President’s Message

Joe Butler – President, EMC Society

A New Millennium

In this first edition of the newsletter for new millennium, I am pleased to introduce myself as your new President. I look forward to serving the Society in this position for the next two years. As a way of introduction, I’d like to provide some insight as to my working relationship with the current Society officers who form what is referred to as the Executive Committee (EXCOM) of the EMC Society Board of Directors. Although I have participated in standards development for many different entities, I do not have quite the international exposure in the standards development area that perhaps Don Heirman, our VP for Standards, enjoys. However, I have actually visited his office where I have seen his one million linear feet of file storage! I have also visited our VP for Membership, Todd Hubing, in Rolla, Missouri, and I know where his barbershop is located. I now serve alongside Kimball Williams, our VP for Technical Services, as a member of the Board of Directors of the National Association of Radio and Telecommunications Engineers (NARTE). Henry Ott, serving in the recently created position of VP for

Conferences, once had me make copies for him of a technical presentation he was giving to the Central New England EMC Chapter. I serve this chapter as chapter angel, sometime meeting host, and previously as chairman. Our VP for Communications, Len Carlson, with his years of experience on both our Board of Directors as well as on the IEEE Technical Activities Board (TAB), and I, have spent many hours together after BOD meetings debating issues affecting EMC Society governance. Warren Kesselman, our Treasurer, not only e-mails me weekly on a host of issues, but even takes the time to send me a Christmas card. Bill Gjertson, past President and current IEEE Division IV Director, leaves our EXCOM this year, but not without leaving fond memories of the Seattle symposium he chaired. My 10-year-old daughter had a great time in Seattle! Finally, the Society’s Secretary and newsletter editor, Janet O’Neil, and I have collaborated on several marketing ideas for the many one-day EMC technical conferences that she organizes. In case you didn’t know, I am the principal architect of where to locate the food and beverage table in relation to the exhibits.

In short, I think I have already established a good working relationship with the officials of the Society and believe I have their full support. I also especially acknowledge our outgoing President Dan Hoolihan for not only serving the Society well but for allowing me to be his confidant and sounding board on Society issues during his tenure as President these past two years. I am fortunate that Dan will remain on the Executive Committee for another year as past President.

Dan has certainly left his mark on our Society with his many accomplishments. Among these is the fostering of increased activities of the Board of Directors in international activities. During his term, the Board held one of its annual meetings at international locales, i.e., Rome in September 1998 and Tokyo in May 1999. As this newsletter goes to press, the board is in the process of drafting potential Memoranda of Understanding (MOUs) to detail our involvement in: IEEE EMC International

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Letter from the Editor

Janet O’Neil – Editor, EMC Society Newsletter

A New Look for the New Year!

With the advent of the year 2000, it seemed like an appropriate time to freshen up the look of the EMC Society Newsletter. In case you haven't noticed, we've revised the format of the Newsletter considerably. Most notably, the text is presented in three columns now, rather than in two. This change is significant as now more text can be printed on each page. (I trust you don't need to use a magnifying glass to read it though!) The resulting savings for printing and mailing fewer pages were considerable. The savings were applied to providing color now throughout the issue – in all photos as well as graphs for the practical papers. I hope you enjoy the new, fresh look of the EMC Society Newsletter. Your comments are most welcome. Please send your comments to j.n.oneil@ieee.org or call me at 425-868-2558. EMC

Eager to begin their terms as new members of the EMC Society Board of Directors in the year 2000 are Jose Perini and Fred Heather (from left) and Larry Cohen (far right) with Joe Butler, newly elected President of the EMC Society. Not pictured are newly elected Board members Andy Drozd, Moto Kanda and Andrew Podgorski. For more information on the newly elected Board members, see page 15.

Don Heirman, Vice-President of Standards, received this prestigious award from the IEEE to recognize his 17 years of Chairmanship of the Standards Committee. Outgoing EMC Society President Dan Hoolihan presented the award to Mr. Heirman at the November Board of Directors meeting. The EMC Society is one of the most active IEEE Societies in the Standards Association, largely due to Mr. Heirman's leadership. For more information on the Board of Directors activities at the November meeting, see page 34.

Matt Chaney of Hargrove Exhibitor Services conducted a tour of the Hargrove facilities in Landover, Maryland for the 2000 IEEE International Symposium on EMC committee members. Enjoying the tour are (L-R) Matt Chaney, Penny Caran, Shelley Grandy and Bill Duff (Committee Chair). For more information on the 2000 EMC Symposium, please see page 33.
President's Message
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symposia in Tel Aviv, Israel (May 2003),
Montreal, Canada (August 2001) and
continuing technical cooperation for
EMC symposia in Zurich, Switzerland
(February 2001), Wroclaw, Poland
(June 2000), and Brugge, Belgium
(September 2000). Technical coopera­
tion is also under consideration with
several other international EMC sym­
posia. During my tenure as President,
I hope to continue to foster this increased
globalization of our Society.

This past November, the Board of
Directors met in Washington, DC, site
of the upcoming EMC symposium. At
this meeting, with the support of Dan
Hoolihan, I orchestrated a long range
planning session with the help of sever­
al of my associates on the Board. The
session focussed on four key issues:
globalization, organization and gover­
nance of the Society, membership, and
communication. The results of our
efforts were the identification of several
initiatives, both short and long term,
which will provide direction to the
Board. As we review these ideas at our
next Board meeting in Phoenix, we
will begin to define tasks and identify
resources to address the relevant issues.
Globalization in all its composite parts
will be a main thrust. Membership
development, chapter development, and
Board of Director representation from
IEEE Regions 7, 8, 9, and 10, i.e., non­
United States, will be focus areas.

As mentioned by Dan Hoolihan in
the last EMC Newsletter, the five-year
review of the EMC Society conducted
by the IEEE during this past
November’s Technical Activities Board
(TAB) meetings was very
complimentary to us. Among the reviewer
comments was the fact that they found it
interesting that the incoming president
would be the chair of the long range
planning activity and thus ultimately
responsible for following through on
the implementation of the plans. Most
Societies have a separate long-range
planning chair, or enlist the services of
the past president. Using my interest
in golf as a metaphor, could I have mis­
managed my handicap negotiation
even before I've teed off? I hope not,
and I really don’t think so - besides I
have strong support for the issues from
the Board. Better still, the Board devel­
op the ideas!

I start my tenure with the financial
health of the Society at an all time
high. Our current net worth is approxi­
mately $950K. The projected surplus
from the Seattle symposium is $150K
and for Washington, DC is $117K.
The budget for 2000 shows a projected
$148K surplus. We are clearly in good
shape financially to address new initia­
tives to foster our growth.

Looking ahead, the Board of
Directors will meet in Phoenix, Arizona
on March 24th, Montreal, Canada on
June 9th, Washington, DC on August
20th and 24th, and finally in Tampa,
Florida on November 16th. I look for­
toward to meeting representatives of the
local chapters at these locations as well
as at other EMC symposia worldwide that
I hope to attend. If you have any
questions or comments regarding the
Society's activities, please feel to stop
and introduce yourself to me as I wander
around the world, or call, fax, or e-mail
me at the Chomerics Division of Parker
Hannifin, 781-939-4267, 781-938-
5071 (fax), jbutler@parker.com.
Chapter Chatter

Todd Hubing, Associate Editor

Doublemint will probably be contacting Don Heirman and me after this year's symposium in Washington D.C. Have you seen those commercials that feature twins doing fun things while chewing Doublemint gum? After I get my Don Heirman haircut, they'll probably want to make a commercial showing Don and me playing golf, running on the beach or doing ESD tests.

As you may have heard, I volunteered to get my hair cut like Don Heirman's if at least $10,000 is donated to the President's Memorial Award fund before the August EMC symposium. The President's Memorial Award is the Society's highest award. Each year, it honors a prominent deceased member of the EMC Society by providing scholarship money to support the education of a promising young student studying EMC. This award is supported entirely by contributions. Without the help of people like you and me, this important program will cease to exist.

I've received lots of email from people telling me they plan to contribute. Even people I've never met tell me they can't wait to see me with a Don Heirman haircut. The only person who's expressed any reservations at all is my wife. She thinks Don's hair looks pretty good on him, but she's quick to point out that Don has more hair to work with. Ever since my hairline started receding, I've been using the longer hairs in the middle of my head to hide the hairless areas on either side. With a Don Heirman haircut, there's no hiding anything. Nevertheless, I'm sure that when my wife sees me with my new haircut, the first words out of her mouth will be, "It looks great, Dear. I love it." I know this because over the years I've learned that this is the only acceptable way to react when your spouse comes home with a new hairstyle.

Speaking of the August symposium, I've noticed that exhibitors at the symposium often give away small items with company logos. It occurred to me recently that hats would be really neat give-away items. Don't you agree? I know that if I received a hat at the EMC symposium, I would want to wear it almost everywhere I went. This would be particularly true if it were a hat from a company that contributed to the President's Memorial Award Fund. Maybe the hats could say, "I support the President's Memorial Award!" Everyone would want a hat like that. Especially people who need to keep the Washington sun off the tops of their heads. Don and I could wear our hats when we make the Doublemint commercial. I hope I can learn to do an ESD test and chew gum at the same time.

Beijing

Dr. Li Shufang reports that Prof. Gao Yougang, chair of the Beijing chapter, invited Mr. Elya Joffe, a Distinguished Lecturer of the IEEE EMC Society, to the Beijing University of Posts & Telecommunications. Mr. Joffe gave a brilliant two-part presentation on November 4th and 5th. The first part was titled, "Grounding Design in Printed Circuit Boards." Mr. Joffe introduced the basics of grounding design followed by many practical application examples. The second part was titled, "High Speed Signal Traces as Transmission Lines in PCBs." First Mr. Joffe proposed the idea of viewing power distribution networks as signal return paths. Then he discussed transmission line effects on PCBs and examples of typical transmission lines on PCBs as well as methods of controlling reflections. 52 researchers from universities, research institutes, and industries such as Beijing Univ. of Posts & Telecom., China Academy of Science, Shanghai Bell Telecommunication Company, Zhong-Xing Company, Hua-Wei Company among others were present. Over 20 IEEE members attended the research meeting. Mr. Joffe’s lecture was very much appreciated by all of those in attendance. When he finished his presentation, the audience burst into thunderous applause. After the presentation, a heated discussion took place to the benefit of everyone involved. Many of those in attendance suggested that such wonderful presentations sponsored by the IEEE EMC Society should be held more frequently.

Atlanta

David Dennis, chair of the Atlanta chapter, reports that they had a meeting on December 2, 1999. Their guest speaker was Mike Hopkins of KeyTek Instruments, and he delivered a presentation entitled “IEC Standards Update - October 1999: Changes to IEC Standards on ESD, EFT, Surge, PQF, RF Immunity and Emissions.” Mike gave a basic overview of the EMC standards relating to these topics and he held an interactive discussion with the meeting attendees on the possible changes or revisions to the standards. Through Mike's firsthand involvement with the IEC Working Group responsible for development of basic EMC standards, he was able to provide valuable insight into what the future holds for these requirements and procedures.
Central New England
John Clarke, chair of the Central New England chapter, reports that three meetings were held in the fall of 1999. The September meeting was a joint meeting with the North East Product Safety Society. Kefeng Liu, of EMC Test Systems in Austin, Texas, spoke on the subject of “EMC Chamber Design and Measurement.” The presentation addressed fundamental parameters involved in designing a large indoor shielded EMC chamber capable of making 10-meter radiated EMI tests. Key components such as RF absorbers and ground plane properties were discussed. Measurement accuracy of various RF instruments used was also addressed. Precision measurement of antenna factors and chamber Normalized Site Attenuation were covered. The use of various broadband antennas, Geometry Specific Antenna Factors and Free-Space Antenna Factors were also discussed. There were 25 people in attendance.

The featured speaker at the November meeting was Dr. Mirko D. Matejic of the Foxboro Company in Foxboro, Massachusetts. Dr. Matejic gave a presentation titled, “EMC Test Laboratory Assessment.” On behalf of NVLAP and A2LA, Dr. Matejic has assessed over 100 EMC test laboratories. He discussed typical laboratories’ strengths and deficiencies identified during on-site assessments. A credible way to determine EMC product compliance with applicable standards is to test the product at a competent accredited laboratory. All deficiencies must be well documented and referenced to either IEC/ISO Guide 25 or relevant technical specifications. If all deficiencies are resolved, the assessor recommends laboratory accreditation.

The topic of the December meeting was “Antenna Behavior, Design and Use.” The speaker was Colin E. Brench of Compaq Computer Corporation in Maynard, Massachusetts. EMC Corporation staff conducted a tour of their new 10-meter semi-anechoic chamber. The facility tour was arranged by Boris Shusterman, a Principal Compliance Engineer at EMC Corp. This was followed by the technical presentation. Many of the differences between test facilities can be traced to antenna issues. Understanding antenna behavior during real measurements, site attenuation measurements and calibration will largely explain discrepancies that result. The speaker discussed these issues and closed by describing the design of an antenna prepared for ANSI. There were 37 people in attendance at this meeting.

Chicago
Derek Walton reports that the Chicago chapter continues to be busy. In December, 3-Com in Rolling Meadows was the venue for a presentation on signal integrity (SI) issues. Ray Lethental of 3-Com was the presenter, and Viewlogic provided an assortment of EMC/SI tools so that attendees could familiarize themselves with what can be simulated.

Election of the Chapter officers also took place at the December meeting. Each of the existing officers were reinstated, with the addition of three new positions. Clifford Kraft of Lucent Technologies has joined the program planning team while Carla Robinson of 3-Com and Frank Krozel of Electronic Instrument Associates have formed a new publicity team to help spread the news about our Chapter program.

The Chapter now has a formal website that is maintained by Frank Krozel. The location is: http://www.eewb.ieee.org/soc/emc/chicago/. Feel free to browse the site, and perhaps join us at an upcoming event. This is also where you will find the latest information on our Mini-Symposium scheduled for May 22-23, 2000.

Sufficient interest was generated at the Chapter meeting discussing the ACIL inter-laboratory comparison that the Chapter has decided to perform its own version using a comb generator. Several test facilities have offered to perform a test and share the results. If any Chapter would like to perform a similar activity and share their data, please alert Clifford Kraft or Derek Walton. Contact information is on the chapter website.

Dallas
(Thanks to Bill Paschetag for submitting the following report on the activities of the Dallas chapter.)

The October meeting of the Dallas EMC Society was held on October 19th at KTL, Lewisville, Texas. The guest speaker was John Olivant, Vice President of Technical Services at KTL, who spoke on “Telecom Regulatory and Testing Issues.” Attendees were also given a tour of the KTL test facilities. There were 26 guests in attendance (12 IEEE members).

The November meeting of the Dallas EMC Society was held on November 15th, at Abbott Labs, Irving, Texas. The guest speaker was distinguished lecturer Don Heirman, Associate Director of the University of Oklahoma EMC Wireless Center, speaking on “Happenings at the University Center for the Study of Wireless EMC.” Attendees were given a tour of the Abbott EMC test facilities. There were 27 guests in attendance (12 IEEE members). Nomination of Officers for 2000-2001 for the Dallas EMC Society chapter was held during the November meeting. Gary Shimko (Marconi Communications) was nominated for Chair, Bob Queen (Abbott Laboratories) was nominated for Vice-Chair and Bill Paschetag (SpectraPoint Wireless) was nominated for Secretary-Treasurer.

No technical meeting of the Dallas EMC Society was held in December, but instead a holiday social was held on December 21st at Enchilada’s Restaurant in Dallas. Twelve people, including five guests, attended the social.

Germany
Dr. Frank Gronwald reports that the German EMC chapter encountered a very special highlight when the "International Symposium on EMC" was held on October 5-7 in Magdeburg, Germany. About 150 participants joined the meeting and listened to 75 presentations, related to 10 main topics and covering most aspects of EMC. It was a scientific treat for the German chapter to
have international experts from the U.S., France, Sweden, and Russia present, among them Dr. C.E. Baum and Dr. F. Tesche. They stimulated a host of challenging discussions. In addition to the talks, two workshops on “European EMC Standards” and “EMC Threats” were conducted. In particular, the last topic sparked curiosity and the interest of the local TV and national press, which reported on the meeting.

