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#### Janet O'Neil, Editor





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### **President's Message**

Todd Hubing President, EMC Society

### What a Great Time to Be an EMC Engineer!

n the April 9 issue of *PC Magazine*, there was an article describing how

easy it can be for an uninvited computer user to tap into a wireless LAN. From the roof of Ziff Davis Media's building in Manhattan, the author was able to detect 61 wireless routers in the surrounding buildings using a 14-dB Yagi antenna. Picking one network at random, he was quickly able to break into the system and surf the web. He could have changed the

router configuration or performed a variety of other malicious deeds had he been so inclined.

For years, hackers and spies have been using high-gain antennas to pick up unintentional radiated emissions from computers then reconstructing the original data from the received signal. This is not particularly difficult, but it requires a moderate level of expertise in signals and fields. With the advent of wireless devices, getting unauthorized access to a computer system has never been easier.

Thanks to wireless LANs and periph-

Thanks to wireless LANs and peripherals, computers are more susceptible to unintentional and intentional electromagnetic interference than ever before. The growing popularity of wireless devices ensures that interference problems will occur more frequently in the years ahead. In addition, as computers become more dependent upon wireless communications, it seems likely that interference problems will demand greater attention than they have in the past.

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problems will demand greater attention than they have in the past. What a great time to be an EMC engineer!

Speaking of great times, this would be a great time to nominate someone in your

company or chapter for an IEEE EMC Society award. The EMC Society strives to recognize people who have made contributions to the Society or to the EMC profession. Some contributions are obvious and well publicized, but most are not. The Society depends upon people like you and me to notice when someone deserves recognition and bring it to the attention of the Awards Committee.

Nomination forms are available on the IEEE EMC Society web site at *http://www.emcs.org.* If you think someone deserves recognition, but you don't see an appropriate award, let us know about it. Henry Benitez, the Awards Committee chair, is very open to ideas for





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## Letter from the Editor



Photo by Stephen Stimac

Newsletter Editorin-Chief Janet O'Neil is shown with Kerry Greer of Skycross, one of the speakers at the Wireless 2002 one-day colloquium and exhibition in Bellevue, Washington. The success of the these IEEE regional table top shows is due largely to the

contribution of time and energy by speakers such as Kerry, as well as to the exhibitors who have displays at these events. For example, Wireless 2002 featured lunch sponsors TDK RF Solutions, Northwest EMC and Laird Technologies as shown on this sign. Reception sponsors included Amplifier Research and ETS-Lindgren.

### Janet O'Neil Editor, EMC Society Newsletter

It's hard to believe the economy is "slow" considering the good turn out at the recent EMC Society regional tabletop shows. There was great attendance at the Wireless 2002 event organized in Bellevue this February as well as at the tutorials presented by Clayton Paul in Phoenix and Milwaukee this March. Exhibitors of EMC products and services strongly supported these events. Companies gladly supported these events by sending a good number of registrants to attend the technical programs. These tabletop shows provide an excellent networking opportunity for the speakers, registrants and vendors. It's always nice to get out of the office and meet members of the EMC community in your area. You'll find profiles of these tabletop shows and several photos in the Chapter Chatter column of this Newsletter on page 8.

Did you read the special issue of the Transactions on EMC dated February 2002? This issue was devoted to the career of the late Moto Kanda of NIST. The guest editors were Christopher Holloway and Perry Wilson of NIST in Boulder, Colorado. I was very impressed with the body of work in this issue. Moto was interested in many different areas of EMC. It was quite impressive to read about his interests and also to see the caliber of authors who contributed to the issue, including his two sons. I encourage you to read or thumb through this issue of the *Transactions on EMC*. It's interesting to note that in this issue of the Newsletter, we have a paper on the history of NIST by Dennis Friday, Chief, Radio-Frequency Technology Division, NIST. Please refer to page 22. In the next issue of the Newsletter, Christopher Holloway, Dennis Camell, and their colleagues at NIST will contribute an article on the history of NIST related specifically to EMC. I am sure that Moto's name will come up more than once in that article.

Finally, among the many interesting articles and photos in this Newsletter, we announce the move of the 2003 IEEE International Symposium on EMC from Tel-Aviv, Israel to Istanbul, Turkey. A new advertisement for the Istanbul venue may be found on page 36 along with an article by the Symposium Chairman, Elya Joffe on page 37. I am sure this was not an easy decision to make, although it was a prudent one given the Middle East tensions. **EMC** 

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### Letters to the Newsletter

#### **March 2002**

It was with considerable interest that I read the excellent lead off article in the Winter 2002 Chapter Chatter column. I was part of the team that participated in the Greek Island Survey in the early 1960's as a young EMC (actually, it was called RFI at that time) Electrical Engineer. I also feel very much like Joe Fischer; to this day, I consider it to be one of my biggest adventures as an EMC Engineer. I even put together a movie film of the trip since we didn't have video at that time. Some of the additional EE's that made the trip were: Don Stafford (deceased) who was part of Joe's team, James Senn, who was the overall Team Leader, Noel Damon, and a great guy by the name of Charlie Ketteman (deceased) who was our senior engineer at the time (past 50)! As Joe pointed out, Genistron was the company we all worked for, and Janet O'Neil's father, the late Fred Nichols (a terrific boss) was President of Genistron at that time. Thanks for the opportunity to revisit this adventure.

Steve Dyrnes, PE Dyrnes Engineering, Portland, Oregon Past Chair, Seattle EMC Chapter Member of Oregon EMC Chapter

P.S. I would like to communicate with any of the team members that are still around. My E-mail is *sdyrnes@aol.com* 

#### **April 2002**

This letter addresses Division IV Director Peter Staecker's report in the last issue of our Newsletter. Though his report is not easily read, *please read it*. *Please read it more than once.*\* If our headquarters bureaucracy gets bailed out of this latest financial crisis, I worry about the long-term survival of IEEE. I know this is just a letter so I can't expect the editor to give me equal space, but let me just make the following points:

1) Look at Peter's first sentence: Fiscal matters continue to dominate the activity horizon in Piscataway... What an endorsement for the value of a truly free and (when appropriate) adversarial press. Have you seen much coverage of this in



Team Leader James Senn at work. Note the Polarad RFI equipment on the left.



One of the Greek helpers getting ready to bit the trail. Look at the size of those wooden crates!

Spectrum, or in The Institute? I compliment Peter in helping our Newsletter to have perhaps the best coverage of this terribly important issue. I just wish he would take the extra time to make it more readable, especially for our English as second language members. As to additional coverage, I would first note that, of my three most recent attempts to communicate with you via our Newsletter, two of those attempts were never published. If you who would like to see this spiked material, send me an e-mail at EMC4D@aol.com and I'll send both letters to you. One of them addressed democracy and possible progress towards direct election of our Society president, the key item in my campaign platform



Steve Dyrnes taking a break. Actually, he was getting ready to head out for a swim!



Team Leader James Senn adjusting the antenna.

for my current term. The other addressed this, the on-going financial crisis in the IEEE and its impact on our Society. I presented a motion to address an editorial review policy which you can read about in this issue's Board of Directors Activities article.

2) As a direct result of this crisis's impact on our Society's financial health, nearly a year ago our EMCS BoD voted to form an AdHoc committee. The committee's charter was to investigate whether our best future may be in separating from the IEEE. I was appointed chair of this committee. This vote was in my opinion the most intensely fought and passionately voted issue that I can recall in my fifteen-year involvement with the EMCS



BoD. I believe the vote was 11 to 10 in favor. Well, with such a close vote, at the very next meeting, when it was noticed that two of the key supporters were absent, a motion was made, and passed, which basically froze all activity of the committee. By the February EMCS BoD meeting, it was clear to me that passions were just too high and support too weak as to what this committee should do, and as to whether it should even exist. My original plan was to interview headquarters managers, get their views and the real data as to their growth rates and customer control connectivity. At one point I was ordered not to do this. I did not want to truly pursue leaving IEEE but to use that club to get headquarters' management attention and responsiveness. Others on the committee truly wanted to separate from IEEE. Some felt that the existing organizational relationships were hopelessly flawed, and incapable of fostering a customer-client relationship which would constrain headquarters growth and waste. I submitted my resignation,

hoping someone else might step forward. But passions have subsided. Some members who count on corporate support for their IEEE activities may be having trouble explaining this rebellion to their employers. But let me make these facts clear: IEEE members pay Institute dues. Society members pay Society dues. Though these two simple statements exist within an otherwise very complicated organization (IEEE), they have, over the years, fostered an entrepreneurial attitude within many Societies. This has very much benefited the Institute and more importantly the engineers themselves. Yes, Societies are required to utilize IEEE, Piscataway for specific support services. But, they have paid and continue to pay the Institute a direct fee for these services. This current financial crisis is a direct result of Headquarters making very optimistic assumptions about the investment returns from Institute Reserves (much or most of which are Society reserves) and using these rosy estimates to enable headquarters to grow its increasingly complex business (see



Peter's article). These Society reserves are, in our case (and in many cases), a direct result of Society volunteer activity, mainly in the area of Symposium sponsorship. This is not properly Institute income. At those times when the IEEE Piscataway folks (Conference Management Services-CMS) help us in running Symposia, we pay them fairly based on an open competitive process (sometimes even when they are not the low bidder).

The Institute is not inclined to raise Institute dues because they worry that it won't raise additional money, but will lose membership. To them the easy solution is to raid Society Reserves. What's Peter's good news? Headquarters is contrite. In some real ways they have reduced costs. Have they also just changed some of the ways they'll take our money? (By taking it before it's accrued to our investment reserves instead of after? Read his article ... you decide.) But two hard questions: How long will Society volunteers work as unpaid servants of the Headquarters bureaucracy? Will this bailout foster prudent business practices at the Institute level? This is not the first Institute financial crisis. When will the next one be? That's what all the big words and overly complicated formulas that Peter describes in his report tend to mask.

> Dick Ford, NCE EMCS BoD Member EMC4D@aol.com

\*The summary of Peter's verbal report to the EMCS BoD on page 48 of the last issue gives an overview and perhaps more concise picture of the crisis. But the reader will have great difficulty finding a clear detailed description of the traditional business relationship between Societies, Sections and the headquarters bureaucracy. This complex relationship, in my opinion, is at the heart of the crisis and is what allowed such a debt to be incurred without timely reaction. **EMC** 



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## **Chapter Chatter**



Todd Robinson, Associate Editor

#### **Dangerous** Levels of Interference

ne of our late compliance colleagues, Lee Ould, Jr., who was obviously slanted by his specialization in electrical safety testing, often told me that he didn't consider EMI to be dangerous unless his airplane landed at the wrong airport. I'll bet the Porsche driver in the following story had a different opinion of what defines "dangerous levels of EMI." Names have been withheld to protect the good reputation of the participating EMC professionals.

In the early 1970's, Porsche introduced a new fuel injection system, which encountered some EMI problems at around 150 MHz. Evidently, RF interference could cause a failure in which the electronic fuel injection system released fuel to all of the cylinders simultaneously, instead of releasing fuel to cylinders according to the firing order.

One sunny Southern California afternoon in 1972, two EMC engineers were cruising the freeway in their 1968 Volvo. All of a sudden, EMC Engineer #1 says, "Hey EMC Engineer #2, that's one of those new Porsches that is susceptible to RF!" Having read the same technical brief that EMC Engineer #1 had read, EMC Engineer #2 quickly grabbed the microphone on his trusty 2 meter HAM radio set and let a barrage of RF energy loose. The shiny new Porsche, at that point almost ready to overtake the cruising Volvo, reacted immediately and violently. The sports car slowed and then surged and slowed again with a huge ball of fire exiting the exhaust system behind the automobile. When EMC Engineer #2 released the microphone key, the Porsche hesitated slightly and then recovered from its out-of-sync overdose of high-octane fuel. Once again, the little sports car was prepared to blow by the engineer's beloved Swedish sedan. Not completely believing what he saw the first time, EMC Engineer #2 again keyed up his 2 meter set. Again, the Porsche hesitated and lurched with a fireball breathing from its tail pipe. Suddenly aware of the moral and legal implications of blowing up a fellow motorist, EMC Engineer #2 hastily released the microphone key. Although the Porsche recovered almost immediately, the driver was most certainly daunted by the experience and cautiously exited at the next off-ramp. One can only speculate about his conversation with the Porsche dealer. "I paid good money for this #%\*@! sports car and it can't even pass a '68 Volvo on Interstate 5!"

#### Austria

On 23rd January 2002, the IEEE EMC Chapter in Austria, the Seibersdorf EMC Test Laboratory and Würth Elektronik EMC & Inductive Solutions, organised the "EMC Practical Seminar 2002" at the Seibersdorf Research Center. The following topics were presented:

- Fitting your design for CE marking: shielding, printed circuit board
- design and layout.
  Implementation of EMC components. The most frequent causes of errors. (Würth)
- EMC in analogue and digital interfaces (TU-Graz)
- Calibration of antennas and field probes (Seibersdorf)
- EMC requirements for electronic devices news 2001/2002 (Seibers-dorf)

Following the presentations, there was a tour of the Seibersdorf EMC Test Laboratory.



Shown left to right are Austria EMC Chapter members Lamedschwandner (Seibersdorf), Kriz (Seibersdorf), Winkler (Technical University Graz), Gollner (Seibersdorf), Prüger (Würth), and Gerfer (Würth).



A capacity audience enjoys the presentations at the "EMC Practical Seminar 2002" organized by the Austria EMC Chapter.

#### **Baltimore**

The Baltimore Chapter's March 2002 meeting had Dr. Paul E. Hussar, an Engineering Science Advisor of IITRI in Annapolis, Maryland, present "UTD Inter-Antenna EMC Analysis with Realistic Platform Modeling." There were 14 members and non-members present at the meeting. The January meeting had Rod Fremd, Spectrum Management Specialist of Northrop Grumman ES Division, speak on "Spectrum Management in the 21st Century." There were 13 in attendance at this meeting. The Baltimore Chapter's newly elected officers are: Chair: Robert J. Berkovits; Vice Chair: Thomas P. Bennington Jr.; Secretary: John Anderson; and Treasurer: Hoosamuddin Bandukwala.

#### **Central New England**

The Central New England Chapter meeting was held on Wednesday, March 13, 2002. The speaker was Colin Brench of Compaq Computer Corporation and a Distinguished Lecturer of the IEEE EMC Society. The presentation covered "EMI Shield Behavior in Real Product Environments." EMI shielding is a mainstay of EMI control. Frequently the design of the cooling or other apertures in a given enclosure is driven by the EMI requirements. This can result in compromised thermal and/or acoustic behavior and may mandate larger, noisier fans to meet other environmental needs. The wellestablished "Shielding Effectiveness" equations have their place, but they also have their limitations. In this presentation, test data and modeling are used to show and explain some commonly seen but misunderstood shielding problems. Typical cases were presented, including the effects of internal and external cables when located close to an array of apertures. Any proximal conductors can influence the shielding performance of an enclosure and can create windows where the shielding is much lower than anticipated, resulting in excessive emissions. There are also situations when an EMI shield can be working much better than anticipated and under these conditions larger apertures are possible. This may permit the use of smaller fans resulting in lower noise and/or less expensive construction details. Designing appropriate EMI shields is a major task for EMC engineers and understanding their true behavior is key to achieving this goal. 32 members and guests were in attendance and the speaker responded to questions from the audience during the presentation. The Chapter has no meetings scheduled for April or May 2002. The next meeting will be held in September 2002 and is usually a joint meeting each year with the North East Product Safety Society (NPSS). This will be the seventh consecutive year for this event with NPSS. The CNE EMCS Chapter Officers will be attending committee meetings in May in preparation for the 2003 IEEE Symposium on Electromagnetic Compatibility to be held in Boston, Massachusetts from August 19 to 23, 2003. As you probably know, the Chairman is Jon D. Curtis of Curtis-Straus LLC, based in Littleton, Massachusetts.

#### **Central Texas**

The Central Texas Chapter of the IEEE EMC Society met in January for a tour of the new ETS-Lindgren facilities near Cedar Park, Texas. About 50 members



and guests were shown ETS-Lindgren's latest antennas and semi- and taperedanechoic chambers. Former Chapter Chairman, Dr. Michael Foegelle of ETS-Lindgren, led the tour. In February, Mr. Marc DeKirmandjian of TDK, visited the Chapter at its regular meeting location, National Instruments in Austin, Texas. He discussed various components and methods for filtering USB 2.0 and IEEE 1394 signal paths. Application notes presented in this lecture may be downloaded from the Chapter's web site at http://www.texas-emc.fr.st/. For further information and the Chapter's meeting schedule, please visit the web site.

