IEEE EMC SOCIETY Newsletter

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MIL-STD-461/2 REVISED DRAFT

Within the next few months, the government will circulate the proposed MIL-STD-461D and MIL-STD-462D drafts for review and comment. For industry, the distribution will be made through the American National Standards Institute Accredited Standards Committee C63 on Electromagnetic Compatibility. Copies will automatically be distributed to members of the SAE-AE4 Committee, the EIA-G46 Group, and the IEEE EMC Society Standards Committee. Others interested in receiving a copy for comment should address their request in writing to: Sue Vogel, IEEE Standards Office, 445 Hoes Lane, P.O. Box 1331, Piscataway, New Jersey 0885-1331 USA. Phone (908)562-3817, FAX (908)562-1571.

A Department of Defense distribution will be handled in accordance with defense standard program procedures.

Comments should be submitted to the organization from which copies were obtained within the defined time limit and not directly to the Tri-Service Committee members who are preparing the document. Furthermore, readers are cautioned not to use or apply the draft document in any way or form since it is likely to change significantly.

BOD ELECTION BALLOT

A ballot for the election of six members to the IEEE Electromagnetic Compatibility Society Board of Directors was issued on July 26, 1991. The ballots returned have been counted, and the following candidates have been elected for a three-year term beginning January 1, 1992: John W. Adams, Donald E. Clark, William G. Gjertson, Sr., Robert D. Goldblum, Robert J. Haislmaier, and Alfred H. Mills.

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

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NEWSLETTER STAFF

EDITOR
Robert D. Goldblum
R & B Enterprises
20 Clipper Road
West Conshohocken, PA 19428
TEL:(215)825-1960 • FAX: (215)825-1684

ASSOCIATE EDITORS

ABSTRACTS	William H. McGinnis Southwest Research Institute P.O. Drawer 28510 San Antonio, TX 78284
BOOK REVIEWS	Reinaldo Perez Jet Propulsion Laboratory M/S 301-460 4800 Oak Grove Drive Pasadena, CA 91109
	J. L. Norman Violette Violette Engineering Corp. 120 East Broad St., Ste. B Falls Church, VA 22046
CHAPTER CHATTER	Charles F. W. Anderson 2302 Keener Road Hagerstown, MD 21740
DIVISION IV DIRECTOR'S REPORT	Martin Schneider 46 Line Road Holmdel, NJ 07733
EMC CERTIFICATION & ACCREDITATION	Russel V. Carstensen, P.E. Naval Air Systems Command AIR-5162, Room 902 Washington, DC 20361
EMC PERSONALITY PROFILE	William G. Duff Atlantic Research Corporation Professional Services Group Defense Systems Division, Suite 300 5501 Blacklick Road Springfield, VA 22151
EMC STANDARDS ACTIVITIES	Herbert Mertel EMACO, Inc. P.O. Box 22066 San Diego, CA 92122
EMCS BOD ACTIVITIES	Donald N. Heirman AT&T Information Systems Crawford Corner Rd., Building 4-112 Holmdel, NJ 07733
EMCS BOD ACTIVITIES	Donald N. Heirman AT&T Information Systems Crawford Corner Rd. Building 4-112 Holmdel, NJ 07733
EMCS EDUCATION COMMITTEE	Dr. Clayton Paul Dept. of Electrical Engineering University of Kentucky Lexington, KY 40506
INTER-SOCIETY ACTIVITIES	Joseph E. Butler Chomerics, Inc. 77 Dragon Ct. Woburn, MA 01888
PRACTICAL PAPERS, ARTICLES & APPLICATION NOTES	Edwin L. Bronaugh The Electro-Mechanics Company P.O. Box 1546 Austin, TX 78767
PCs for EMC	Edmund K. Miller Group MEE-3, MS J580 Los Alamos National Laboratory P.O. Box 1663 Los Alamos, NM 87545
PHOTOGRAPHER	Dick Ford Naval Research Laboratory Code 5330 Washington, D.C. 20375-5000
POINT AND COUNTERPOINT	Anthony G. Zimbalatti 294 Crowell St. Hempstead, NY 11550
PRODUCT SAFETY	John McBain Hewlett Packard 19447 Pruneridge Ave. Cupertino, CA 95014

IEEE NEWSLETTER PUBLICATION SCHEDULE

PUBLICATION DATES	EDITORIAL DEADLINES
November	September 15
February	December 15
May	March 15
August	June 15

Editorial contributions for the February 92 issue should be received by December 15.

BACK ISSUES OF THE EMC NEWSLETTERS ON MICROFICHE

We still have a few sets of the uFiche copies of the back issues of the IEEE EMC Society Newsletters from the present to 1955 when it was called "Quasies and Peaks." The price is $25.00 post paid. If you would like to have one of these sets you can order it from: Dr. Chester L. Smith, EMC-Society Historian, 2 Jonathan Lane, Bedford, MA 01730.

EMCS BoD ACTIVITIES

DON HEIRMAN
ASSOCIATE EDITOR

The third EMC Society Board of Directors meeting of 1991 was held on August 17, 1991, in the Hyatt Cherry Hill, which was the venue for the annual EMC Society Symposium. Board members present included Ed Bronaugh, Bob Hofmann, Dick Ford, Chet Smith, Gene Cory, Hugh Denny, Pat Coles, Henry Ott, Dave Staggs, Warren Kesselman, Joe Butler, Dan Hoolihan, Bob Haislmaier, Don Clark, Don Heirman, Al Mills and Herb Mertel. Members missing were Janet O'Neil, Walt McKerchar and Don Weber. Guests present were Len Carlson, Terry Cantine and Perry Sensin. Representatives from the 1992 Beijing, China, the 1992 Tel Aviv, Israel, and the 1994 Sendai, Japan steering committees were also present.

President Ed Bronaugh called the meeting to order at 10:15 AM. The agenda and minutes were approved with minor changes. Ed circulated a get well card for Director Walt McKerchar, who is recovering from surgery. Next, Treasurer Ford reported that our Society's current net worth figures were not available yet. He did indicate that our expenditures for 1991 through 15 July were a little over $27K, resulting in a net surplus of approximately $60K. He also discussed the final inputs for the 1992 budget. The Board approved his report.

TERRY CANTINE
1992 SYMPOSIUM CHAIRPERSON

Director Bob Haislmaier (Communications Services) gave his report.

Gene Cory (Symposium Committee) gave his report by

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Photo: Dick Ford

1991 IEEE EMCS Board of Directors (l to r): (Front) Don Clark, Dick Ford (Treasurer), Ed Bronaugh (President), Bob Hofmann (Vice President), Bob Haislmaier, Don Heirman. (Middle) Hugh Denny, Herb Mertel, Al Mills, Gene Cory, Henry Ott, Pat Coles. (Back) Len Carlson (Rep Div IV), Chet Smith, Warren Kesselman, Dan Hoolihan, Dave Staggs and Joe Butler.

introducing several future EMC Symposium committee chairmen and representatives. Professor You-Gang Gao indicated that the 1992 Beijing Symposium was progressing well and that 251 paper synopses were received. Terry Cantine, 1992 Symposium Chairperson presented her preliminary budget. Rafi Rubenstein described the 1992 Israeli Regional EMC Symposium to be held in Tel Aviv in November 1992. The Board approved participation in the India International Conference on EMI and EMC (INCEMIC) to be held in Calcutta in December, 1992. Gene then indicated that the Washington DC 1990 Symposium had a net surplus of $4K. Don Heirman reported preliminary numbers for the Cherry Hill Symposium:

Full registration	534
One Day and Students	156
Life IEEE/EMCS	24
Exhibitor Full Registration	120
	834
Spouses and additional exhibitors	725
Approx. Total	1559

In addition, 90 questionnaires were returned to the IEEE booth. With few exceptions, the attendees enthusiastically endorsed the additional two days for the workshops and the elimination of the plenary session. The most rewarding aspect of the symposium is that over 250 more attendees than planned showed up, although this did put a strain on resources.

Next, there was a request by Dr. Kanda, Transactions Editor, for a special issue on the sensing, detection, monitoring and interpretation of nature and man-induced low frequency noise and intelligible signatures. The Board disapproved the request since there were no clear EMC applications. Chet Smith, EMCS historian, requested and the Board approved $5K for 1992 to cover the archival expenses of our symposium records using microfiche. Perry Sensi, Manager of the IEEE Conference Services, presented the services IEEE can offer to local symposium committees. This triggered an extensive discussion. This was especially critical since the BoD is interested in pursuing ways to use common, professional resources year-to-year for certain services such as registration, exhibits, etc. A meeting in Piscataway is planned to follow up on this discussion.