The strength of the EMC community was clearly demonstrated when a historic experiment of Otto-von-Guericke (1602-1686) was performed during the symposium banquet. 14 EMC experts were required to separate two evacuated Magdeburgian half spheres of 20-cm diameter, tightly held to each other by the surrounding air pressure.

The organization of the symposium had been put into the hands of Professors Juergen Nitsch and Guenter Wollenberg who just established the Institute for Fundamental Electrical Engineering and EMC at the University Magdeburg. Everybody agreed that they succeeded in not only assembling a meeting of high scientific value, but also in providing an enjoyable and relaxing atmosphere.

The 6th meeting of the German IEEE EMC Chapter took place on November 17 in Frankfurt. The main topics were the reports from the chair, from the “Numerical Field Calculation” Group and from the “Biological Effects” Group. The chairman, Professor Garbe, thanked the chapter members for their last year activities and presentations and congratulated Professor ter Haseborg on his appointment as the first Fellow in the German EMC Society. Altogether, Professor Garbe reported about 15 meetings in Berlin, Braunschweig, Hamburg and Magdeburg, which were organized by German IEEE members. He announced a presentation of Mr. Joffe dealing with “Transients and Electrical Overstress Protection in Electronic Systems.” In November 1999, there was a special issue of the Transactions on EMC, organized by the German Chapter.

The German EMC Society was represented on two executive committee meetings and one chairman meeting by Professor Garbe. Mr. Mrozynski reported for the working group on “Numerical Field Calculation” which created 15 configurations and problems to benchmark different calculation tools. A complete list can be downloaded at http://www-tet.uni-paderborn.de. This benchmark catalog will also be part of a workshop at the IEEE EMC symposium in Washington, DC this year. The working group on “Biological Effects” was renamed “Human Security in Fields” to underline the electro-technical aspect. A new suggestion was the creation of a working group on “EMC and Defense-Devices” to help with the scientific interchange of information between civil and military developments. Professor Garbe reported also about a cooperation between the VDE and IEEE.

Korea

The Korea Chapter of the IEEE EMC Society hosted a workshop and exhibition called “EMC Korea '99” with the cooperation of the Korea Electromagnetic Engineering Society (KEES). The event was held at the Seoul Education and Culture Center on
Korea Chapter Chairman, Prof. Dong-Chul Park and speaker Mark Montrose pause in the exhibition hall to visit with Dr. Kyung-Chan Min at EMC Korea '99, hosted by the Korea EMC Chapter.

September 30 and October 1, 1999. 140 attendees and 17 exhibitors attended the workshop. Mr. Mark Montrose, Montrose Compliance Service, Inc. (USA) and Prof. Shuichi Nitta, Tokyo University of Agriculture and Technology in Japan opened the workshop with two one-hour invited talks. The topics of their presentations were “EMI and PCB Fundamental Concepts and Design Techniques” and “The Practice and the Problems of Shielding by Metal Plates,” respectively. The invited talks were chaired by Korea Chapter Chair, Prof. Dong-Chul Park and another 11 talks were successively presented by Korean EMC engineers and professors during the two days. The talks were organized to introduce practical EMC techniques to engineers and students. Topics included “PCB design for EMC compliance,” “EMC considerations on semiconductor devices,” “EMI suppression experiences in home-appliance products,” “Electromagnetic shielding and absorbing techniques,” and “Regulations on EM hazards.” A technical exhibition was also organized for the first time in Korea in the EMC area, and 17 booths were attended successfully. The Korea Chapter plans to hold this kind of technical workshop and exhibition annually.

Melbourne

The inaugural meeting of the Melbourne, Florida chapter was held on 2 December 1999. The chapter was officially formed on 5 October 1999, and will serve EMC engineers working in Central Florida. The meeting took place at the Indian River Brewing Company facilities in Melbourne, where the 18 attendees enjoyed pizza and cold drinks.

After Chapter Chair Bruce Crain welcomed everyone to the chapter and meeting, Ed Kirchner of Northrop Grumman presented the paper, “An EMC Design Approach for Integrating COTS Equipment into an Existing Military Platform.” This paper, which was also given at the 1999 IEEE International Symposium on EMC in Seattle, described Northrop Grumman’s experience in integrating COTS computing equipment into the E-8C Joint STARS aircraft. The paper generated an interesting group discussion about the growing use of COTS equipment and the various EMC challenges that result.

Attendees at this inaugural meeting were enthusiastic about the formation of the Melbourne chapter and we look forward to reporting our activities and plans in upcoming issues of “Chapter Chatter!”

Los Angeles

(Thanks to Ray Adams, chair of the Los Angeles chapter, for submitting the following report.)

Looking back on 1999, the Los Angeles Chapter had a good year but not as good as in years past. This can be attributed to changes at our old meeting facility. The officers of the LA chapter looked high and low in the area for an affordable and acceptable new meeting location. We had two meetings at the Ramada Inn Hawthorne prior to the summer break and two after the break at our new location WEMS Electronics. The Ramada was no bargain and Vice-Chair Kaniya Mahendra and WEMS’ John O’Brien came up with the WEMS location for our next two meetings. We had the following speakers in Y2K-1:

In April, Bill Whitlock of Jensen Transformers spoke on “Practical Applications of ‘Grounding’ Home Theater and Stereo Systems.” This was a pleasant change from the usual “grounding” talks. It was actually something we could use at home! Our chapter has looked at “grounding” from many different perspectives over the years: spacecraft, equipment, facility, lightning, and safety. This was new and appreciated territory to cover.

In March, Dr. Jason Chai of the Aerospace Corporation spoke on “A Lightning Data Survey and Parameters in Retest Criteria for Spacecraft.” Dr. Chai’s presentation was an analysis of the various re-test criteria such as distance from launch site to lightning strike that had been used by three contractors. Depending upon the distance/amplitude criteria set by the contractor, they could unknowingly penalize themselves thus delaying their preparations for launch.

In September, Dr. Scott Bennett gave a presentation titled, “The Basic Source of EMI — And The Key to EMC.” Dr. Bennett used basic trigonometry and algebra to visualize the complex integrations required in electromagnetics.

The October meeting featured Dr. Richard Briet, who spoke on “The Verification and Validation of the Theory of Lightning Propagation and Lightning Protection: What it Means to the User and to the Supplier of Lightning Protection Systems.” Dr. Briet’s presentation was very interesting as it questioned the validity of current lightning protection practices. He had some real interesting photos of lightning strikes that seemingly defy physics or explanation.

Now that we have a stable meeting location, we are in the early stages of planning a full lineup of speakers for 2000. We have Steve Jensen coming to talk to us in January on "EMC War Stories: Tales From The Trenches" and have several others tentatively lined up for subsequent meetings. Y2K has the potential to be an excellent year for the Los Angeles Chapter.
Montreal
Benoit Nadeau, chair of the Montreal chapter reports that they had two meetings this past fall. The October meeting featured a talk on "Unusual and Hidden Forms of Electrostatic Discharge" by Mr. Douglas C. Smith of Auspex Systems. The November meeting featured a presentation by Dr. Kok-Swung Tan of Health Canada. The topic of this presentation was "Susceptibility of Medical Devices to Electromagnetic Interference." Both presentations were very informative and well appreciated by the people who attended these meetings.

On another subject, the committee for organizing the 2001 IEEE EMC Symposium is busily preparing for the upcoming symposium in Montreal. The real work will begin following the Washington, DC Symposium this August.

Nanjing
Prof. Wen Xun Zhang, chair of Nanjing chapter, reports that the Nanjing chapter successfully completed its schedule of technical activities in 1999. A total of 29 technical events were organized at Nanjing and Shanghai.

Two IEEE Distinguished Lecturer Programs were sponsored by the Nanjing chapter and also the Beijing chapter. Dr. Mark Gouker of MIT gave three presentations in May-June; Prof. Nader Engheta of the University of Pennsylvania also gave presentations on three topics in October and November. In addition, four experts from abroad were invited individually. Prof. O.P. Gandhi (USA) spoke on the topic of bioelectromagnetics. Dr. Y. H. Gu (USA) gave an interesting lecture on smart antennas. Dr. M. Zhang (Germany) spoke to the chapter on EM simulators. Dr. Z. X. Shen (Singapore) gave a presentation on modal expansion techniques. There was a pronounced academic environment present during the discussion between these speakers and the Chinese members and colleagues in attendance.

The chapter also co-sponsored a National Symposium on Antennas and chaired its technical program committee. The proceedings published included 310 pages (66 papers). Two local workshops were held on prediction models for mobile propagation and EM software, respectively. Ten normal lectures on a wide range of topics were also arranged during 1999.

The accumulated attendance for the above activities was over 1600 (~1.5 times of that in 1998). About one third of the attendees were IEEE members. In addition to the technical meetings, a "Chapter Members Meeting" and sightseeing program were held for the membership in Shanghai. The number of chapter members has increased from 95 to over 100 during the past year.

Oregon and SW Washington
The Oregon and SW Washington EMC Chapter closed 1999 with a Christmas social. This was held at the "Amadeus at the Fernwood" restaurant. (See pictures.) The event was held at this former mansion atop a hill overlooking the Willamette Valley: the perfect setting for socializing and getting away from those ever-present RF fields!

In October, Doug Smith turned the "static" subject of ESD into an electrifying educational and comedic adventure. Doug filled the house with over 40 people in attendance. The 12 large pizzas were just enough!

Henry Benitez, chapter chairman and also EMCS BoD Awards Chairman, took advantage of the occasion to present Doug with a belated award for his contributions to experiments and demonstrations at past EMC symposiums. Also in attendance was Daryl Gerke, Phoenix chapter officer, who received an award for his contributions to the success of the '99 Arizona EMC Colloquium.

Mr. Ed Blankenship of Hewlett-Packard was a last minute guest speaker for our November chapter meeting. Ed did a fabulous job presenting his topic "Lloyd’s Mirror - Interferometer and Comparison to Free Space, a.k.a. OATS."

The Oregon and SW Washington EMC Chapter has been committed to providing quality activities to its membership each and every month. With this goal in mind, the planned '00 program is just as impressive. Planned are talks from Mike Windler on C63.4 antenna and site calibration, Werner Schaefer on measurement instrumentation, Maqsood Nicole Lockart-Rayner, the renowned guest pianist, provided entertainment at the Oregon and SW Washington Chapter Holiday Social. Great job Nicole!

Daryl Gerke (L) is presented with an award for his contributions to the success of the 1999 Phoenix Chapter Colloquium by Oregon and SW Washington Chapter Chairman and EMC Society Awards Chairman Henry Benitez.
Mohl on the effects of lightning on equipment and humans, Elya Joffe on EMC troubleshooting, and Doug Smith's famous workshop on building high frequency probes. Continued speaker coordination with the Seattle chapter has been very rewarding.

Happy New Millennium!

Phoenix

Harry Gaul, secretary/treasurer of the Phoenix chapter reports that their last meeting was held on November 4, 1999. Charlie Swiontek of Power-One (Camarillo, CA) entertained the audience with a well-received talk on "How to Meet the EC Harmonic Requirements." Most electronic systems create a certain amount of harmonic distortion to the AC powerlines. This harmonic distortion may be small on a product by product basis, but these harmonic effects become a very real problem when the entire AC power grid is considered.

Charlie discussed the new legislation in Europe which will enforce the requirements of the EN61000-3-2 as of January 1, 2001, wherein all new electronic products sold in Europe with power requirements greater than 65 watts will be required to meet a new power line quality standard.

There is some confusion in the U.S. concerning whether the lower limit is 50 watts, 65 watts, or 75 watts. Charlie's response to this was that the Europeans generally design in power factor correction because it adds value to the product. They don't understand why Americans typically try to avoid meeting requirements by using a strict legalistic interpretation of applicability. Thus, it doesn't matter to European manufacturers if the lower limit of applicability is 50 watts, 65 watts, or 75 watts. They will design and test their equipment for compliance with EN61000-3-2 regardless of the lower limit.

Charlie outlined various approaches possible for meeting the new legislative requirements and the costs associated with these approaches. The attendees learned that in some cases there may be no cost delta to add power factor correction (PFC) if done early in the design phase. Typically, the cost of a power supply will be higher by 10% when PFC is added. The usual approach is to add a second switcher, which operates on the AC side to smooth the current drawn over the entire sine wave cycle. Charlie also shared some "low budget" approaches where a 50-Hz resonant filter is built from two inductors with capacitors connected across each one. The cost delta of this approach is maybe 7 or 8% but it is usually used on low power products drawing less than 200 watts.

The Phoenix chapter was very fortunate to find such a dynamic speaker as Charlie. Other chapters may wish to have Charlie talk at their upcoming meetings. A copy of his PowerPoint presentation is available at http://www.esbe.ieee.org/ro/phoenix/phoenixemc/powerone.ppt.

At the December meeting, Bob Dockey, an IEEE EMC Society Distinguished Lecturer, enlightened the Phoenix chapter about how a "good ground plane" on a circuit board can still produce common mode radiation, similar to a dipole. There were 25 attendees, 60% of which were IEEE members.

In 1993, Bob Dockey began investigating various means to reduce common mode radiated emissions from printed circuit boards (PCBs). During the course of Bob's research, he attached wires to opposite sides of a ground plane to simulate the attachment of shielded cables. He found that the radiated emissions tended to increase upon adding the wires due to the common mode current flowing along these wires. The emissions were caused by a small voltage gradient in the ground plane.

Research performed by Bob showed that the emissions can be reduced by decreasing the distance between the signal trace and the ground plane, by providing additional low-impedance paths for the signal current, and by placing an image plane above the PCB and connecting it to the ground plane around its periphery. Since Hewlett-Packard manufactures computer accessories such as ink-jet printers in great quantities, all of their EMC design rules for PCBs concentrate on minimal parts and inexpensive manufacturing costs. For example, HP strives to use PCBs that have no more than four layers. With a four-layer board, Bob recommends that the two inner layers be ground planes with a 62-mil separation. The two outer layers are for signal traces and they are separated from the ground layers by only seven mils of pre-preg. Ground via connects the two ground planes wherever a signal via penetrates the ground planes. Also, guard traces are routed along side any high-speed traces to reduce common mode radiation. In response to a question from the audience, Bob explained that they don't place the ground planes on
Bob Dockey, EMC Engineering Group Manager for Hewlett Packard (Vancouver, WA), displays his circuit board that he used for investigating the phenomena of common mode radiation induced by return currents in a ground plane.

Mark Montrose displays the PCB that he used to research the effect of capacitor placement.

Over 100 engineers attended the Phoenix Chapter's January meeting with PCB expert and IEEE Distinguished Lecturer, Mark Montrose.

Charlie Swiontek of Power-One talks about the benefits of Power Factor Correction in consumer electronics.

the outside layers of the PCB due to manufacturing problems during the soldering process.

At the January meeting, the Phoenix chapter hosted a three-hour workshop with the EMC Society's Distinguished Lecturer, Mark Montrose. A total of 109 people attended this very popular event with 39 of them being IEEE members.

The workshop focused on designing printed circuit boards (PCBs) correctly from the start. According to Mark, "We're going to get the job done by using design rules. Let the others analyze it to death with Maxwell's equations solvers."

The attendees learned that the purpose of an autorouter is to maximize emissions, thereby ensuring job security for EMC Engineers. Mark outlined several important steps to successfully laying out a PCB:

1. Identify the "high threat" signals, which include reset, clock, audio, analog, video, high-speed digital and RF.
2. Manually route these signals to keep them short, direct, and separate from other high threat signals.
3. Protect these traces with the "protect" feature of the routing program.
4. Finally, allow the autorouter to route the remaining signals.

Mark also provided details on segmenting power and ground planes with moats and bridges to provide isolation for digital, analog, and I/O circuitry.

The workshop concluded with a special presentation of Mark's IEEE paper titled "Why Decoupling Capacitors Radiate." The results of his research showed that capacitor placement on a PCB is not critical, provided that each device and each decoupling capacitor has its respective VCC and GND pins tied directly to the power and ground planes with vias.

The Phoenix Chapter is sincerely grateful to Mark for sharing his expert knowledge on designing and laying out PCBs.