#### Chicago

The Chicago chapter held a wellattended meeting on February 20th, 2002 at Elite Electronic Engineering. Our speaker was Jerry Meyerhoff from Motorola. Jerry's presentation outlined his experience with applying NEC modeling to evaluate EMC compliance issues. Nearly 40 attendees were on hand to hear Jerry's presentation. The 2005 IEEE International Symposium on EMC steering committee also met recently and will



Jerry Meyerboff answers questions during bis presentation on NEC modeling at the Chicago Chapter meeting held at Elite Electronic Engineering.



be getting together again soon. We hope to see everyone at the Chicago Symposium in 2005!

#### Israel

The present security situation in Israel has regrettably forced the Committee of the 2003 IEEE EMC Symposium to decide on relocation of the EMC 2003 Symposium. The event had been planned to be held in Tel Aviv, May 11-16, 2003. The new venue is in Istanbul, Turkey, most likely at the Hilton Convention Center, although this is not finalized.

On April 14, 2002 the EMC Chapter organized a one-day meeting at the Holon Academy Institute of Technology. The meeting theme was "Electromagnetic Radiation Aspects." The meeting included four interesting topics pertaining to cellular radiation and technology:

- Dr. Sigal Sadetzky spoke on "Who is Afraid from Cellular Technology: Is There A Linkage Between Cancer and Cellular Radiation?"
- Dr. Reuven Tzemah spoke on "Stochastic Processes of Radiation Emitted from Cell Towers"
- Moshe Netzer (IEEE EMC Chapter
  - *Chairman) spoke on* "Radiation Safety and Environmental Effects around Cellular Base Stations of Third Generation: DAMPS, DCS-1800, and UMTS"

• *Prof. Jacob Gavan spoke on* "Interference between Transmitters and Receivers and Radiation Effects: How Are They Linked?"

The meeting was open and free of charge to anyone who would like to attend. We had more than 100 attendees!

#### Korea

Prof. Dong Il Kim was elected as the Korea EMC Chapter Chairman and the President of the Korea Electromagnetic Engineering Society (KEES), respectively, for two years starting January 1, 2002. Dong Il Kim received the B.E. and M.E. degrees in nautical science and electronic communications from the Korea Mar-



Professor Dong Il Kim, the newly elected Korea EMC Chapter Chairman.

Steve Lay

itime University, in 1975 and 1977, respectively. He received a Ph.D. in electronics from the Tokyo Institute of Technology in 1984. Currently, he is a professor of the Department of Radio Sciences & Engineering at the Korea Maritime University. His research interests include the design of microwave circuits and CATV transmission circuits, development of EM absorber, and EMI/EMC countermeasures. He received the Academy-Industry Coop-



Several members of the 2005 IEEE International Symposium on EMC steering committee were present at a recent Chicago EMC Chapter meeting. Seated (left to right) are Jerry Meyerboff, Tom Braxton, Frank Krozel, Randy Johnson, and Ray Klouda. Standing (left to right) are Roy Leventhal, Mike Windler, Craig Dinsmore, Oscar Guevara, Norm Webling, Jack Black, Cliff Craft, Roger Swanberg, and Steve Laya. (Not pictured are Bob Hofmann, Carla Robinson, Bruce Curry, Don Sweeney, Marilyn Sweeney, and Wally Pilat.)

eration (A-I-C) Award from the Korea A-I-C Foundation in 1990, Treatise Awards from the Korea Electromagnetic Engineering Society and the Korea Institute of Navigation in 1993 and 1998, and the Korea President's Award from the Promotion of Science and Technology. in 1995. He is a member of the Korea Electromagnetic Engineering Society (KEES), the IEEE, the Institute of Electronics, Information and Communications of Japan, the IEEC of Korea, and the KICS.

The Korea EMC Chapter is MHz dur planning joint activities with Chapter. KEES-including a seminar on

EM Wave Technology on June 29, the EMC Korea Workshop on September 27-28 and a workshop for EMF Influence on Humans October 18-19.

#### Malaysia

The Malaysia Chapter recently held two technical talks organized by our joint AP/EMC/MTT Chapter. The first presentation, entitled "Research in Artificial Intelligence Systems" was given by Professor Marzuki Khalid on January 26, 2002. Dr. Khalid is the Director of the Center for Artificial Intelligence and Robotics (CAIRO) at the Universiti Teknologi Malaysia in Kuala Lumpur. The presentation was well attended by 35 Chapter members and guests. The second presentation, given by Mr. Jaafar Haji Mohamad Abu Bakar was entitled,



The Korea EMC Chapter is Dr. Hoeft presents his view of electromagnetic life above 100 MHz during the February 20 meeting of the Melbourne EMC Chapter.

"Examining the Opportunities of R&D in Wireless Communication." Mr. Bakar is with Ericsson Sdn Bhd in Kuala Lumpur. Mr. Bakar's paper, given during the meeting on February 6, was very well attended by 80 Chapter members and guests.

We also had our annual general meeting of the IEEE Joint Chapter AP/MTT/EMC on March 9, 2002 at the Hotel Nikko in Kuala Lumpur. The following officers were elected:

*Chair*: Associate Professor Dr. Deepak Kumar Ghodgaonkar, MARA University of Technology, Shah Alam, Malaysia

Deputy Chair: Associate Professor Dr. Zaiki Awang, MARA University of Technology, Shah Alam, Malaysia

Secretary: Associate Professor Dr. Mazlina Esa, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia Committee Members: (1) Mr. Hartono Zainal Abidin (2) Dr. Mohammad Zaar B. Mohamed Jenu and (3) Mr. Tony Centeno.

#### Melbourne

The Melbourne, Florida chapter held its first meeting of 2002 on February 20 at the campus of the Florida Institute of Technology (FIT). The meeting was held jointly with the FIT student chapter of the IEEE. We were privileged to have newly appointed EMCS Distinguished Lecturer, Dr. Lothar (Bud) Hoeft, make his presentation entitled, "A View

of Electromagnetic Life Above 100 MHz." This was a wonderful lecture, especially for the many students and non-EMC specialists in the audience. Dr. Hoeft is an experimentalist, and his look at high frequency electromagnetics was rich with allegories to the other physical sciences, while purposely sparing with electromagnetics equations. Many electronic circuit engineers and students do not have a good grasp of the behavior of various electronic components at high frequencies, and this presentation introduced the audience to these phenomena in a common sense and non-threatening manner. For the "seasoned" EMC engineers in the audience, Dr. Hoeft presented some new and unique insights on familiar EMC topics. The Melbourne Chapter appreciates the EMCS Distinguished Lecturer program and encour-



Steve Laya of Elite Electronic Engineering (center) visited with Mark DeBattista of Haley-Davidson (left) and Ping Lee of Rockwell Automation (right) during the Milwaukee Chapter event on March 13.

Drs. Thomas Swiontek and Vince Canino of the Milwaukee School of Engineering (from left) dropped by the Laird Technologies tabletop display during the Milwaukee Chapter one day tutorial and exhibition.



Over 100 people participated in the Milwaukee one day EMC event on March 13.



The Milwaukee Chapter organizing committee is shown with their illustrious event speaker, including (from left) Jim Blaha and Teresa White of LS Compliance, speaker Dr. Clayton Paul, Janet O'Neil of ETS-Lindgren, and Bruce Fiorani of GE Medical.



Photo by Jim Blah

Dr. Clayton Paul demonstrating "The Show Must Go On!" can-do attitude!

ages all chapters to make use of this valuable resource provided by your Society.

#### Milwaukee

This relatively new EMC chapter has started out with a bang! On March 13 they organized a one-day tutorial and exhibition with Clayton R. Paul from Mercer University in Macon, Georgia. This was a repeat of the presentation Dr. Paul gave two days earlier to the Phoenix EMC Chapter (see summary under Phoenix below). Committee members for the event included Jim Blaha and Teresa White of LS Compliance, Bruce Fiorani of GE Medical Systems, and Janet O'Neil of ETS-Lindgren. 15 exhibitors of EMC products and services were on hand to showcase their offerings to the over 85 registrants present. As with the Phoenix EMC Chapter lecture, the registrants greatly appreciated the sage advice and expertise Dr. Paul shared throughout the

day. Despite fighting a bad case of the flu, Dr. Paul insisted: "The show must go on!" His positive attitude saved the day. A highlight of the event was the "traveling road show raffle." During the reception following the daylong technical presentation by Dr. Paul, Jim Blaha traveled around the exhibit tables and drew business cards from bowls on several tabletop exhibit displays. Raffle items won by a few lucky participants included a digital camera donated by the Milwaukee EMC chapter, four hours of EMC test time in UL's Northbrook, Illinois ten meter semi-anechoic chamber courtesy of Underwriters Laboratories, a probe donated by Credence Technologies, and a free full registration to the 2002 IEEE International Symposium on EMC in Minneapolis provided by Dan Hoolihan, Symposium Chair, and his steering committee. LS Compliance also got into the act and donated several electronic devices to the raffle. All had a good time.

#### Nanjing

On January 18, 2002, the Nanjing chapter enjoyed a presentation by Professor Q.J. Wang entitled, "Neural Networks for RF/Microwave Modeling and Design." Nearly 40 members and guests enjoyed the hour and a half long presentation. Professor Wang works in the Department of Electronics at Carleton University in Ottawa, Canada.

On March 11, in Shanghai, Professor D.R. Jackson of the University of Houston gave his presentations entitled, "Leaky Waves on Planar Structures: The Good, the Bad and the Ugly" and "Microstrip Antennas with Reduced Surface: Wave and Lateral-Wave Excitation." Professor Jackson's presentation was well received by 64 members and guests. Two days later in Nanjing, Professor Jackson repeated his "Leaky Waves on Planar Structures" presentation to another sizable audience of 65 members and guests. Professor Jackson's presentations were well received and appreciated by the Nanjing Chapter members in both Shanghai and Nanjing.

#### **Orange County**

The Orange County Chapter met on March 20th at CKC Laboratories in Brea. The topic was regulatory processes in Brazil and other Latin and South American countries. Richard L. Swarz, President of Net Connection Corporation (NCC), provided an overview of



Richard Swarz of Net Connection Corporation was the speaker at a recent Orange County Chapter meeting.

the Brazilian regulatory history and present requirements for product certification. NCC focuses on assisting clients with EMC, Safety and Telecom approvals South of the US Border. NCC is licensed by Brazil as an official telecom certification agency known as an Organization for Certification Designate. The direction of Brazil's requirements was presented in detail. Richard's presentation covered the three categories that Brazil separates products into, including Category 1: Consumer Electronics, Category 2: Radio Based Products, and Category 3: Network Products. Mr. Swarz provided the attendees with the EMC requirements per category of equipment. Mr. Swarz has a copy of the Brazilian Standard available for download at: ftp://CKC-BRZ:NCC @nccrc.com/CKC-BRZ/.

#### Phoenix

The Phoenix Chapter was honored to have the EMC Society Board of Directors attend their February 13th meeting while they were in town for a Board meeting. Dr. Todd Hubing, President of the EMC Society, presented a wellreceived talk on "Printed Circuit Board Power Bus Decoupling" to a packed room of 56 people. In this talk, Todd addressed the many, seemingly conflicting, rules-of-thumb that EMC practitioners use when laying out power bus and grounds on PCBs.

Much of the controversy in capacitor placement has to do with how close the power and ground planes are placed. For boards that have closely spaced planes



Dr. Clayton Paul with a jar of salsa in appreciation for his tutorial on the "Fundamentals of EMC" to the Phoenix EMC Chapter.

(i.e., 10mils or less), the capacitor placement is not critical. That is because the planes themselves are providing the high frequency capacitance by virtue of their low inductance and consequently low power bus impedance. On the other hand, we have boards with widely spaced planes such as those used in 4-layer boards. In this case, the capacitor placement is critical because widely spaced planes have lower inter-plane capacitance. The mutual inductance between closely spaced vias can work to our advantage by drawing current from nearby decoupling caps before it is drawn from the planes. By placing the decoupling caps close to the ground or Vcc pins (whichever connects to the plane furthest from the component), we are able to keep the power bus noise to a minimum because of mutual inductance coupling.

The bottom line in power bus decoupling is that we're not trying to supply charge, but rather current. And the rate at which current can be drawn out of a

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Twenty vendors participated in EMC Fest 2002 in Phoenix, Arizona.



Dr. Todd Hubing speaks to a full bouse about power bus decoupling issues at the Phoenix EMC Chapter meeting on February 13.

capacitor is related to inductance, not capacitance. Thus, power bus decoupling techniques must focus on minimizing inductance. In general, a good approach for power bus decoupling is to use closely spaced power and ground planes with vias tying the components' Vcc and Gnd pins directly to the planes without the use of traces. However, in many situations (e.g. boards with only a few active high-speed devices), boards with wider plane spacing or boards with no power plane at all can be just as effective at minimizing power bus noise while supplying the current necessary to ensure signal integrity. On March 11th, the Phoenix Chapter sponsored EMC Fest 2002, an all day exhibition and tutorial with Dr. Clayton R. Paul from Mercer University in Macon, Georgia. The event was truly successful with over 70 people attending. The 20 exhibitors are to be commended for their tremendous support of this program, as they were instrumental in enabling this special event to take place.

Dr. Paul put together the technical program with both new and experienced EMC personnel in mind. He began his tutorial describing the "hidden schematic" that is present in all designs, which accounts for the nonideal behavior of the circuitry. A traditional Electrical Engineering curriculum focuses only on ideal behavior. But as EMC practitioners, we must "get ourminds right" and not automatically think in ideal behavior terms. As Dr. Paul says, electrons do not read schematics.

Dr. Paul covered a considerable amount of material in his "Fundamentals of EMC" tutorial. He suggested that power supply emissions are often difficult to fix because of the constraints of safety and power. We also learned that bigger is not always better when it comes to capacitors and inductors because of the parasitic elements. Dr. Paul provided an innovative technique for reducing common-mode power supply emissions by placing an inductor in the green wire ground. He pointed out that because of safety constraints, one should be careful not to



Everyone appreciated having lunch outdoors during the Phoenix EMC Fest 2002 on March 11. It was the perfect Arizona day, sunny and warm!



David Stanis (left) and John O'Brien (center) of WEMS Electronics were one of the many exhibitors on hand for the Phoenix EMC Chapter one-day tutorial and exhibition. This tabletop show featured a full day technical presentation by Clayton Paul: always a sure thing in drawing a good crowd!



break the green wire, but rather loop the green wire through a toroidal core several times and then use a star washer to ground it to the product's chassis.

In Dr. Paul's summary, he encouraged us not to use shielding as a crutch but rather beat things down at the source. One can use shielding as a last resort after all other mitigation techniques have been exhausted.

Following the technical presentation, the Phoenix Chapter sponsored a reception with door prizes and a book signing by Dr. Paul. Information on upcoming meetings is available at the chapter's web site, http://www.ewh.ieee.org/r6/ phoenix/ phoenixemc/. (Left) A reception concluded EMC Fest 2002 in Phoenix. The beat must have affected this crowd by the end of the day! Toni Gurga of Credence Technologies is shown giving a "thumb's up" sign of approval after having won a digital camera donated by the Phoenix EMC Chapter as a raffle prize. Toni shows his excitement by hugging Janet O'Neil of ETS-Lindgren who drew the winning business card. Harry Gaul (far left) of the Phoenix EMC Chapter who bandled registration for the event cheerfully passed along the camera. It was all exhibitor Wendy May of Eclipse Shielding (seated) could do to keep from laughing at the spectacle of fellow exhibitor Jerry Ramie of Compliance Systems Corporation (partially hidden) giving Toni the "bunny ears" look. That Jerry!

Clayton Paul is shown doing what he does best: Educating engineers and technicians on the fundamentals of EMC.

