal variation and distribution of the magnetic fields that have harmonics are shown. The occurrence mechanism of harmonics is explained. And, a new mitigation method of jitters by the compensation magnetic field is presented.

Index terms: CRT, jitters, alternating magnetic field, magnetic shielding.

EMCABS: 09-5-2000

ANALYSIS OF ELECTROMAGNETIC FIELDS IN THE EXTERNAL AUDITORY CANAL FOR PORTABLE TELEPHONES WITH A HELICAL ANTENNA

Jiaquing Wang and Osamu Fujiwara
wang@odin.elcom.nitech.ac.jp
Department of Electrical and Computer Engineering, Nagoya Institute of Technology
EMC-Japan meeting at Tokyo University of Agriculture and Technology, Tokyo, January 18, 2000, EMCJ99-123

Abstract: A half-wave dipole antenna trends towards being adopted for the immunity test of medical devices for portable telephones from the viewpoint of operation efficiency. In this paper, assuming the immunity test of hearing aids, we analyzed the electromagnetic fields in the external auditory canal for a portable telephone with a helical antenna using the finite-difference time-domain (FDTD) method, and compared the results with that for a half-wave dipole exposure. The helical antenna was modeled as a stack of dipoles and loops with an adequate relative weight according to Lazzi and Gandhi's proposal. The head model was developed from magnetic resonance imaging (MRI) data of a Japanese adult head. As a result, it was found both for the helical antenna and half-wave dipole that the electric field shows a standing-wave characteristic in the extetnal auditory canal, while the magnetic field decreases gradually with deepening into the external auditory canal. The electric field around the entrance of auditory canal for the helical antenna is stronger than that for the half-wave dipole, and vice-versa in the middle auditory canal. The magnetic field in the external auditory canal for the half-wave dipole is generally higher than that for the helical antenna.

Index terms: Portable telephone, immunity test, hearing aid, external auditory canal, FDTD analysis.

EMCABS: 10-5-2000

DEVELOPMENT OF ELECTROMAGNETIC ENVIRONMENT DESIGN SYSTEM FOR PRIVATE WIRELESS COMMUNICATION SYSTEM

Yuji Maeda and Kazuhiro Takaya
maeda@nttqn.tnl.ntt.co.jp
NTT Lifestyle and Environmental Technology Laboratories, 3-9-11 Midori-cho, Musashino-shi, Tokyo 180-8585
EMC-Japan meeting at Tokyo University of Agriculture and Technology, Tokyo, January 18, 2000, EMCJ99-124

Abstract: Recently, several kinds of wireless communication systems such as 2.4 GHz band wireless LANs and cordless phones are used in buildings. Communication trouble due to electromagnetic interference has increased. This report describes the electromagnetic environment design system, which was developed to design ideal electromagnetic environments where communication trouble did not occur, for 2.4 GHz band wireless LANs and cordless phones. This system simulates the electromagnetic interference and effect of building materials for electromagnetic propagation. It can provide an ideal arrangement of center stations of wireless systems and an ideal indoor or outdoor environment where wireless systems are installed by estimating propagation characteristics and communication characteristics. The system configurations and two examples of actual design by using our system are introduced.

Index terms: Electromagnetic environment, private wireless system, propagation, ray tracing, communication characteristics.

EMCABS: 11-5-2000

A THEORETICAL STUDY ON ANALYSIS OF TV GHOST CAUSED BY SUPER HIGHRISE TOWER AND THE SUPPRESSION OF REFLECTED WAVE USING THE WAVE ABSORBER

Takahiro Aoyagi+, Yasutaka Shimizu+, Tishio Saito++ and Kenichi Harakawa++
+ CRADLE, Tokyo Institute of Technology, 2-12-1 O-okayama, Meguro-ku, Tokyo 152-8552, Japan, aoyagi@cradle.titech.ac.jp
++ Research and Development Department, Takenaka Corporation, 15-1 Ohtsuka, Inzai, Chiba 270-1395, Japan.
EMC-Japan meeting at Tokyo University of Agriculture and Technology, Tokyo, January 18, 2000, EMCJ99-125

Abstract: In this report, TV ghosts caused by a super high rise tower are theoretically analyzed at the viewpoint of DU ratio. The scattering waves from three types of a super high tower are calculated taking into account distances between the transmission

point, receive points and the tower. The effectiveness of the electromagnetic wave absorber is also considered when the absorber is put on the surface of the tower. As results, in this report, the absorber of –10 dB reflection coefficient is enough characteristics for cylindrical model to vanish the TV ghost problem caused by the reflected wave. For X-shaped model and the eight-column model, the absorber that has –15 dB characteristics, is satisfying.

Index terms: EMC, GMT, wave absorber, super high rise tower, TV ghost, scattering wave.

EMCABS: 12-5-2000

EXPERIMENTAL STUDY ON MANUFACTURING MAGNETIC WOOD USING ELECTROMAGNETIC WAVE ABSORBER IN GHZ BAND

Koichi Narita and Hideo Oka
hoka@iwate-u.ac.jp
Graduate School of Electronic and Electrical Engineering, Iwate University, 3-4-5, Ueda, Morioka, 020-8551, Japan

EMC-Japan meeting at Tokyo University of Agriculture and Technology, Tokyo, January 18, 2000, EMCJ99-129

Abstract: The purpose of this article is to examine the possibility of using magnetic wood as a woody electromagnetic wave absorber in the GHz band. The results from measuring four types of different magnetic wood show that sandwich-type magnetic wood had good electromagnetic wave absorbing characteristics. This article covers experimental electromagnetic wave absorbing characteristics for sandwich-type magnetic wood under different parameters. The results showed that the 20 mm thickness sandwich-type magnetic wood which was made with 40 vol % mixture of Ni-Zn ferrite 400L with particle diameter of 600 micro-m over and 4 mm layer of magnetics, could be used as a woody electtromagnetic wave absorber under 1.93 GHz.

Index terms: Electromagnetic wave absorber, magnetic wood, EMC, GHz band, magnetic-powder, composite material.

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4th International Symposium on Electromagnetic Compatibility

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The fourth European EMC Symposium offers a new opportunity to researchers, scientists, and EMC engineers to present the progress of their work and to discuss problems of current and mutual interest. Tutorials and workshops will be organized on actual topics. The Symposium will be accompanied by a technical exhibition related to EMC.

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Fax: (059) 70.42.15
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2001

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EMCS Cooperating Symposia

U.K.: Biannually, even years, in September
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2005	Chicago, IL Bob Hofmann 630.979.3627

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