The Rocky Mountain chapter kicked off its fall program on September 28 with a highly amusing program "How to Design Digital Systems to Fail FCC & CISPR (in 20 easy steps)," presented by Daryl Gerke of Kimmel Gerke Associates, Ltd. 38 chapter members and guests enjoyed pizza sponsored by Criterion Technology then rolled along with Daryl for an interactive hour evening program. Starting with the advantages of "Design for Failure" (save component costs, gain management visibility and career mobility), Daryl provided RMC members with 20 easy to remember rules in three key design areas of components and circuit boards, cables and connectors and enclosures. Fundamentals included the keys to a strong transmitter and a good antenna. Daryl provided special tips on techniques, elaborating on using fastest components available, locating clock and I/O lines together, using long leads on caps, and providing slots in enclosures. He included secrets on how to ensure failure even when forced to use EMC control measures such as shielded cables, bypass caps or line filters. During the presentation, several chapter members offered enhancements to the techniques that product designers had demonstrated at their companies, which will remain anonymous. Daryl concluded the light-hearted look at EMC problems with the most important rule: never ask for help or advice.

The October 14 meeting featured Richard Charbonneau and Charles Grasso of StorageTek presenting "Embedded Capacitance - The Next Step in PWB Design." 21 members attended the evening session. The presentation started somewhat uniquely with Charles Grasso moderating an interactive discus-
over some of the performance data taken at the UMR EMC laboratory and finally presented some design guidelines. A downloadable copy of the presentation is also available at the Chapter website.

The Rocky Mountain chapter web site is regularly updated with information on past and future programs with links to other sites of interest for EMC engineers. The meeting program schedule and downloads of recent meeting presentations are available on our web site at http://www.ewh.ieee.org/r5/denver/rockymountainemc/.

Intel showed up in force at the October Seattle EMC Chapter meeting. That's Leo Heiland, Mike Wyman and Chapter Chairman Gberv Pettit (L-R) all of Intel.

Seattle

In October, the Seattle EMC chapter welcomed Doug Smith of Auspex Systems who responded to popular demand by presenting "Unusual Forms of ESD." That plastic bag of change that Doug carries around sure is getting a lot of mileage these days!

Doug began his presentation by stating the obvious: probably the main requirement a customer has for a piece of equipment is that it works. It can pass all of the IEC, CISPR, FCC, etc. tests, but if it does not work reliably, the customer will be unhappy. His entertaining talk covered some unusual and hidden forms of ESD that have caused many field problems for a number of companies and even government agencies. These forms of ESD are not described in any standard and can cause problems even if the equipment passes CE requirements. These hidden forms of ESD can result in hundreds of hidden ESD events per minute with bandwidths to 20 GHz and beyond. It is not possible to prevent them by trying to control the environment (floor wax, wrist straps, etc.). Demonstrations of these ESD effects were shown — hence the plastic bag of change — and some general case histories were discussed.

Todd Hubing enjoyed visiting with the Rocky Mountain Chapter officers following his presentation. Shown from left are Charles Grasso (Vice-Chair), Todd Hubing, Bob Reinert (Secretary) and Lyle Luttrell (Chairman).
Many of the case histories were very entertaining (at least to those not originally involved in the problem) and helped keep the talk on the light side. Upcoming standards activity that addressed ESD were discussed to round out the presentation.

At the November chapter meeting, Chairman Ghery Pettit was the local hero who filled in at the last minute for the originally scheduled speaker. Ghery rose to the occasion and presented an update on CISPR SC G proposed changes to CISPR Publication 22 and other documents. He addressed such topics as frequency range extension, ITE containing radio transmitters or receivers, limits over 1 GHz, user installation testing and ferrite clamps and tubes on radiated test sites, EMC requirements for multimedia equipment and EMC requirements for power line communication equipment. Ghery's unscheduled presentation was a surprise "hit." In the parking lot following the presentation, several chapter members were overheard to say, "Why haven't we asked him to speak before?" and "Boy, was he a good speaker!" Everyone present was most appreciative of Ghery's pitch hitting as speaker for the evening.

Southeastern Michigan
(Thanks to Kimball Williams for submitting the following report.)

The Wednesday, November 17, 1999 gathering of the Southeastern Michigan EMC chapter featured a lecture by James Muccioli of X2Y Attenuators discussing "Techniques for DC Automotive Motor Noise Suppression and Filtering of Common Mode and Differential Mode topics as frequency range extension, ITE Noise. " The lecture was held at 6 pm containing radio transmitters or receivers, limits over 1 GHz, user installation testing and ferrite clamps and tubes on radiated test sites, EMC requirements for multimedia equipment and EMC requirements for power line communication equipment. Ghery's unscheduled presentation was a surprise "hit." In the parking lot following the presentation, several chapter members were overheard to say, "Why haven't we asked him to speak before?" and "Boy, was he a good speaker!" Everyone present was most appreciative of Ghery's pitch hitting as speaker for the evening.

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The lecture employed a live demonstration of the phenomenon. (Those of us that work constantly with electronic instrumentation can appreciate the tendency of such equipment to make us aware of here-to-fore undiscovered 'features' when we least expect it). All the demonstrations were coaxed into full function and clearly showed the characteristics of noisy motors and of filter performance (both good and bad). By the time he was through, everyone was interested in the possibilities represented by an integrated, balanced filter structure.

After the formal presentation, Jim and several members of the audience discussed the subject material in greater detail. EMC

Call for Raconteurs

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

Please submit a written version of your proposed war story - 500 to 2000 words - to the panel of judges (torn@7ms.com) on or before 1 May 2000.

The story should be about an EMC project in which you were involved. Like any good story, embellishments and exaggerations are expected, in fact encouraged. Oh yes. The story should have a kernel of truth. The chosen stories will be presented verbally at the symposium session by the authors (or their designee) and should be at least 10 minutes but not more than 20 minutes long. An overhead projector will be available for cartoons and notes so that you needn't write on your shirt cuffs. EMC
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For further information:
Kimball Williams: Co-Chair, Technical Program
248-354-2845, k.williams@ieee.org
Janet O’Neil: Co-Chair, Exhibits: 425-868-2558, j.n.oneil@ieee.org


Sponsored by the Southeastern Michigan Chapter of the IEEE Electromagnetic Compatibility (EMC) Society.

IEEE EMC Society Education and Student Activities Committee
Maqsood Mobd, Associate Editor

I hope everybody had a bug-less Y2K beginning. Here at the Education and Student Activities Committee we have been busy putting together some wonderful activities for the 2000 IEEE International Symposium on EMC in Washington, DC. Also, just before the holidays, two EMC-S representatives (Andy Drozd and myself) attended a WEB-Education Seminar in the Washington, DC area. The attendees included education chairs or their associates from various Societies of the IEEE. I had the opportunity to talk to a few of them, including the representatives from the Antennas and Propagation and Microwave Theory and Techniques Societies. I must congratulate you, the members of the EMC-S, that your Board of Directors places high value on educational activities (and rightfully so). This is evident in the high level of funds they allocate for various activities of this Committee. They always are willing to support new and innovative ideas if it is going to bear better fruit than what we are accomplishing now. The other sister societies are not as lucky as we are in our EMC-S. Also, the educational activities (such as fundamental tutorials, experiment demos, student paper contest, and now student design contest) that we do at the annual symposia are by far more than any other IEEE Society does for its membership. I learnt this because each Society representative had to give a presentation about the current activities and future needs for their membership. Also, some other Society education Chairs or their representatives asked me during breaks how we are doing so many activities. There is one area however, that we lack seriously — that is in educational material such as video tapes, CDs, etc. We have a plan to improve this area. We are considering all options including dissemination through the World Wide Web. This is the main reason why we attended that workshop. If you have any inputs, suggestions, comments, or even wish to take on this challenge, please contact me at (850) 729-6115 or send me an email at mohammed@teas.eglin.af.mil. If you want to see what happened at the web-education workshop you can view some of the highlights at http://www.ieee.org/organizations/eab/web-ed­home.htm. They will update the site periodically, so visit it again if you need to find out more.

Plans for 2000 IEEE International Symposium on EMC

We have planned some exciting activities during this symposium. In the Monday Tutorial sessions, we have some outstanding speakers such as Professor VanDoren, Clayton Paul, and Henry Ott. So don’t miss this exciting session and sharpen up your skills in the fundamentals. In the Experiments area, we have some unique experiments planned similar to last year. If you want to participate in this activity please contact Andy Drozd who is leading this activity (he is also the vice chair of Education and Student Activities Committee) at andro1@aol.com. We are planning a NARTE preparation workshop on Monday and the exam on Friday. Professor Whalen and Dave Case lead this activity. In the student activity area, we have excellent participation in the Student Paper Contest this year. An additional activity that we have introduced this year is the Student Design Contest. This idea was introduced to us by TC-7. We have struggled with the idea for a while and this will be our pilot year for this activity. This year will be a learning year for us. We may not be able to do everything just perfectly this year; we need help,
support, and understanding from every one of our EMC-S members. Ahmad Fallah is leading this activity. He can be contacted through email at afallah@phoeintl.com. Some highlights of the competition are included in this article. Don’t hesitate to provide some healthy feedback on this activity to Ahmad or to me.

**Highlights of Student Design Competition**
These are some of the highlights provided as general awareness to the membership of the EMC-S. Student participants and their sponsors may obtain the detailed version from Ahmad Fallah at afallah@phoeintl.com or phone 701-277-6322. The last day to request a kit was February 18, 2000. Entries must be received prior to May 31, 2000. If the contest interests you and you did not hear about it before the deadline to request a kit, please consider participating next year. Read on to learn what you will need to do and start thinking about your entry for the 2001 symposium now!

**General Description:**
The IEEE Student Electromagnetic Compatibility (EMC) Design Competition is a student competition sponsored by the IEEE Electromagnetic Compatibility Society (EMC-S), and is conducted by the Education and Student Activities Committee. The goal of this competition is to provide the Electrical and Computer Engineering students who are interested in the field of EMC an opportunity to exercise their knowledge and to gain hands-on experience.

**Objective:**
The objective is to develop the best solution to a standardized broadband electromagnetic interference (EMI) problem while maintaining the capability to perform required electronic functions. A standard kit containing the required components for the broadband EMI circuit will be employed.

**Problem Description:**
The problem involves the design, construction, evaluation, and documentation of the EMI mitigation techniques for a prescribed electronic circuit. A diagram for a simple electronic circuit and a standardized kit containing electronic components are provided with each “design kit.” The experimental evaluation will involve testing the completed circuit by measuring representative EMI quantities using simple laboratory techniques and equipment.

**Rules of Participation:**
The competition is open to all undergraduate and first-year graduate students in an EE curriculum. All participants must have a faculty as a sponsor who will attest to their qualification. Teams are limited to three members, however, only one member will be invited to attend the EMC symposium if that entry is deemed to be the winner. The name of the principle author shall appear first in the author list of the final report. Design contestants shall provide the reviewing committee with the assembled and tested circuit board, all of the remaining parts from the kit, and a report containing all measurement results along with a description of how the solution was achieved.

**Entry Reviews:**
The review committee will select three finalists during the first round by reviewing the measurement results provided by the competitors, and by making measurements on the actual design entries using a standard means of measurement technique. The finalist entries will be invited by the pre-screening committee to participate in the final competition to be held during the IEEE International Symposium on EMC. An all-expense-paid trip to the location of the EMC symposium will be a part of the prize for the top three design entries.

**Important Notes:**
Proper packaging and delivery of the design entries are the responsibility of the contestants. The EMC-S Education Committee can not assume responsibility for entries that may be damaged or delayed during transportation. Participants should submit their best design (i.e., lowest emission levels) at the least cost. The committee shall determine the winning entry based on criteria listed in the descriptions provided herein. Adherence to the guidelines listed in this document is a necessary condition for qualification.

The variety and depth of activities that the Education and Student Activities Committee of the EMC-S undertakes is envy of other Societies in the IEEE. By the way, this just doesn’t happen by chance. We are fortunate to have volunteers who are dedicated to excelling in their tasks and who are enthusiastic about what they do. I would like to express my personal thanks and appreciation for each of these volunteers who tirelessly work throughout the year to bring the very best in EMC education materials, workshops, demonstrations, and tutorials at every symposium and to all the members of the EMC profession throughout the year. When you email them, contact them, or see them during a symposium, please express your appreciation for volunteering their valuable time for the EMC-S and the Education and Student Activities Committee. EMC

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Introducing Members Newly Elected to the EMC Society Board of Directors

The following members began a three-year term on the Board effective January 1, 2000. Abbreviated biographies of these gentlemen are shown below.

Jose Perini
Prof. Jose Perini was born in Sao Paulo, Brazil, where he received the BS degrees in Electrical and Mechanical Engineering from Escola Politecnica de Sao Paulo in 1952. In 1961, he obtained the Ph.D. in EE from Syracuse University. He joined Syracuse University in 1962 as an Assistant Professor, moved through the ranks to Full Professor, and retired in 1991. He is now an Emeritus Professor of EE. He has taught in many different areas such as EMF, Antennas, EMC, Digital Signal Processing, Communications, Radar, Circuit Theory, Mathematics, and Computers. Prof. Perini has had continuous research support from the Navy, Air Force, Army, and industry, mostly in the EMC area, during his 29 years at SU. He is still active in the profession as a lecturer and researcher. As a Consultant he has done extensive work in the US and abroad. He has published and presented over one hundred papers in the US and overseas. He has given many invited papers, lectures, and tutorials. He was a Distinguished Lecturer for the EMC Society until 1998. He is an IEEE Fellow, and a certified NARTE EMC Engineer. He is a reviewer for the IEEE Transactions on EMC, AP-S, MTT, and Education.

Moto Kanda
Motohisa (Moto) Kanda received the BSEE degree in 1966 from Keio University, Tokyo, Japan, and the MSEE and Ph.D. degrees from the University of Colorado, Boulder, in 1968 and 1971, respectively. From 1965 to 1966, he was a research technician at Keio University, and from 1966 to 1971 he was a research/teaching assistant at the University of Colorado. In 1971, he joined the staff of the Radio-Frequency Technology Division (formerly Electromagnetic Field Division), National Institute of Standards and Technology (formerly National Bureau of Standards) and served as group leader of the Fields and Interference Group for 15 years. Concurrently, he has served as an adjunct professor in the Department of Electrical and Computer Engineering at the University of Colorado, Boulder. Dr. Kanda is an IEEE Fellow, Life Member of the EMC Society and has been Editor-in-Chief of the IEEE Transactions on EMC for 12 years. He has been the leader of EMC research at NIST, has written over 100 archival papers, and has participated in the writing and editing of a number of EMC books and EMC standards for ANSI and IEEE Standards Committees. He was technical member, vice chair and technical program/paper committee chair of the 1981, 1989 and 1998 IEEE EMC Symposia in Denver, Colorado, respectively. He was elected to serve as Vice Chair from 1994 to 1996 and as chair of the International Commission A (Electromagnetic Metrology) of the International Union of Radio Science (URSI) from 1997 to 2000. He has received two Bronze Metals (1981 and 1992) and a Silver Medal (1989) from the U.S. Department of Commerce. He has received three EMC Transactions Best Paper Awards in 1982, 1989 and 1992. Dr. Kanda has been a leader in promoting EMC research and disseminating research results in the IEEE Transactions on EMC. His main goal has been to emphasize technical issues in EMC Society activities through the Technical Advisory Committee (TAC) and to upgrade the technical quality of the EMC Society publications.

Andrew Podgorski
Andrew Stan Podgorski has a MASc and Ph.D. degree from the Department of Electrical Engineering, University of Waterloo, Waterloo, Ontario, Canada. He has published over 100 scientific papers and over 30 classified and nonclassified reports. He holds many patents in the area of electromagnetics. Currently, he is President of ASR Technologies (Ottawa, Canada)—an independent Research and Engineering Company conducting research in the area of broadband electromagnetics. His scientific interest focuses on electromagnetic theory, microwave networks and antenna theory in application to measurements, modeling and generation of picosecond electromagnetic phenomena. For 15 years, he was a Group Leader of the EMI/EMC Group at the National Research Council of Canada and was involved in numerous programs of national significance for the Canadian Government and Industry. He has served on many international, intergovernmental military and civilian panels of experts representing Canada in USA, Europe, and Australia. For several years he was on the Board of Directors for the Electromagnetic Compatibility (EMC) Society of IEEE where he was the Treasurer and a "Distinguished Lecturer" for the Society. He is a Senior Member of IEEE and a Life Member of the IEEE EMC Society. Currently, he is a Chair of the Technical Activities Committee (TAC) of the IEEE EMC Society. Dr. Podgorski is a Registered Professional Engineer in the Province of Ontario and a member of the Association of Old Crows. His name is listed in the Canadian "Who's Who" Publication.