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#### Seattle

On January 22, the Seattle EMC Chapter held a meeting at CKC Labs in Redmond. The speaker was Juha Junkkarinen of Juha Junkkarinen, Inc. His topic was "NEBS: It's Not Mission Impossible." Several dramatic slides showed the significance of Network Equipment Building System (NEBS) testing. Bob Nees of CKC Labs and Keith Andersen of Wyle Labs are partners in NEBS compliance testing. Together they sponsored the delicious dinner buffet of barbecue beef sandwiches catered by Tony Roma's. In February, the Seattle EMC Chapter was very busy! The EMC Chapter co-organized a one-day colloquium and exhibition titled "Wireless 2002" along with the Seattle IEEE chapters of the Microwave Theory and Techniques,

Computer and Communications Societies. This event was held on February 25 at the Hyatt Regency Hotel in Bellevue, just east of Seattle. Over 120 people attended in this event. The technical program included: "Introduction to Wireless Technology" by Joe Decuir; "How to Use Bluetooth<sup>TM</sup>: Implementation of Current Technology" by Tim Reilly, Stonestreet One; "Rationalizing Bluetooth<sup>TM</sup> in a Wireless World" by Andy Glass, Microsoft; "Antenna Design for Wireless Products" by Kerry Greer, Skycross; "Wireless LANs: Physical Layer Overview and RF Testing" by Todd Stockert, Agilent Technologies; and "Bluetooth<sup>TM</sup> Compliance Testing" by Karsten Beckmann, Rohde & Schwarz. The technical program was very well received by the participants. Several exhibitors were also on hand

with displays of products and services for the wireless industry. The technical program and photos of the event are available on the IEEE Seattle Section website at www.ieee-seattle.org. The following evening, on February 26, the Chapter hosted Colin Brench, EMC Society Distinguished Lecturer, with Compaq Computer Corporation, who spoke on "EMI Shield Behavior in Real Product Environments." Over 30 Chapter members attended this practical presentation, including Steve Marx from Seattle Central who teaches a course on wireless communications. Steve brought along several students who enjoyed the tour of the EMC facilities at CKC Labs where the meeting was held, the pizza dinner, and the presentation. Everyone enjoyed the speaker's command of the subject and his



Registration at the Wireless 2002 event on February 25 was ably bandled by Pat André (left) of the Seattle EMC Society Chapter and Dick Wilkins (shown pointing) of the Seattle Computer Society Chapter.



Northwest EMC had a prominent display at the tabletop show held during Wireless 2002. The Northwest EMC folks were not present at their display when this photo was taken as they attended the technical presentations. They are serious about wireless technology!



Todd Stockert of Agilent Technologies manned his tabletop display during Wireless 2002 when he wasn't busy giving a presentation. Todd was one of six speakers at the all day event.



The tabletop display area provided a relaxed atmosphere for attendees to network during the breaks in the Wireless 2002 technical program.





Dinner at the January Seattle Chapter meeting was provided courtesy of CKC Labs and Wyle Labs, partners in NEBS compliance. Bob Nees of CKC Labs, Juba

Junkkarinen of Juha Junkkarinen, Inc. and Keith Anderson of Wyle Labs (from left) were on band to ensure everyone enjoyed the dinner catered by Tony Roma's.



It was a full house at CKC Labs in Redmond for the January Seattle Chapter meeting with speaker Juha Junkkarinen. The topic presented was NEBS testing.

sense of humor. On March 26, the Chapter presented the "Pat and Steve Show." This meeting was held at Netro (formerly AT&T Wireless) in Redmond. Fortunately for the 46 Chapter members present, there was a great dinner catered by the Claim Jumper restaurant. After dining on rotisserie chicken, mashed potatoes and Caesar salad, the Chapter was treated to an entertaining presentation by Pat André and Steve Jensen, two noted EMC consultants. The evening started with Pat giving a "Shirt Pocket Guide to EMC." He shared a variety of equations and design techniques, including impedance equations, wavelength calculations, case shielding and design considerations, and even how to wind a balun. Steve Jensen next shared an interesting EMC tale. Steve was contacted in July of 2001 by the New York State department of transportation, bridges and roads division regarding a situation on the KOSCIUSZKO Bridge spanning "North Creek" which separates Queens County from King County in New York. The bridge is a part of the Brooklyn-Queens-Expressway (BQE) connecting Brooklyn NY with Queens. Painters and maintenance personnel were experiencing "shocks" and in some cases minor burns when disembarking from man-lifts onto the bridge. Steve's presentation reviewed an investigation of the effect of illuminating the bridge and associated equipment with the electromagnetic field from a nearby AM radio station transmitter (WQEW). This is not the usual EMC problem. The results and solution were of interest to all, however. It was a lighthearted, fun evening and everyone learned a thing or two while being entertained by these EMC consultants.





Joe Decuir of the Seattle **Communications Society** Chapter played a pivotal role in Wireless 2002; be organized the technical program, coordinated the audio-visual equipment for all the speakers on-site as be is shown doing here, and was the lead speaker who started the day with an introduction to wireless technology. His enthusiasm and experience were indeed infectious, not to mention invaluable for the success of Wireless 2002!



The crowd at Wireless 2002, a one day technical program and exhibition co-organized by the Seattle Chapter Chairs of the IEEE Microwave Theory and Techniques Society, the Communications Society, the EMC Society and the Computer Society. Working together, these four Chapter Chairs put on quite a show!



Steve Marx from Seattle Central (top center with glasses) brought along the students from the class he teaches on wireless communications to the February Seattle Chapter meeting. The students enjoyed the pizza and a hands-on tour of the EMC chambers at CKC Labs.



Speaker Colin Brench, Keith Peavler of Netro and Seattle Chapter Vice Chair Pat André (from left) visit prior to the February Chapter meeting.



A reception followed the technical presentations at Wireless 2002. Members of the participating Society Chapters were invited to attend the reception only free of charge. Donn Harvey of Techlink NW joined Janet O'Neil, Seattle EMC Chapter Chair, Tom Raschko of Sea-Port Technical Sales, Seattle MTT Chapter Chair, and Nick Garinger of Intel Dupont (from left) for a great sampling of appetizers. Incidentally, Donn is chairing IMS 2002 in Seattle the week of June-3. This is the annual symposium for the MTT Society.



Ed Blankenship (standing) of Hewlett Packard in Vancouver, Washington made a surprise appearance at the March Seattle Chapter meeting. Ed is Chairman of the Portland EMC Chapter. Ghery Pettit of Intel in Dupont, Washington is shown seated.



The "Pat and Steve Show" turned out to be one of the most popular Seattle Chapter meetings in recent memory. 46 people turned out to hear EMC consultants Steve Jensen (left) and Pat André discuss some humorous EMC tales.

#### Singapore

Associate Professor Kye-Yak See, Chair, Singapore Chapter reports that two events were organized in the first quarter of 2002. On January 31, a one-day tutorial on "Electromagnetic Compatibility in Industrial Equipment: Standards, Problems and Solutions" was held at the National University of Singapore. This event was jointly organized with the IEEE Industry Applications Chapter. Both the IEEE EMC and IA Chapters were very honored to have Professor Paolo Tenti and Associate Professor Giorgio Spiazzi in Singapore to give the one-day tutorial under the IEEE Distinguished Lecturers program. Both Professor Tenti and Associate Professor Spiazzi are from the University of Padova, Italy. The tutorial covered the main aspects related to electromagnetic compatibility issues in industrial equipment. The presentation began by covering the main standards developed under the EMC Directive, illustrated by some significant case studies. Then, the most important engineering

aspects that must be considered to properly approach the EMC-related problems were discussed. The tutorial was very well received with about 70 participants. The Singapore EMC Chapter would like to thank the National University of Singapore for sponsoring the tutorial venue and tea breaks.

On March 12, a half-day seminar entitled "EMC Regulations and European Legislation for Radio Equipment and EMC on 3G Mobile Terminals" was

organized jointly with the Chapter and the Rohde & Schwarz Support Center in Singapore. The seminar speaker was Dr. Klaus-Dieter Goepel, Director of Marketing, Rohde & Schwarz, Asia. The seminar was well attended by 28 participants. Dr. Goepel gave an excellent presentation outlining the impact of EMC regulations on the radio and telecommunications test equipment. The participants benefited greatly from the sharing of his experience and findings on EMC. There was very positive feedback from many of the participants; all felt that they had benefited from the seminar. The Singapore EMC Chapter would like to thank Joseph Soo, General Manager of Rohde & Schwarz Singapore, and his staff, for helping to coorganize this seminar.

### Southwest Washington and Oregon

The Southwest Washington and Oregon Chapter is excited about the opportunity to host the 2006 IEEE International Symposium on IEEE in Portland, Oregon. In addition, the chapter continues to work very hard to bring great speakers to our meetings. Most recently, in March the chapter brought out Tom Moyer from Amplifier Research for a presentation on RF Conducted Immunity Testing. In April, the chapter is planning a presentation from Ghery Pettit of Intel and Steve Berger of TEM Consulting. They will be discussing ferrite clamps and their use in radiated emissions testing as they relate to CISPR 22 Amendment 1. In May, Keith Hardin from Lexmark will come and speak on the history and usage of spread spectrum clock generation. In June, tradition warrants a summer social for members and their families. The EMC Chapter has made a concerted effort to provide greater support for its affiliate product safety technical committee (PSTC). It



Dr. Goepel gave a half-day seminar to an attentive audience at the Rohde & Schwarz Support Center on March 12.



(L-R) Dr. Wai-Kuan Lob, Technical Director of Control Techniques Singapore Pte Ltd., Dr. Sanjib K Panda, Secretary of IEEE Singapore Section, and Professor Tenti, during the tea break.



There was a nearly full lecture hall for the one-day EMC tutorial held at the National University of Singapore on January 31.

### EMC SOCIETY: PRODUCT SAFETY TECHNICAL COMMITTEE NEWS

The Product Safety Technical Committee has created an e-mail forum so members can discuss product safety, product EMC and other product regulatory issues, including worldwide standards. The forum is a tool to share information on these topics and more. To see or search past discussions, go to: http://ieeepstc.mindcruiser.com/ and click on "browse" and then "emc-pstc mailing list". You can subscribe by sending an e-mail to majordomo@majordomo.ieee.org with the words "subscribe emc-pstc" in the text of the e-mail OR by visiting: www.ewh.ieee.org/soc/emcs/pstc/sub-domo.html

### **AWARDS NOMINATIONS REQUESTED!**

It's time to start thinking about nominations for awards to be presented at the Awards Luncheon held during the 2002 IEEE International Symposium on EMC, August 19-23, in Minneapolis, Minnesota.

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

Nominations must be submitted by June 15, 2002 to Henry Benitez, Awards Chairman, at phone 360-212-0471, e-mail henry\_benitez@ hp.com.



jump started the local group with funds this year and helped contribute to its organizational structure. The EMC PSTC has had a very successful start with monthly meetings and/or activities since September. The membership and awareness of these activities has increased. The following topics have been covered this year:

September: "Emerging Markets", Ms. Lisa M. Brown, Intertek Testing Services/ETL Semko

- October: New International Attributes of the National Electrical Code (NEC), presented by Thomas Childers, UL
- November: An Industry Panel Perspective on "Fire", Rich Johnson (HP) and Wendy Blanton (IBM)

December : Holiday Social

- January: Testing of Transient Voltage Surge Suppressors, Erik Schellenberg
- February: NEBS, Juha Junkkarinen (EMC/PSTC joint meeting)
- March: The Hidden Pitfalls of California's Proposition 65, Suzanne Henderson

April: SEMI S2 Workshop

The PSTC has established a full slate of active officers, including: Henry Benitez (HP), Lisa Brown (ITS), Randy Mayorga (UL), Ivan Vandewege (HP), Ali Elmi (Xerox), Wendy Blanton (IBM), and Art Henderson (Olson). The success of this affiliate product safety group and contributions to the national PSTC organization has sparked the active development of a new IEEE Society for product safety. There has been a substantial crossover of members attending both monthly EMC and product safety meetings.

#### Ukraine

The joint AP/C/EMC/SP Chapter of the Ukraine Section (Kharkov) recently elected new officers: Chair: Prof. Gennadiy I. Churyumov, Senior Member of the IEEE; Vice-Chair: Prof. Nicolay N. Kolchigin, Member of the IEEE; and Secretary-Treasurer: Dr. Peter L. Tokarsky, Senior Member of the IEEE. Other Officers elected included: Professor Yakov S. Shifrin, Fellow of the IEEE and Dr. Valeriy I. Zaritskiy, Member of IEEE







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## **Practical Papers, Articles and Application Notes**

#### Bob Olsen, Associate Editor

In this issue you will find one practical paper that should be of interest to the EMC community. It is entitled, "Radio-Frequency Metrology from NBS to NIST: The Legacy" by Dennis Friday and was originally presented at the Antenna Measurement Techniques Association Symposium, Denver, Colorado in October 2001. Those of you who do not know much about NIST will find a wealth of information about their history and extensive contributions to electromagnetic metrology. Even those of us like myself who spent a period of time in Boulder will some find some interesting facts of which we were not aware. In the next issue of the Newsletter, we will be publishing a companion paper by several NIST staff members on the specific contributions of NIST to EMC.

Submission of material to the Practical Papers section of the Newsletter is encouraged. While all material will be reviewed prior to acceptance, the criteria are different from those of Transactions papers. Specifically, while it is not necessary that the paper be original or archival, it is necessary that the paper be correct, useful and of interest to readers of the Newsletter.

Comments from readers concerning this paper are welcome, either as a letter (or e-mail) to the Technical Editor or directly to the author.

### **Radio-Frequency Metrology From NBS to NIST:** The Legacy

#### Dennis S. Friday, Member, IEEE

Radio-Frequency Technology Division, National Institute of Standards and Technology, Boulder, Colorado 80305-3328, USA

Abstract — We review a century of radio metrology research and development in the U.S. that paralleled the birth and evolution of radio/wireless and other electromagnetic technologies. The interplay between the scientific and technological advances and the research, measurement and standards development programs at the National Institute of Standards and Technology (formerly the National Bureau of Standards (NBS)) was a factor that facilitated both commercialization of products and implementation of systems for the public benefit.

Key words – microwave metrology, NBS, NIST, radio history, RF measurements

#### I. Congress Creates NBS

The year 2001 is the centennial anniversary of the National Institute of Standards and Technology (NIST), formerly the National Bureau of Standards (NBS). The organic act that created NBS was enacted on March 3, 1901, and the first transatlantic radio transmissions followed shortly on December 12, 1901. The Bureau's creation coincided with the emergence of radio technology and resulted in the first new and original technical programs at NBS. Radio technology, then called wireless, has played a critical role in the first hundred years of NIST's activities [1-5].

The radio technology of the day consisted of spark-gap transmitters, inherently broadband devices. As the number of transmitters increased, interference became a serious limiting factor, particularly for maritime applications. NBS explorations in radio technology began in 1905, under Navy funding and with civilian Navy technical staff assigned to the Bureau. The first formal radio project, in 1911, involved the design and construction of a standard wavemeter. An unexpected byproduct of this effort was a totally new instrument, known as the Kolster Decremeter, which measured both the nominal wavelength and the time-decay, or decrement, of the spark-gap impulse. An international agreement was reached in London in 1912 to limit the logarithmic decrement of spark-gap transmissions to no more than 0.2, and to allocate a band exclusively for maritime use. The Kolster Decremeter is an example of how new NBS measurement technology allowed for the enforcement of new regulations. This technology facilitated the first steps toward achieving order in the use of the radio spectrum and reliability in radio communications.

In 1915, Congress allocated \$10,000 as the first appropriation for radio research, and in 1916 they allocated \$50,000. While this seems a paltry sum by today's standards, it allowed for the construction of a complete radio laboratory on the NBS campus in Washington, D.C. Just prior to and after the U.S. entered World War I, in 1917, NBS began a program focused on aircraft radio. The shortage of trained men caused by the war in Europe, led to the employment of the first woman in a technical capacity. Although a college physics professor, she was retained only as a temporary Guest Researcher. In 1918, the Armistice was signed, and the new Radio Building was occupied. Although this building no longer exists, its legacy is preserved in the name of the main building on the NIST Boulder site.

Contribution of the National Institute of Standards and Technology, not subject to copyright in the United States.

#### II. The Peace Between the Wars

Toward the end of World War I, NBS also initiated research on radio antennas and radio propagation. These programs required both spatial separation for experiments and a less cluttered electromagnetic environment than downtown Washington, D.C. The first NBS field site was created in 1919 at Kensington, MD. It was to be the first of many.

Spark-gap technology became obsolete as vacuum-tube technology emerged, and NBS played a key part in the development and acceptance of this (then) new technology. The NBS role as an expert and impartial laboratory that developed standard measurement-based methods for characterizing the new devices greatly facilitated the adoption of vacuum-tube technology. NBS also played a key role in the development of methods for circuit design using vacuum tubes. Technical reports, called Circulars, were sold to the public and aided the transition to vacuum-tube technology for both the hobbyist and the new radio manufacturing industry. Many years elapsed before the first textbook on vacuum tube circuit design appeared. In addition, NBS developed the first receiver designs that could be powered from 60 Hz power lines, eliminating the dependence on batteries.

NBS also helped pioneer commercial broadcast radio. In May 1920, NBS began weekly broadcasts from its new Washington, D.C. station, WWV. Initial programming consisted, not of time and frequency broadcasts, nor weather reports, nor anything technical. It was pure entertainment, and consisted of a few hours of recorded music broadcast every Friday night to the fortunate few in the Washington area who owned radio receivers.