Director Don Heirman (Technical Services) presented several reports. First, as Chairman of the EMCS Standards Committee, Don indicated that Standard 299 (Shielding Effectiveness Measurements) has been published. P1140 (Near-field Measurement of Electric and Magnetic Fields from VDTs) is now in sponsor ballot in both the Computer Society and in our Standards Committee. Don also reported that Joe Butler (Chomerics) and Dave Staggs (Dell Computers) were approved as balloting members of the committee. Don then reviewed Clayton Paul's report (Education Committee). The Distinguished Lecturer Program chaired by Dave Hanttula is on target with nine lectures made in 1991 to date. The final version of the package of information that can be used to help educators establish an undergraduate course on EMC was completed at the symposium. For information call Clayton at 606-257-1644. Three student papers were invited and approved by the Cherry Hill symposium. Two of the three student presenters were reimbursed for travel and lodging by the EMCS and the Symposium Steering Committee. Finally, the Board approved Clayton as the EMC Society member of the Policy Board of the Computer Aided Electromagnetics Education (CAEME) project. The Board also approved George Contache as our representative on CAEME's Board of Technical Advisors. Don then presented Wilf Luber's (Technical Advisory Committee) report. Jim Randa (NIST) has taken over the chairmanship of TC-3 (EM Environments) replacing Al Smith who retired. He indicated that all TC's except TC-1 have provided their next 5-year plans. Wilf also distributed at his Cherry Hill meeting a series of newsletter articles on the TCs that he felt should be given to new EMCS members. These articles describe the TC activity and give points-of-contact for those interested in joining a TC activity. For more information, call Wilf at 613-998-2377. Finally Wilf passed on to George Kunkel, the 1992 Technical Program Chairman, an offer of the TCs to review the 1992 technical paper abstracts, to form workshops/special sessions, and to provide session chairmen. Joe Butler (Representative Advisory Committee) presented his report. Joe sought and received Board approval for adding John Osburn (EMCO) as the RAC representative for EIA G-46 matters, replacing Joe. He also received approval to add two other committee representative positions for the SAE EMI Standards and Test Methods Technical Committee and the Automotive EMR Standards Committee. Don Hoolihan (COMAR) briefly updated the BoD on several activities including safety of exposure to police radar, health effects of electric and magnetic fields, and IEEE-USA entity position statements on microwaves, VDTs, power-frequency EM fields, etc. Finally, Don Heirman (IEC/CISPR A and G) noted activity within CISPR on calibration of anechoic chambers and immunity of information technology equipment.

Director Dan Hoolihan (Member Services) presented his report. Our Society membership through June was 3706, for an annual increase of 114 or 3.2% as compared to the Institute's increase of 0.7%. Our senior membership is now up to 329, a rise of 18 over the past 12 months. There are six locations seeking sufficient membership to form new EMC Chapters: Austria, India, Stuttgart (Germany), Ontario (Canada) and Buena Ventura, California. Pat Coles (Awards and Recruiting) indicated that 54 people had signed up for IEEE and EMCS membership (38 joining the IEEE and EMCS). That was exceptionally high. She also reported on the Society awards that were presented at the symposium Awards Luncheon. The Board also passed two motions on the IEEE/EMCS booth activity. First, the booth and its operation, planning, staffing, and all local arrangements are the responsibility of the Membership Chairman (presently Pat Coles), and all EMCS booth expenses (drayage, furniture, electricity) must be borne by the Symposium Committee.

Director McKerchar's (Professional Services) report was presented by Herb Zajac. (We wish Walt a speedy recovery

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INTER-SOCIETY ACTIVITIES

JOSEPH BUTLER
ASSOCIATE EDITOR

SAE AEROSPACE EMC STANDARDS ACTIVITY

SAE AE-4 Electromagnetic Compatibility. The recent meeting at the IEEE EMC Symposium was in part a review of the work on the update of the various SAE EMC standards mentioned in detail in the last EMC newsletter. The work in this area involves various proponents of the revision work polling the ballots of the AE-4 members who indicated needed revisions. After collecting specific information, proposed document revisions will be presented for ballot by the AE-4 committee. The next meeting will be in April, 1992.

SAE AE-4R Radiated Environments. The draft FAA advisory circular, which deals with High Intensity Radiated Fields (HIRF), has been sent out for technical review by both the AE-4R as well as AE-4 parent committee. Comments were due on September 1, and would then be reviewed by the AE-4R executive committee. The next meeting of the AE-4R, scheduled for New Orleans, 5-7 November, 1991, will be used to deal with comments received on the Advisory Circular and to provide inputs necessary for finalization of the accompanying user guide. This upcoming meeting, advertised to be the next to last for this committee, is meant to discuss/decide all remaining issues on this advisory circular. FAA issuance of the Notice of Proposed Rulemaking (NPRM) for HIRF is expected around this time as well.

SAE SURFACE VEHICLE EMC STANDARDS ACTIVITY

SAE Automotive EMI Standards & Test Methods Committee. This committee continues its work on revisions to J1113 and J551, although most of the activity has been with J1113. Work on ISO/TC22/SC3/WG3 road vehicle standards documents for "ISO XXXX: Vehicle Test Methods" and "ISO YYYY: Component Test Methods" have also been predominant. These ISO documents generally track the above mentioned SAE standards.

SAE Automotive EMR Standards Committee. This group is working on activities in concert with CISPR subcommittee D/WG 1 and WG2. WG1 activities involve review of CISPR 12.

Both WG1 and WG2 are involved with preparation of the forthcoming European Automotive EMC Directive (EMC/27/1990).

AMERICAN NATIONAL STANDARDS INSTITUTE C63 STANDARDS COMMITTEE ON ELECTROMAGNETIC COMPATIBILITY

Subcommittee 1, Techniques and Development, has recently sent out no less than 22 different ballots on draft standards for the C63.1 membership. These ballots cover revision of C63.7-1988 "Guide for Construction of Open Area Test Sites for Performing Radiated Emission Measurements" (1 Ballot); C63.16-199X "Guide for Electrostatic Discharge Test Methodologies and Criteria for Electronic Equipment" (1 Ballot); and C63.15-199X "Recommended Practice for the Method of Immunity Measurement of Electrical and Electronic Equipment" (20 separate ballots per different immunity test methods). These documents are being expeditiously reviewed in order to bring them forth as soon as possible.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC) CISPR SUBCOMMITTEES A & G

Subcommittee A is finishing up its work on the new Publication 16 which includes both instrumentation and measurement techniques. There is a push to evaluate anechoic shielded rooms using both a magnetic and electric field generator and to provide correction factors to open area results. In Subcommittee G, there is a whole raft of activity centering around the total rewrite of Publication 22 and the new documents on immunity testing including ITE versions of the IEC 801 series of tests (-2 through -6). The USNC is presently contributing rebuttals on these documents.

ELECTROSTATIC OVERSTRESS/ELECTRONIC DISCHARGE (EOS/EOD) ASSOCIATION

The association is holding its thirteenth annual symposium September 24-26 in Las Vegas. A report on this will be given in the next newsletter.

EDUCATION COMMITTEE NEWS

CLAYTON R. PAUL
ASSOCIATE EDITOR

At the meeting of the Education Committee at the Cherry Hill EMC Symposium, the EMC Course Package was approved. The intent of that package is to aid universities in establishing an undergraduate EMC course in their Electrical Engineering programs. The package consists of a description of the need for such a course, a suggested course outline, the EMC Experiments Manual, and the EMC Bibliography. I will be putting the finishing touches on the document and having copies printed. The package should be available for distribution by the first of the year. Anyone interested in obtaining a copy should send his/her name and address with a request to:

Clayton R. Paul
Department of Electrical Engineering
University of Kentucky
Lexington, KY 40506

The Distinguished Lecturer Series continues to be successful under the able leadership of Dave Hanttula. The current speakers are Ed Bronaugh, Henry Ott, Joe Fischer, and Bob Cowdell. Anyone interested in obtaining a distinguished lecturer to give a talk at an IEEE function should contact Dave at Silicon Graphics, Mountain View, CA (415) 335-1071.

At the Education Committee meeting at Cherry Hill, questions arose about the omission and/or corrections of definitions in the IEEE Dictionary that relate to EMC. Fred Cribbens will act as our liaison to Don Heirman, who is one of our representatives (along with Ralph Showers) on the SCC-10 committee that provides guidance to the IEEE Dictionary. Anyone who has input on items in the dictionary should forward those to Fred:

Prof. Fred Cribbens
EMI Engineering & Management Institute
1700 West Third Avenue
Flint, MI 48504-4898

ELECTROMAGNETIC COMPATIBILITY (EMC) AS A FUNDAMENTAL ELECTRICAL ENGINEERING DISCIPLINE

Clayton Paul, Department of Electrical Engineering, University of Kentucky, Lexington, KY 40506

In April of this year, I gave a presentation to the Southeastern Michigan section of the IEEE EMC Society at the University of Michigan. The EMC Society Board of Directors asked that I summarize that talk in this EMC Newsletter.

The title of the talk is given above and my remarks were directed to some 20 Electrical Engineering undergraduates who attended the meeting. The intent was to point out that although the fundamental topics they study are critically important to their success in the industry, EMC is rapidly becoming viewed by employers as another fundamental aspect of their Electrical Engineering education. My talk was divided into five topics: Aspects of EMC, Governmental EMC Requirements, Company EMC Requirements, Educational Preparation, and Employment Opportunities.

The first item, Aspects of EMC, acquainted them with the requirements of EMC. Electromagnetic Compatibility concerns the design of electronic systems so that the system will not create electromagnetic emissions that will cause interference with other electromagnetic systems, will not be susceptible to electromagnetic emissions from other systems, and will not create interference with itself. Many of us have our own definitions of EMC but this seemed to cover the primary points. I then talked about Radiated Emissions and Susceptibility, Conducted Emissions and Susceptibility, Electrostatic Discharge, and the internal radiated and conducted interference mechanisms such as Crosstalk. Also discussed were some examples of interference ranging from the humorous to the life threatening. The students seemed to relate to these more readily than to the legal requirements.

I then discussed the governmental requirements such as the FCC and CISPR 22 limits on digital products and showed some typical emissions of digital products. The students seemed quite amazed that a digital device was defined as having a clock frequency of 9 kHz or greater. However, once they understood that it was illegal to sell any such product unless its emissions (radiated and conducted) were measured and were below the limits set by the regulatory agency, they soon realized why virtually all manufacturers of electronic products today are keenly interested in the topic.

Some typical company-mandated EMC requirements such as ESD, radiated susceptibility and conducted susceptibility were also discussed. When they understood that these were imposed by the manufacturer to insure a quality product, they realized their necessity.