Andrew Drozd
Andrew L. Drozd is President of and Chief Scientist for ANDRO Consulting Services, which is dedicated to work in the fields of EMC, CEM, and electromagnetic environmental effects (E3). He received a BS in Physics and Mathematics in 1977 and an MSEE specializing in Communications/Signal Processing in 1982, both from Syracuse University. His professional responsibilities include: systems engineering; EMC computer modeling, simulation and analysis; exploitation of innovative, expert system technologies for EMC/
Larry Cohen  
Lawrence S. Cohen was born in Washington, DC on December 20, 1948. He received a BSEE from George Washington University in 1975 and an MSEE from the Virginia Polytechnic Institute and State University in 1994. Mr. Cohen was involved in the integration of antennas for surface combatants while employed by the Naval Sea Systems Command from 1975 to 1987. From 1987 to the present, Mr. Cohen has worked in the Radar Division of the Naval Research Laboratory in Washington, DC where he has conducted research on model-stirred chambers, enhanced radar absorption materials and T/R modules for future radar applications. Mr. Cohen is a past Chairman of the Washington, DC/Northern Virginia IEEE EMC Chapter and is presently a co-chairman for the EMC Society Education Committee's sponsored experiment demonstrations presented at the IEEE EMC Symposia. Mr. Cohen is the Technical Program Chair for the 2000 IEEE EMC Symposium in Washington, DC. Mr. Cohen is a NARTE Certified EMC Engineer.

Fred Heather  
Fred Heather is a senior member of the IEEE and a 12-year member of the EMC Society. In 1993, he founded and currently serves as chairman of the Southern Maryland Chapter of the Communications, Computers, and EMC Society. Over the past 20 years he has published several papers on EMC. In addition to his activities within the EMC Society, he has been a major participant with the SAE AE4 Committee. He served as chair on the AB4R High Intensity Radiated Fields (HIRF) Test and Analysis panel. Later he went on to supporting the Electromagnetic Effects Harmonization Working Group (EEHWG). This international body was tasked with harmonizing the US and European HIRF documents into one common set of documents. He currently is chairman of the SAE AE4H Subcommittee, chartered with specification, standards and technology for High Power RF Simulator and Effects. His professional certifications include NARTE, Senior Member, Certified EMC Engineer, and DWIA Certified in Systems Engineering and Test and Evaluation. He holds a BSEE degree from Rochester Institute of Technology granted in 1977. His professional career has been with the Naval Air Warfare Center, Aircraft Division, at Patuxent River, Maryland. During his 20-year career he has had responsibility for both major and minor aircraft development programs. He has conducted major Electromagnetic Environmental Effects (E3) tests on all the platforms for which he was responsible. His current position is E3 Technical Specialist and Consultant. In this position he is the Navy's E3 manager for the Joint Strike Fighter. He is the project manager for an OSD Test Technology and Demonstration Program on a Fiber Optic Microwave Transmission System and Project Director for another OSD program to develop a joint high power RF capability to simulate worldwide high power RF emitters. In his off time, he pursues his interests in the outdoors by providing adult outdoor training classes from basic camp training to advance backpacking as a volunteer member of the Girl Scout Council of the Nations Capital.

We wish the newly elected members of the Board of Directors success and thank all candidates for their willingness to serve and for permitting their names to be included on the ballot.

EMC
Two New Speakers and a Chairman for the Year 2000 Distinguished Lecturer Program

By Lee Hill, Chairman, Distinguished Lecturer Program

Werner Schaefer and Doug Smith recently began their two-year terms as the newest Distinguished Lecturers (DLs) of the IEEE EMC Society. They replace Don Bush and Bob Dockey whose terms expired on December 31, 1999. Our other three DLs, Elya Joffe, Michel Mardiguian, and Mark Montrose, are midway through their two-year terms.

At the end of August 1999, I volunteered to take over responsibility of DL Program from outgoing Chairman Scott Roleson. Under Scott's leadership, the IEEE EMC Society Distinguished Lecturer program has become a "must-have" resource for our members who seek expert speakers for local chapter meetings. Since Scott became chair in 1995, he has rallied support to increase the number of Distinguished Lecturers to five, including two new international speakers (Elya Joffe in Israel and Michel Mardiguian in France) especially for the benefit of our members in Europe. Please join me in extending a huge "thank you" to Scott for his service to the Society!

Here are our new Distinguished Lecturers:

Doug Smith is currently Manager of EMC Development and Test at Auspex Systems in Santa Clara, California. He received a BSEE degree from Vanderbilt University in 1969 and an MSEE degree from the California Institute of Technology in 1970. In 1996, he retired as a Distinguished Member of the Technical Staff at AT&T Bell Laboratories. Doug's interests include high frequency effects in electronic circuits, especially EMC, Electrostatic Discharge (ESD), Electrical Fast Transients (EFT), and other forms of pulsed EMI. He has been granted over 15 patents, including several for measurement apparatus, has published over two dozen technical papers and articles, and has authored one book. Doug is a senior member of the IEEE. Doug's favorite topics to present are Unusual Forms of ESD (and War Stories), Signal Integrity Measurements and Probe-Building Workshop, and Common Signal/Noise/EMI Measurement Snafus. You can reach Doug at doug@dsmith.org, telephone 1-408-356-4186.

Werner Schaefer is currently an EMC Technical Contributor at Agilent Technologies (formerly Hewlett Packard Company) in Santa Rosa, California. He received an MSEE in 1982 from the Technical University of Darmstadt, Germany, and an MBA from Hochschule für Berufstätige, Germany, in 1990. He has been active in EMC product design, marketing, and applications development at Hewlett Packard since 1983. He has published many papers on EMI and microwave measurements, and has co-authored one book. Werner is an active member of the IEEE, SAE, CISPR committee A, ANSI C63 subcommittees, VDE, and is a NARTE certified EMC Engineer. Werner's favorite topics to present include "Use of Scanning Receivers in EMI Compliance Measurements," "Understanding Impulse Bandwidth Specifications of EMI Receivers," and various aspects concerning the automation of radiated and conducted EMI measurements. You can reach Werner at werner_schaefer@agilent.com, telephone 1-707-577-2817.

It is my pleasure and privilege to inherit a well-structured and well-established program that serves the technical needs of our members. My interest in EMC began back in 1985, when I picked a co-op job that had me spinning the dials and listening to the output of an EMC-25 analog EMI receiver! Since then I have completed an MSEE at the University of Missouri-Rolla's EMC Laboratory, and also served as a Distinguished Lecturer from 1994-96. The best place to find me is at my favorite place, the Experiments and Demonstrations area, during the annual IEEE EMC Symposium. So you see my personal label should be "EMC technical and education junkie." The DL program's charter to make expert speakers more accessible to our members seemed like a great place for me to help "give back" to the Society.

The EMC Society's Distinguished Lecturer Program provides speakers for Society chapter meetings and similar functions. Each Distinguished Lecturer (DL) usually can offer one of several pre-prepared presentations on various EMC topics. The EMC Society Board of Directors appoints DLs to two-year terms. Currently, the Society has five speakers serving on alternating terms.

Distinguished Lecturers may give up to six talks per year under the Program, which reimburses the DL for their approved traveling expenses up to a recommended limit of $750 per US engagement, or $1000 per international engagement. To provide as many opportunities to as many members as possible, the Society encourages hosting chapters whenever possible to absorb some part of the speaker's costs, such as by providing or paying for local transportation, meals, and lodging.

For more information about the EMC Society's Distinguished Lecturer Program, visit our web site at http://www.emcs.org/lectur.html. You can also contact me at 1-603-465-3920, or via email at Lee_Hill@silent-solutions.com.
For those new to the idea of applying computational electromagnetics (CEM) to solving EMC problems, two things become immediately apparent. First, there are a variety of numerical techniques available, each with unique strengths and weaknesses that need to be understood. Secondly, there is the question of how these techniques can be applied to a particular problem. These two issues create a tough barrier that must be overcome before further investigations of CEM are made. However, once these have been addressed it becomes easier to determine if CEM modeling will be a beneficial tool for any given situation.

The numerical techniques used in CEM are the means by which a set of equations is solved. For all EMC problems, it is Maxwell’s equations that are being solved. However, in many cases the full set of equations is not necessary and constraints or simplifications can be applied. It is the addition of such constraints that result in the variety of techniques in use today for EMC modeling.

The three most common numerical techniques used in EMC modeling are the Finite Difference Time Domain (FDTD), the Finite Element Method (FEM), and the Boundary Element Method (BEM), more commonly though less accurately known as the Method of Moments (MoM). These techniques are all used for solving a variety of field problems. Other techniques include the Partial Element Equivalent Circuit (PEEC) method and the Transmission Line Method (TLM). These two techniques were especially developed to provide a link between physical structures and circuit models.

The most general solution to an electromagnetic problem might well be obtained using the FDTD technique, as there are very few constraints required in formulating a practical EMC tool. The price to pay for the flexibility afforded by FDTD is the magnitude of computational resources required for a given problem. A more specific tool such as the Numerical Electromagnetics Code (NEC) uses the MoM. This tool was written to address a specific class of problems, namely antenna modeling. NEC has considerably more constraints within its code but because of this it runs much more efficiently. Different formulations, also using MoM, are written to address other specific tasks such as solving coupling problems.

The other numerical techniques mentioned have also been developed with the appropriate constraints to efficiently address a wide range of EMC related problems. This area is rapidly developing, with new customizations of these techniques being added frequently. Therefore, it is often equally important to consider what kinds of problems a tool is intended to solve rather than simply which technique should be used.

The application of numerical techniques to solving an EMC problem is the second hurdle to face. Some problems match so well to an easily implemented formulation of a particular numerical technique that the electromagnetic problem and numerical technique have almost become synonymous. The antenna modeling tool, NEC, is a good example of this, where MoM has become so closely associated with NEC that many don’t realize the wider range of applications that the MoM can be used to solve.

The creation of EMC models has much the same procedure as the preparation of a problem to be solved by any other means. The first three steps are to determine what is wanted from the model, what is known as a starting point, and what pieces of information might be missing. This information is then incorporated into the framework of the available modeling tools and the best method of solving the problem can then be determined.

While it is the clear goal of TC-9 to help develop all aspects of EMC modeling, the primary goal is to help EMC engineers understand the subject so that they can decide on its relevance to their particular problems. Not everyone will need EMC modeling, and EMC modeling is not needed to address every problem. While there is still much that can be done without the need to apply modeling, this is slowly changing. Design and analysis in the related discipline of signal integrity (SI) were once also performed by following rules and through the use of basic equations. However, as data rates increased and tools improved, SI modeling grew from occasional use to a mainstay in the field. It is to be expected that EMC design and analysis work will develop in the same manner. A more in-depth overview of several common numerical electromagnetic methods, listing of available commercial and public-domain codes, and a brief bibliography of CEM books is available at the web site http://www.emclab.uwm.edu/numer.html.
A Low Cost Test Method for Making Dual Line Filter Measurements

by James P. Muccioli

Abstract:
The purpose of this article is to present a test method for dual line filter measurements of common and differential mode noise using a small current probe. This test method is similar to the MIL-STD-461 “Current Injection Insertion Loss Measurement Method,” however two lines are tested simultaneously and modifications are made to the probe and cable lengths for measurements up to 1000 MHz. Data is developed with several different types of filter configurations to characterize the test method.

Introduction:
In today’s EMC environment, where both common and differential mode noise need to be reduced, there are very few test procedures that measure the results of a dual line filter in its dynamic state. Typically, a dual line filter is tested in a static state, where one side is tested and then the other side, showing the insertion loss of each line but not both simultaneously. The author will describe a simple test methodology in which a spectrum analyzer with a tracking generator and a current probe is used for dynamic testing of the dual line filter.

Test Configuration:
The test setup is shown in Figure 1. Three different dual line filter configurations are used for the device under test (DUT), as shown in Figure 2. The DUT is characterized using the tracking generator from the spectrum analyzer as the noise source for the before and after measurements. The tracking generator is connected to a power divider so both sides will receive equal amounts of noise. The actual test is conducted using a quart paint can to isolate the fields before and after the filter, as shown in Figure 3. The different filter configurations are attached to the top of the paint can and the wires protrude through the top of the paint can and terminate to a 50-Ω load. The small current probe is used to measure line A, line B, and then both lines A+B before the filter. Then the top is placed on the paint can and line A’, line B’, and lines A’+B’ are measured.

Test Methodology:
The purpose for using a miniature current probe (Fischer Custom Communications F-36-4) is to make quantitative measurements of the currents (magnetic fields) generated by the electrical noise from the tracking generator on the transmission lines. The current probe can be used in a non-shielded room because only the magnetic fields related to the electromagnetic radiation potential of the tracking generator affect the probe and it is relatively insensitive to stray electric fields. The windings of the probe are in a shield that reduces E-field pickup. Typical values of shielding from external E-fields vary from 60 dB below 100 MHz to greater than 30 dB at 450 MHz.
The current probe has transfer impedance from 100 kHz to 1000 MHz, as shown in Figure 4. The transfer impedance \( Z_T \) is defined as the ratio of voltage developed across the output of the probe to the conductor under test. The current \( I_p \) in the conductor is calculated from the current probe output \( E_s \) in volts divided by the probe transfer impedance \( Z_t \):

\[
I_p = \frac{E_s}{Z_t} \quad \text{(Equation 1)}
\]

The spectrum analyzer used in this test is an IFR AN920 (9kHz - 2.9 GHz) and the frequency range is set from 100 kHz to 1000 MHz. The resolution is set to 120 kHz and the video bandwidth is turned off so that the spectrum analyzer does not filter the signals being analyzed.

**Test Results:**

In Figures 5 through 10, the thin lines are the baseline references before the filter is introduced and the heavy lines are the measurements taken after the filter is in place. The delta between the baseline (before) and after filter measurements in these figures is the insertion loss in dBUV.

Figure 5 shows that a normal capacitor placed across lines A & B produces very little insertion loss over the frequency range. Below 150 MHz there is no insertion loss due to the filter. Between 150 MHz and about 500 MHz, there is a negative insertion loss (amplification of the noise). Finally, above 550 MHz, the data shows 2 to 15 dBUV of insertion loss.

Figure 6 shows the test results using a 3-pole capacitor filter. There is 10 to 40 dBUV of common and differential mode noise insertion loss, depending on frequency. A dip in the baseline values above 800 MHz is due to the wire length of 4.25 inches and movement of the wire to the side of the paint can, which causes resonance.

Figure 7 shows that the X2Y filter provides between 20 and 54 dBUV of insertion loss over the frequency range tested for both common mode and differential mode.

**Comparisons of Test Results:**

In Figures 8, 9, and 10, the baseline data for both the 3-pole capacitor filter and the X2Y filter are very similar. The X2Y filter provides better common and differential mode insertion loss over the frequency range tested.

**Conclusion:**

The test methodology used to measure the dual line filters is repeatable and easy to run. The current probe used in this test procedure was very effective in measuring both common mode and differential mode noise. However, the wire length of 4.25 inches needs to be reduced to eliminate high frequency resonance effects.
In summary, both the 3-pole filter and the X2Y device proved very effective in reducing common and differential mode noise. When EMC requirements are too stringent for normal capacitors, the X2Y device can provide added insertion loss.

This study was conducted with the filter values mentioned. The filtering can be improved by optimizing the filter value for any particular application. The load network in this test was built to 50-Ω impedance, but can be changed to meet any specific load requirements.

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I would like to thank Joe Fischer from Fischer Custom Communications, Inc. (http://www.fischercc.com/) for supplying the calibrated current probe used in the test setup. I would also like to thank Tony Anthony from X2Y Attenuators, LLC (http://www.x2y.com/) for supplying samples of the X2Y device manufactured by Syfer Technology Limited (http://www.syfer.com/).