The scarcity of receivers nationwide was to change rapidly. In 1920 very few American households possessed radio receivers, but by 1928, almost every household had one. The commercial development of radio and the salaries that the private sector was able to offer made it very difficult for NBS to recruit and maintain technical staff. Furthermore, in the years between World War I and World War II, NBS suffered reductions in funding and workforce size.

However, with the persistence of a few dedicated, quality people, research continued on radio propagation and radio technology. The main programs were: propagation research in specific bands; continued work on vacuum tube characterization and design; antenna theory and design; aircraft radio technology; radio navigation, for both ships and aircraft; research on the causes and prevention of radio interference; the accurate measurement of EM field intensity; the development of radiosondes for meteorological studies; the study of insulating materials for RF applications; and early research on cathode ray oscilloscopes. In addition to carrying out this research, NBS developed and provided measurement services to the nation for a wide range of electrical and radio-related physical quantities, and published a wide range of technical reports that advanced the state of knowledge in radio science and technology.

#### III. World War II

World War II generated new funding, staff and programs that enabled the Bureau to support military and strategic needs. Work continued on more advanced radiosondes to improve meteorological predictions, and included not only balloonbased devices, but also the first remotely operated ground-based devices parachuted behind enemy lines. Propagation programs were extended to include ionospheric measurements and research to facilitate more reliable communications.

The Ordnance Development Division was formed during World War II to develop reliable radio proximity fuses for weapons applications. A branch of this Division later focused on guided missile applications. Earlier research on radio direction finders was extended to higher frequencies in pursuit of greater accuracy. Programs were initiated to develop critical new strategic materials needed for radio technology, such as mica for capacitors, Bakelite for structural insulators, and quartz crystals for oscillators.

During this period, the collection of different programs in radio propagation research grew to significant proportions and impacted the entire military as well as civilian communications. This led to the formation, in 1942, of the Interservice Radio Propagation Laboratory at NBS. The purpose was to centralize all of the radio propagation activities as well as future research, and to provide a single body of expertise to support all government needs in radio propagation.

As a key new wartime technology, the primary responsibility for radar development was assigned to the Radiation Laboratory under the administration of MIT. However, NBS also played a key role in radar development. One program, an extension of earlier radio-based remote weather measurements, was to develop a method of using the Mark 4 radar on-board Navy ships to measure wind velocity. Another program was directed at passive radar reflectors, the objective of which was to develop practical balloon-borne targets with maximized radar cross section. There was also an extensive radar countermeasures program at NBS that led to the development of systems for both deception and jamming.

Another event that was to have a significant impact on the future of microwave technology was a classified letter from the chairman of the Joint Chiefs of Staff and the Secretary of Commerce that arrived at NBS in April 1944. In addition to declaring all standards and information about frequencies above 2.4 GHz to be classified, the letter directed the Bureau to develop, "as promptly as possible," measurement standards for frequencies between 1.55 and 11 GHz. Furthermore, the document set in place sufficient funding to carry out this mandate, and the Radiation Laboratory and others were directed to provide support to NBS in this effort. The most critical need was for frequency standards and before the end of hostilities, NBS was able to provide frequency calibrations up to 30 GHz to the US military and its allies. These were based on a family of quartz oscillators that comprised the national frequency standard.

#### IV. The Move West

It is no surprise that the post-war period resulted in downsizing and regrouping of the technical agencies. However, international conflict simply changed in form with a rapid transition into the (sometimes hot) Cold War. Consequently the emphasis on scientific and technological development never waned, and the programs that exploited the radio-frequency spectrum continued to advance within a changing federal structure. During this period of time, various NBS wartime programs evolved into separate agencies or laboratories. One of the first was the NBS Central Radio Propagation Laboratory (CRPL), established in 1946, in which all of the radio-related work at NBS was concentrated.

In 1951, the NBS programs related to radio missile guidance were moved to Corona, CA. In 1953, this operation was transferred to the Navy and the ordnance-related radio proximity fusing programs at NBS were transferred to the Army, and became known as the Harry Diamond Laboratory.

Field sites were critical to the radio research at NBS and were becoming difficult to find. Recall that in 1919 the first "unofficial" field site was established at Kensington, MD, where antennas and portable hardware could be tested. In 1921, a new field site with some essential facilities was established at Chevy Chase, MD, but it had to be abandoned, due to development, in 1926. The Kensington site was then upgraded, and it became the formal NBS field site until 1933. At that time, it was replaced by two larger and more remote field sites: one in Beltsville, MD and the other in Meadows, MD. Although the Beltsville site was used for NBS time transmissions until 1966, the Meadows site was closed in 1943 to create Andrews Air Force Base. A new and more remote site was established in Sterling, VA, in 1943. In less than a decade it became apparent that an even more remote site for radio research was necessary because the NBS Sterling site was needed for the planned Dulles International Airport. After a long and thorough search for a new site, Boulder, CO was chosen and, in 1954, the Sterling field station was closed and the Boulder laboratories were dedicated and occupied.

The entire NBS CRPL staff and all of the laboratory equipment were transferred to Boulder between 1951 and 1954 and operated in temporary quarters until completion of construction. While there was always a metrology and measurement service component in the electrical and radio programs at NBS, the radio work was dominated by fundamental research and technology development from its inception until just after World War II. The return to fundamental metrology programs for RF and microwave technology was finally realized in the Boulder labs. In 1956, the CRPL Radio Standards Laboratory was created. As requested and funded in a 1944 Department of Defense (DOD)-Department of Commerce (DOC) agreement, basic metrology and measurement services began to flourish and to become the dominant theme in NBS radio-frequency programs.

In 1965, all CRPL programs in radio propagation, upper and lower atmospheric studies, solar physics, and space environmental forecasts were transferred to a new agency called the Environmental Science Services Administration (ESSA). The Radio Standards Laboratory remained in NBS and the Bureau's radio work was finally concentrated on its primary mission, basic radio metrology and national measurement traceability. In 1970, ESSA was split into the Institute for Telecommunications Sciences (and placed under the National Telecommunication and Information Administration) and the National Oceanographic and Atmospheric Administration (NOAA), both of which are still located in Boulder. Also in 1965, the NBS Boulder Labs became part of the DOC and the Electromagnetics Division was formed in 1970.

Early Boulder programs included attenuation, impedance, power, RF voltage and current, noise, EM field strength, antennas, pulsed fields, material characterization, coaxial connector evaluations, and automated measurements. New technologies over the intervening years had a significant impact on the Electromagnetics Division. There are currently four Divisions in Boulder, focused on cryoelectronic technology (the Electromagnetic Technology Division), optoelectronics (the Optoelectronics Division), magnetic information storage (the Magnetic Technology Division), and both guided-wave and free-field EM metrology (the Radio-Frequency Technology Division). The original radio programs are most closely linked to this fourth Division. Present program areas include: Fundamental Microwave Quantities, High-Speed Microelectronics including microwave digital technology, Wireless Systems including the characterization of nonlinearities, Electromagnetic Properties of Materials, Antenna and Antenna Systems, and Electromagnetic Compatibility.

#### V. A New Focus

The work on fundamental RF metrology that served both industry and all aspects of government (civilian as well as military) was funded almost entirely by the DOD in 1944. This process was to continue for another 45 years until the end of the Cold War. In the past decade, a shift in microwave metrology funding from the DOD to NIST has taken place, along with a significant reduction in staff. The Technology Competitiveness Act of 1988 changed the name of NBS to NIST and broadened the mission to include support for technology development. New technology development mandates are carried out in separate non-laboratory functions.

However, the core NBS metrology mission has not changed, and remains a critical part of the NIST mission. The RF Technology Division's programs are strong and focused on the most critical current needs of the wireless, the microwave, and the electronics industries. Many of our accomplishments are documented in IEEE, MTT, EMC, and APS archival and conference publications.

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**Dennis Friday** is Chief of the NIST Radio-Frequency Technology Division. Prior to assuming his present position he served in various capacities, including: Deputy Division Chief, Program Development Coordinator, Program Analyst on the NIST Directors Staff, Chairman of the NIST Research Advisory Committee, and NIST Liaison to the DOD Calibration Coordination Group. He

had a diverse technical career before joining NIST in late 1979, in the Center for Applied Mathematics. He was formerly: a member of the technical staff in the Operations Research Center of Bell Laboratories, Holmdel, New Jersey; an electrical engineer with Boeing, both in Seattle and at Cape Canaveral; a consultant in signal processing for Locus Inc. and the Applied Research Labs in State College, Pennsylvania; and a measurement systems design specialist at the GE Space Technology Center in King of Prussia, Pennsylvania. He began his career working full time as an electronics technician at the GE Missile Systems Division in Philadelphia, while majoring in electrical engineering at Drexel University. He holds a PhD in mathematical statistics from Penn State. Shortly after assuming his present position, he carried out a major restructuring of the Division (formerly the Electromagnetic Fields Division) and is in a continuous process of assessment and adjustment of division programs to meet the most critical needs of industry. EMC

### **President's Message**

continued from page 1

expanding and enhancing our awards structure. Perhaps we should have an award for the best new award idea. It could be called the *IEEE EMC Society Award for New Award-Winning Award Ideas* (or something like that).

Speaking of great ideas, this would be a good time to make your reservation to attend the 2002 IEEE International Symposium on EMC in Minneapolis. There's no better way to keep up with the latest advances in technology affecting the EMC profession. Dan Hoolihan and the 2002 Symposium steering committee have put together a great program including short courses, workshops, hardware and software demonstrations, technical papers, exhibits and social events. You'll have a chance to meet people working on the same types of problems that you are, learn more about EMC than you ever wanted to know, and have fun doing it.

I recommend you plan to stay a while and explore the area. It's a really nice place to visit during their summer month. Just ask any native Minnesotan. Wenz da baest taime a year ta veezit Minnesota? August ay. Ya, you betcha! **EMC** 



### **Book Review**



Ray Adams, Guest Associate Editor

Spectrum and Network Measurements, 297 Pages Author: Robert A. Witte Publisher: Noble Publishing, 2001 Originally Published: 1993 by Prentice-Hall

Most EMC engineers are familiar with spectrum analyzers as they use them to verify product compliance to emission requirements. However, the spectrum analyzer is a versatile troubleshooting tool to the EMC engineer if the spectrum analyzer capability and limitations are understood. This also applies to the network analyzer, which is often used to measure various characteristics of two port networks. However, many engineers have learned how to use these instruments by using one or some combination of the following methods: (1) reading the voluminous instruction manual, (2) watching and later imitating a fellow technician or engineer, or (3) reading application notes, provided they exist.

Some of the problems with this approach to spectrum and network measurement are: (1) The initial investment of time to read the instruction manual far out weighs the immediate short term goal of making a measurement, (2) the person whose "experience" you are depending upon may have limited capability, and (3) the versatility and limitations of the instrument may be unknown to the user.

This book helps to bridge the gap between theory and practice to enable a better understanding of how spectrum and network measurements relate to theory. Most instruction manuals assume some minimal level of knowledge of specific instrument types, so they are usually very light on the theory of operation. This book describes spectrum, wave, network and FFT analyzers. It covers the following topics related to the FFT analysis: coherence, correlation, cross correlation and auto correlation. These topics are explained in a practical sense, with just enough mathematics, something that is missing when you are first introduced to this topic in college.

This book consists of 17 chapters, which I have arbitrarily broken down into six parts. The first part is comprised of the first three chapters. Introductory material on spectrum and network measurements, decibels and Fourier Theory are covered. The brief review of Fourier Theory bridges the gap between theoretical calculations and how to relate these to actual measurement values. It compares the Fast Fourier Transform (FFT) with the Discrete Fourier Transform (DFT) and how it is implemented into analyzers. The FFT is computationally more efficient than the DFT as the FFT requires less than 1% of the computation time that the DFT requires for the same record length.

The second part is made up of chapters 4 and 5, which are devoted to FFT analyzers and swept spectrum analyzers. Basic theory of operation, instrument architecture, window functions and FFT functions are covered in these chapters. The FFT window functions covered are hanning, flat top, uniform and exponential. Other FFT functions such as coherence, auto correlation and cross correlation are covered. Equations for computing the minimum sweep rate for specific spectrum analyzer settings are given. If the selected sweep rate does not meet the criteria of the equation (frequency span and resolution bandwidth), the measurement will be in error. Other areas covered are: LO feed thru, detectors, tracking generators, differences between FFT analyzers, swept analyzers and hybrid analyzers.

Chapters 6 to 10, which are the third part, are basic theory and descriptive material for the various measurements that a spectrum analyzer is used for: modulation, distortion, noise and pulsed power. The role of averaging and filtering on measurement sensitivity and accuracy are also covered. Amplitude modulation and frequency modulation measurements are described in the time and frequency domain. Useful equations to calculate and measure the modulation indices for AM and FM are presented. The spectrum analyzer zero span function can be used to examine the modulation characteristics of a carrier in the time domain. This chapter on modulation also explains Bessel functions, Carson's Rule and carrier nulls in a practical manner.

The chapter on distortion clearly explains the effects of distortion in amplifiers and how to measure amplifier distortion. The fundamental concepts of gain compression, second and third order intercept points, as well as second and third order distortion products are clearly illustrated. It describes how to perform single tone and two-tone distortion measurements, which are useful concepts to understand when performing CS103 (Intermodulation), and CS105 (Cross-Modulation).

The chapter on noise and noise measurements is a brief introduction to noise theory. Theory is reviewed before more practical information is presented. Noise units, noise measurements, noise floor and noise floor corrections are explained. Phase noise, phase noise terminology and phase noise measurements are briefly introduced. For those that require more detailed information, a list of references is presented.

The chapter on pulse power measurements presents useful equations to determine the optimum spectrum analyzer settings (resolution BW, sweep time) provided the duty cycle and PRF of the signal are known. The average power of the pulsed signal can also be calculated. The amplitude of pulsed signals, due to the pulse desensitization factor, are actually higher than measured. The pulse desensitization factor and how to calculate it are presented. The role of averaging and filtering to enhance measurement sensitivity and accuracy is discussed. The role resolution bandwidth, video bandwidth, predetection and post-detection filtering

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## **EMC Personality Profile**



Bill Duff, Associate Editor

Last year, we had four new Fellows elected from the candidates that were evaluated by the EMC Society Fellow Evaluation Committee. Our four new Fellows are:

> Dr. Gerard T. Capraro Andrew L.S. Drozd Dr.Valeri Ya Kontorovitch Dr. Thomas Van Doren

Two of our new Fellows are featured in this Newsletter. In the next issue, we will profile the other two Fellows. Congratulations to all four gentlemen!

#### **Introducing Andy Drozd**

Andy Drozd was recently elevated to the grade of IEEE Fellow "For the development of knowledgebased codes for modeling and simulation of complex systems for Electromagnetic Compatibility."



The EMC Society sponsored Andy's nomination based on his technical and professional achievements in the area of computational electromagnetics (CEM), and for his dedication and active involvement in the EMC Society. To say he is dedicated and active is an understatement. Actually, Andy is one of our most energetic Society members. His contributions to the Society have been on behalf of many Standards, Technical, Membership, and Communications Services activities. As Andy has said, "...one way of finding out where you are best suited and how you can be of the greatest benefit (to the Society) is to dive in head first and test the waters ... " Andy's philosophy has always been "...take a chance, get to know your way around and find out what works best for you and those around you." This philosophy has endured in his career and the many facets of his professional work. He hopes to someday narrow his focus on areas where he can be of most benefit. In the parlance of the EMC Society, this means servicing the membership and promoting the

growth of the Society in the best ways possible, particularly through education.

Many of you may best know Andy Drozd for his work on behalf of the Experiment Demonstrations for the annual EMC symposia since 1992 and more recently, for the EMC Computer Modeling and Simulation Demonstrations which he inaugurated at last year's Montreal EMC Symposium. Andy has successfully launched a highly popular and well-attended forum at the symposia, which emphasizes both the technical and educational aspects of EMC. His efforts have added a new dimension to our annual symposia as well as helped promote our Society's goals to further EMC education at many different levels.