The relation of their undergraduate EE education to EMC was then discussed. I pointed out that almost all of their fundamental EE courses were critically important to good EMC design. I tried to emphasize that EMC relied on a sound understanding of the basic principles of circuit analysis, signal analysis, electromagnetic fields, and digital circuit operation. I also discussed my EMC course at the University of Kentucky so that they could see where these basic principles fit.

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TUTORIALS BIG HIT AT CHERRY HILL

DR. ROBERT J. HAISLMAIER
DIRECTOR, COMMUNICATION SERVICES

Experimenting with format changes, the Cherry Hill EMC Symposium sandwiched the symposium between two half-days of tutorials. On Monday, August 12, three-hour tutorials were conducted: The European EMC Environment; Computer Analysis Techniques for EMC Problems; and Ultrawideband Technology and EMC Issues. On Friday morning, August 16, three-hour tutorials were conducted: Proposed Changes to MIL-STD-461/2/3; The Effects of Transient Overstress; and EMC Effects on Spectrum Management Decisions. Despite a nominal charge to cover the cost of reproducing tutorial notes, all were well attended, some to overflow capacity, such as the tutorial on the European EMC environment. The pervasive observation was that the tutorial material was current and helped attendees come up to speed in specialized areas.

Of 71 attendees who returned completed questionnaires, 59 said they definitely liked the tutorials, with several suggesting that they should be held on only one half-day, preferably Monday, because of the difficulty of taking a full week off from work to attend a symposium. Six said they did not like the added tutorials, and six had no opinion. One observation heard several times during breaks was that the tutorial on EMC fundamentals which had been offered in past years should be an annual event for the new engineers who enter the EMC field every year.

The attempt to present EMC Certification and Accreditation as a poster session on Wednesday afternoon was partially successful. Presentations were posted on boards, with authors standing by to discuss them with visitors. Most attendees, however, arrived during the lunch hour and seated themselves to hear scheduled papers. Adjusting to the situation, the authors took turns in briefing symposium participants on their posted papers. A new topic many heard about for the first time dealt with corporate or company EMC certification by NARTE in addition to individual EMC certification.

Photo: Dick Ford

Overflow attendance at the Monday tutorial.

1992 IEEE INTERNATIONAL SYMPOSIUM ON EMC

The 1992 EMC Symposium will be held in Anaheim, California at the Anaheim Marriott August 17 through 21, 1992.

The Marriott is located equidistant to four major airports. It is just two blocks from Disneyland Park and convenient to Pacific Ocean beaches, Knott's Berry Farm and other Southern California attractions.

Having just completed a multi-million dollar renovation, the Anaheim Marriott will welcome symposium attendees and their families in grand style. Exhibit area and meeting rooms are all on the ground floor with easy access to restaurants and lounges.

The Technical Program of the symposium will run Monday through Friday with exhibits open Tuesday through Thursday. On Monday and Friday there will be workshops with sessions Tuesday through Thursday.

For further information:

Chairman	Terry Cantine	(818) 767-6770
Co-Chairman	Bernard Cooperstein	(310) 373-0690
Registration	Oscar Crawford	(213) 922-4091
Exhibits	Derek McNally	(805) 254-2677

EDUCATION COMMITTEE NEWS *(Continued from page 6)*

Finally, I discussed the employment opportunities in EMC. I pointed out that as yet there was not a large number of "EMC companies" but that having a basic understanding of EMC would make their services more marketable. Employers can no longer afford the expense of training their designers in EMC, so coming on board with an elementary understanding of EMC would be a desirable attribute.

The students' response to this presentation was very encouraging. There were quite a few questions, many of which showed insight that I hadn't given them credit for. My impression of the graduating seniors today is that these students have an overwhelming desire to "do something practical." EMC seems to be unique in satisfying that requirement for them.

The difficult question of where to put such a course in an already crowded curriculum will always be with us. We have had a four-year EE program since the beginning. A great deal of new information has come into it and very little has gone out. However, the topic of EMC will no doubt become increasingly important to our crowded planet. Sooner or later we will need to face the fact that EMC has become an integral part of the Electrical Engineering discipline.

EMC CERTIFICATION & ACCREDITATION STATUS REPORT

RUSSELL V. CARSTENSEN

A lot has happened since I last reported on the status of the EMC certification and laboratory accreditation. Professionally, I have been reassigned from Branch Head to a position as Division Director. I am now responsible for personnel, budget and the library for the engineering group. I supervise twice as many people as before. You guessed it--more work, better title, same pay.

One of the things I notice in my new capacity is a lack of individual attention to continuing professional development. It is all too common to see mid-level professionals depend on work experience and corporate training alone to satisfy shaping their career. They just do not recognize the need to make themselves marketable in a highly competitive environment.

It is not that difficult. For example, one approach to enhancing a person's worth is to add to their initial training by demonstrating technical competence such as in EMC certification.

The value of EMC certification is expanding. The Department of the Army has begun a discussion with the National Association of Radio and Telecommunications Engineers (NARTE) on certification of EMC technical personnel. In March of 1991 the U.S. Army published an electromagnetic environmental effects action plan which included the establishment of an E^3 qualification/certification process. This requirement is being addressed in a decentralized fashion much like the pilot certification and accreditation effort started in the Navy. The U.S. Army Information Systems Command (USAISC) at Fort Huachuca, AZ has developed and implemented an internal command procedure for first training and qualifying personnel then submitting requests to NARTE for EMC certification.

Even though the process is in place, a documented memorandum of understanding between USAISC and NARTE is currently being prepared. USAISC is staffing and developing a policy on certification which could be used by other Army commands to comply with Army E^3 directives.

By the way, NARTE moved its headquarters to Medway, MA. The new address is:

National Association of Radio and
Telecommunications Engineers
P.O. Box 678
Medway, MA 02053
Phone: 508-533-8333

Prior to the move, NARTE had issued about 1900 application packages for EMC certification. The NARTE team is now settled in and working efficiently. As part of the move, they cleared out backlogged and duplicate applications, expedited both new applications and renewals.

Of the 1900 packages, a sizeable number were disapproved. Thus far 988 EMC engineers have been certified, 327 EMC technicians have been certified and 190 applications are still in various stages of completion. If all complete, there will be more than 1500 certified EMC practitioners.

The renewal rate for NARTE certified EMC engineers is well over 85% for the first year. Of the 457 which came due between March and June of 1991, 389 renewed their certificate. Considering that for some the renewal may still be in the mail, the numbers could be even higher.

Certification renewal for EMC technicians is running in the same range; of the 158 potential renewals, 132 have been submitted.

The Navy is reassessing their stand with respect to EMC certification and accreditation. The Naval Air Systems Command was initially tasked to develop a pilot program. That has been successfully accomplished. The pilot program has been in operation for more than two years. In that time several procurements requiring EMC certified personnel have been issued and awarded without challenge. I understand that a current procurement requires both certified personnel and accredited EMC test laboratories. Thus the major challenges of procurement and self implementation have been addressed. The next step is for the Navy to impose the strategy of the pilot program service-wide.

The National Institute of Standards and Technology (NIST) sponsored National Voluntary Laboratory Accreditation Program (NVLAP) has a new manager, Al Tolen. Al participated in the EMC certification and accreditation workshop at the IEEE EMC Society International Symposium at Cherry Hill, NJ in August. I was not able to attend, but I understand that there was an energetic exchange on the execution of the NVLAP EMC laboratory accreditation program. I plan to have some of Al's response for the next issue.

PCs FOR EMC

E.K. MILLER

This column summarizes my impressions and observations based on the 1991 AP-S/URSI meeting held at the University of Western Ontario, London, Ontario, Canada and of the 1991 PIERS (Progress In Electromagnetics Research Symposium) meeting held in Cambridge, Massachusetts.

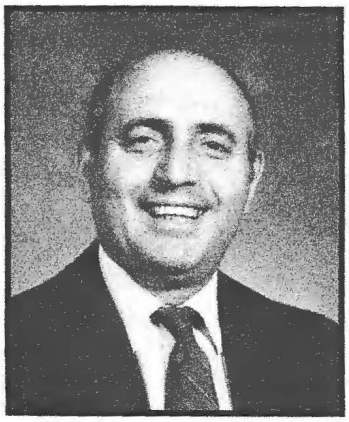
It is my impression that the number of FDTD (Finite-Difference Time Domain) papers being presented, either in terms of algorithm research and development, or even more so in applications, seems to have expanded explosively. This is probably caused by at least two factors. One is the fact that the potential and utility of FDTD as a modeling tool is becoming more widely known. The other is that the computer memory becoming available on both the mainframe level and for desktop computing has grown to the point that many more problems are now practically solvable using FDTD. An additional factor of this growing popularity is probably also due to the interpretability of the results produced by FDTD and other time-domain models, something that seems to be increasingly appreciated.

Although implemented differently from FDTD, TLM (Transmission-Line Method) modeling also seems to be growing in popularity. As is true of FDTD, TLM develops a spatial solution as a function of time, and so is being applied to many of the same kinds of problems as FDTD. TLM was first presented in 1971 by Peter Johns (P. B. Johns and R. L. Beurle, "Numerical Solution of 2-Dimensional Scattering Problems Using a Transmission-Line Matrix," *Proc. Inst. Elec. Eng.*, 118, 1203-1208, 1971), five years after the Yee paper that is the primary origin of FDTD (K. S. Yee, "Numerical Solution of Initial Boundary Value Problems Involving Maxwell's Equations in Isotropic Media," *IEEE Trans. Antennas and Propagat.*, AP-14, 302-307, 1966). TLM is based on a scattering-node model of wave propagation in free space and material media as a discretized version of Huygens' principle. A good source of references for TLM is *The International Journal of Numerical Modeling*, published by John Wiley.