James Muccioli is associated with Jastech EMC Consulting, LLC and X2Y Attenuators, LLC. He has extensive experience in EMC design, analysis, and testing. He is a NARTE certified EMC and ESD engineer, an active member of SAE J-1113 and J-551 EMC committees, and chairman of the SAE Integrated Circuit EMC Task Force. He was selected as an IEEE Fellow in 1998 for contributions to integrated circuit design practices to minimize electromagnetic interference. Mr. Muccioli teaches seminars on EMC through his consulting firm, Jastech EMC Consulting, LLC (www.jastech-emc.com) and an undergraduate course on EMC at the University of Michigan-Dearborn. He can be reached by e-mail at: jastech@ameritech.net.

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THE KEY TO EMC

by W. Scott Bennett

Abstract - A simple, straightforward approach is described for minimizing the fields of any electrical circuit. The method is based on a study of the causes of the fields — circuit currents, and circuit geometries — rather than a study of the fields themselves.

Introduction

The current element is a differential length of current that is assumed to be isolated in free space. Now, because of its assumed isolation, the current element is a concept; it is not something that can be physically realized. However, the current element is a very useful concept, because any circuit current can be accurately modelled as a superposition of its current elements. And, the electromagnetic fields of any circuit current will be equal to the superposition of the electromagnetic fields that each of its current elements would have [1-4]. Therefore, since unexpected electromagnetic fields of circuit currents are the sources of EMI, the current element is the basic source of EMI. And, the minimization of the fields of all current elements is obviously the key to EMC.

Now, as shown in Fig. 1(a) and (b), equal current elements with opposite directions would have equal, oppositely directed, electromagnetic fields at every corresponding point in space. This follows, because each field component of an upwardly positive current element is directly proportional either to sin θ, or to cos θ [1-4]; and, if that current element is rotated 180°, those proportionalities become sin θ +π = -sinθ, and cos θ +π = -cosθ. As a result, if two equal, oppositely-directed current elements were placed closely parallel to one another, the sums of their fields would approach zero, as shown in Fig. 1(c). Therefore, if the oppositely-directed equal of every current element can be found in a circuit, and if all such equals can be positioned closely parallel to one another, the fields of that circuit current will approach zero.

In other words, EMC can be achieved by taking two steps: (1) be sure that every current element of a circuit has an oppositely-directed equal, and (2) place the current elements of each pair of oppositely-directed equals as close and as parallel to each other as possible.

Circuit Currents

Now, an electric current is the flow of electric charge. For example, the charge flow that is the current in a metal conductor is the flow of electrons. Therefore, when the conduction current from a time-varying source increases, more electrons start to flow out of one source terminal and more electrons start to flow into the other source terminal. And, when that conduction current decreases at the source, fewer electrons start to flow out of one source terminal and fewer electrons start to flow into the other one. Also, in both cases, those changes in electron flow propagate away from the source and toward the load. In other words, one current component leaving the source propagates in the direction of positive current, and the other current component propagates in the opposite direction — one clockwise, and one counterclockwise. As a result, when they come together, at any point in the circuit, both current components have the same positive direction and their sum is the total current at that point.

These current characteristics are illustrated in Fig. 2. In Fig. 2(a), i(t - t0) is the clockwise propagating current component at the upper point shown, where t0 is its propagation time from the upper source terminal to that point. And, i(t - t0) is the counterclockwise propagating current component at the lower point shown, where t0 is its propagation time from the lower source terminal to that point. In these expressions,
\( \frac{q^2 R}{2} \) losses, and \( t_{pp} \) includes any time change induced by the load as the result of capacitance or inductance. The effect of the load on current components propagating in either direction is the same, because the current components have the same positive direction as they pass through the load.

Thus, if the points in Fig. 2 are equidistant from the source, then \( d_c = d_{ic} \) and \( t_c = t_{ic} \), and the total currents at those points will be equal. However, the total current in one conductor is positive in the direction from source to load, and the total current in the other conductor is positive in the direction from load to source. Therefore, if the conductors from a circuit’s source terminals to its load terminals are given exactly the same length, every current element in one conductor will have an oppositely-directed equal in the other. And, the first step toward obtaining EMC for that circuit will have been taken.

**Circuit Geometry**

As observed above, if both source-to-load conductors of a circuit have the same length, then every current element in that circuit will have an oppositely-directed equal. Therefore, to achieve EMC, all that remains to be done is to make the two members of each of those oppositely-directed current element pairs parallel and as close to one another as possible. A geometry that meets those requirements is illustrated in Fig. 3. As shown in that figure, the pairs need not form a straight line. However, by reducing the distance from source to load, the circuit’s fields would be further reduced, because the total number of current element pairs would be lessened.

**Other Observations**

It should be noted that an alternate method of implementation to that of two individual conductors can be obtained with one conductor close to a ground plane. However, two things should be kept in mind if a ground plane is used: (1) the spacing between a current element and its oppositely-directed image in the ground plane is effectively twice the distance between the current element and the ground plane, and (2) there will be no fields on the opposite side of the ground plane from the current element with an ideal implementation. In other words, for a given spacing between two conductors, or between one conductor and a ground plane, there will be quite different results. On one side of the ground plane there will be considerably less field cancellation than that of a conductor pair with the same spacing, and on the other side of the ground plane there will generally be near-complete cancellation. However, for a given spacing, two individual conductors will, in general, be more effective than one conductor and a ground plane.

Finally, it should also be noted that complete cancellation of the fields of oppositely-directed, equal current elements is obtainable by making them coaxial. In other words, for the ultimate in EMC, a circuit’s source-to-load conductor pair should be coaxial.

**References**


Scott Bennett is an EMC Consultant, and can be reached at 7093 East County Road 74, Carr, CO 80612 (Tel: 970-897-2764) e-mail: w.scottbennett@juno.com.

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Donald McMlemore
Telephone: +1 505 889 7009
mclmlemore-abq1@kaman.com
ANGEL: Bill McGinnis

ATLANTA
Term: 4-15-99, 12-31-99
David Dennis
David Dennis Intertek Testing Services
4317-A Park Drive NW
Norcross, GA 30092
Telephone: +1 770 925 2444
DDennis@itqs.com
ANGEL: Dave Millard

AUSTRIA
Term:
Mr. Dipl. Ing. Kurt Lamedschwandner
Austrian Research Center Seibersdorf
Division of Electronics
Head of EMC Laboratory
A-2444 Seibersdorf
Telephone: +43 2254 780 2800
kurt.lamedschwandner@arcs.ac.at
ANGEL: Elya Joffe

Please send all corrections and changes to Todd Hubing (t.hubing@ieee.org)
OTTAWA
Term: 12-18-99, 12-18-00
Gianluca Arcari
Product Integrity
Northern Networks
PO Box 3511 Station C
Ottawa ON K1Y 4H7
Canada
Phone: +1 613 765 1532
Fax: +1 613 765 8091
gianluca@northernnetworks.com
ANGEL: Ghery Pettit

PHILADELPHIA
Term: 10-01-93, 10-01-94
Michael Daniele
CSC
1301 Virginia Drive
Suite 100
Philadelphia, PA 19135
Phone: +1 215 542 5409
Fax: +1 215 283 2507
mdaniele@csc.com
ANGEL: Ghery Pettit

PHOENIX
Join AP, MTI, AP, ED, LEO
Term: 1-1-00; 12-31-00
Jim Youngman
Millpoint Corporation
1301 Virginia Drive
Suite 100
Phoenix, AZ 85027
Phone: +1 602-436-5974
Fax: +1 602-436-8056
j.a.youngman@ieee.org
ANGEL: Ghery Pettit

PIKES PEAK
Join MTI, AP, ED, LEO
Term: 1-1-99, 12-31-99
Terence Donohoe
Honeywell
M/S M25A1
2111 N. 19th Ave
Phoenix, AZ 85027
Phone: +1 602-436-5974
Fax: +1 602-436-8056
terry.donohoe@honeywell.com
ANGEL: Ghery Pettit

PORTLAND & SW WASHINGTON
Term: 8-1-96, 7-31-00
Henry Benitez
Santos Point Corporation
135 Garden of the Gods Road
Colorado Springs, CO 80907
Phone: +1 719 548 1201
j.a.youngman@ieee.org
ANGEL: Ghery Pettit

ROCKY MOUNTAIN
Term: 1-1-99; 12-31-99
Lyle Luttrell
Regulatory Agent/Component Engineer
Breezec Hill Technologies
Phone: +1 303 664 8286
Fax: +1 303 449 1027
lluttrell@ieee.org
ANGEL: Henry Ott

SAN DIEGO
Term: 1-1-97, 12-31-97
Dave Bernardin
TUV Product Service
10040 Mesa Rim Rd.
San Diego, CA 92121
Phone: +1 619 546 3999
Fax: +1 619 546 0364
d.a.bernardin@ieee.org
ANGEL: Ghery Pettit

SANTA CLARA VALLEY
Term: 7-1-99, 6-30-00
Zorica Panic-Tanner
San Francisco State University
Phone: +1 415 338 7739
Fax: +1 415 338 0525
zpr@sfsu.edu
ANGEL: Janet O'Neil

SEATTLE
Term: 7-1-98, 6-30-99
Ghery S. Pettit
Intel Corporation
DP3-303, 2800 Center Drive
Pinecone, WA 98037
Phone: +1 253 371 5515
Fax: +1 253 371 5690
gh.pettit@eeiee.org
ANGEL: Leonard Carlson

SOUTH EASTERN MICHIGAN
Term: 10-01-99, 12-31-99
Dennis Barberi
Midland Group
1567 Eason
Waterford, MI 48328
Phone: +1 810 825 8854
Fax: +1 810 825 4013
barberi@midland.com
ANGEL: Kimball Williams

SOUTHERN MARYLAND
Term: 7-93, 12-94
Frederick W. Heath
202 Bob's Court
Lexington Park MD 20653
Phone: +1 410 332 3308
Fax: +1 410 332 0305
mick@emcs.org
ANGEL: Bill Duff

ST. PETERSBURG (RUSIJA)
Term: 8-1-99, 7-31-99
Prof. Dr. Shuichi Nitta
Department of Electrical & Computer Engineering
University of Tokyo
10 Kings College Road
Toronto, Ontario, CANADA MS 3G4
Phone: +1 416 978 4534
Fax: +1 416 978 4425
ramesh@waves.ucnroto.ca
ANGEL: Ghery Pettit

TAYWAN
Term: 11-95, 12-31-96
Song-Tsuen Peng
National Chiao Tung University
Department of Comm. Eng.
1001 Ta Hsueh Road
Hsinchu 30050 Taiwan
ANGEL: Ghery Pettit

TORONTO, ONTARIO (CANADA)
Joint MTI, AP
Term 8-1-99, 7-31-00
Ramesh Abhari
Department of Electrical & Computer Engineering
University of Toronto
10 Kings College Road
Toronto, Ontario, CANADA MS 3G4
Phone: +1 416 978 4534
Fax: +1 416 978 4425
ramesh@waves.ucnto.ca
ANGEL: Ghery Pettit

UNITED KINGDOM & REPUBLIC OF IRELAND
Term: 11-92, 11-93
Martin Green
International Interference Technology
The Corner House
Severham Lane
Shireham, Swindon, England SN6 6DX
Work Phone: +44 793 787 0209
Home Phone: +44 793 787 0209
Fax: +44 1793 782 310
ANGEL: Elya Joffe

WASHINGTON/NORTHERN VIRGINIA
Term: 7-1-97, 6-30-98
Lawrence Cohen
11521 Sullnick Way
Gaithersburg, MD 20878-1052
Phone: +1 202 404 7726
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Aparfiles, Virgilio (Vili)
9542 Westwood Drive
Ellicott City, MD 21042-3728
Phone: +1 301 688 6276
Fax: +1 301 688 0056
vparfiles@aol.com

Benitez, Henry
3755 N.W. Columbia Avenue
Portland, Oregon 97229
Phone: +1 503 645 6613
Fax: +1 503 645 8056
h.benitez@ieee.org

Berger, H S (Steve)
Siemens
2205 Grand Ave Pkwy
Austin TX 78726-1364
Phone: +1 512 258 6982
Fax: +1 512 258 6687
Hugh.Denny@gtri.gatech.edu

Bogusz, Michael
EMC Compliance Specialist
Newbridge Networks Corporation
508 W Snoq. River Rd SE
Auburn WA 98002
Phone: +1 360 979 5755
Fax: +1 360 355 2440
dcase@aironet.com

Boronaugh, Edwin L
EdB EMC Consultants
10210 Prism Dr
Austin TX 78726-1364
Phone: +1 512 258 6687
Fax: +1 512 258 6982
Edwin.L.Boronaugh@siemens.com

Brook, Robert H
9 Blue Place
Plainview NY 11803
Phone: +1 516 938 6991
Fax: +1 516 938 4363
rbrook@worldnet.att.net

Bush, Donald R.
131 French Ave.
Winchester, KY 40391-2520
Phone: +1 606 744 8695
Fax: +1 606 733 0740
dbush@ieee.org

Butler, Joseph E
Parker Chomerics
77 Dragon Court
Woburn MA 01888
Phone: +1 781 939 4267
Fax: +1 781 938 5071
Home Phone: +1 978 468 0080
jbutler@parker.com

Carlson, B Leonard
N&W Emetek Services
516 W Snoq. River Rd SE
Carnation WA 98014
Phone: +1 425 222 5268
Fax: +1 425 222 5268
l.carlson@ieee.org

Case, David
Aironer Wireless Comm., Inc.
367 Ghent Road, Suite 300
P.O. Box 5292
Akon, OH 44333-0292
Phone: +1 330 665 7396
Fax: +1 330 665 7301
dcase@aironet.com

Clarke, John
24 Althea Drive
Yarmouthport, MA 02675
Phone: +1 508 362 7195
JClarke805@aol.com

Chesworth, E. Thomas
Seven Mountains Scientific Inc.
P.O. Box 650
Boalsburg, PA 16827-0651
Phone: +1 814 466 6559
Fax: +1 814 466 2777
tom@7ms.com

Chubukjian, Arto
Industry Canada
300 Slater Street, Room 1859C
Ottawa Ontario Canada K1A 0C8
Phone: +1 613 990 4717
Fax: +1 613 991 3961
Chubukjian.Arto@ic.gc.ca

Cohen, Lawrence
Naval Research Laboratory
Search Radar Div Code 53326
455 Overlook Drive
Washington, DC 20375
Phone: +1 (202) 404 7726
Fax: +1 (202) 767 6172
lcohen@radar.nrl.navy.mil

Dawson, Dr W Kenneth
TRIUMF
4004 Westbrook Mall
Vancouver British Columbia
Canada V6T 2A3
Phone: +1 604 222 1047
Fax: +1 604 222 8325
k.dawson@ieee.org

Denny, Hugh W
2528 LaVista Rd
Decatur GA 30033
Phone: +1 404 894 7358
Fax: +1 404 894 7301
Hugh.Denny@grt.gatech.edu

Drewniak, James
Department of Electrical Engineering
University of Missouri-Rolla
Rolla, MO 65401
Phone: +1 573 341 4169
Fax: +1 573 341 4169
drewniak@ee.umr.edu

Drozd, Andrew
Andro Consulting Services
P.O. Box 543
Rome, New York 13442-0543
Phone: +1 315 357 4396
Fax: +1 315 334 1165
Alt. Fax: +1 315 337 4396
a.drozd@ieee.org

Duff, Dr William G
Computer Sciences Corp
5501 Backlick Rd, Suite 300
Springfield VA 22151
Phone: +1 703 914 8450
Fax: +1 703 914 8499
w.duff@ieee.org

Fenical, Gary
Instruments Specialties Co
PO Box A
Delaware Water Gap PA 18327-0136
Phone: +1 570 424 8510
Fax: +1 570 421 4227
gary_fenical@www.instr.com

Ford, Richard T
6 Westcot Place
Falmouth VA 22405
Phone: +1 202 767 3440
Fax: +1 202 404 4064
dford@radar.nrl.navy.mil

Gjerstson, William G
Boeing Information, Space & Defense Systems
PO Box 3993, MS: 8H-10
Seattle WA 98124
Phone: +1 206 342 2693
Fax: +1 206 448 8675
w.gjerstson@ieee.org

Heather, Frederick W
45870 Bob's Court
Lexington Park MD 20653
Phone: +1 301 342 6973
Fax: +1 301 342 6982
heatherf@ieee.org

Heilman, Donald N
Don HEILMAN Consultants
143 Jumping Brook Rd
Lincoln, NE 68504
Phone: +1 402 448 8675
Fax: +1 402 448 8675
d.heilman@worldnet.att.net

Hill, Lee
Silent Solutions
20 Patch Road
Hollis, NH 03049
Phone: +1 603 465 3920
Fax: +1 603 465 3921
Lee_Hill@silent-solutions.com

Hoeft, Lothar O. (Bud)
7001 Haines Ave., NE
Albuquerque, NM 87112
Phone: +1 505 298 2065
Fax: +1 505 298 2065
bud.hoeft@ieee.org

Hofmann, H R (Bob)
Lucent Technologies
Room 2B-220
2000 N Naperville Rd
Naperville IL 60566
Work Phone: +1 630 979 3627
Home Phone: +1 630 355 2440
Fax: +1 630 355 5755
hrhofmann@lucent.com
continued on page 30
Wireless Communications Design Handbook
Aspects of Noise, Interference, and Environmental Concerns
Volume II: Terrestrial and Mobile Interference

Author: Reinaldo Perez
Spacecraft Design
Jet Propulsion Laboratory
California Institute of Technology
Academic Press, San Diego, CA 1998

Introduction
This book is the second volume of a three-volume handbook series by the author titled: Wireless Communications Design Handbook. This five-chapter, 184-page Volume 2 is titled and addresses Terrestrial and Mobile Interference. Volume 1 of this series was reviewed in the EMC Society Newsletter, Summer 1999, Issue 182.