Others know Andy from his work for over 25 years in developing new approaches to CEM modeling and simulation, and advancing the current state of EMC analysis and prediction tools. Andy is the President and Chief Scientist for ANDRO Computational Solutions, a small company he started in 1994 devoted to research and development in the area of CEM technologies, products and services. The company is located in Rome, New York. Most recently, Andy has been at the helm of research and development to apply AI/expert system based technologies and common database architectures to the task of EMC computer modeling and analysis. The methods he has developed are used to facilitate the integration and communications among

different CEM tools for EMC problem solving applications. Instead of using a set of independent computer codes in an individual manner to perform an EMC analysis of a complex problem, he has developed and demonstrated techniques for interfacing codes through a common database structure and to translate results from one code to another in a relatively seamless way. As Andy puts it, "Easier said than done. In the process you need to carefully bridge the physics and properly condition the simulation data from one step to the next to assure validity." This reconciliation of different computational stages and simulation data is a challenging process and one that Andy will continue to fine tune in an attempt to establish a highly flexible, multi-fidelity EMC modeling and analysis toolkit.

Andy has found that AI/expert system technologies are also useful in developing computer utilities that mimic the way an experienced EMC engineer approaches a complex problem-solving task. There is much work ahead, but a great deal of interest as well. According to Andy, the area of CEM modeling and simulation is a good place to be if you are a recent engineering graduate. The CEM discipline will continue to grow by leaps and bounds with advancements in both software and computer technologies. Andy says that many more companies today are focusing on multi-disciplinary simulation-based engineering. This means that improvements in computer modeling

and analysis technologies will be realized, which will rely more and more on the use of high performance computers and ways to intelligently interface with the computer tools. Andy likes the challenges that this technology area offers.

Andy earned a B.S. degree in Physics with a minor in Mathematics graduating Magna Cum Laude in 1977, and an M.S. degree in Electrical Engineering which he received in 1982, both from Syracuse University. He is also a NARTE certified EMC Engineer since the inception of the program.

Andy is currently serving the second of a three- year term on the EMCS Board of Directors. He is a member of the EMC Society Standards Development Commit-

#### Introducing Valeri Ya Kontorovitch

Valeri Ya Kontorovitch was elected to the grade of IEEE Fellow "For contributions to the theory of EMC of radio communication systems, analysis and mitigation of interferences, and non-Gaussian channel modeling and simulation."



Valeri was born in Sverdlovsk, Russia on July 29, 1941. He received the M.S.E.E. (1963), Ph.D. (1967) and Dr.Sc. (1986) degrees, all from the Bonch-Bruevich Institute of Communications, St. Petersburg, USSR.

From 1963 to 1993, he was a member of the technical staff at the State Radio Institute where he was engaged in EMC system analysis for radio communications. In 1968, he founded the Laboratory of Electromagnetic Compatibility at the St. Petersburg Institute of Communications, where he performed research on the EMC analysis of communications systems and simulation of interference of different physical natures for experimental testing of various communication systems. His main efforts were dedicated to theoretical prognosis of EMC parameters of communications systems (so-called multipoint interference approach) and new methods for communications channels and interference simulation based on a stochastic differential equations approach (SDE). He was a Department Head at the Bonch-Bruevich tee leading a working group on the development of CEM modeling and simulation standards. He is also a member of the IEEE Standards Association. Andy is presently the Vice President of Member Services for the EMC Society and Vice Chair of the Education and Student Activities Committee. Andy is also the Society Webmaster. Additionally, Andy is a member of the Applied Computational Electromagnetics Society (ACES) and is the Technical Features Article Editor for the ACES Newsletter.

In 1997, he received the IEEE Region 1 Award for *Contributions to the 1997 IEEE Dual-Use Technologies and Applications Conference.* He was the General Chair of the conference whose theme was on information

Institute of Communications when he left.

Since 1993, he has been a full professor at the Research and Advanced Studies Center of the National Polytechnic Institute (CINVESTAV), Mexico. He has published about 200 scientific papers and conference proceedings, five books and he holds 17 patents. He is Member of the Mexican Academy of Sciences. His present interests are the development of new methods for interference parameters calculations for EMC analysis and communications channels modeling.

Valeri has made significant and original contributions in the area of "EMC of radio communication systems." During the 30 years that he worked for the Bonch-Bruevich Telecommunication Institute (later Telecommunication State University) USSR, Russia, Valeri founded the Branch Lab Ministry of Telecommunications (USSR) "Electromagnetic Compatibility (EMC) of Communication Systems" and became its Head and Scientific Leader for many years. This Lab was in charge of creating a new set of equipment (channel and interference simulators) devoted to EMC. The Lab also provided theoretical support to USSR EMC standards for several types of informationtransmission systems. In Mexico, Valeri formed a group of researchers that actively developed topics dedicated to EMI problems in radio communications (using a probabilistic approach for interference calculation, outage probability evaluation, etc.).

All of these achievements were based

age technologies, systems, and strategies. Andy was responsible for establishing information technology tracks including special sessions devoted to defining the role of electromagnetics and multi-discipline engineering in the evolving information age.

He chaired the IEEE Mohawk Valley EMC Chapter from 1998-2000 where his efforts were directed at raising the awareness and importance of EMC within local companies and organizations.

Andy lives in Rome, New York with his wife Barbara and their son Evan. Andy enjoys recreational travel, occasional hiking, wine tasting, and an eclectic range of musical styles. Especially, Andy enjoys being with his family and playing with his son during those rare quiet times.

on the scientific investigations using "Stochastic Differential Equations (SDE) Modeling" and "Multipoint Interference Analysis." His investigations in the field of detection, filtering and estimation of signals in the presence of non-Gaussian noise provided a theoretical basis for interference mitigation techniques in HF communication channels. The results achieved by Valeri show the robustness of the proposed algorithms, which give several advantages for its practical implementation.

Valeri made pioneering investigations in the following areas:

- Optimal and robust detection, filtering and estimation of signals in the presence of Non-Gaussian noise
- Dynamic systems approach for solving EMI problems of complex communication systems
- EMC analysis based on multipoint interference calculations
- Stochastic differential equations approach for description, modeling, simulation and measurement of stochastic processes (mainly non-Gaussian) in communication systems (focused particularly on EMC and related topics)

The significance of his investigations is evident in considering that his papers dedicated to optimum detection problems were published several years before the classical works of David Middleton and A. U. Spaulding. All of the projects started as profound theoretical research on rather complex topics. Finally, the results were implemented in the form of practical interference mitigation equipment for HF communications, test equipment design, theoretical prediction of EMC parameters for future standardization, expert EMC system design for complex radio equipment, etc. Taking into account the fundamental character of the research initiated and developed by Valeri, together with the dates when they were achieved, it is obvious that he was a "true pioneer."

Although considered mainly as an engineer/scientist, Valeri possesses

remarkable technical and educational leadership abilities. The creation and development of the EMI mitigation equipment was possible because of a combination of novel theoretical results, and the work of a strong and talented team of collaborators with outstanding technical leadership. Because of the skills of its leader, Valeri, the Telecommunications Ministry authorized the Lab to manufacture the set of equipment.

As an "Educator", Valeri had 12 Ph.D, and 47 M.Sc. students graduate and he supervised 2 Dr.Sc. (full Dr. degree) thesis. He founded an M.Sc. course, "EMC of Radio Electronic Systems," and published the first manual for the Leningrad Bonch-Bruevich Telecommunications Institute.

In Mexico, he developed, for the first time, several educational projects, for instance EMC between LEO, GEO and terrestrial systems, interference analysis for microwave radio links, etc. Currently, Valeri is active in forming groups of researchers in the EMC field and keeps close collaboration with them in Mexico as well as in other countries (Russia, Canada and Israel). **EMC** 



## A 'Note' from TC-1 The EMC Management Technical Committee

By Kimball Williams, Member TC-1 (k.williams@ieee.org)

ormal activity in any technical committee is focused on tasks relevant to the committee charter and goals. However, committee members are human, and at breaks discussions drift off into the 'wild blue yonder'.

About two years ago, the TC1 committee was settling down after a break and the discussion came back to the subject of how easy it is to postpone tasks until 'later'. At that point, one of our members quoted the old saying: "Tomorrow is today's greatest labor saving device."

Some of the younger members on the committee had never heard that inverted version of "Never put off until tomorrow what you can do today" and asked to have it repeated. Dick Ford (the Society's Photographer) suggested there was enough truth and humor in sayings like it to warrant their capture and publication for the edification and enjoyment of our members. We talked briefly about including it as a regular 'filler' in the Newsletter.

As usual with busy committees, other business took front stage and the idea languished until it re-surfaced at our next committee meeting in Montreal. Our chairman, Dan Hoolihan, proposed that we go forward on the idea, but with the addition of a cartoon to illustrate the saying.

After the meeting, we tracked down Tom Braxton of our Chicago EMC Chapter



Tomorrow is today's greatest labor-saving device.

who is known to 'doodle' a cartoon now and then, and asked him if he would volunteer his talent to the project. The result is the cartoon and saying you see today. We felt it would be an interesting addition to the Society's newsletter. We are very pleased with how it turned out. We hope you like it. **EMC** 

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## **EMC Standards Activities**



Don Heirman, Associate Editor

#### Let's Get to the Bottom of What Those Conductive Gaskets Can Do!

More and more the EMC community has to deal with manufacturers needs for using conductive gaskets well into the GHz region. In the commercial side of the house, there are already PCs running at 2 GHz and above as well as network routers running at speeds approaching 10 GHz. Clearly there is a need to help gasket users with the EMC impact on their product shielding at these frequencies. Making these judgments requires confidence in performing tests to determine such EMC characterizations. This work on P1302 described below will help focus on these needs. I urge you to pitch in to help this committee move this project to completion. Don't wait, sign up now!

## Revision/Update of IEEE STD 1302, "Guide for the EM Characterisation of Conductive Gaskets in the Frequency Range of DC to 18 GHz."

IEEE Standard 1302 was originally published in 1998. This standard was the culmination of several years of effort to develop a standardized technique for measuring EMI gaskets. At that time, the working group determined that there were several measurement techniques in use throughout the community, each having its advantages and disadvantages (and "disciples" and "dissenters"). However, there was "no clear winner" and the group decided to issue this guide to assist manufacturers and users of gaskets in either specifying the technique to be used or in evaluating the results provided by a particular technique or to compare the results provided by the different methods. Hence, the work was published as a Guide, not a Standard or Recommended Practice. Since its publication, progress on the characterization of conductive gaskets has been made, and new applications are arising requiring additional measuring techniques. Therefore, an effort to revise and update IEEE STD 1302 by taking out a new Project Authorization Request (PAR) was approved by the EMC Society Standards Development Committee and by the IEEE Standards Association Board in 2000. Professor Johan Catrysse leads the present revision effort.

#### 1. Current Status

The existing document was the first guidance document for the characterisation of conductive gaskets:

- It was a first attempt to compile an overview of available measuring methods;
- Some methods were covered in an extensive way, others just 'mentioned as existing';
- Methods covered include:
  - transfer impedance (as by SAE ARP 1705)
  - relative aperture transmission, derived from the 'old' MIL STD 285
  - reverberation chamber methods
  - effective power transmission
  - modified ASTM D4935-89 fixture
  - slot aperture
  - TEM-t and H-t fixtures
- The standard concludes with a short discussion on selecting a measurement technique and a discussion on repeatibility.

In the meantime, more work has been done on some methods and some are no longer supported. So, an update of this P1302 is needed in order to make it applicable to current circumstances.

### NOTICE: IEEE STANDARD 140 WITHDRAWN

At its December 2001 Board Meeting, the IEEE Standards Association withdrew IEEE-STD-140-1990 (R1995) "IEEE Recommended Practice for Minimization of Interference from Radio-Frequency Heating Equipment." Persons wishing to obtain a photocopy of the last version of the standard should go to http://standards.ieee.org or call 1-800-678-IEEE.

### 2. Items Not Covered in Original Guide

After a first compilation of the actual guide, looking for its practical use and taking into account the evolution in gasketing techniques, the following issues still need to be addressed:

- The frequency range above 1 GHz, where only small sizes of samples are available (so that the modified MIL STD 285 is not applicable in practice), needs to be more fully addressed
- Correlations (if any) between different methods such as DC resistance, transfer impedance, fixture methods and gaskets applied on enclosures need to be established, if possible
- A test/evaluation method needs to be established for small and thin gaskets which are used under near field conditions for INTRA system use (as in mobile phones)
- All methods should be documented in an equal way based on frequency

### COMMENTS WANTED ON IEEE STANDARD 1128

IEEE STANDARD 1128 (Recommended Practice for RF Absorber Performance Evaluation in the Range 30 MHz to 5 GHz) is due for reaffirmation in 2003. If you have any comments, suggestions, or corrections, please send them to jperini@ieee.org prior to the end of August 2002 so that they can be included in the reaffirmation process.



### AUGUST 19-23, 2002 | www.2002-ieee-emc.org

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• An overview table of all methods, including pro's and con's, needs to be produced.

#### 3. Scope of the PAR Revision

The scope of P1302 is to provide manufacturers of gaskets and designers of (electronic) systems appropriate methods for the characterisation of gaskets, in the way that a test method is used, giving figures which will provide an indication of the shielding that will be obtained in a specific application.

#### 4. Purpose of P1302

This revision of P1302 proposes to provide additional guidance on the strengths and the weaknesses of each method contained in the original guide, and to provide an in-depth documentation for each method.

This document should be the basis for further work at a later date into a standard that will:

- Identify possible additional measuring methods for the characterisation of conductive gaskets
- Identify measuring methods appropriate for small samples of gaskets (and including the frequency range over 1 GHz)
- Correlate between different methods (DC resistance, transfer impedance, shielding, etc.)
- Identify possible measuring methods for near field characterization of gaskets (as to be applied for INTRA system shielding applications)
- Provide a table with pro's and con's of each method, and an indepth description of each method.

The target date for completion is September 2004. Work must start this year to meet this target date considering not only the textual changes needed, but to do any experimentation to provide data to make decisions in the working group.

#### 5. Development Strategy

It is the intention that most of the work will be done by electronic communication (E-mail). However, some meetings will be scheduled. Where possible, these meetings will be in conjuction with a major EMC symposium.

Are you interested in participating in and contributing to this P1302 Working Group? If so, please contact:

Prof. Johan CATRYSSE Lab for EMC, KHBO Zeedijk 101 B 8400 Oostende, Belgium phone: +32/59/56 90 34 or +32/59/56 90 39

Email: johan.catrysse@khbo.be

I hope to hear from you soon!

#### Short Curriculum of Prof. J. Catrysse

- Professor at the Electronic Department, KHBO (formerly KIHWV) since 1974.
- Teaches courses on: circuit theory
  - automotive control engineering
  - HF circuit design
  - Electromagnetics and antennas
  - EMC
- Head of Electronic Department, KHBO since 1981.
- Head of EMC laboratory at KHBO, Oostende since 1983.



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Basic ESD and I/O Design Sanjay Dabral, Timothy Maloney

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Dennis M. Sullivan

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FLECTROMAGNETIC

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#### Dear Colleagues and Fellow EMC Engineers,

We are delighted to announce that the 2003 IEEE International Symposium on EMC will be held in Istanbul, Turkey, on May 11-16, 2003.

Due to current conditions in Israel, the Symposium venue was relocated to Istanbul, Turkey

The Symposium will provide excellent opportunities for EMC researchers, scientists, engineers and vendors, working in the area of theoretical and applied EMC to present the latest research results, discuss problems of current and mutual interest and exchange views and experience, related to new EMC components, materials and equipment.

Workshops, tutorials, "Birds of Feather" panels and special sessions will be organized on stimulating topics. The Symposium will also be accompanied by a technical exhibition.

For the latest information, please visit our web site at: http://www.ortra.com/emc2003/



The Symposium will take place in the Hilton Istanbul Hotel, a spacious, elegant and comfortable hotel, ideally situated, overlooking the spectacular view of the Bosphorus, magically attractive amid the glittering lights of the City.

Istanbul is a thriving vibrant metropolis! As an exciting and cosmopolitan city, blending east and west, Istanbul offers something for everyone: outdoor cafes, ethnic restaurants and cultural centers will compete for your attention with historic sites and open oriental markets a haven for the dedicated shoppers.

Istanbul - built on two continents, bridging across Europe and Asia, connecting East and West with two suspension bridges over the Bosphorus Straits. Those bridges symbolize the bridge these International Symposia make across the EMC professional world and EMC professionals worldwide, bringing them together, experts and students alike.

#### FOR FURTHER INFORMATION PLEASE CONTACT THE SYMPOSIUM SECRETARIAT:

#### ORTRA Ltd.

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## 2003 IEEE International Symposium on EMC, Istanbul: "Radiating Compatibility from the East"

by Elya B. Joffe, Symposium General Chairman

e are delighted to announce that the 2003 IEEE International Symposium on EMC has been RELOCAT-ED from Tel-Aviv, Israel to



ISTANBUL, TURKEY due to the ongoing current events in Israel. The dates of the Symposium have remained unchanged: May 11 - 16, 2003 – an entire week (Sunday through Friday) of EMC action.