Professor W.J.R. Hoefer of the University of Ottawa and an associate, P.P.M. So, have produced a software package *The Electromagnetic Wave Simulator, A Dynamic Visual Electromagnetics Laboratory based on the Two-dimensional TLM Method.* This package was released in 1991 by John Wiley, ISBN 0 471 93075 X, at a price of $95.75. Quoting from the preface it "...comprises a detailed treatment of the two-dimensional transmission line matrix (TLM) method of electromagnetic field modelling, and TLM electromagnetic wave simulation software for MS-DOS computers.... This simulator allows the user to observe electromagnetic processes which could only be imagined until now. It thus enriches the perception to an extent rarely achieved by any other tool in science or engineering. In graphical representation, most electromagnetic processes can be comprehended in their full complexity by intuition. New ideas and associations are stimulated, and the creative potential of all those who think in pictures is awakened. Engineers and scientists have always thought in pictures. Now they can create and observe these pictures on personal computers or workstations." I plan to include some examples of the graphics produced by this package as part of future visual electromagnetics examples in this column.

The trend seems to be for more computer-graphic presentation of EM phenomenology as one way of more effectively presenting the results of increasingly complex model applications. One particular example caught my attention at the AP-S/URSI meeting. A movie was included as part of a presentation titled "Computer Simulation for a High Gain Antenna Including Interactions with Local Scatterers" by A. M. Bucceri, J. C. Herper, and E. Mertz of Unisys Corporation, Great Neck, New York. The movie showed the pattern of a rotating antenna as affected by various obstacles in its beam, "producing a striking visualization of the antenna performance," a point on which I concur. The effect on both the main lobe and the side lobes was made dramatically evident. The benefit of adding an absorber to screen out mast scattering was also clearly demonstrated. Although these effects can be appreciated from observing single graphs for various antenna positions, they are more understandable when shown dynamically. This is especially the case for this situation, where the movie correlates with the "real-life" application. The antenna models that serve as the "engines" for the authors' antenna-design work station used for this application are the NEC Moment-Method and NEC Basic Scattering Codes, with the latter the one employed for this specific problem.

EMC PERSONALITY PROFILE



DR. ANATOLY TSALIOVICH

Dr. Anatoly Tsaliovich, a Distinguished Member of the Technical Staff at AT&T Bell Laboratories in Holmdel, New Jersey, is responsible for EMC engineering and applied electromagnetic compatibility research.

Perhaps his first hands-on encounter with electronics took place in 1949, in a town just east of the Carpathian Mountains (only several hundred miles from You-Know-Who's castle in Transylvania), where fate landed a twelve year old boy and his family for a short period of time. The boy had just survived the evils of World War II and still remembered the sound of German fighters attacking the ship which carried him away from Hitler's "final solution." But life had in store for Anatoly much more attractive options. One day he found a treasure: a brochure on how to build a crystal receiver. A box of safety matches and a fishing plummet provided sulfur and lead which, when minced, mixed, and heated together in a metallic pot, produced detector crystals. A homemade large inductor coil and a variable capacitor was all that was needed to assemble the circuit and allow the boy to diligently look for that magic "point." If successful, it would bring to the earphone the sound of noise, whistling and -- just maybe -- some faraway voice or music.

This might have been the beginning of Anatoly's career in electronics. Or it could be that the roots were in his fascination with radio technology, which several years later would bring into his small room the BBC and the Voice of America through thousands of miles and thoroughly guarded borders -- quite a risky business in those times! Whatever it was, it resulted in his entering the Telecommunications Institute after graduation from high school. This was not easy to accomplish, for fierce competition, ethnic hostility and injustice, and economic hardships all had to be overcome.

His first research work, conducted in 1958-1960 while he was still a student, was entitled "Transmission of FM-Modulated Signals over the Steel Open Wire Lines in the High Frequency Range up to 260 kHz." It dealt with serious problems of transmission medium non-linearity and with electromagnetic radiation from the system, and later became the basis for his MSEE thesis. Practical engineering work followed, first in managing design, installation, and maintenance of long distance telecommunication systems, and then in R & D in the areas of electromagnetic shielding, transmission lines, electronic cables, analog and PCM telecommunication systems.

WILLIAM G. DUFF
ASSOCIATE EDITOR

In 1966, Anatoly Tsaliovich earned his PhD degree. In the course of his ensuing career, Dr. Tsaliovich authored the telecommunication system and transmission line optimization theory and achieved important theoretical and practical results in studying coaxial cable shielding and crosstalk problems. His scientific and engineering background, combined with organizational and managerial talents, contributed much to the development and introduction in the USSR of new types of electronic products: small size coaxial long distance and local telecommunications cables, carrier and PCM telephone systems for rural areas, and petroleum jelly-filled telephone cables. Concurrently, he taught academic and professional courses on telecommunications lines and systems, electronic cables, optimization, and electromagnetic shielding. He was the author, co-author, and scientific editor of several widely used technical manuals and textbooks and also translated technical literature in three languages: English, Russian, and German.

In 1980, Anatoly, his wife and two daughters arrived in the United States. More than a year was lost before the new phase of his career started. Anatoly had been fired from his job in the USSR for his intention to leave, and the recession in the U. S. caused employment problems. Eventually Anatoly took a position in advanced product development at the Belden Wire and Cable Corporation, Technical Research Center, and then as a fellow engineer in R & D electronics at Thomas & Betts Corporation. At this time, he developed the concept of electronic system component and element EMC performance. He utilized it in the development of state of the art electronic cables (e.g., for ETHERNET, IBM Token Ring, CATV), shielded flat cables with longitudinal and multi-layer shields, controlled impedance and filtered connectors and termination techniques, and electronic package testing techniques for DIP, PGA, and chip carriers. An innovative theory of braided shield design and optimization resulted in up to 30 percent product cost reduction. He suggested and developed the Transfer Impedance Test Clamp, a test method and device which were patented in 1983.

Continued on page 11

EMC PERSONALITY PROFILE *(Continued from page 10)*

In 1985, Dr. Tsaliovich joined AT&T. Now his extensive scientific background and engineering and management experience are utilized to solve practical and theoretical EMC problems, to consult with electronic product designers on EMI mitigation techniques and measurement, and to teach and lecture on EMC design and testing. The method of RF absorber testing he suggested in 1986 is incorporated in an IEEE standard presently under development. In 1987-88 he developed and experimentally verified the concept of an innovative EMC test facility, an absorber-lined open area test site. His more recent research works cover the areas of EMC test facility correlation (open area test sites, shielding and absorber-lined rooms, TEM cells), EMC design and testing to U.S. and international specifications, electronic cable and connector crosstalk, and electromagnetic shielding development of new measurement techniques.

Dr. Tsaliovich is the author of five technical books and more than seventy papers, articles, and patents on electromagnetic compatibility, electromagnetic shielding, telecommunications lines and networks, and electronic and telephone cables and connectors. He created and presented an international series of seminars and courses on electromagnetic shielding, EMC, cables and transmission lines. He is the recipient of national and international awards for his work in applied research, product development, and scientific contributions. Two technical papers describing his research on EMC were cited by the 1983 IEEE International Symposium on EMC in Washington, D.C., and the 1987 International EMC Conference in Zurich, Switzerland. In 1989, the IEEE Society presented Dr. Tsaliovich with the prestigious Richard R. Stoddard Award which cited "numerous contributions to EMC, including electromagnetic shielding, telecommunication transmission lines and networks, and electronic and telephone cables and connectors." He is a NARTE certified engineer and is listed in "Who's Who in Electronics & Computer Science."

Anatoly lives in East Brunswick, New Jersey, with his wife Nelly and their youngest daughter Fradiana, who studies violin at the Mannes School of Music in New York. When he is not working on his scientific projects, he enjoys swimming in his pool (in summer), listening to classical music (all year round), playing piano, accordion or guitar, reading, and hiking or exercising. Traveling and exploring far and near lands is still another attraction.

EMCS BOD ACTIVITIES *(Continued from page 4)*

from surgery). A motion was disapproved pending further details to spend $20K to cover the cost of producing a video on the effects, if any, of low frequency magnetic fields near overhead power lines.

Under old business, the BoD (Don Clark and Len Carlson) is pursuing suggested changes to our EMCS bylaws to bring them into full alignment with our voting and committee structure. The Board approved a motion that this year's election for President and Vice President proceed based on our traditional approach. Hugh Denny reported that the IEEE Press Booth at our Cherry Hill symposium was a success, with considerable traffic. He is looking for potential book reviewers. If interested, call Hugh at 404-894-3522.

Under new business, the Board approved mailing the annual symposium records to all EMC members except students. This will now be a yearly activity. The Board approved an ad hoc committee, chaired by Herb Mertel, to plan direct management by the BoD of the annual USA IEEE EMCS symposium. This is intended to aid the local steering committee by providing year-to-year continuity and facilitating the negotiations with contractors such as those used for registration, exhibits, publications, etc. This may include the use of the IEEE Conference Services operation in Piscataway. Herb requested that the past chairpersons of our most recent symposia serve on this ad hoc committee. Already discussed as items for the continuity committee to consider were:

1. Continuing the workshop format first introduced in Cherry Hill.

2. Deleting the plenary session the first morning of the full technical program.

3. Establishing a booth for advertising other EMC-related international symposia (all booth expenses paid).

Other reports were presented including TAB, Division IV, and EAB activities. Vice President Bob Hofmann then presented a brief review of his Planning Committee objectives for 1991 and 1992. The meeting adjourned at 5:00 PM.