Chapter 1 - Base Stations, Mobile RF Communication Systems, and Antenna Interference
Mutual interference in today's telecommunication systems is considered directly related to the ITU frequency allocation. Types of potential mutual interference described among frequency sharing systems include: (1) interference between terrestrial stations; (2) interference between satellite-earth links; and (3) interference between terrestrial stations and earth stations.

Included among the factors that are linked to these interference situations are frequency spectra and planning, ground terminal location and positioning, transmitted signal power levels, antenna types (radiation patterns, gain, polarization, and orientation), satellite orbit utilization (such as low earth or geosynchronous orbit), propagation paths and spacing, and sharing of frequency bands. Technical means for protecting radio channels from interference are described. These techniques include means of interference cancellation.

Pager concepts, including pager loop antenna models and design techniques, are presented.

Basic cellular phone operation is described. Standards applicable to guide the design of cellular phones are identified and basic design techniques are described. The requirements for audio-to-cellular interface are presented. Analog and digital phone signal composition and processing, including basic TDMA architecture, are illustrated. Other topics addressed include coding and decoding, modulation techniques, filtering requirements, the effects of multipath phenomena, DSP applications, AD and DA conversions. Several illustrative figures are provided.

Antenna performance parameters and characterization for ground stations are described. The basic antenna parameter relationships between radiation patterns, gain, effective area, beamwidth, directivity, impedance, polarization, and beam area are summarized. Antennas considered suitable for use in wireless system base stations are described as falling into three basic groups: resonant, aperture, and phase array. The features of each group are described, including the parameters involved in antenna-to-antenna interference. Environmental factors in antenna selection are described. The performance of dipole arrays is analyzed and applications described.

Passive repeater technology for PCS systems is described. The objective is to provide adequate coverage in cell-based systems in handling the great number of new subscribers. The author describes how a passive repeater design could be placed in a covered zone to modify and shape the radiation pattern to reduce the losses due to multipath, diffraction, and shadow regions. The basic design, construction, and application of a device called a space lattice passive repeater (SLPR) are described and illustrated. The use of RF coaxial and optical distribution systems is also described.
The use of smart antennas is described to increase the coverage and capacity as well as signal quality. Basically, two kinds of smart antennas are described: switched beam and adaptive array systems. The capabilities and advantages of smart antennas over omnidirectional antennas are described including coverage of larger areas, lower transmitting power, and interference reduction such as reducing co-channel interference. Smart antennas are used in CDMA applications.

Propagation models are provided for simulating interference. The physical medium between antennas, referred to as the propagation channel, includes the different kinds of obstacles that could influence the propagation of electromagnetic waves such as mechanisms that can cause reflections, diffractions, and scattering. Models described include multipath interference, envelope fading, Doppler spread, time delay spread, path loss, co-channel and adjacent channel interference. The application of Rayleigh fading principles is presented.

Chapter 2 - Space Environment Effects in Communications
The natural radio noise environment for frequencies up to 300 GHz is described including such noise sources as lightning, extraterrestrial sources, and atmospheric thermal emissions. Quantum noise and the effects of the ground on antenna temperature are considered. The concept of noise factor is defined. Relationships are presented tying noise power flux density, electric field strength, and effective antenna area.

The effects of temperature are discussed including defined distinctions between antenna temperature, sky noise temperature, and brightness temperature. Blackbody thermal radiation is briefly described. The characteristics are presented of natural noise at the Earth's surface, atmospherics, and extraterrestrial noise.

The effects of the interaction of ions in the ionosphere and geomagnetic field lines are discussed. This section describes the variations of the quiet and disturbed plasmasphere and the impact on VLF whistlers and other wave propagation. Also, space storms, including solar activity (solar wind and sunspots), are described along with their effects on satellites.

Chapter 3 - Electromagnetic Interference and Receiver Modeling (Non-average Power Sensitivity Receptor Modeling)
This Chapter provides detailed developments of the concepts of the applications of deterministic and stochastic waveforms as applied to receiver modeling. The details discuss waveform parameters of total energy, peak current (and voltage), and rise time. The discussion is in terms of the electromagnetic interference (EMI) margin for each of these parameters that preserve the important features of the average power margin. Interference models are developed for deterministic and stochastic waveforms.

Chapter 4 - Nonlinear Interference Models
Detailed mathematical derivations are provided of several nonlinear models. The basis of these derivations is the modified nonlinear transfer function, which is discussed in great detail, with particular emphasis on its derivation from an approach based on the more general Volterra series. The mathematical theory of functionals and functional expansion (proposed by Vito Volterra in 1930) is presented in detail and used to develop the modified nonlinear transfer function approach. Limitations of the approach are discussed, and the response of a weakly nonlinear system is developed for sinusoidal steady-state and two-tone sinusoidal inputs.

Receiver desensitization, gain compression and expansion, intermodulation, cross modulation, and spurious responses, are described. Included is a discussion of transmitter intermodulation products.

Chapter 5 - Propagation Effects on Interference
This chapter describes interference problems that can arise between terrestrial systems, between terrestrial and space systems, and between space systems. Potential interference situations are described. The signal-to-noise and signal-to-interference ratios are defined and described. Communications over long distances and transhorizon propagation related to interference are presented, including the troposcatter propagation technique. The effects of ducting and rain scatter are discussed.

The analysis of the problem of interference to or from an earth station is described based on determining a coordination area surrounding the earth station. This approach is described in detail based on great circle propagation and for scattering by rain. Interference between space and surface stations is described and detailed procedures for interference analysis are presented.

A discussion is presented on the permissible level of interfering emissions. Other topics include link communications systems design (digital and analog systems), allocations of noise and signal-to-noise ratio, and diversity reception.

The end of the book includes a comprehensive list of references and an index.

EMC
Mark I. Montrose, has an unusual background that involves two paths. These paths bounced between becoming a professional musician and an electrical engineer.

His first significant exposure to engineering was when a high school teacher asked if he wanted to get an amateur radio license at age 16. This he achieved easily, progressing from Novice to Extra Class in the course of two years. His current call sign is K6WJ, having changed it from its original issue. He set up a radio shack in his bedroom with an ARC-5 crystal control transmitter and a BC-348 receiver. Every time he keyed the transmitter, the lights dimmed in the house and caused the TV to go into inverse video - a definite EMC effect. He had no knowledge about EMC at that time, except it was driving his family crazy. He also had no idea what he did to his neighbor’s TVs.

While his interest in electronics was increasing, so was his music talent as a student. He became an accomplished musician playing tenor saxophone in both high school and college. He has performed in Carnegie Hall (New York), Constitution Hall (Washington D.C.), Royal Albert’s Hall (London), plus other famous concert locations throughout Europe.

When it came time for college, he had to flip a coin between becoming a music major or electrical engineer. Engineering won.

For college, Mark selected California Polytechnic State University, San Luis Obispo. At Cal Poly, he double majored in Electrical Engineering and Computer Science, receiving two Bachelor of Science Degrees simultaneously in 1979. He spent two years as a co-op student working first at Mare Island Naval Air Station for six months and then 1-1/2 years at Vandenberg Air Force Base. While at Vandenberg, he was responsible as the primary design engineer for six modules used in a new control console for the Telemetry Integrated Processing System (TIPS) to support dual unmanned satellite launches. This system replaced a patch-panel, Honeywell/RCA analog system that had to be manually configured for each launch.

After graduation, Mark moved to the Silicon Valley in Northern California and began work as a digital designer, including work in the field of product engineering. He earned a Masters Degree in Engineering Management from the University of Santa Clara in 1983.

In 1980 while at Zilog, the FCC had issued a Docket that mandated compliance with CFR 47, Part 15. As with most EMC engineers, he was assigned the task of FCC engineer, because when he acknowledged to management that he had an amateur radio license, and that he knew what the letters RF meant, “tag, your-it” occurred. This started his career within the field of regulatory compliance. His experience as a product engineer became valuable as he learned how to design systems and make them compatible with other assemblies and their operating environment, while performing FCC/VDE, UL, CSA and TÜV submittals.

After working at several other companies, he joined MIPS Computer Systems as principal compliance engineer, specializing in EMC. It was here that he was introduced to several world-class EMC consultants. These experts took the time to train and educate him in advanced EMC related to system design and PCB layout. This training set the stage for his current position as an independent EMC consultant in Santa Clara, California.

When Silicon Graphics purchased MIPS, Mark went independent, forming his own company where he is owner and principal consultant of Montrose Compliance Services, Inc. At MIPS, he recognized that there was little information available to the general engineering community regarding EMC and applied techniques. He started to document information that he learned from the experts into a design manual. This manual ended up becoming a book, which was not the original intent of this project. The book, *Printed Circuit Board Design Techniques for EMC Compliance*, published by IEEE Press has become one of the all-time best sellers for the IEEE.

As his consulting business developed, Mark started teaching seminars and public workshops: He was professionally trained and received classroom accreditation by the State of California Council for Private Postsecondary and Vocational Education in Printed Circuit Board Technology. He is an adjunct professor for several private training schools. He also teaches in-house seminars privately for client companies in addition to public workshops around the world.

After becoming successful as a consultant and lecturer, he authored another specialty book *EMC and the Printed Circuit Board - Design Theory and Layout Made Simple*. He is also a contributing author for the *Electronics Packaging Handbook*, a joint publication of CRC and IEEE Press.

Currently, Mark is a senior member of the IEEE and sits on the Board of Directors for the EMC Society. In addition, he is a Distinguished Lecturer for the Society, a member of the dB Society, a member of TC-8, Electromagnetic Product Safety, and a life member of the American Radio Relay League (ARRL). In addition to his affiliation with the IEEE, he is assessed by a European Competent Body as a Test Laboratory to ISO Guide 25, performing in-situ testing of industrial products.

Mark is married with two children, an 11-year old boy and 14-year old daughter (another accomplished tenor saxophone player in the family). There are two items not related to EMC that Mark has an interest in: scouting and martial arts. He is still affiliated with the scouting program as an assistant scoutmaster for his son’s troop. He enjoys monthly activities that include hiking, camping and backpacking. In regards to the martial arts that he is still active in today, Mark is black belt level in Shotokan Karate. EMC
WHERE
WILL YOU
BE IN
AUGUST,
2000?

Join your hosts, the IEEE EMC Society, as engineering professionals from all over the globe meet in Washington DC at the 2000 IEEE International Symposium to discuss the news and views on the World of EMC, the challenges facing the EMC engineer in the government, commercial and military arenas, trends in standards and regulations, changes affecting product and system design, new ideas and challenges for the decade ahead. The spectrum of challenges for EMC is changing, ensure you're a part of the future at the 2000 IEEE International Symposium on EMC.

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Technical Program - Larry Cohen
202-404-7726, cohen@radar.mrl.navy.mil
Exhibits - Penny Caran
804-897-5334, pcaran@TechIntl.com
Attendee Info - IEEE Conference Services
800-810-4333, d.catapano@ieee.org

www.dcemc2000.org
Chairman’s Message

by Dr. William G. Duff

Highlights of the 2000 IEEE International Symposium on EMC in Washington, DC

As Chairman of the 2000 IEEE International Symposium on Electromagnetic Compatibility, and on behalf of the EMC Society, the Washington/Northern Virginia EMC Chapter and the Symposium Committee, I invite you to attend this special EMC event. The theme of the symposium is “A Spectrum of EMC Challenges for the Next Millennium.” The symposium will highlight numerous EMC challenges that must be addressed in the future and will, hopefully, provide some solutions. The symposium will be held during the week of August 21-25, 2000 in Washington, DC at the Washington Hilton and Towers Hotel.

We plan to have a great technical program with thirty-six technical sessions featuring two hundred papers on the latest developments in EMC technology. There will be an open forum session where attendees can interact directly with the authors of selected papers. To take advantage of the unique opportunities that Washington, DC has to offer, we are planning to have six organized sessions that will address some of the specific “EMC Challenges” that the regulatory community and various government agencies will have to address in the new Millennium. The “EMC Challenges” sessions will be of particular interest to local government agencies and contractor personnel. These sessions may be attended by individuals with a limited registration (which is available at a significantly reduced fee). The limited registration will only provide admission to the “EMC Challenges” sessions. Tickets to Social Events or a Symposium Record may be purchased separately.

Exhibits of EMC products and services will supplement the technical program. Approximately two hundred exhibitors will participate in the symposium.

The latest developments in EMC technology will be on display and the exhibitors will be happy to describe how their products or services may help you with your EMI problems. Individuals that are interested in the “Exhibits Only” will be admitted for a nominal fee. I encourage you to visit the exhibit area and take advantage of the opportunity to learn about the latest in EMC products and services.

Our social program will begin on Tuesday evening with a reception at the Air and Space Museum - the most visited museum in the world! The Wednesday evening gala will include an Exhibitors Reception followed by a Moonlight Tour of the Washington Monuments. On Thursday, we will have the Awards Luncheon. These social events will provide an opportunity for attendees to interact informally.

I would like to thank the symposium committee, attendees, exhibitors, presenters, companions and volunteers that are involved in making this symposium a huge success.

EMC

“EMC Challenges Sessions”

Presented at the 2000 IEEE International Symposium on EMC

The “EMC Challenges Sessions” will address some of the specific EMC issues that the regulatory community and various government agencies will have to address in the new Millennium. These sessions may be attended by individuals with a “Limited Registration” or a “Regular Registration.”