The slogan for the 2003 EMC Symposium is: "Radiating Compatibility from the East" or "Ex-Oriente Radians" in Latin, alluding to the Byzantine period, where Istanbul (or Constantinople) was the center of the ancient world. Today, Istanbul is simultaneously an important and thriving tourist attraction, as well as a modern business and industry metropolis. For the week of 11-16 May, 2003, Istanbul will also be the international center of the EMC Community.

Technical Program: The International Organizing Committee is preparing an exciting top-notch technical program with something for everyone attending the Symposium: workshops, tutorials, special invited sessions and innovative "Meet the Expert" sessions. Special "Birds of a Feather" panels will be organized on stimulating topics.

We take great pleasure in inviting you to actively participate in this Symposium, which serves as a forum for engineers, technicians and scientists to discuss their personal views, theories and solutions to our volatile and exciting electromagnetic environment.

The year 2003 is a special year in the history of flight — 100 years of modern powered aviation (1903-2003) since the Wright Brothers' first powered flight in the Kitty Hawk.

In commemoration of this important milestone in the area of transportation, truly making it a "Small, Small World," special events and sessions on the topic "EMC in



Aerospace and Aviation" are planned. Submissions of papers on EMC in Aerospace and Aviation are highly encouraged.

Exhibition: The Symposium will also be accompanied by a large technical exhibition of the latest EMC innovations, technology and techniques. An integral part of the exhibition will form the "Advanced Products and Technology Sessions," offering exhibitors the opportunity to elaborate on their products and services in extended public presentations. These presentations will also be accessible to all exhibition visitors.

Seize the opportunity! Profit from the synergy between the Symposium and the Exhibition.

Symposium Venue: The Symposium will take place at the Hilton Istanbul Hotel, a spacious, elegant and comfortable hotel, ideally situated, overlooking the spectacular view of the Bosphorus, magically attractive amid the glittering lights of the city.

Istanbul is a thriving vibrant metropolis! As an exciting and cosmopolitan city, blending east and west, Istanbul offers something for everyone. Outdoor cafes, ethnic restaurants and cultural cenkets are a haven for dedicated shoppers. Social Program and Tourist Activities: The social events accompanying the Symposium will also give you "get together" opportunities with your old colleagues and friends as well as

ters will compete for your

attention with historic

sites. Open oriental mar-

ones. Make sure to take part in the unforgettable social events, which will be held in some of the most magnificent sites of Istanbul.

enable you to get acquainted with new

Summary: Our organizing committee is already hard at work to make the Symposium both a professional and entertaining event.

For updated information and details on paper submission, exhibition and patron opportunities, please visit our web site at: http://www.ortra.com/emc2003/.

May this Symposium, in the cosmopolitan city of Istanbul, also form the bridge between people, making EMC the bridge of cooperation and exchange of technical information between people and professional societies and enhancing the quality of life for all people throughout the world through the constructive application of technology.

Welcome to Istanbul! EMC

### **CALL FOR IEEE STD 473 WORKING GROUP VOLUNTEERS**

**Editor's Note:** When Mr. Joffe is not busy with the 2003 Istanbul symposium activities, he is busy working on IEEE Standards, including IEEE STD 473 (IEEE Recommended Practice for an Electromagnetic Site Survey from 10 kHz to 10 GHz). This document describes a systematic approach for performing an EM site survey.

IEEE has approved a PAR for the revision of IEEE Standard 473 and a Working Group has been formed. The proposed revision will: 1) Extend the frequency band up to 40 GHz, and apply to a broader set of applications; 2) Incorporate the usage of modern measurement equipment and techniques; and 3) Incorporate statistical techniques and measurement uncertainty issues. The working group is seeking more technical expert volunteers to join. If you are:

· involved in RF site studies or experienced in running "on site" RF measurements

familiar with statistical analysis techniques

• or simply have interest in this field and would like to contribute to this activity, WE NEED YOU!

For further information, please contact Elya B. Joffe, WG 473 Chairman, at: eb.joffe@ieee.org

## **IEEE Fiscal State of Affairs: Part IV**



Peter Staecker, Divison IV Director (p.staecker@ieee.org)

#### **March 2002**

Residual matters continue to be the major issue before volunteers and staff, and, for yet another installment of this column, our original selection of topics is still, well, topical:

- 1. Selection and management of initiative programs within the Institute.
- 2. Periodic review of the Corporate Infrastructure activities.
- 3. A closer look at (read "simplification of") the complicated set of business rules that are required to support the many offerings of the Societies and Councils.
- 4. A financial model that more properly allocates expenses among users.

#### 1. Initiative Programs

An Adhoc Committee of the Board of Directors will continue to look closely at initiative spending throughout the year. New and old initiatives will be scrutinized for strategic impact. TAB initiatives will be internally scrubbed before being sent on to the BoD. We should begin to see the outlines of a formal review process by the time you read this. In related activity at the February BoD series, P2SB, TAB, and the Board passed two out-of-cycle 2002 initiatives: an IEEE Member Digital Library, and an IEEE Medical Online Package. The first is just what it sounds like: online access to IEEE publications for individual Members. The second is the first experiment in a series of topical technical offerings across the Institute which cut across traditional Society lines, AND make a great deal of sense to our technical customers. Clear and detailed business plans showing rapid investment recovery facilitated passage of both items, which still leave a net positive operating budget for 2002.

#### 2. Infrastructure Charge Distribution within TAB

The two methods (*Principles, Blended*) under consideration for Infrastructure

Charge Distribution were described in the last column. The motion before TAB in February was to accept the *Principles* method, with a 4 year phase-in from the *Blended* method, as follows:

Year	Blended	Principles
2002	100%	
2003	2/3	1/3
2004	1/3	2/3
2005		100%
2005		100%

When the discussion ended and the votes were counted, TAB moved to adopt the transition by nearly a 3:1 margin. Minority opinions held that:

- The Principles method discouraged membership growth, because of the large per-member charge (~\$15) to Societies.
- 2. The transition period is too slow.

Having voted to IDENTIFY charges related to membership infrastructure as part of the Principles method, TAB is now armed with the awareness to do something about it. Congratulations to us all, and read on...

#### 3. Business Rule Complexity

Speaking of membership costs, during 2001, the IEEE Infrastructure Oversight Committee (IOC) examined the value proposition offered by IEEE and Society membership, and proposed that there are substantial savings to be gained by simplifying or reducing our present membership offerings (briefly described in the last column). The range of savings here is between \$2 and just under \$9 per member. A savings of \$9 per member (minimum feature alternative) would make a sizeable dent in the \$15 charge identified by the Principles method of infrastructure charges. Here's an example: That membership card we carry around in our pocket costs

about \$1.40. Each. In November, the BoD authorized RAB and TAB to investigate business rule changes to realize savings in a *minimum feature* alternative, and a TAB committee formed in February will give its first suggestions in June.

#### 4. Financial Model and the Budget Update

IEEE budget principles adopted at the November Board of Directors Meeting for the 2002 Budget are serving as a template for the 2003 Budget development. The non-controversial principles are:

- The operating budget will be balanced.
- All investment income, including dividends and interest (D&I), is NOT part of the operating budget. Further, initiatives (continuing plus new) will be capped by D&I income. Excess D&I income will be used to offset infrastructure charges.
- Other surplus investment income will be returned to reserves.

These principles were put into place for the 2002 Budget, which was passed at the February BoD meeting. Additional elements of the financial model, including methods of re-establishing Corporate Reserves, and modifying the method of paying for additional indirect core functions, ate still under consideration.

#### Discussion

The 2002 Budget, net positive, is finally final. While we address the challenge of delivering the revenues, we must also finalize the Financial Model and Budget principles, and publish them in the IEEE financial operating manual, so that we don't forget them in the future. These will let us begin to drive down infrastructure costs, in effect, to quote an old saying, "Repairing the airplane while in flight." **EMC** 

## **Board of Directors Activities**

Tempe, Arizona February 13, 2002

#### THE PRESIDENT'S OPENING REMARKS

President-elect Todd Hubing called the meeting to order at 8:30 am. He invited immediate past President Joe Butler to say a few words. Mr. Butler thanked the Board for their support during his tenure as President. He welcomed John Norgard and Ron Brewer, newly elected Board members. A round of introductions was made. Board members present included H. Benitez, R. Brewer, J. Butler, L. Carlson, T. Chesworth, L. Cohen, B. Crain, A. Drozd, R. Ford, F. Heather, D. Heirman, T. Hubing, E. Joffe, W. Kesselman, M. Montrose, J. Norgard, J. O'Neil, H. Ott, J. Perini, A. Podgorski, C. Sartori, K. Williams, and T. Yoshino. Members absent included J. Muccioli, G. Pettit, and Z. Pantic-Tanner. Guests present included D. Fischer and H. Gaul. Regarding the items discussed at the Excom meeting, Mr. Hubing talked about the IEEE Transactions on Mobile Computing. The EMC Society will run an ad for this new publication in the Transactions on EMC. EMCS members in return can receive a discounted price on this new publication. Mr. Carlson will chair a task force to look at term limits for the Transactions on EMC editor. Mr. Hubing dis-

cussed the "Policies and Procedures" manual and the task to update and maintain this document. He suggested creating a new position on the Board, such as a parliamentarian, to be responsible for the policies and procedures of the EMC Society. The Board consensus was that a parliamentarian position was needed and this person should sit on the Executive Committee, Mr. Hubing concluded his remarks on the topics covered at the Executive Committee meeting by talking about the three Technical Councils which require represen-

#### **TREASURER'S REPORT**

Treasurer Warren Kesselman presented his report. The Treasurer reported a preliminary 2001 Operating Surplus but cautioned that the available financial data was incomplete and believes that the IEEE post-audit report will contain a significant 2001 deficit. The final ASPP and Book Broker distributions, long-term investment return and final balance sheet are not included in the December reports. Also, Society/Council Reserves have not yet been reduced to cover Corporate Infrastructure expenses. Complete pre-audit reports should be available in the near future. The IEEE Board approved the 2002 budgets only through February. IEEE TAB issued a preliminary EMCS budget that contains a net deficit of \$65.5K. The Society's "Committee & Other Cost Center" budgeted expenses were reduced (relative to the Board approved June 2001 budget) by \$35.1K. The IEEE Board of Directors also encouraged a 15% reduction of all Society travel related budget line items.

#### SECRETARY'S REPORT

Secretary Janet O'Neil reviewed the minutes from the last Board meeting on November 13, 2001. A few changes were required. The Board approved the minutes as amended.



tation by a member of the EMCS, Immediate Past President of the EMC Society, Joe Butler of such as the IEEE Sensors Council, Parker Chomerics (left) passes the gavel to incoming President, the IEEE Nanotechnology Council, and the IEEE Intelligent friendly exchange took place following the February 13 meeting Transportation Systems Council. of the EMC Society Board of Directors.

#### COMMUNICATION SERVICES REPORT

Len Carlson, Vice-President for Communication Services, presented his report. He reviewed the VP of Communications 2002 budget. In the absence of Professor Marcello D'Amore, Transactions on EMC Editor-in-Chief, Len Carlson advised that the Transactions budget would be overrun this year since the page count for 2001 has been exceeded. Janet O'Neil, Newsletter Editor, reported that the Fall 2001 issue was the longest issue to date with 56 pages. This issue focused on the Montreal symposium and the majority of articles in the issue related to the symposium. Ms. O'Neil acknowledged Mark Montrose for contributing the book review on the children's books presented in Montreal and Tami-Lee Joffe for contributing comments on the children's program. Society photographer Dick Ford was commended for supplying photos for this issue, including some photo collages that required a tremendous amount of time to create. The Winter 2002 issue features paid advertising for the first time in the Newsletter's history. Susan Schneiderman of IEEE Media has secured the advertising for the Newsletter. There are 7.58 pages of advertising from 13 advertisers. This includes the inside front cover as well as the inside and outside back covers. There are 4.58

pages from 10 ads inside the Newsletter. The billing totaled \$11,000 for these ads in this issue. Of this total, the EMC Society will receive approximately \$5,000 (the balance goes to commissions for sales people and to IEEE Media and IEEE Magazines Production). Susan Schneiderman of IEEE Media will be present at the Minneapolis Symposium to solicit ads for the Newsletter. Since there are no longer any "Institutional Listings" on the back cover of the Newsletter starting in 2002, those companies with a listing in 2001 have been contacted to see if they would like to renew their listing for 2002 on the back cover of the Transactions on EMC. Newly elected Board member, Zorica Pantic-Tanner,



Jose and Myrthes Perini joined Ana and Carlos Sartori (from left) at a reception hosted by the EMC Society Board of Directors for members of the Phoenix EMC Chapter. The February Board meeting was held in Tempe, Arizona, which is centrally located for many members of the Phoenix EMC Chapter.



has agreed to write a column regarding women in engineering in future issues of the Newsletter. Finally, the annual IEEE Panel of Editors meeting for this year, typically held in February/March, was cancelled for financial reasons. Mark Montrose next presented his report as IEEE press liaison. Not much has happened since his last report in November. He noted there was an error in the royalties paid in 2000 to the EMCS. This amounted to an overpayment of \$420.03, which will be deducted from the next royalty payment. Wiley has an on-line authors web site. From here, authors can check the status of their book sales, royalty payments and other items of interest. Five books are currently sponsored by the EMCS (with royalties to the EMCS and authors). One new book on anechoic chambers by Dr. Leland H. Hemming is expected to be released during June-August 2002. Currently there are five IEEE staff members in the IEEE Press Department. Wiley has assumed the majority of the expenses to publish these books. Lastly, Andy Drozd presented his report as EMCS Webmaster. Efforts continue to update and maintain the committee web pages. The Web Page Summary Guideline is almost complete and ready for release to the TCs and other committees. The web page templates for the Standards Committees were prepared and are in the process of being uploaded and populated. There are currently four paid advertisers on the EMCS web site.

#### STANDARDS SERVICES REPORT

Don Heirman, Vice-President of Standards, presented his report. It was noted that the webpage (http://www.ewh.ieee. org/soc/emcs/) for EMC Standards is now operational. Standards activity is currently at an all time high and covers three major areas: The Standards Education and Training Committee (SETCom) chaired by Hugh Denny, the Standards Advisory and Coordination Committee (SACCom) chaired by Elva Joffe and the Standards Development Committee (SDCom) chaired by Stephen Berger. He noted that IEEE Standard 140 is being withdrawn as there is outdated information and other methods of getting information on in-situ mitigation of ISM equipment. A notice to this effect was posted in the EMC Society Newsletter, Winter 2002 issue. He reviewed the 2002 Standards budget. The budget is

set for expenses of \$12,000 in 2002. For 2003, they expect to raise the budget to \$19,000 in part to finance the production of a video. Hugh Denny, SETCom Chair, did not hold a meeting of his committee in Tempe. Elya Joffe, the SACCom chairman, advised that there has not been much activity since his last report. The active areas involve the SAE and commercial aerospace. Regarding SDCom, SDCom Chair Stephen Berger held a meeting in Tempe. All Standards Committees will next meet in Minneapolis in conjunction with the EMC Symposium.



The reception offered an excellent opportunity for members of the Board to meet and "talk shop" with members of the Phoenix EMC Chapter. Shown from left (in foreground) are EMC Consultant Bill Blandford of the Phoenix EMC Chapter with EMCS Board members Henry Benitez of Hewlett Packard and Mark Montrose of Montrose Compliance Services.

#### MEMBER SERVICES REPORT

Andy Drozd, Vice President for Membership Services presented his report. He reviewed the 2002 budget for Membership Services. He advised that the committee is looking at several new membership services initiatives for Region 8. The top six ideas were discussed, including hosting an "International EMC Chapter Retreat" meeting with Chapter Chairs and Officers (such as the traditional IEEE Sections Congress), exhibiting with an

improved EMCS membership booth at international EMC symposia, and other cost saving initiatives to spur growth. Membership Chair Bruce Crain advised that there was little response to his last Newsletter article on the Senior Member program. Nevertheless, he will contin-I ue to promote this. Membership in the EMCS is currently at 5,109 members as of January 2002. This is down by approximately 2% compared to last year at this

time. Mr. Drozd then reported for Lee Hill, chair of the DL program. The program is proceeding successfully and all positions for DLs are filled. Henry Benitez report-

ed on Awards. There was an advertisement on the call for awards in the Fall 2001 issue of the Newsletter, which has not resulted in any nominations. Nominations for awards must be made by June 15, 2002. Treasurer Kesselman noted that





EMC Society President Todd Hubing (left) did double-duty on February 13. He chaired the EMCS Board of Directors meeting during the day and gave a 60-minute technical presentation at the Phoenix EMC Chapter meeting that night. Phoenix EMC Chapter member Harry Gaul of General Dynamics presented Todd with some authentic southwest salsa to show the Chapter's appreciation for his efforts.