The next meeting of the BoD will be held on 15 November at the Marriott in Anaheim, California, the site of our 1992 EMCS symposium. The EMCS Standards Committee will meet the same day between 8 and 10 AM, with the Board meeting starting at 10:15 AM and extending through the rest of the day. For more information, call Secretary Janet O'Neil at 213-870-9383.

IEEE 1991 INTERNATIONAL SYMPOSIUM OI
AUGUST 13-15, 1992, HYAT

EMCS BOOTH DUTY.
Herb Mertel (center left) and Henry Ott (center) assist two attendees and distribute literature for the EMC Society.

Photo: Seymour Krevsky

Photo: Dick Ford

A TRIBUTE TO FRED NICHOLS.
This year's Founders Award, presented by the EMCS was given to Fred Nichols. His daughter, Janet O'Neil accepted the award in his honor.

MANNING THE BOOTH.
Henry Ott (left) and John Van Savage (right) man the advanced registration booth.
Photo: Seymour Krevsky

A LOCAL CELEBRITY.
Ben Franklin took a moment to talk to Bob Goldblum, IEEE EMCS Newsletter Editor, during his visit to the symposium.

Photo: Seymour Krevsky

ECTROMAGNETIC COMPATIBILITY
ERRY HILL, CHERRY HILL, NJ

QUESTION & ANSWER SESSION.
Bill Baisley (left) andJohn Zenter (right) of the Air Force answers questions during a workshop regarding the MIL-STD-461 revision.

Photo: Dick Ford

Photo: Dick Ford

STRUTTING THEIR STUFF.
A Mummers band tours the exhibit area.

Photo: Seymour Krevsky

EXHIBIT ALLEY.
More than 120 exhibits were featured at the IEEE 1991 EMC Symposium.

Photo: Seymour Krevsky

SOME FAMILIAR FACES.
Pictured left to right: Angelo Santandrea, John Gamble and David Cofield, U.S. Army CECOM. David Cofield and Robert Weeks (far right) U.S. Army Information Command, are Army representatives to MIL-STD-461/2/3 Revision Committee.

IEEE EMC SOCIETY QUESTIONNAIRE RESULTS 1991 SYMPOSIUM

At its November 15, 1991 meeting, the EMC Society Board of Directors will review the results of the member survey distributed during the August, 1991 IEEE EMC Society Symposium, which was held in Cherry Hill, New Jersey. Since the Board wants to share the results of the survey with the Society members, the summary to be presented to the Board is reproduced below. Your comments are welcomed. Please send them to: Bob Hofmann, Room 2B-220, AT&T - Bell Labs, 2000 North Naperville Road, Naperville, Illinois, 60566.

The following is a summary of the responses received from the survey distributed at the 1991 symposium. Many of the responses listed were given several times, and only those that were different are listed separately. The responses that appeared more than once have an (M) following the response. Responses to the salary section of the survey are being tabulated separately and will be presented in a future newsletter.

1. Are you a member of the IEEE?
   a. Y-95%, N-5%
   A member of the EMC Society?
   a. Y-88%, N-12%

2. If you have a "local" EMC Society chapter, do you attend the meetings?
   a. Most responses indicated attendance at some chapter meetings except for those with no chapter within driving distance or with personal time availability conflicts.
   a.Both technical and social interactions are useful. (M)
   How could chapter meetings be improved?
   a.Make meeting more interesting by using more non-local and distinguished lecturers. (M)
   a.Give more advance publicity to the meetings. (M)

3. If you do not have a "local" EMC Society chapter, would you be interested in helping to form a chapter?
   a.We obtained a few names of interested individuals.

4. Do you read the quarterly newsletter?
   a.All-36%, Most-46%, Some-16%, None-2%
   What do you find interesting in the newsletter?
   a.Book reviews. (M)
   a.Everything. (M)
   a.People information. (M)
   a.Chapter chatter. (M)
   a.Late-breaking news (M)
   a.Standards activities. (M)
   What do you look for in the newsletter?
   a.Late-breaking news. (M)
   a.New technical news. (M)
   a.More technical news. (M)
   a.Suggest EMC newsletter editor look at AP newsletter.
   What could the newsletter editors do to encourage feedback from readers?
   a.Put in a feedback forum. (M)
   a.Have a "comments" page. (M)
   a.Put in more detailed activities about chapters to encourage others. (M)
   a.Provide a fax number to send information to. (M)
   a.Suggest topics for readers to comment upon. (M)
   a.Provide more transnational information. (M)
   a.Write editorials on, and encourage reader feedback on controversial subjects. (M)

5. Do you read the EMC Society Transactions?
   a.All-15%, Most-34%, Some-47%, None-4%
   What kinds of articles do you read in the Transactions?
   a.Test and measurement methods. (M)
   a.Antenna design and analysis. (M)
   a.Systems EMC.
   a.Software for modeling.
   a.Basic tutorials.
   a.Articles that have practical applications. (M)
   a.Those that actually relate to EMC. (M)
   a.Absorber theory and use.
   a.Filtering and shielding.
   What kinds of articles would you like to see in the Transactions?
   a.More antenna and sensor articles. (M)
   a.More applications oriented articles. (M)
   a. Papers relating to EMC; too many don't relate to EMC. (M)
   a.Papers with both theory and applications together. (M)
   a.Papers on methods of moments modeling. (M)
   a.Results and discussion of studies that get incorporated into national and international standards. (M)
   a.Papers explaining how theory relates to everyday experiences. (M)
   a.Discussions of new measurement techniques, pro and con. (M)
   a.Papers showing predictions of results along with actual measured results. (M)
   a.Some papers relating to TEMPEST.
   a.Papers dealing with incorporation of EMC into product design.
   a.Printed circuit board analysis and actual performance.

6. How can the EMC Society help you in your career?
   a.Continue Distinguished Lecturer program.
   a.Publicize the importance of EMC to engineering managers. (M)
   a.Continue symposium and chapter meetings. (M)
   a.Provide job forum/postings in newsletter. (M)
   a.Encourage continuing education.
   a.Keep members informed of new technical developments quickly. (M)
   a.Lobby for international harmonization of standards. (M)
   a.Present viewpoints of key industry decision-makers on EMC issues.
   a.Discourage age discrimination by showing what senior engineers can do.
   a.Develop a list of college EMC courses.
   a.Foster a greater public understanding of EMC.

7. What issues/actions/policies should the EMC Society Board of Directors be addressing on behalf of the Society members?
   a.Job availability. (M)
   a.Push NARTE certification.
   a.Oppose NARTE certification.
   a.Become more active in standards. (M)

Continued on page 15

QUESTIONNAIRE RESULTS *(Continued from page 16)*

a.Promote advanced technology such as that of the stealth bomber.
a.Continue to act professionally.
a.Encourage opposition viewpoints. (M)
a.Encourage corporate EMC R & D.
a.Encourage professional registration.
a.Encourage transnationalism. (M)

8. Secret opinions/ideas/gripes/suggestions about EMC activities you want to tell us. Replies are anonymous, but will go to the board for consideration.
a.Registration was impersonal - telephone calls not answered.
a.Board of Directors is doing a good job. (M)
a.Expose the government's role in EMC to the younger engineers who do not understand how to deal with the federal government/military.
a.Need a brochure describing what the Board does and where it needs help.
a.Keep members informed of trends in both military and commercial EMC.
a.Increase the number of poster sessions at the symposium.
a.Allow for more Q & A at the sessions and workshops.
a.Promote EMC to minority, especially black, engineers.
a.Encourage more young authors and symposium attendees. (M)
a.Shift emphasis somewhat more toward practical applications.
a.Increase the technical content of the papers; encourage new ideas. (M)
a.Become more active transnationally; send distinguished lecturers to areas 7, 8, 9, and 10.
a.Provide translators for speakers with limited English skills. (M)
a.Improve symposium room acoustics with more microphones.
a.Provide sessions for EMC newcomers.
a.Limit length of chairperson and speaker introductions.
a.Bus system between hotels did not work very well.
a.Keep session timing to that planned so session hopping works.
a.Oppose vendors taking too active a role in setting standards. (M)
a.Prohibit smoking in exhibit hall.
a.Put a cross-reference to symposium record pages in the final program.
a.Thanks to all involved in putting on the symposium. (M)
a.Speaker evaluation hard to do if you're session hopping.
a.Session helpers were more concerned with speaker evaluation forms than helping turn the room lights off and on as needed by speakers.
a.Perhaps we need one late exhibit day for those who go to all sessions.
a.Awards luncheon was first class, not too long or too short.

9. Do you like the 1991 Symposium format with Monday and Friday workshops?
a.Y-90%, N-10%
a.Include workshop fees in registration; prepare handouts for all attendees. (M)
a.Perhaps only one day of workshops, or 1/2 day on Monday and Friday.
a.Only have one day of workshops - five days overall too long.

10. Do you like skipping the Tuesday plenary session for additional technical sessions?
a.Y-89%, N-11%

TECHNICAL COMMITTEE ON EM ENVIRONMENTS

TECHNICAL ACTIVITIES AND CALL FOR ELF MEASUREMENT RESULTS

The EMC Society's Technical Committee on Electromagnetic Environments, TC-3, is concerned with all aspects of electromagnetic environments and of man-made and natural noise. These include characterization techniques, measurement methods, instrumentation, and characteristics of particular environments. Man-made noise sources include power generation and transmission facilities, broadcast and communication fields, ESD, automotive ignition systems, ISM equipment, and consumer electrical and electronic devices. Natural radio noise arises from atmospheric (lightning), solar and galactic sources.