Tuesday Morning

“EMC Challenges” – Providing Spectrum for Use by the Private Sector
Chairperson – Julius Knapp – Federal Communications Commission
• Meeting the Spectrum Needs for New Satellite Services
• Providing Spectrum for Third Generation Mobile Services
• Spectrum Requirements for Fixed Services
• The New Spectrum Management Paradigm – Auctions and Flexibility
• Government/Non-Government Spectrum Sharing
• Impact of New Technologies in Spectrum Management

Tuesday Afternoon

“EMC Challenges” – Providing Spectrum for Use by the Federal Government
Chairperson – TBD
• A Wireless World and New Spectrum Dependent Technology
• Federal Government Requirements for Spectrum
• How NTIA Will Meet the Challenges
• Optimum Utilization of the Spectrum – Spectrum Sharing
• Spread Spectrum Systems
• DSP and Error Detection and Correction Coding

Wednesday Morning

“EMC Challenges” – E3 and Spectrum Support to the Warfighter
Chairperson – Bill Lensi and Steve Caine – Joint Spectrum Center
• The Warfighter’s Requirements for Spectrum
• How the JSC Will Meet these Requirements
• Incorporating E3/SC in Acquisitions
• Utilization of Ordinance in Future Joint Operations
• Standardizing Spectrum Information Systems
• Siting Mobile Service Providers on DOD Property

Wednesday Afternoon

“EMC Challenges” – Dealing With EMI Problems in the Transportation Industry
Chairperson Andy Drozd – Andro Consulting Services
• Intelligent Transportation Systems and Potential EMC Concerns
• Transient Protection of Transportation Equipment
• Aircraft Protection Requirements for High Intensity Radiated Fields
• Measurement Methods and Application of EMC Regulatory Limits to Ground and Commercial Transportation Systems
• Spread Spectrum Communications and Control Systems in Modern Transportation and Traffic Control Applications
• Practical Techniques to Minimize EMI in Commercial Vehicles
• Space Transportation Systems Spectral – Orbital Congestion

Thursday Morning

“EMC Challenges” – Using COTS Equipment for Military/Critical Applications
Chairperson Dave Dixon – Naval Undersea Warfare Center
• The Guides EMC Specification/Platform Requirement Matrix and Some Navy COTS Issues
• Harmonization of Military and Commercial EMC Specifications
• The Difficulty in Comparing Military and Commercial EMC Standards
• Proliferation of EMC Standards
• A Comparison of Commercial and Military High Level EMI Susceptibility Requirements

Thursday Afternoon

“EMC Challenges” – Impact of EMC Metrology on Specifications and Standards
Chairperson Dr. Motohisa Kanda – National Institute of Standards and Technology
• EM Shielding Measurement Methods and Techniques
• Application of EMC Measurement Methods and Techniques to Cables
• EMC Measurement Methods and Techniques for PCBs
• EMC Measurement Methodology for Lightning and ESD
• Radiation Hazard Measurements
• EMC Measurements and Modeling
• Neural Networks
Board of Directors Activities

Washington, DC
November 19-20, 1999

Call to Order

The agenda was presented. Bill Gjertson was asked to report on the recent TAB meeting. Warren Kesselman was asked to report on the IEEE Millennium Awards. Discussion on the selling of IEEE Intellectual Property was added. The topic of an EMC BoD Administrator was added. The Survey Report was moved to “Unfinished Business.” The Vice-Presidents were asked to present a short summary of their respective areas of responsibility. The agenda was approved with these additions.

President’s Report
President Hoolihan reported on the recent IEEE meetings in Salt Lake City. The Society review occurred at this meeting. Generally speaking, the review was very favorable for the EMC Society since membership growth has been steadily increasing, as has symposia attendance. Likewise, income from the symposia has remained strong. We continue to develop, update, and publish standards at an above average rate. The fastest growing membership regions are 8, 9 and 10. President Hoolihan shared some of the view graphs he presented for the formal review. The IEEE will issue a written report summarizing the review. Bill Gjertson reported on the IEEE Board of Directors meeting on November 12 in Salt Lake. He discussed the branding issues - the IEEE logo currently used will remain in place. The IEEE 2000 budget was approved; however, $1.7 million in initiatives were defeated. Warren Kesselman summarized the Millennium Awards activity. The list of candidates and status of balloting was presented. These awards will be presented during the 2000 IEEE EMC Symposium in Washington, DC.

Treasurer’s Report
Treasurer Warren Kesselman presented his report. The year-end budget net for the EMC Society is expected to be $100,000. Cash on hand as of September 30, 1999 was $360,190 and the long-term investment value was $693,920. Regarding the 2000 budget, the IEEE increased the surplus of $38,000 by $15,000 for a total 2000 budget surplus of $53,000. Mr. Kesselman’s report included a breakdown by line item of the 2000 EMC Society budget and a summary of IEEE activity since 1967 related to finances. Regarding the IEEE’s new financial model, in the worst case scenario, Mr. Kesselman expects that the reserves of the EMC Society may be “taxed” by 3%.

Secretary’s Report
Janet O’Neil presented the minutes from the Board meeting held August 1 and 5, 1999 in Seattle, Washington. Two changes were required. The minutes were approved as amended.

Membership Services Report
Todd Hubing, Vice-President for Membership Services, distributed his report. The Transactions Best Paper Award cash prize was increased from $50 to $1000 for the year 2000 and beyond. New chapters have been established in Melbourne, Florida and St. Petersburg, Russia. There will be an IEEE Chapters Coordinator meeting in New Orleans in February 2000. Henry Benitez will attend from the EMC Society. Regarding the Distinguished Lecturer (DL) program, there have been 21 DL presentations to date this year and at least three more are planned. Five of the 24 were in Region 8 and three were in Region 10. Doug Smith and Werner Schaefer were approved as the new DL candidates for two-year terms, respectively, starting in the year 2000. Membership Chairman Andy Drozd advised that there are currently 5,189 members of the EMC Society. He is working with the Washington, DC Symposium committee to reserve two booths for the EMC Society. The membership booth display needs to be replaced and he is investigating projected costs. He is working with Elya Joffe to establish contacts in the Middle East to facilitate the 2003 Israel EMC Symposium. The new Region 8 membership chair is Elya Joffe and Jose Perini agreed to be the new Region 9 membership chair.

Technical Services
Kimball Williams, Vice-President for Technical Services, reviewed the goals and objectives for Technical Services. Regarding the activities of the Education Committee, the University Grant RFP has been issued. The committee is coordinating with the Washington DC symposium committee for space for the tutorials and demonstrations. The line item budget for 2000-2003 was reviewed. There is a new chair, Ahmad Fallah, for the Student Design Contest Committee. They are mailing design kits to students now and the hope is to schedule the contest during the Washington DC symposium.
Greg Schneider and Mike Hatfield have joined Andy Drozd on the Experiments Committee. Regarding video production, Dick Ford advised that he does not have the time to work with Empire Video for creating the video of the EMC demonstrations. However, the committee took a video of Clayton Paul performing a demonstration at the Seattle symposium. The Washington DC committee will use this to promote attendance at the symposium by distributing this to local universities and colleges. President Hoolihan requested that Kimball Williams investigate the IEEE's Nano Technology Committee and report on this at the next Board meeting. Andy Drozd reported on the recent ITS Council Symposium in Japan. It was well attended and posted a $30,000 surplus. Mr. Drozd recommends continuing the EMC Society's involvement in this Council. There will be a joint Representative Advisory Committee (RAC) luncheon scheduled with the SACC on during the Washington DC symposium. Three new membership organizations have been approached. RAC also wishes to connect with other EMC symposia and conferences worldwide. Dave Case, RAC Chair, will present a paper at the Biological Effects of EMC conference in Crete, Greece next year. In the absence of Technical Activities Committee (TAC) Chair Andrew Podgorski, Kimball Williams discussed the EMC symposia paper review process. Electronic review of the proposed symposia papers was discussed. The committee would like to review the papers 100% electronically.

**Standards Services**

Don Heirman, Vice-President for Standards Services, presented his report. This included an organizational chart of the three committees reporting to Standards. The committee is working on development of their website with a hot link to the Society's website. The IEEE is providing the web site services. Regarding the SDCom (Standards Development Committee), as a result of the elections held at the last meeting, Steve Berger is the new Chairman of the Standards Committee, Dave Traver is the new Vice-Chairman and Hugh Denny is the new Secretary. There are five active standards. Hugh Denny is the chairman of SETCom (Standards Education and Training Committee). This committee desires to enhance the awareness of the EMC standards process by conducting training seminars for working groups. They also want to educate the broader community to show how standards can be implemented. They are planning a Standards Development workshop for the Washington, DC symposium. IEEE Policies and Procedures will be reviewed. Guidelines for running and managing an effective working group will be provided. Finally, how to review and track an actual document will be presented. Bob Hofmann has stepped down as chairman of SACC on (Standards Advisory and Coordination Committee). A replacement is being sought. Volunteers interested in this position should contact Don Heirman at d.heirman@worldnet.att.net.

**Tour of Washington Hilton and Towers Hotel Facilities**

Bill Duff, Chairman of the Washington, DC EMC Symposium, introduced Shannon Byrne, Conference Center Manager of the Washington Hilton and Towers, Larry Cohen, Symposium Committee Chairman, Dan Hoolihan, outgoing EMC Society President, and Joe Butler, incoming EMC Society President.

**Vice-President Reports**

Each Vice-President gave a brief report on their respective activities for the benefit of the new members of the Board present at the meeting. It is expected that each new Board member will volunteer to work under one or more of the Vice-Presidents.

**Long Range Planning**

Joe Butler, President-Elect, presented a report on Long-Range Planning. The Board then broke into four separate groups to formulate goals and objectives.
for the next five years. Each breakout group focused on one of the four following topics: globalization, membership benefits, communications, and organization/governance. Mr. Butler also distributed a copy of the IEEE Strategic Plan as a reference document for the planning exercise.

The meeting then adjourned for the day at 5:00 pm.

The Board reconvened and President Hoolihan called the November 20, 1999 meeting to order at 9:00 am.

Communication Services
Len Carlson, Vice-President for Communication Services, presented his report. This summarizes the recent Society review related to Periodicals, including the Transactions and Newsletter. Mark Montrose reported for Hugh Denny, chair of the IEEE Press committee. He advised that significant revenue has been raised. The Society’s return on investment in the IEEE Press has been good. The books have generated $30,000 in income with $3,000 in expenses. Janet O’Neil, Editor, reported on the Newsletter. The budget for next year has been increased to cover the increasing page length as well as the increasing use of color for cover photos and graphs/figures that accompany some of the practical papers. Andy Drozd reported on the activities of the EMC Society web pages. He has reviewed the content and operating functions of several EMC Society websites. The goal is to ensure each site works properly, has current and correct information, and projects a professional image for the EMC Society.

Conference Services
Henry Ott, Vice-President for Conference Services, presented his report. He reviewed the financial surpluses realized at the various EMC symposia held annually since 1991. The average surplus of these symposia as a percentage of revenue is some 20%. The Denver 1998 Symposium committee was fined $300 by the IEEE for not having their books closed within one year. Mr. Ott advised that the books need to be closed to avoid additional fines. Treasurer Kesselman advised that the IEEE has implemented these fines due to pressure from the IRS. Bill Duff reported as chairman of the 2000 IEEE International Symposium on EMC in Washington, DC. Regarding the technical papers, 254 have been received and are being evaluated. 245 exhibit booths and 29 tables have been sold. Ads have been placed in various magazines and press releases have been issued. There will be no increase in registration fees from last year. The issue of single sponsors for symposium promotional opportunities was discussed. President Hoolihan asked the symposium committee chaired by Barry Wallen to address this issue.

Unfinished Business
Dick Ford presented a report on the symposium survey. Overall the Seattle symposium received a good rating in terms of the presentation quality, hotel, registration, and social.

New Business
Janet O’Neil presented a proposed policy for website advertising that was approved as modified. Russ Carstensen, Executive Director of NARTE, presented a report on NARTE activities. NARTE is the only known entity that certifies individuals as competent EMC engineers. He would like to see the organization establish a formal relationship with the IEEE EMC Society. Most importantly, they would like to formally recognize the EMC Society as containing the body of knowledge defining EMC. He requested the assistance of four to five Board members to create a Memorandum of Understanding (MOU) to describe this relationship. The intent is to present the draft MOU to the Board for approval at the March 2000 Board meeting. President Hoolihan requested that Kimball Williams, as Vice-President for Technical Services, form the task force to address this issue and present the draft MOU at the March meeting. Don Heirman, Dick Ford, Gergy Pettit, Tom Chesworth, Don Sweeney, Joe Butler, and Elya Joffe volunteered to be on this task force.

By-Laws
Warren Kesselman recommended amending the by-laws to delete paragraph 12.2 “Typical Standing Committees.” The Board agreed.

Angel Program
Dick Ford suggested renaming the EMC Chapter “Angel” program the “Haislmaier Angel” program in memory of Robert Haislmaier, a longtime member of the Board. The Board agreed.
recognition prizes will be presented for the 1st and 2nd best war stories presented at the symposium. Todd Hubing accepted the action item from President Hoolihan to establish a task force to address this as an ongoing special session at each symposia, assign an official name to the committee, create the recognition and/or prize, etc.

Board Meeting Schedule for 2000

Joe Butler reviewed the schedule of meetings for the year 2000. The new schedule of meetings will be distributed to the Board in the near future.

Planning Committee

The four separate breakout groups reconvened to rank their respective goals and objectives. The leader of each group then reported out on the group’s activities. Mr. Butler subsequently summarized this reporting.

Action Item Review

Secretary O’Neil reviewed the status of open action items from previous meetings and summarized the action items presented at the current meeting.

President’s Closing Remarks

President Hoolihan recognized and thanked the outgoing Board members, including those present Norm Violette, Dick Ford, Andy Drozd and Bill Gjertson. He also thanked the Board for their support over the last two years and voiced his support for the incoming new President of the EMC Society, Joe Butler. The gavel was then passed to Mr. Butler who acknowledged the fine leadership of the EMC Society by Mr. Hoolihan and presented him with a past President’s pin.

Since there was no further business, the meeting adjourned at 4:45 pm.

Janet O’Neil
Secretary,
EMC Society Board of Directors

Call for BoD Nominations

Nominations are now being accepted for candidates for the IEEE EMC Society Board of Directors. In accordance with the Bylaws, nominations may be made by petition or by the Nominations Committee. Petitions shall carry a minimum of 15 names of Society members in good standing (dues paid), excluding those of students. Nominees should possess professional stature and significant technical skills in electromagnetic compatibility. They must have adequate financial support outside the Society and have the approval of their organizations or employers to actively participate. Duties include attendance at three of four Board meetings a year and participation on committees, both of which require telephone, fax, mail and e-mail communications. Nominees must be full members of the IEEE and members of the EMC Society. Elected Directors must serve a three-year term starting January 1, 2001. Attendance at the last meeting of the 2000 year is also desirable. No member can serve more than two consecutive three-year terms, including partial terms. All nominees are required to submit a biographical summary to the Nominations Chairman for inclusion on the ballot. The summary must not exceed a one-half typewritten page and must be in the following format:

First paragraph
Name, title, place of employment, educational background
Second paragraph
Technical and professional experience
Third paragraph
IEEE service and activities including offices, committees, etc.

Please submit petitions and biographical summaries to the Nominations Chairman:

Dan Hoolihan
Hoolihan EMC Consulting
PO Box 367
Lindstrom, MN 55045
phone: (651) 213-0966
fax: (651) 213-0977
d.hoolihan@ieee.org

Submissions must be postmarked no later than May 31, 2000. Information can be obtained from Mr. Hoolihan or any member of the BoD.
NOMINATION PETITION
ELECTROMAGNETIC COMPATIBILITY SOCIETY
BOARD OF DIRECTORS
(Nomination guidelines given on preceding page.)

I. NOMINEE’S NAME:__________________________________________________________

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ADDRESS:___________________________________________________________________
____________________________________________________________________________
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PHONE:_______________________________________________________________________

II. BIOGRAPHICAL SUMMARY: Attach Typed Copy

III. SIGNATURES: (Minimum of 15 names.) We, the undersigned, all of whom are current
IEEE Electromagnetic Compatibility Society (EMCS) members in good standing, nominate the
above-mentioned person to serve on the EMCS BoD for a three-year term beginning January 1,

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38
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Enter your name as you wish it to appear on your membership card and all correspondence. Please circle your last/surname as a key identifier for the IEEE database. Do not exceed 40 characters or spaces per line. Please use English language characters and abbreviate as needed.

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Are you now or were you ever a member of the IEEE?  
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Grade

Year Membership Expiration

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Campus

State/Province

Country

Month/Year Received

B Highest Technical Degree Received

Program/Course of Study

College/University

Campus

State/Province

Country

Month/Year Received

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You may attach a resume to provide additional information for IEEE membership grade determination.

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Department/Division

Title/Position

Years in Current Position

Years in the Profession Since Graduation

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State/Province

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Country

Office Phone

Office Fax

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4 SIGNATURE OF APPLICANT

I hereby make application for IEEE membership and agree to be governed by the IEEE Constitution, Bylaws, and Code of Ethics.