IEEE has advised that the cash awards need to be accelerated to comply with IRS regulations. A discussion was held about the funding of the President's Memorial Award. Mr. Drozd then reported for Chapter Activities Chair Ghery Pettit. Mr. Pettit received a request for Angel funding from the Melbourne chapter to purchase audio/visual equipment for chapter meetings. This request was approved. A petition was received from Gennadiy Churyumov to form the Signal Processing/Antennas & Propagation/Computer/Electromagnetic Compatibility joint chapter of the Ukraine Section (Kharkov). The Executive Committee of the Section approved the petition. Pending no objections to this chapter formation, it will become official by February 7, 2002. Elya Joffe then reported as Region 8 Membership chair. There were no international EMC symposia held recently, thus, there were no related Region 8 membership activities since the last Board meeting in November 2001. Future Region 8 EMC symposia include the 16th International Wroclaw Symposium and Exhibition from June 25-28, 2002 in Poland, the EMC Europe 2002 Symposium in Sorrento this September, and the 2003 IEEE International Symposium on EMC in Tel-Aviv, Israel. Mr. Joffe continues to monitor EMCS chapter formation in Romania, Georgia (the former USSR), and Greece. Jose Perini next advised that there is not much

EMC activity in South America, or Region 9. There is some activity in Mexico. Paco Sepulveda is an EMCS member in Mexico City and he has requested material from the IEEE on forming a new chapter there. Takeo Yoshino then reported on EMC activity in Region 10. There are several EMC conferences being organized in his region, including the international EMC Japan 2004. There will be an international EMC conference in Bangkok, Thailand on July 25-27, 2002. He distributed a copy of the "Final Call for Papers" for the ICEMC 2002 conference in Bangkok, Thailand on July 24-27. Regarding Nominations and By-laws, chair Joe Butler noted that the Winter 2002 Newsletter would contain the call for nominations for the Board of Directors. He will work with Dan Hoolihan, past Nominations Chair, to amend the by-laws to address returned ballots that result in a tie. Also, he reminded Board members that the Vice-President positions on the Board are appointed positions. You do not need to be elected to the Board to fill the position of Vice-President. Regarding the Fellows Search Committee, Mr. Drozd reported for Bill Duff and Tom Chesworth that six Fellow nominations were received and evaluated by the EMCS last year. Four individuals were elected to the grade of Fellow. This is double the number of EMCS individuals typically elected in one year. The awards will be presented at the

Minneapolis Symposium this August. Mr. Drozd is evaluating the role of PACE in relation to the EMCS. Lastly, Dick Ford discussed the annual symposium survey. He is planning a major change to the survey this year. He solicited input from Board members about anything they would like to see in the next survey. He noted that last year they almost did not receive enough returned surveys to make the results meaningful. As Society photographer, he submitted several photos from the Montreal symposium to be published in the Newsletter.

#### **TECHNICAL SERVICES REPORT**

Kimball Williams, Vice President for Technical Services, presented his report. He reviewed their budget for 2001 and their actual spending levels. Next, he showed their five-year budget plans. Regarding video production, Dick Ford discussed the "War Stories" video, which can be used as a tribute to the late Don Bush. The Board approved the cost to produce two CDs, one on the Y2K War Stories and one on the Experiments/Demonstrations. 400 CDs of each subject will be produced. Henry Benitez next reported that the Product Safety Committee (TC-8) would officially present a business plan to TAB during the IEEE meetings in Tempe. Michael Garrison, Jack Burns, Mark Montrose and Todd Hubing will be present to promote the development of the Product Safety Committee as a separate Society within the IEEE. TC-8 will not change and will continue to operate as is; i.e. addressing product safety issues related to EMC. The TCs have reviewed 236 papers for the Minneapolis symposium. Multiple papers were sent to the various technical committees. RAC Chair David Case is working on a special speaker for the 2002 Minneapolis Symposium. Mark Montrose reported that he attended the Nano Technology symposium in Maui, Hawaii last year. John Norgard has volunteered to assist Mr. Montrose representing the EMCS on this council. He will attend their next meeting scheduled for February 14 in Tempe. Magsood Mohd, Chair of the Education and Student Activities Committee, submitted a report that the fundamentals tutorial is being planned for the Minneapolis symposium. The experiments demonstrations for next year's symposium have been solicited in the EMCS

Newsletter through an article by Andy Drozd. The modeling demonstrations are still being worked on and developed since they are very new. They were presented for the first time at the Montreal symposium. The student paper and student design contests for the Minneapolis symposium are being promoted now.

#### CONFERENCE SERVICES REPORT

Henry Ott, Vice President for Conference Services, presented his report. Mr. Ott reviewed the status of future symposia as follows: 2001: Montreal: \$260,000 USD was the surplus from the Montreal symposium in 2001. This was originally reported to exceed \$300,000 USD by the chairman, Benoit Nadeau, however; this amount contained an error related to tax issues. The audit still needs to be completed. 2002 Minneapolis: All is going well with this symposium. The symposium website address is www.2002-ieee-emc.org. 177 booths have been sold to date to a total of 105 exhibiting companies. The advance program should be mailed in mid March. The children's program debuted in Montreal will again by presented by Amy Pinchuk in Minneapolis. 239 technical papers were received; of which 185 were accepted and 54 rejected. 22 of the 27 proposed workshops were accepted. 2003 Boston: Jon Curtis of Curtis-Strauss is the new chairman for the 2003 Boston Symposium Steering Committee. They met in September and will meet again in May. All of the hotel and exhibit space has been contracted. 2003 Tel Aviv: Elya Joffe presented a report on this symposium. He reported that the symposium is on track with all milestones. He invited the Board to visit the symposium venue during May to July 2002. 2004 Santa Clara: Franz Gisin reports that they have contracted with ITCMS to manage the symposium. Hotel contracts have been signed with the Westin, Hyatt, Marriott and Embassy Suites, all near the Santa Clara Convention Center. 2005 Chicago: Tom Braxton is the new Chair of the 2005 Symposium steering committee. They have signed a contract with the headquarters hotel (Sheraton Chicago) and the Navy Pier (site of the technical program and exhibition). 2006 Location to be Determined: Mr. Ott advised that there are three proposals for locations for this symposium, including

Singapore, Portland and Dresden (Germany). The Board approved holding the 2006 EMC Symposium in Portland, Oregon from August 14-18, 2006. 2007 (50th Anniversary of the EMC Society): At the last meeting, Mr. Ott suggested that San Diego be considered as a location for this symposium. Fred Heather volunteered to look into the convention facilities in Las Vegas for the 2007 symposium and report back at the next meeting. The Board next approved including the workshop notes from the IEEE EMC Symposia in the CD ROM produced by each symposium. Janet O'Neil presented her report as EMCS Exhibitor Liaison. The revised policy which addressed the gray areas in the "points system" was sent out for review to an unofficial "exhibitor advisory committee" for comment/critique. Comments were received and incorporated. The revised policy was sent to IEEE's Vita

Feuerstein. She advised that IEEE's legal department does not need to review this. This material will soon be posted to the EMCS website along with the updated point allocation grid. Fred Heather has updated the points allocation grid for exhibitors and this is being reviewed now. Fred implemented the "roll over" policy that was required for the points in the year 2000. Future considerations for the Exhibitor Liaison include the points to be awarded in 2003 to exhibitors who exhibit in Boston and/or Tel Aviv and also the institutionalization of the program advertising/sponsorship component of each symposium committee. This latter effort is on going. Janet O'Neil next reported as Regional Conferences Coordinator. There are five tabletop shows planned to date from February to May 2002 in the greater

continued on page 47





### EMCABS

EMC Abstracts Osamu Fujiwara, Associate Editor

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

#### EMCAB COMMITTEE

Bob Hunter, Consultant r.d.bunter@ieee.org Sha Fei, EMC Research Section, Northern Jiatong University, Beijing, China emclab@center.njtu.edu.cn Ferdy Mayer, L.E.A.D., Maisons, Alfort France FerdyMayerLEADFrance@compuserve.com Maria Sabrina Sarto, Department of Electrical Engineering, University of Rome, Italy sarto@elettrica.ing.uniroma1.it

#### "How Can I Get a Copy of an Abstracted Article?"

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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**  REDUCTION OF CROSSTALK NOISE IN MODULAR JACK FOR HIGH-SPEED DIFFERENTIAL SIGNAL INTERCONNECTION

Nanhoom Kim+, Myunghee Sung+, Hyungsoo Kim+, Seungyong Baek+, Woonghwan Ryu+, Jeong-Gyun An++, and Joungho Kim+

+Terahertz Media and System Lab., Division of Electrical Engineering and Computer Science, Korean Advanced Institute of Science and Technology, Taejon 305-701, Korea ++Korea Telecommunication, Taejeon 305-811, Korea IEEE Transactions on Advanced Packaging, Vol. 24, No. 3, August 2001, pp. 260-267

Abstract: Much of the near-end-crosstalk in unshielded twisted-pair (UTP) cable is due to capacitive coupling in the standard CAT-5E modular jack where the conductors are not twisted. This paper describes the use of capacitors formed on the PCB of the modular jack to compensate the unbalanced capacitive crosstalk that occurs in the plug and insert of the modular jack. The design of the embedded capacitors is presented along with results of measurements. Both emissions immunity of the cable system are improved.

*Index terms*: Crosstalk noise, CAT-5E modular jack, differential signal transmission in unshielded twisted pair (UTP) cable, UTP cable terminations.

#### EMCABS: 02-5-2002

A NOVEL TECHNIQUE TO ACHIEVE UNITY POWER FACTOR AND FAST TRANSIENT RESPONSE IN AC-TO-DC CONVERTERS

Zaohong Yang+ and Paresh C. Sen++

+Tyco Electronics Power Systems, Mesquite, TX 75149 USA, ++ Department of Electrical and Computer Engineering, Queen's University, Kingston, ON K7L 3N6 Canada

IEEE Transactions on Power Electronics, Vol. 16, No. 6, November, 2001, pp. 764-775

Abstract: Power factor correction (PFC) circuits for converters frequently result in poor transient response. This circuit uses the diode current to develop a control signal for a voltage feedback loop to provide better transient response than similar PFC circuits. Simulation and experimental results confirm the improved performance of the converter which achieves a PF of 0.999 and a total harmonic distortion (THD) of 1.96%. Index terms: Switch mode rectifier, PFC converter, fast transient response.

#### EMCABS: 03-5-2002

INTERLABORATORY COMPARISON OF RADIATED EMISSION MEASUREMENTS USING A SPHERICAL DIPOLE RADIATOR

T.-W. Kang, Y.-C. Chung+, S.-H.Won+ and H.-T. Kim++ +Electromagnetic Compatibility Group, Division of Electromagnetic Metrology, Korea Research Institute of Standards and Science, PO Box 102, Yusong Taejon 305-600. Korea

++Department of Electrical Engineering, Pohang University of Science and Technology, Pohang, Kyungbuk 790-330, Korea

IEE Proceedings, SCIENCE, MEASUREMENT AND TECHNOLOGY, Vol. 148, Number 1, January 2001, pp. 35-40

Abstract: EMC laboratory accreditation requires inter-laboratory comparisons and the determination of the applicable measurement uncertainties. In the study reported, the uncertainties are determined for three parts: the transmitting part, the OATS itself, and the receiving part for twelve 10-meter sites. Table 2 summarizes the measurement uncertainties for a specific OATS. The analyses presented here indicate the major sources of uncertainty are the antenna factor calibration, mismatch, the site imperfections and the receiver performance.

*Index terms*: Radiated emission (RE) measurement uncertainty, inter-laboratory comparisons and accreditations, spherical dipole radiator (SDR) as reference emitter, sources of uncertainty in OATS.

EMCABS: 04-5-2002

SIMULATION OF NORMALIZED SITE ATTENUATION MEASUREMENT USING BICONI-LOG ANTENNAS Katsumi Fujii+, Atsuo Senga+, and Takashi Iwasaki+

+Dept. of Electronic Engineering, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu-shi, 182-8585 Japan The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 2, 2001, pp. 272-282.

Abstract: Normalized site attenuation (NSA) using a pair of biconi-log antennas is calculated in horizontal and vertical polarizations using the method of moment. The calculated results are confirmed by a comparison with experimental results. It is found that the radiation patterns, the positions of active antenna elements, the height dependency of antenna factors, and near field effects have influence on the difference in NSA between the measurement values in CISPR 16. From these results, it is concluded that correction for the biconi-log antennas is difficult in the NSA model.

*Index terms*: Biconi-log antennas, normalized site attenuation, moment method, antenna factor

#### EMCABS: 05-5-2002

SUPPRESSION OF FIELD ON POWER LINES INDUCED BY MEDIUM WAVE BROADCASTING WAVE BY LOAD-ING INDUCTANCE

Takayuki Sasamori+, Kunio Sawaya++, saburo Adachi+++, Yasuhito Murai++++, Massahiro Ogawa++++, Katsuhiro Iguchi+++++, and Mitsuo Nishiyama++++

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++++Tokyo Electric Power Co. Ltd., Kasukabe-shi, 344-0054 Japan

+++++Kandenko Co. Ltd., Tokyo, 108-8533 Japan

The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 2, 2001, pp. 283-290.

*Abstract*: It has been known hitherto that a very strong electromagnetic field is induced occasionally along aerial power lines located near a MF broadcasting station, and thus the construction and maintenance of power lines are sometimes endangered. In this paper the induced electric field strength near the power lines is analyzed by using the moment method, and is compared with the measured values. It is shown that the loading of appropriate inductance coils is very effective to suppress the induced electric field, and accordingly to avoid the danger induced.

Index terms: Moment method, power line, broadcasting wave, induced field, inductance

#### EMCABS: 06-5-2002

ELECTROMAGNETIC NOISE INDUCED ON UNSHIELD-ED TWISTED PAIR CABLE

Naoki Yamamoto+, Yoshifumi Shimoshio+, Hiroaki Koga+, and Masamitsu Tokuda++

+Dept. of Information and Communication Engineering Kumamoto National College of Technology, 2659-2 Suya, Nishigoshi-machi, Kikuchi-gun, Kumamoto-ken, 861-1102 Japan

++Dept. of Electrical Engineering, Kyushu Institute of Technology, 1-1 Sensui, Tobata-ku, Kitakyushu-shi, 804-8550 Japan

The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 3, 2001, pp. 551-561.

Abstract: This paper describes an inducing mechanism of the electromagnetic noise between a single inducing wire above ground and an unshielded twisted pair cable above ground. A twisted pair cable consists of winding wires on a wooden cylindrical bar. An inducing wire is placed near the twisted pair cable. A calculation method is derived using chain matrices for the induced voltage on the twisted pair cable. The paper shows the electromagnetic noise characteristics for a pitch, inducing wire position, cable height and terminal impedance theoretically and experimentally. It has confirmed that the experimental values agree well with the theoretical values.

*Index terms*: Twisted pair cable, induced voltage, pitch, inductive coupling, capacitive coupling.

#### EMCABS: 07-5-2002

AN IMMUNITY TESTING CELL USING A RECTANGU-LAR RESONATOR CONSISTING OF A CONDUCTING CHANNEL PLATE AND A CAPACITIVE GAP

Masahiro Saito+, Kenji Saegusa+, and Nozomu Hasebe+ +College of Science and Technology, Nihon University, Funabashi-shi, 274-8501 Japan

The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 7, 2001, pp. 1365-1372.

Abstract: In this paper, an immunity testing cell using a rectangular loop resonator is proposed. The resonator consists of a conducting channel plate and a capacitive gap set onto the ground plane. The cell has a size of 1/10 wavelength at the testing frequency. The electric and magnetic field distribution inside the cells of two types are analyzed by the FDTD method, and the results are compared with the experimental results. A close agreement is obtained between both results. The electric field strength inside the two types of cells is increased 31.2 dB and 14.3 dB, respectively, when compared with the field strength inside a TEM cell of the same size. The latter type of resonator yields an amplitude deviation of 2 dB inside a square area of 100 mm length. The resonator, when covered by a shield case for practical use, shows an increase in the electric field strength of 11.2 dB over the level of the same size TEM cell. The amplitude deviation remains the same as that of the resonator without the shield case.