The activities of the Technical Committee on Electromagnetic Environments include reviewing papers in cooperation with Symposium Technical Papers Committees or at the request of the Transactions Editor, organizing technical sessions and workshops at meetings of the EMC Society, developing standards for processing by the Standards Committee of the EMC Society, and evaluating the state of the art in the field of electromagnetic environments. The Committee has recently undertaken an extensive, long-term project to compile an inventory of measurements of electromagnetic environments. The frequency spectrum has been divided into tractable bands, with the current effort being devoted to the 30-300 Hz range. For each band, we intend to compile a bibliography of published measurements, accompanied by a brief article summarizing what has been measured. The project will encompass published measurements of electromagnetic fields or "exposure" (time integral of field level). In general, it will not include effects, calculations, or unpublished results. Since it is almost inevitable that some papers will be inadvertently overlooked, authors of relevant papers dealing with the 30-300 Hz range are invited to send copies to the TC-3 chairman:

Dr. James Randa
NIST-813.03
325 Broadway Ave.
Boulder, Colorado 80303
Telephone: (303)497-3150 FAX: (303)497-6665

Anyone interested in joining the Committee or participating in particular Committee activities should contact the chairman. The annual Committee meeting is an open meeting and is held during the week of the IEEE Symposium on EMC. The next meeting is scheduled for the week of August 17, 1992, in Anaheim, CA.

BOOK REVIEW

REINALDO PEREZ
ASSOCIATE EDITOR

ELECTROMAGNETIC INTERACTIONS WITH BIOLOGICAL SYSTEMS
Edited by James C. Lin
University of Illinois, Chicago
Plenum Press, New York
300 pages, $62.50
Reinaldo J. Perez

A subject that is receiving increasing obtaining attention among scientists, engineers, and the general public is that of biological effects from electromagnetic (EM) fields. The increased attention demonstrated is not because this is a new area of research (work has been done for over 20 years), but because in the last several years significant progress has been achieved in the understanding of some of the possible interaction mechanisms between EM fields and the smallest entity of living tissue, the cell. It is possible that the topics addressed in this book may develop into areas of interest among members of the EMC community.

The book is divided into three major parts: medical diagnostics and therapy (four chapters), biological effects and mechanisms (five chapters), and safety guides and rationales (five chapters). Chapters are written by different authors. Though the topics covered in each chapter are different, in some instances it was noticed that subjects were repeated (even though addressed differently) by other authors. It is difficult to assess whether this was intentional to emphasize areas of importance or due to an oversight of the authors. The authors provide the readers with extensive references for those who may have further interests.

The first chapter of Part I provides a description of the several uses of microwaves for studying physiological signatures through non-invasive sensing. The chapter briefly describes several of the fundamental concepts in EM theory such as dielectric permitivity, and transmission (T) and reflection (R) coefficients as they relate to biological tissues. It seems that because the cell membrane behaves as a lossy dielectric $\varepsilon(a) = \varepsilon(1-j\sigma/\omega\varepsilon)$, and ε_r and σ vary for different types of tissues (e.g., fat vs muscle), wide variations in field penetration and reflection may occur within the body. This is especially true at the air/tissue interfaces due to the wide differences in dielectric properties. This complexity increases when several layers of different tissues are considered; hence, the difficulty and limitations in the use of microwaves as diagnostic tools using "T" and "R" factors. The chapter ends with a brief review of detection circuits, processing systems, and measurement techniques used in microwave sensing.

The second chapter extends the use and study of microwaves to radiometry (measurement of EM thermal noise generated by living tissue) as a non-invasive technique for diagnostics and thermometric control in hyperthermia (described later). Most of the chapter is dedicated to a historical review of the work done, and not much insight is given into the field of radiometry. The same can be said about the third chapter on the use of magnetic resonance imaging (MRI) for medical diagnostics. The author provides some of the fundamentals about MRI, but a good portion of the chapter is spent describing the author's facilities for present and future research. Readers should consult other sources to learn more about MRI.

From the medical-applications point of view the fourth (and final chapter of Part I may elicit the highest interest. It covers the technical and clinical advances in hyperthermia for the treatment of cancer. The chapter is well written and summarizes the most salient technical advances in the field. The use of EM radiation for "heating" tumors (hyperthermia) has become a viable technique because it tends to increase the odds for survival by localizing the treatment (only 1/3 of cancer deaths are attributed to uncontrolled regional spread). Cancerous tissue is heated for several hours at a temperature of 42-45 degrees centigrade, destroying malignant cells. The problem with hyperthermia is that the penetration depth of EM fields depends on so many factors that the efficiency of the medical treatment may fluctuate substantially. Some of these factors are: frequency, thickness $\hat{\varepsilon}(w)$ of tissue, curvature of tissue, blood flow, dimensionality, antenna dimensions, and water content of tissue. Hyperthermia has been found to be most effective in non-fat, superficial (2-3 cm deep) cancerous tissue.

The chapter ends with several new techniques used in hyperthermia: use of microstrip antennas, use of array antennas for tumors occupying large areas, and the use of low frequency (8-14 MHz) and large antennas (20-25 cm) for "deep" hyperthermia. The author suggests that technical challenges in this field are: gaining the ability to heat deep-seated tumors, and tailoring the field distributions to particular cases rather than producing uniform fields.

Part II covers the biological effects and interaction mechanisms of EM fields. The first chapter looks at the biological response to static and time varying magnetic (B) fields. For static B fields, three interaction mechanisms are addressed:

Continued on page 17

a. Electrodynamic: ionic currents (electrolytes in water medium) interact with B fields, giving rise to an induced electric (E) field ($E = V \times B$), due to the flow velocity (V) of electrolytes.

b. Magnetomechanical: the B field exerts forces and torques on paramagnetic and ferromagnetic substances (e.g., retinal rods in the outer segment of the eyes); and

c. Effects on electron-spin states. For time-varying B fields, the authors describe how the induced electric fields ($E = K\, dB/dt$, and K is a constant) produce a current ($J = \sigma E$) in the tissues which may produce changes in the cell's membrane surface. These changes set up transmembrane signal events affecting the biochemistry of the cells.

If one had time only to read one chapter in this book, the second chapter of Part II is the chapter to read. The chapter is one of the largest in the book and deals with the biological effects of extreme low frequency (ELF) electromagnetic radiation. The aim of the chapter is to provide a few theories which can explain, at the biological level, how EM fields can interact with biological tissue.

Though ionizing radiation, with its high photon energies, can disrupt the nuclear organization of a cell (e.g., use of isotopes for cancer treatment), the energies involved in weak ELF EM radiation are far below what is needed for similar interactions to occur with the nucleus. This means that a different interaction mechanism must exist between the cell and ELF EM radiation. Indeed, experimental evidence suggests that the possible typical cell membrane is about 40 angstroms thick and its membrane potential (created by the flow of ionic substances) is about 0.1 volt, which creates an electrical gradient of 10,000 volts/meter — too big for the energies associated with ELF fields to overcome. What else may occur? It seems that the molecular arrangement of the cell's membrane is such that ELF EM radiation can physically alter some aspects of that molecular arrangement, creating channels within the cell's membrane through which hormones, antibodies, and chemical cancer-promoting agents can travel.

How this interaction mechanism develops is not understood, and the author suggests that numerous strands of protein (intramembranous particles—IMPs) protruding to the outside of the cell's membrane may be sensitive to ELF fields. Is this due to antenna behavior or resonance effects? Other chemical and/or physical processes may be involved. This lack of understanding may lie at the root of why controversy has arisen in the past concerning the possible harmful effects of ELF fields. While some researchers have seemingly provided experimental evidence of such linkage, others have reported the contrary. Lack of understanding about these interaction processes may translate into the wrong experimental approaches, providing results that do not necessarily correspond to the theory. It seems to this editor that an example to this analogous situation exists in EMC. If it wasn't known that there was such a thing as common-mode current, it wouldn't be known that it may be responsible for most of the electric field emissions in the equipment under test; hence, the required care may not be taken to account for such emissions in testing (e.g., exposing I/O cables for maximum pickup). It may turn out, however, that the right experiment may reveal the correct theory. This is not new: Maxwell's equations came into being that way.

The following two chapters of Part II address the biological effects of microwave and pulsed fields. The chapter on microwaves mainly describes a series of experimental evidence about damaging effects, from decreased spermatogenesis/chromosome aberration to decreased performance of the immune system. For pulsed radiation, some biological effects are described, but this is a new field, so not much experimental work is available. The last chapter of Part II describes at a more fundamental level several of the physical interaction mechanisms between EM radiation and biological systems: torques at the microscopic level, and thermal effects through a description of relaxation processes at the macroscopic level.

The last part of the book contains five chapters, each devoted to safety guides and rationales which have been published in several parts of the world for the purpose of providing a safe environment against possible harmful effects of EM radiation. The safety guides described are from the United States, Eastern Europe, Western Europe, and Canada. Most of the safety guides are divided into two parts, environmental (population) and occupational. It's difficult to compare the safety guides because of the different criteria used in their development. The book ends with the work of several researchers in the development of an international health criteria document for EM fields under the guidance of the United Nations.

The book is valuable and is recommended as a reference guide which can be easily read by any engineer. Although it is concise, it provides the general background needed to get the reader up to speed in this interesting subject.

LETTER TO THE EDITOR

The book, *Elektromagnetische Vertraglichkeit*, written by Professor, Dr. -Ing. Adolf J. Schwab, was reviewed in the IEEE EMC Society Newsletter, Fall 1990, issue #147. The following is the author's reply to that book review.

When I read Dr. Werner Graf's review of my EMC book I felt highly surprised because the book has been exceptionally well received in German speaking countries and has been sold [out] within the first year. Presently, already the second printing is available.

Apart from one or two exceptions the "many errors and omissions" detected by the reviewer turn out to be either negligible or not substantial. In order to provide the "Newsletter" reader with a balanced view I... comment on the reviewer findings.