SIGNATURE

DATE

Application must be signed.
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   - Electronics
   - Industrial Control
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   - Nuclear
   - Other (please specify)

B. What is your principal function?
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   - Marketing
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EMC Abstracts
Osama Fujiwara, Associate Editor

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

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

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

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

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

EMCABS: 01-2-2000
A ZERO-CURRENT-SWITCHING PWM FLYBACK CONVERTER WITH A SIMPLE AUXILIARY SWITCH
+Dept. of Electronic Engineering, City University of Hong Kong, Hong Kong,
+Dept. of E.S., University of Sydney, Sydney, Australia.
Abstract: It is well known that Switch Mode Power Supplies (SMPS) that use “soft switching” generate less conducted emissions than the “hard switched” units. A simple modification, an auxiliary winding, a switch and a small capacitor, converts a conventional isolated flyback PWM circuit to a ZCS (Zero-Current Switching) circuit with several advantages, including reduced conducted emissions. The analysis in the paper is complemented with measured data on a multi-output 80 W circuit. A simplified design procedure is shown by an example.
Index terms: Conducted emission reduction, soft-switching flyback SMPS

EMCABS: 02-2-2000
A STUDY ON THE OPTIMIZATION OF A 60 GHZ WIRELESS LAN INSTALLATION ENVIRONMENT
Tomoya KUBO, Masafumi KIMURA and Risaburo SATO, Electromagnetic Compatibility Research Laboratories Co., Ltd., 6-63, Minami-Yoshinari, Aoba-ku, Sendai, 980-3204 Japan
Abstract: This paper describes the conditions for placing electromagnetic absorbers to control the delay waves appearing in a 60 GHz band wireless LAN installation environment. It was found that absorbers located at the reflection points of the waves, which were calculated using a ray-tracing method simulation, could suppress the delay waves effectively, and the level of delay waves could be controlled by the size of the absorber.
Index terms: Wireless LAN, absorber location, ray-tracing method, computer simulation

EMCABS: 03-2-2000
CALCULATION OF LOAD EFFECT PRODUCED BY FERRITE CORE ATTACHED TO WIRE ABOVE A GROUND PLANE
Al Zaher Samir and Osamu Fujiwara, Faculty of Engineering, Nagoya Institute of Technology, Showa-ku, Gokiso-cho, Nagoya 466-8555 Japan, Phone: +81-52-735-5421, Fax: +81-52-735-5442, E-mail: fujiwara@odin.elcom.nitech.ac.jp
Abstract: Ferrite cores are commonly attached to a cable/wire to reduce the electromagnetic noise emission form digital information equipment. In this paper, an equivalent circuit for the load effect produced by a ferrite core attached to a wire above a ground plane was considered. A practical method for determining the equivalent circuit parameters was presented, and the resultant load effect was calculated. The validity was confirmed by measurements of scattering transmission parameters for the wire with attachment of a commercially available ferrite core above a ground plane.
Index terms: Wire above a ground, ferrite core, load effect, equivalent circuit

EMCABS: 04-2-2000
RISE TIME EFFECTS ON CROSSTALK IN HIGH-SPEED MICROSTRIP TRANSMISSION LINES
Settapong Malisuwan and Vichace Ungvichian, Chulachomklao Royal Military Department of Electrical Engineering Academy, Nakhon-Nayok, Thailand, Department of Electrical Engineering EMR&D LAB, Florida Atlantic University, Boca Raton, Florida, USA
Abstract: Effects of a high-speed pulse with rise time (quadratic-linear-quadratic transition) on crosstalk along microstrip transmission lines are investigated. Closed form analysis equations for coupled microstrip lines have been used to calculate the crosstalk transfer function. The substrate loss, line loss, line thickness correction factor, and cover plate correction factor are included in the calculation. The simple closed form expressions of crosstalk in this paper are given in a form such that they can be implemented easily on a desktop computer or a programmable pocket calculator.
Index terms: Microstrip lines, rise time, crosstalk, closed form analysis

EMCABS: 05-2-2000
MEASUREMENT FOR ELECTROMAGNETIC SUSCEPTIBILITY OF THE ELECTRONIC MEDICAL EQUIPMENT
Han-Kil Bae and Jong-Heon Kim, Dept. of Radio Sci. and Engr., Kwangwoon Univ., 477-1 Wolgye-dong, Nowon-ku, Seoul 139-701, Korea
E-mail: ihkim@daisy.kangwoon.ac.kr

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Al Zaher Samir and Osamu Fujiwara, Faculty of Engineering, Nagoya Institute of Technology, Showa-ku, Gokiso-cho, Nagoya 466-8555 Japan, Phone: +81-52-735-5421, Fax: +81-52-735-5442, E-mail: fujiwara@odin.elcom.nitech.ac.jp
Abstract: Ferrite cores are commonly attached to a cable/wire to reduce the electromagnetic noise emission from digital information equipment. In this paper, an equivalent circuit for the load effect produced by a ferrite core attached to a wire above a ground plane was considered. A practical method for determining the equivalent circuit parameters was presented, and the resultant load effect was calculated. The validity was confirmed by measurements of scattering transmission parameters for the wire with attachment of a commercially available ferrite core above a ground plane.
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Settapong Malisuwan and Vichace Ungvichian, Chulachomklao Royal Military Department of Electrical Engineering Academy, Nakhon-Nayok, Thailand, Department of Electrical Engineering EMR&D LAB, Florida Atlantic University, Boca Raton, Florida, USA
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EMCABS: 05-2-2000
MEASUREMENT FOR ELECTROMAGNETIC SUSCEPTIBILITY OF THE ELECTRONIC MEDICAL EQUIPMENT
Han-Kil Bae and Jong-Heon Kim, Dept. of Radio Sci. and Engr., Kwangwoon Univ., 477-1 Wolgye-dong, Nowon-ku, Seoul 139-701, Korea
E-mail: ihkim@daisy.kangwoon.ac.kr
Abstract: In this paper, the electromagnetic immunity of electronic medical equipment was tested by employing a standard test method for medical equipment. In addition, the electromagnetic interference to the medical equipment caused by two different types of portable transceivers have been studied. In this study, 20 medical equipments of 14 different types were investigated. There are a patient monitor, an infusion pump, a neonatal incubator and so on. In the case of the EMS test, interferences were detected for seven medical products of four different types (53.3%) such as the patient monitor. For the two portable transceivers, 16 medical equipments of 11 different models (80%) were affected. The experiment results show that the malfunction of the electronic medical equipments is dependent upon the frequency range and the electric field strength of the mobile phones.

Index terms: Medical equipment, portable transceiver, malfunction, electromagnetic immunity test

EMCABS: 06-2-2000

FORMATION OF HOT SPOTS IN THE HUMAN EYE FOR PLANE WAVE EXPOSURES

A. Hirata, G. Ushio, and T. Shiozawa, Department of Communication Engineering, Osaka University, Yamauchi-oka 2-1, Suita-shi, Osaka, 565-0871, Japan

Abstract: The interaction between the human eye and EM waves in the hot spot frequency range is investigated with the aid of the FDTD method. Numerical results show that hot spots appear in a certain frequency range, and the location and number of hot spots depend upon the frequencies of the incident wave. In particular, hot spot formation is found to be mainly caused by the resonance due to the geometrical structure of the eye. Additionally, temperature rises in the human eye are calculated to assess the possibilities of microwave-induced cataract formation. The numerical estimate shows that the EM wave with the power density 22 mW/cm² induces a temperature rise of 3.0 degrees centigrade, the threshold temperature rise for cataract formation.

Index terms: Human eye, electromagnetic wave exposure, FDTD method, temperature rise, hot spot formation

EMCABS: 07-2-2000

DEPENDENCE ON ANTENNA OUTPUT POWER OF TEMPERATURE RISE IN HUMAN HEAD FOR PORTABLE TELEPHONES

Jiangjing Wang, Takashi Joukou and Osamu Fujiwara, Department of Electrical and Computer Engineering, Nagoya Institute of Technology Gokiso-cho, Showa-ku, Nagoya 466-8555, Japan, E-mail: wang@wdn.elcom.nitech.ac.jp

Abstract: Since biological hazards due to RF exposure are caused mainly by a temperature rise in tissue, the localized specific absorption rate (SAR) should be related to the temperature rise in the human head for portable telephones. Although the SAR is known to be directly proportional to the antenna output power of portable telephones, the dependence of temperature rise on the antenna output power remains unclear. In this paper, the relationship between the peak temperature rise in a human head and the antenna output power is investigated by using the finite-difference time-domain (FDTD) method. It is found that the peak temperature rise is approximately proportional to the antenna output power below 1 W and also that the peak temperature rise in the brain can be estimated from its blood-flow and heating potential.

Index terms: Portable telephone, human head, FDTD method, antenna input power, SAR, temperature rise

EMCABS: 08-2-2000

SAR INDUCED IN A MULTILAYERED SPHEROIDAL HEAD MODEL BY THE EM FIELD IRRADIATED FROM A CELLULAR PHONE

X.K. Kang, L.W. Li, M.S. Leong, P.S. Kooi and T.S. Yeo, Communications & Microwave Division, Department of Electrical Engineering, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260.

Abstract: The recent development of cellular phones has resulted in an increasing public concern about the biological effects of electromagnetic (EM) fields on the human head. This paper presents the computation of the specific absorption rate (SAR) distribution inside a multilayered prolate spheroidal model of human head exposed to a GSM dipole, using spherical vector wave functions.

Index terms: Cellular phone, multilayered spheroidal head model, SAR, theoretical analysis

EMCABS: 09-2-2000

CALCULATION OF CURRENT IN A HUMAN MODEL INDUCED BY LOW FREQUENCY MAGNETIC FIELD

Boonchai Techmanot, Shoji Hamada and Tadashi Takuma, Kyoto University, Kyoto EMC-Japan meeting at Kyodai-Kaikan, Kyoto, December 3, 1999, EMC-99-1

Abstract: The paper describes the calculation result of induced current in a human model due to a 50 Hz uniform magnetic field. The calculation method is the boundary element method using a human model composed of the second order curved elements. The maximum current density was calculated at each z-plane in the human model. The overall maximum induced current was determined for the magnetic field in the horizontal direction from back to front and in the vertical direction. In the case of the horizontal magnetic field, five internal organs were simulated with ellipsoids and their maximum induced current was calculated.

Index terms: Numerical calculation, boundary element method, ELF magnetic field, human model, induced current

EMCABS: 10-2-2000

TEST METHOD OF ELF MAGNETIC SHIELDING EFFECTIVENESS USING MAGNETIC FIELD EXPOSURE METER

Kenichi Yamazaki+, Hideaki Yasaki++, Hiroyuki Sakata++ and Yuuo Okazaki++ in Central Research Institute of Electric Power Industry, ++ Tokyo University of Agriculture and Technology, ++ Gifu University

EMC-Japan meeting at Kyodai-Kaikan, Kyoto, December 3, 1999, EMC-99-2

Abstract: A new test method for evaluation of ELF (extremely low frequency) magnetic shield effectiveness was proposed. A cubic shielding box without any apertures and a magnetic field exposure meter, which contains a data storage function and placed in the center of the box, were used to characterize shielding effectiveness of several shielding materials. A procedure, an experimental setup and data formats of the proposed method are shown.

Index terms: ELF magnetic field, magnetic shielding, magnetic field exposure meter

EMCABS: 11-2-2000

ELF MAGNETIC FIELD MITIGATION NEAR ELECTRIC POWER LINES USING AUXILIARY CONDUCTOR LOOP

Hideaki Yasaki+, Yuto Takahashi+, Kenichi Yamazaki++ and Tadashi Kawamoto+++ + Tokyo University of Agriculture and Technology, ++ Central Research Institute of Power Industry

EMC-Japan meeting at Kyodai-Kaikan, Kyoto, December 3, 1999, EMC-99-3

Abstract: Some investigations regarding ELF (extremely low frequency) magnetic field mitigation for the overhead power line were conducted. We focused on a mitigation method using an auxiliary conductor loop installed near the phase conductors. In this paper, the effect of the existence of conductor sag was investigated, for both passive and active loop methods. In addition, the concept of the current dipole moment was rewritten by a simple formula and some optimal conductor arrangements for effective active loop mitigation were shown.

Index terms: ELF magnetic field, passive loop, active loop, current dipole moment, conductor sag

EMCABS: 12-2-2000

STUDY ON A LOCATING SYSTEM OF A PARTIAL DISCHARGE OCCURRENCE POSITION FOR POWER DISTRIBUTION LINE


EMC-Japan meeting at Kyodai-Kaikan, Kyoto, December 3, 1999, EMC-99-6

Abstract: Equipment trouble may be caused by the partial discharge phenomenon that has its root in deterioration of insulation or contact. Besides the partial discharge pulse may generate an obstruction on television screen in area of low electric field strength. Under present condition we have to inquire poles one by one to specify that source. Since it is very inefficient, we developed the system mounted on a car, which analyze phase difference of pulse signals from partial discharge by receiving the signal on four antennas. The system can locate a partial discharge occurrence position in a short time. In this paper, the causes of location deviation in process with development of this system are reported.

Index terms: Partial discharge pulse, spatial phase difference method, antenna, global positioning system
Calendar

EMC Related Conferences & Symposia

2000

May 3-7
Co-Sponsored by the IEEE Communications Society
SECOND ASIA-PACIFIC CONFERENCE ON ENVIRONMENTAL EMC -CEEM ’2000
Shanghai, China
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May 9
Sponsored by the Southeastern Michigan EMC Chapter
(see ad on page 13)
EMC FEST 2000: A COLLOQUIUM AND EXHIBITION ON LOW COST, EASY TO USE, EMC DEVELOPMENT TEST METHODS
With Henry Ott and Doug Smith
The Dearborn Inn, Dearborn, MI
Kimball Williams, 248.354.2845
k.williams@ieee.org

May 14-19
CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS (CPEM - 2000)
Technical Forum and Trade Exhibition
Sydney Hilton, Australia
Barry Inglis, Conference Chairman
cpem2000@tourhosts.com.au

May 17-19
Sponsored in Cooperation with the German Section of the IEEE Computer Society
4th IEEE WORKSHOP ON SIGNAL PROPAGATION ON INTERCONNECTS
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http://www.tet.uni-bonnover.de/SP1

May 22-23
Sponsored by the Chicago EMC Chapter
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Frank Krozel, 630.924.1600
www.ewb.ieee.org/so/emc/chicago

May 22-23
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Action 261
CAGLIARI EMC WORKSHOP 2000
UE COST 261 WORKSHOP ON COMPUTATIONAL ELECTROMAGNETICS FOR COMPLEX AND DISTRIBUTED SYSTEMS (in English)
Plus “A Premise on Electromagnetic Pollution” (in Italian) on May 20
Prof. Maurizio Migliaccio
Fax: +39.070.6755900
Phone: +39.070.6755871
e-mail: migliaccio@diee.unica.it
www.diee.unica.it/cost261.html

July 5-14
PROGRESS IN ELECTROMAGNETICS RESEARCH SYMPOSIUM (PIERS 2000)
Royal Sonesta Hotel
Cambridge, MA
Hsiu C. Han
515.294.5320
http://www.piers.org/PIERS2K

September 11-15
EUROPEAN EMC SYMPOSIUM (formerly EMC ROMA)
Brugge, Belgium
Prof. Johan Cartryse
Fax: (059) 70.42.15
e-mail: johan.cartryse@kb.kbbo.be

October 23
Sponsored by the Eastern North Carolina EMC Chapter
A ONE DAY EXHIBITION AND TUTORIAL ON "THE FUNDAMENTALS OF EMC"
by Dr. Clayton R. Paul
The Radisson Governors Inn
Research Triangle Park, NC
Jim Marley, 919.549.1408
james.r.marley@us.uil.com

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

2000
Washington, DC
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703.914.8450

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Montreal, Canada
Montreal Convention Center
Christian Dube
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Dan Hoolihan
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E-Mail: d.hoolihan@ieee.org

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(International IEEE)
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Fax: 972.9.765.7065

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2005
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June 9, 2000
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August 20 and 24, 2000
Washington DC

November 16, 2000
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