Index terms: Resonator, immunity, TEM cell, FDTD method

#### EMCABS: 08-5-2002

### A SYSTEM DETECTING MALFUNCTION AREAS WITH ESD SIMULATOR FOR PCBS

Hiroshi Onomae+ and Yoji Nagasawa++

+Kagoshima Prefectural Institute of Inductrial Technology, Hayato-cho, Aire-gun, Kagoshima-ken, 899-5105 Japan

++Faculty of Engineering, Kagoshima University, Kagoshima-shi, 890-0065 Japan

The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 8, 2001, pp. 1514-1522.

Abstract: In order to evaluate immunity levels during an Electrostatic Discharge (ESD) test for electronic equipment, a high efficiency detecting system for malfunction areas on printed circuit boards (PCBs) was developed. A small conductor board connected to an ESD gun was faced close to a PCB, and then local electromagnetic waves were injected to the PCB. In order to search low immunity level areas efficiently, three conductor boards (9x9cm, 3x3cm and 1x1cm) were used stepwise to narrow the electromagnetic waves injection area. In this article, influence of the size of the conductor board, experimental confirmation for narrowing the range of electromagnetic waves by changing the conductor board size, and the validity of the method for real electronic equipment were described. The induced voltage wave was slightly varied in the waveform and the peak voltage level by the conductor board size when a micro-strip line was tested in the EUT. However, the induced voltage levels of each conductor board had a direct proportion to the set voltage of the ESD simulator. When the conducting line in the EUT overlapped to the conductor board, very strong coupling was observed compared with the other areas. In the proof test of the equipment on the market, several malfunction causes were made clear, and there was a correlation between these results and results of an international standard examination (IEC61000-4-2).

Index terms: ESD, immunity, printed circuit board, malfunction.

#### EMCABS: 09-5-2002

#### EFFECTIVENESS EVALUATION OF SHIELDING MATE-RIAL FOR REDUCING ELECTROMAGNETIC INTER-FERENCE OF CARDIAC PACEMAKER INDUCED BY PORTABLE INFORMATION TERMINALS

Jianqing Wang+, Takeshi Ohshima+ and Osamu Fujiwara+ +Dept. of Electrical and Computer Engineering, Nagoya Institute of Technology, Gokiso-cho, Showa-ku, Nagoya-shi, 466-8555 Japan

The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 10, 2001, pp. 1829-1833.

Abstract: A shielding technique is an effective means to protect implanted cardiac pacemaker users from portable information terminals, whereas no evaluation methods for this aim have been established. In this paper, and FDTD model for predicting EMI levels in the pacemakers was introduced for numerical shield effectiveness evaluation. In the model, the pacemaker acted as a receiving antenna and the open-voltage at the pacemaker connector proved to be an appropriate index for EMI level prediction. With this model the effectiveness of a magnetic rubber sheet and a resistive film were evaluated for reducing the EMI level in the pacemakers by portable information terminals. The results have shown that the resistive film has an excellent shielding effect so that even if the distance between the antenna and the human body is as close as 1.5 cm, the resistive film enables one to secure the effective distance longer than the 22 cm being specified in the guideline of the Pacemaker Committee of Japan.

*Index terms*: Portable information terminal, cardiac pacemaker, electromagnetic interference, shield, FDTD analysis.

#### EMCABS: 10-5-2002

ANALYSIS FOR THE SUPPRESSION OF COUPLING BETWEEN TWO MICROSTRIP LINES IN MICROWAVE AMPLIFIER MODULES BY LOSSY MAGNETIC MATERI-AL LOADING

Akihiko Saito+ and Atsuhiro Nishikata++

+Daido Steel Co. Ltd., 2-30 Daido-cho, Minami-ku, Nagoyashi, 457-8545 Japan

++Tokyo Institute of Technology, 2-12-1 O-okayama, Meguro-ku Tokyo, 152-8552 Japan

The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 10, 2001, pp. 1834-1840.

Abstract: In manufacturing the microwave amplifier module, the problem of coupling between input and output circuits inside the metal case is a serious topic. For the reduction of the coupling, putting a lossy magnetic composite material beneath the upper cover is known to be effective. To theoretically explain the decoupling mechanism by this method, we derived the coupling formula between two micro-strip lines in the metal case. For the formulation, the coupling model of the trilayer waveguide's fundamental mode and the micro-strip lines were introduced. For the experiment, the composite material sheet made from soft magnetic metal powder and rubber was applied. The numerical result based on the formula agreed well with the experimental result, which supported the validity of the formula.

*Index terms*: Microwave amplifier module, characteristics improvement, lossy magnetic material, micro-strip line, decoupling effect, EMC.

#### EMCABS: 11-5-2002

A METHOD TO REDUCE ELECTROMAGNETIC NOISE CAUSED BY ARC DISCHARGE OF AG-PD ELECTRICAL CONTACTS IN TERMS OF THERMAL FACTOR

Yasuo Ebara+, Hideaki Aone++, and Yoshiaki Nemoto++ +Deta Processing Center, Kyoto University, Yoshidahoncho, Sakyo-ku Kyoto-shi, 606-8501 Japan

++Graduate School of Information Sciences, Tohoku University, Aramaki-Aza-Aoba 05, Aoba-ku, Sendai-shi, 980-8579 Japan The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 12, 2001, pp. 2367-2373.

*Abstract*: The authors proposed the method to reduce electromagnetic noise (frequency 5 MHz) caused by arc discharge in Ag-Pd electrical contacts (circuit condition; DC48 V, 4 A). In opening electrodes, continuous burst noise is generated in the whole period of arc discharge, and high and low periods of noise level were observed in the noise waveform. First, it was confirmed that the duration of whole burst noise could be reduced by improving the thermal condition of the electrode using a large-diameter Ag electrode. Next, the authors analyzed statistically on relationship the division of periods by feature of arc voltage and noise waveforms for discussion on noise reduction. With these results, it was shown that the larger the diameter of Ag electrode was, the shorter the duration of highnoise level period became. In this paper, the authors showed a fundamental technique to reduce electromagnetic noise by the design of electrode in consideration of thermal factor.

Index terms: Electric contact, arc discharge, electromagnetic noise, electrode diameter, thermal factor.

#### EMCABS: 12-5-2002

CALCULATION OF ELECTRIC FAR-FIELD RADIATED FROM TRANSMISSION LINE ATTACHED TO A FER-RITE CORE ABOVE A GROUND PLANE

Tetsuya Maekawa+ and Osamu Fujiwara+

+Faculty of Engineering, Nagoya Institute of Technology, Nagoya-shi, 466-8555 Japan The Transactions of the Institute of Electronics, Information and Communication Engineers B, Vol. J84-B, No. 12, 2001, pp. 2374-2381.

Abstract: Magnetic materials are often used as a means to reduce the electromagnetic (EM) noise on the source side and also improve the immunity against the EM noise on the device side. Effects on the suppression of the EM noise from printed circuit board (PCB) traces and cables are being investigated. In this paper, we first derived a formula for calculating the farfield level radiated from a ferrite-core-attached transmissionline above a ground plane, and then numerically investigated the effect of the ferrite core attachment on the suppression of the radiated far-field. As a result, we found that the radiated field level is proportional to the spatial average value of the current distribution along the line, and its suppression directly contributes to the reduction of radiated field level. Moreover, we also found that the attachment of a ferrite core to the near-end of the line results in a suppression of the radiated field, while the attachment of ferrite core to the far-end of the line results in an increase of the radiated field.

Index terms: Transmission line, ferrite core, electric far-field, suppression effect. EMC

#### **Board of Directors Activities**

continued from page 43

areas of Seattle, Phoenix, Milwaukee, Detroit and Chicago. These have all been advertised in the Calendar Section of the EMCS Newsletter. The tabletop event considered for May 2002 with the Boston EMC Chapter will not take place for various reasons. She is working with the IEEE's Meeting Planning Services Department now to schedule a venue for a November 2002 tabletop show with the Sao Paulo,-Brazil Chapter. Carlos Sartori is spearheading this effort. The table-top/regional conferences are posted in a separate section of the EMC Society Newsletter Calendar section and conference chairmen have been advised in advance that they can place free ads in the Newsletter to promote their respective shows if they so desire. In conclusion, Mr. Ott advised that an MOU has been signed with the EMC Workshop in Rhodes, Greece, October 7-11, 2002.

#### **NEW BUSINESS**

Treasurer Warren Kesselman presented a draft financial policy dated January 24, 2002 for Board members to review. This policy addresses management of EMCS finances in accordance with IEEE policy/guidance. Travel expense subsidies for Board members who lose adequate financial resources to support continued participation on the Board of Directors are also reviewed in the policy.

Dick Ford discussed the EMCS Newsletter and editorial policies. The Board approved the formation of a subcommittee to 1) evaluate the current Society Newsletter editorial policy as concerns censoring letters-to-the-editor and other material provided for Newsletter publication, 2) make recommendations for an editorial review policy to assure the Newsletter is a forum for the exchange of ideas among Society members, and 3) make recommendations for an editorial review policy to assure that both elected and candidate BoD members have access to their Society constituents to report progress and provide commentary in areas that address their candidate platform commitments and issues related thereto. Kimball Williams, Elya Joffe, Dick Ford, and Len Carlson volunteered to be members of this committee. President Hubing asked Kimball Williams to chair this committee. The committee should be providing a report at the next Board meeting.

Andy Drozd discussed the FIRST Robotics Competition, which is a team building, engineering project. The website is www.usfirst.org. The Board approved providing a \$1000 stipend from the Membership Services budget to fund this effort.

#### **OLD BUSINESS**

Dick Ford advised that he is resigning as chair of the ad hoc committee that was addressing disassociating the EMC Society from the IEEE. President Hubing then advised that this committee is dissolved.

#### **ACTION ITEM REVIEW**

President-elect Todd Hubing reviewed the action items discussed during the meeting.

#### NEXT MEETING

The next meeting of the EMCS Board of Directors will be on Friday, May 31 in Boston, Massachusetts at the 2003 IEEE National Symposium on EMC host hotel. Possible locations for the February 2003 Board meeting were discussed. There being no further business, the meeting then adjourned at 4:00 pm.

Submitted by:

Janet O'Neil Secretary, EMC Society Board of Directors

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play on accuracy and signal stability is described.

The fourth part of the book, chapters 11 and 12, examines the effect transmission lines and measurement connections have on the measurement accuracy of spectrum analyzer measurements. Those with limited knowledge often ignore these effects and this can result in erroneous measurement values. Basic transmission line theory is reviewed. Also presented are the fundamental concepts of characteristic impedance, reflection coefficient, return loss, standing wave ratio and how these items are related. The role that transmission line characteristics play in measurement accuracy is quantified and specific examples are given. The loading effect of measurement connections to the unit under test is described

for some common connection devices such as high impedance probes, attenuating probes, high impedance inputs, characteristic impedance inputs and input connectors. Some rules of thumb are presented along with some of the common limitations of each connection type.

Two port network theory, network analyzers, transmission measurements and reflection measurements are covered in the fifth part of the book in chapters 13 to 16. The concept of a transfer function applied to a two-port network is developed prior to the presentation of the more common network parameters. The network parameters described are Z, admittance, hybrid, transmission and scattering. The basic concept of a network analyzer is illustrated from the simplistic model of an oscilloscope with a sweep generator to the more sophisticated spectrum analyzer with a tracking generator configuration. The S-parameter test set is described. The minimum

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sweep speed required for accurate network analyzer measurements is described. Advanced network analyzer functions such as amplitude sweep, gain compression point, and frequency offset are described.

The chapter on transmission measurements illustrates the following concepts: insertion loss and gain, phase error, group delay, line stretch, measurement plane, normalization, and how they must be used for accurate measurements.

Reflection measurements, as described in chapter 16, are the measure of the return loss or reflection coefficient of a two-port network. The concepts of directivity, coupling factor, directional coupler error model, error correction, twoterm error correction, and three-term error correction are explained. The use of directional couplers and how the directivity specification limits the accuracy and limits the overall dynamic range of the measurement are discussed.

The final part of the book, chapter 17, covers analyzer performance and specifications. This chapter discusses how the instrument manufacturer will describe performance. This insight will aid the EMC engineer in selecting an appropriate instrument for a particular measurement type.

#### **Closing Comments**

I would recommend this book to anyone that performs spectrum and network measurements. The material presented in this book is easy to understand for those new to spectrum and network measurements. It is also useful to those already familiar with these measurements as it can help one to perform more accurate measurements by understanding how the instrument works, limitations of the measurement technique, limitations of the instrument, relating theory to actual measurements and understanding the potential impairments to accurate measurements and how to avoid them.

Ray Adams, of Hughes Space and Communications, is currently Chairman of the Los Angeles Chapter of the IEEE EMC Society. He may be reached at ray.adams@bsc.com.

EMC

# Calendar

## EMC Related Conferences & Symposia

#### 2002

#### June 25-28

16th International Wroclaw Symposium and Exhibition on EMC Wroclaw, Poland Professor W. Moron Phone: +4871-348-3051 Fax: +4971-372-8878 E-mail: emc@il.wroc.pl http://www.emc.wroc.pl

#### September 9-13

Organized by the Associazione Elettrotecnica ed Elettronica Italiana, the University of Rome "La Sapienza", the University of L'Aquila, the University of Naples "Federico II" EMC Europe 2002 Sorrento, Italy Massimo Iandolo Phone: +39.02.77790-218/230 Fax: +39.02.798817 E-mail: emceurope2002@aei.it

#### October 7-11

Technically Co-Sponsored by the IEEE EMC Society 2nd International Workshop on "Biological Effects of Electromagnetic Fields" Rhodes, Greece Ms. Kety Apostolou Workshop Secretary Conf2002@imm.demokritos.gr bttp://imm.ariadne-t.gr/bioeffects bttp://www.uoi.gr/conf\_sem/bioeffects

November 3-8 AMTA 2002: 24th Annual Meeting and Symposium Sponsored by the Antenna Measurement Techniques Association (AMTA) Cleveland, OH Sally Kronk, 614.888.2700 x218 Sally.kronk@lintek.aeroflex.com http://www.amta.org

### EMCS Cooperating Symposia

U.K.: Biannually, even years, in September

Zurich: Biannually, odd years, in February

Wroclaw: Biannually, even years, in June

#### **EMCS Symposia Schedule**

2002 August 19-23 Minneapolis/St. Paul Hyatt Regency, Minneapolis Dan Hoolihan 651.213.0966 E-Mail: d.hoolihan@ieee.org

2003 May 11-16 (International IEEE) NOTE: Change location from Tel-Aviv, Israel to Istanbul, Turkey Elya Joffe Fax: 972.9.765.7065

E-Mail: emc2003@ortra.co.il

2003 August 18-22 Boston, MA Sheraton Boston Jon Curtis 978.486.8880

2004 August 16-20 Santa Clara, CA Franz Gisin 408.495.3783

2005 August 8-12 Chicago, IL Tom Braxton 630.759.8674

### IEEE EMC Society Board of Directors Meetings

(For information on all meetings, contact Janet O'Neil, 425.868.2558)

August 18 and 22, 2002 Minneapolis, Minnesota (in conjunction with the IEEE EMC Symposium)

November 24, 2002 Sao Paulo, Brazil

#### IEEE EMC Chapter Colloquium and Exhibition "Table-Top Shows"

There are no table-top shows scheduled for the late spring and summer months as the EMC Chapters will take a break for the summer and support the 2002 IEEE International Symposium on EMC in Minnesota from August 19-23. If you would like to add your name to the list of exhibitors to receive direct announcements in advance of these upcoming tabletop shows, please send an e-mail to j.n.oneil@ieee.org.



#### **ADVERTISER'S INDEX**

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### Visit the IEEE Virtual Museum

*Piscataway, NJ* — Thomas Edison didn't invent the light bulb, so why does everyone think he did? What was the first computer? How did the patterns in a Utah cornfield lead to the development of TV? What is the "X" in an X-ray? Why are Alvin and the Chipmunks part of a museum about technology?

The answers to these questions and more are found in the new IEEE Virtual Museum launched at http://www.ieee.org/museum. Designed for educators, pre-college students, and the general public, the virtual museum debuted with two exhibits containing audio and video clips, and interactive features: Socket to Me! How Electricity Came to Be and The Beat Goes On: How Sounds are Recorded and Played.

Three more exhibits are in production and are scheduled for release by third quarter 2002. These will explore the different applications of microwaves, the works of Thomas Edison, and contributions women have made to electrical and information technologies.

The IEEE Virtual Museum explores the global social impact of electrical and information sciences and technologies and demonstrates the relevance of engineering and engineers to society. It is supported by the IEEE Foundation, the IEEE Life Members, and the Trustees of the IEEE History Center.

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