Rev: *However, since the figure [Figure 1.3] has no scale, it really does not give any information other than to restate the obvious: planning ahead is a good thing.*
Author: I agree that this should be obvious. However, although EMC awareness has become more popular today, early EMC planning is still frequently neglected. Therefore, in an introductory book, this graph is legitimate...

Rev: *The definition of the dB is given in terms of a voltage ratio....*
Author: I do not define the dB as a voltage ratio but I define the logarithm of pu (per unit) voltages in dB notation. This is perfectly okay and can be found in many other EMC books. This does not at all exclude that the dB has its origin in a power ratio definition. Further, for completeness, I have also defined the Neper and have shown to the newcomer that dB and Neper differ only by using either the natural logarithm or the decadic logarithm...

Rev: *The figure on page 30 is a bit misleading.*
Author: The figure shows a ground loop also if the two shields are closed. Given perfectly conducting material, the internal loop mentioned by the reviewer could not even be detected from outside.

Rev: *An error occurred in the translation of earth ground and signal ground on page 32.*
Author: This chapter on the difference between earth and signal ground is one of the most translucent chapters on the subject in German language. Even in the Anglo literature, this is a semantic problem as can be seen from reading the books "Electronic Circuits and Applications" (Senturia/Wedlock) and "Grounding and Shielding in Facilities" (Morrision/Lewis)...

Rev: *The introduction continues with the somewhat laborious description of Fourier series, Fourier integral and Fourier transforms.*
Author: Again, this chapter is the only chapter in German (and probably U.S.) literature which shows very clearly and transparently how the Fourier integral can be derived from the Fourier series by taking the limit for the period T striving toward infinity. Simultaneously, this chapter explains precisely and very transparently why, when using Fourier integrals, one no longer talks about spectral lines with a magnitude in volts but why one uses spectral densities with the dimensions volt/Hz.

Rev: *The reader is then left to believe that narrow-band sources are usually man-made whereas broad-band sources are natural.*
Author: Literal translation of the German test: "Broad-band-sources excel by a spectrum with extremely dense or infinitely dense spectral lines (continuous spectrum, so-called amplitude density). Typical examples are natural noise sources (for instance cosmic noise) and all nonperiodic switching transients.

Rev: *The table on page 68 contains a typo: FM extends to 108 MHz, not just to 100 MHz as stated.*
Author: This is in fact a regrettable typographical error.

Rev: *The latter is discussed as having a peak current of 200 KAmps. The probability of such an occurrence should be stated, or perhaps the more typical value of 20 KAmps given.*
Author: This is precisely mentioned about 20 lines later, literal citation from the original German: "most of the lightnings exhibit only peak values of some 10 KAmps." Moreover, in German nuclear power plants, we use precisely 200 KAmps as a design value.

Rev: *A brief description of high altitude EMP is also given, but the peak value of the field (50 kV/m) is never stated. The figure on page 93 has no scale.*
Author: True, but NEMP receives almost zero attention on civilian EMC in Germany and, therefore, nobody cares about this magnitude. Nevertheless, I have added this info. in the 2nd edition.

Rev: *The description of optical couplers (p. 113) should mention that these micro-devices only decouple effectively at low frequencies, since their coupling capacitance is usually quite small.*
Author: In this context I am referring to chapter 4.3 which deals extensively with opto-couplers. Literal translation from that chapter: "For high frequency common-mode signals the common-mode rejection of opto-couplers decreases rapidly because of the stray capacitance between in- and output (1...10 pF).

Rev: *What is curiously absent here is the relationship of these devices used in conjunction with electromagnetic shields. All of these items, including a shield, are elements of an electromagnetic barrier.*
Author: By definition, filters rejected conductive interference, conducted through conductors! These filters function, in general, without any shield, for instance in any type of

Continued on page 19

LETTER TO THE EDITOR *(Continued from page 18)*

household appliance, or vacuum cleaner with universal motors and plastic housing. Of course, a filter works better with a shield than without a shield because of the usually lower ground impedance of the shield. Of course, there may exist in parallel either radiated or coupled interference.

Rev: *Schwab neglects to point out that a shield is designed to accomplish the same thing as the passive components discussed in the previous chapter. However, nowhere is mention made that, in order to be effective, a shield must be closed.*
Author: The main point of chapter 5.3.2 is dedicted to the fact that a shield must be closed in order to allow for a low impedance path for short-circuit or shielding currents, see for instance Fig. 5.8 and the accompanying text.

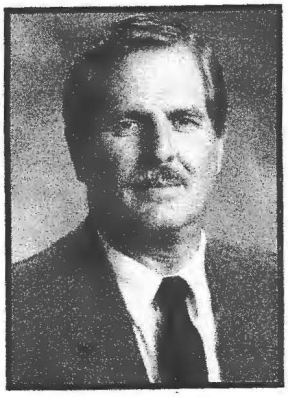
Rev: *This is a highly theoretical chapter that really has no place in a book that is otherwise filled with practical information.*
Author: This chapter is primer to the analytical solution of shielding problems and leads the reader gently into the understanding of Kaden's book. It is, of course, very theoretical. . .

Rev: *For example, on page 267, we find a statement that the impedance of a line impedance stabilization network (LISN) was chosen to be 150 W since it' s between 500 W for overhead transmission lines and 40 W for power cables.*
Author: Historically, this was the major reason as one can learn from the early members of the standardizing committees.

Rev: *And on page 289 the author states that the advantages of measuring the noise power lies in its reproducibility, especially when measuring an equipment unit that is well shielded, since the coupling is then preferably due to the power cabling.*
Author: Regarding unshielded equipment with long leads, EMI is radiated or received by the equipment itself and by its leads acting as antennas. The German text simply says that if the equipment itself is in a metal cabinet, radiation of EMI or reception of EMI is mainly due to leads. Literal translation of the German text: "Noise power measurement is particularly recommended when, by virtue of an EMC-proof cabinet, emissions from a noise source emanate exclusively from the leads."

Rev: *Unfortunately, it is not made clear that an insertion loss measurement, although reproducible, usually contains at least part of the test equipment mixed in with the property of item under test.*
Author: Literal translation of the German text completely ignored by the reviewer: "Insertion-loss measurements exhibit the problem that results depend significantly on the antenna radiation diagrams and that, given other sources and receivers, insertion-loss of the same test sample may attain different values."

EMCABS



WILLIAM H. McGINNIS
ASSOCIATE EDITOR

In this issue we continue publishing abstracts of papers from previous EMC Symposia, other conferences, meetings and publications. The EMCABS committee is composed of the members listed below. By way of introduction to the community, they are listed with their company affiliations:

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Bob Hunter, Texas Instruments
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Most large public libraries, some small public libraries, all engineering school libraries and most other college or university libraries have copies of publications in which articles appear. If they do not have the desired publication, such libraries usually can obtain it or a copy of the article from other libraries or sources. Many company libraries, both large and small, also have such arrangements. Many articles are available from the National Technical Information Service (NTIS) and/or the Defense Technical Information Center (DTIC). To retrieve an article or publication containing an article abstracted in EMCABS, contact one of these libraries. If the library does not have the publication, the librarian can help you get the publication on loan, perhaps from another library or, for a nominal charge, from NTIS. If you have a Department of Defense contract, the contracting officer or your company librarian can help you get publications from DTIC. The information needed is contained in the EMC abstract heading.

NOTE: The steering staff of the EMC Japan Technical Group and the EMCS Tokyo Chapter have graciously offered to act as a central point for requests of papers abstracted. Most of the papers will be in Japanese only. The Steering Staff will assist in routing your request to the author(s) but will not do translating of the papers. The contact person is Yoshio Kami, The University of Electro-Communications, 1-5-1, Chofugaoka, Chofu-Shi, Tokyo 182, Japan.

Readers should be aware that many of the Chinese papers are not available in English. Associate Professor Sah Fei, EMC Research Section, Northern Jiatong University has offered his time and assistance in routing requests for papers to the appropriate author(s). However, he cannot supply translations.

A NEAR-FIELD THREE-LOOP ANTENNA METHOD FOR DETERMINING THE RADIATION CHARACTERISTICS OF AN ELECTRICAL SMALL RADIATION SOURCE — **EMCABS: 01-11-91**

M. Kanda and D. Hill, Fields & Interference Metrology Group, EM Fields Div.
National Institute of Standards and Technology, Boulder, CO
1991 N. American Radio Science Mtg., U. of Ontario, London, Ontario, Canada
Program and Abstracts, Int'l Union of Radio Science
June 24-28, 1991, p. 18

ABSTRACT: In this paper we describe a new method that involves locating the radiator at the center of three orthogonal loop antennas. Each loop is terminated with identical loads located at two diametrically opposite points. This type of loop loading has been used in a sensor for simultaneous measurements of electric and magnetic fields.

INDEX TERMS: Antennas, EME, metrology

MEASUREMENTS OF EM FIELDS WITH ARBITRARY WAVE IMPEDANCES GENERATED INSIDE A TEM CELL — **EMCABS: 02-11-91**

M. T. Ma
1991 N. American Radio Science Mtg., U. of Ontario, London, Ontario, Canada
National Institute of Standards and Technology, Boulder, CO
Program and Abstracts, Int'l Union of Radio Science, June 24-28, 1991, p. 20

ABSTRACT: Transverse electromagnetic (TEM) cells have been used widely in the electromagnetic compatibility (EMC) community for performing EM susceptibility and vulnerability tests. Conventionally, one of the two ports is connected to an RF source, and the other port is terminated with a *matched* load so that a far-field environment is created inside the cell for testing. The wave propagation direction is from source to load, and the wave impedance (defined as the ratio of electric field to magnetic field) has the free-space value of 377 Ω.
INDEX TERMS: TEM cells, magnetic fields, electric fields

THE SINUOUS MICROSTRIP ANTENNA — **EMCABS: 03-11-91**

V. K. Tripp and J. J. H. Wang
Georgia Tech Research Institute, Atlanta, GA
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 1, June 24-28, 1991, pp. 52-55

ABSTRACT: Multioctave microstrip antennas recently developed by the present authors for a spiral geometry have been extended to a sinuous geometry with good performance over a 5:1 bandwidth. The motivation for using the sinuous configuration is to achieve polarization diversity. Dual linear polarizations or dual circular polarizations can be obtained from a single sinuous antenna. Other desirable performance improvements over the loaded-cavity configuration of the sinuous antenna, such as that of antenna gain, were also achieved.

INDEX TERMS: Broadband antennas, microstrip

CYLINDRICAL MAGNETIC CURRENT RING ANTENNA ARRAY -- THEORETICAL STUDY — **EMCABS: 04-11-91**

C. L. Law, Edward K. N. Yung & Wilson W.S. Lee
Dept. of Electrical Engineering, City Polytechnic of Hong Kong
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 2, June 24-28, 1991, pp. 694-697

ABSTRACT: The feeds of most satellite receiving antennas including the horn antenna, the LNA and the down converter are placed at the focal point of the parabolic dish. This arrangement has a number of drawbacks. The size of the horn and other active components must be small relative to the diameter of the dish to minimize blocking, and the active components must be perfectly shielded from external electromagnetic interference. Nevertheless, most drawbacks can be removed by an innovative feed, such as one consisting of an oversized coaxial waveguide of radii a and b, where $a < b$. The waveguide is perfectly terminated at one end and excited at the other. Narrow circumferential slots transverse to the direction of the wave propagation are cut on the outer cylinder. The key radiation elements are these circumferential slots; therefore, the feed is termed as Cylindrical Magnetic Current Ring Antenna Array.
INDEX TERMS: Parabolic antennas, DBS

A NOVEL ULTRA-WIDEBAND ANTENNA — **EMCABS: 05-11-91**

Albert Lai, Walter D. Burnside and Albert Sinopoli
Electroscience Lab, Columbus, OH
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 2, June 24-28, 1991, pp. 703-706

ABSTRACT: An ultra-wideband antenna that operates from 2 to 18 GHz is developed in this paper. It is capable of producing a flat main beam with controllable E- and H-plane beamwidths and low sidelobes, as well as a low VSWR. Applications are plentiful, ranging from satellite communication applications to feeds for compact range reflectors. The successful development of this antenna is achieved by overcoming two major obstacles: input impedance and pattern control in a wideband context. Since no present antenna can fulfill both requirements at the same time, two types of antennas were brought together to achieve these goals: a slotline antenna to provide a wideband and balanced feed structure and a bowtie horn to provide wideband radiation pattern control. These two antennas, with a properly matched shape, were joined together to form a new antenna type that is capable of achieving the goals mentioned earlier.
INDEX TERMS: Wideband antenna, GHz

CHARACTERIZATION OF A HIGH FREQUENCY BEVERAGE ANTENNA USING A FIBER-OPTIC MEASUREMENT TECHNIQUE — **EMCABS: 06-11-91**

B. Rama Rao and David N. Jones
Mitre Corporation, Bedford, MA
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 2, June 24-28, 1991, pp. 1190-1193

ABSTRACT: The Beverage antenna has been widely used as a receive and direction-finding antenna in the High Frequency band (2-30 MHz) because of its high directivity at low take-off angles, inexpensive construction and low physical profile. This important antenna has been analyzed by several authors using a variety of approximate theories with less than desirable results. More recently, King has proposed a rigorous, generalized theory for the Beverage antenna above a dielectric half-space; unfortunately, his theory has received only scant attention thus far.
INDEX TERMS: Fiber-optic, HF antenna, metrology

REFLECTIVITY OF COMMERCIAL ABSORBERS AT 100-200 GHz — **EMCABS: 07-11-91**

Arto Lehto, Jussi Tuovinen, and Antti Raisanen
Helsinki University of Technology, Finland
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 2, June 24-28, 1991, pp. 1202-1205

ABSTRACT: Different types (pyramidal, convoluted, wedge, flat) of absorber panels made by three manufacturers have been measured at 107 and 183 GHz. These measurements revealed a rapid degradation of the quality of absorbers from 107 to 183 GHz: reflectivity increased nearly 10 dB. Best absorbers have reflectivities below -40 dB at 107 GHz and about -35 dB at 183 GHz.

INDEX TERMS: RF absorber, millimeter frequencies, measurements

FINITE ELEMENT SOLUTION OF A 4 WIRE ANTENNA IN TAPERED ANECHOIC CHAMBER — **EMCABS: 08-11-91**

Changyul Cheon and Valdis V. Liepa
Dept. of Electrical Engrg. and Computer Science, University of Michigan
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 2, June 24-28, 1991, pp. 1236-1239

ABSTRACT: A four wire antenna system is analyzed in tapered anechoic chamber using frequency domain finite element technique. In the analysis, wedge absorbers are replaced by equivalent dielectric layers to reduce the number of unknowns. To handle the lossy medium (absorbers and loading resistance), full magnetic vector fields are used in the three-dimensional finite element formulation. The system matrix equation is solved using Frontal technique.

INDEX TERMS: Analysis, anechoic chamber, wideband antenna, susceptibility

THE STATISTICAL PROPERTIES OF EM FIELDS WITH APPLICATION TO RADIATION & SCATTERING — **EMCABS: 09-11-91**

T. H. Lehman, Consultant and E. K. Miller
Los Alamos Nat'l Laboratory, New Mexico
3200 Carlisle NE Albuquerque, NM 87110 and Los Alamos, NM 87545
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 3, June 24-28, 1991, pp. 1616-1619
ABSTRACT: As the size and complexity of electronic systems continue to increase, there is a growing need to characterize their electromagnetic behavior in statistical terms. For this to be useful, one should be able to establish the range of validity, and functional forms for distribution functions of the fields, using Maxwell's equations directly, as the number of samples required to do this is prohibitive from a measurement point of view. In the classical electromagnetic theory governed by Maxwell's equations, one assumes that the electric field and magnetic field are measurable functions of position and time. In principle, one can follow in detail the instantaneous variations of the electric or magnetic field, no matter how intricate the boundary conditions. In many cases, however, the procedure is extremely difficult and may, in fact, *mask important physical effects* . . . The situation is analogous to the one arising in classical statistical mechanics. Although in principle it is possible to follow in detail the dynamics of the system, it often proves much more useful to provide a statistical description."
INDEX TERMS: Electromagnetic theory, reverberation-chamber, statistics

A TIME-DOMAIN METHOD FOR MEASURING THE REFLECTION COEFFICIENT OF MICROWAVE ABSORBERS AT FREQUENCIES BELOW I GHz — **EMCABS: 10-11-91**

Arthur R. Ondrejka and Motohisa Kanda
Nat'l Institute for Standards and Technology, Boulder, CO
1991 Digest of the Antennas and Propagation Society Symposium
Vol. 3, June 1991, pp. 1656-1659

ABSTRACT: A wideband time-domain reflectometer has been developed to measure the reflection coefficient of rf/microwave absorbers. The advantage of using a time-domain approach is that reflections from various parts of the test chamber can be separated from one another by the differences in their time of arrival at the receiving antenna.

INDEX TERMS: RF absorber, wideband, time domain

UTILIZING A PROTOTYPE TRANSVERSE EM/REVERBERATING CHAMBER COMBINATION FOR THE CONDUCT OF RADIATED SUSCEPTIBILITY & VULNERABILITY TESTING OF LARGE TACTICAL SYSTEMS — **EMCABS: 11-11-91**

Robert Weeks and Jeffrey Bolton, EMI TEMPEST Branch
U.S. Army Electronic Proving Ground, Fort Huachuca, AZ
1991 Test Technology Symposium, MD
Johns Hopkins Univ., Applied Physics Lab., Laurel, MD
Technical Proceedings, 8-10 April 1991, pp. 417-430
ABSTRACT: This paper discusses a test and evaluation methodology to determine the susceptibility and survivability of tactical platforms when exposed to high level electric fields (E-fields). The test and evaluation methodology presented is radiated susceptibility and vulnerability testing within a combination transverse electromagnetic cell/reverberating (TEM/REV) chamber. The paper presents a description of the operational concepts of both the TEM and reverberating modes, a discussion of the benefits of the TEM/REV chamber methodology over present anechoic chamber and open-site facilities, limitations of the TEM/REV chamber, and an overview of testing concepts utilizing the TEM/REV prototype chamber.
INDEX TERMS: Susceptibility, TEM, reverberating chamber

TESTING OF LARGE AIRCRAFT IN HIGH FREQUENCY EMP ENVIRONMENTS — **EMCABS: 12-11-91**

Dean I. Lawry
Phillips Lab, Kirkland AFB, NM
1991 Test Technology Symposium, Johns Hopkins Univ., Laurel, MD
Technical Proceedings, 8-10 April 1991, pp. 543-556

ABSTRACT: Testing of weapon systems in EMP simulators for hardness verification results in a higher degree of confidence over analytical approaches especially for complex systems. Testing, while eliminating many of the uncertainties associated with analytical modeling, is not without its own problems. Problems such as EMP ground reflections, sub-threat field levels, and power-on operational conditions have been addressed in past testing. Facilities were designed to meet the amplitude and frequency requirements of the 1970's EMP type threats. Even then, not all threat criteria requirements were met and adjustments to the measured cable responses had to be made to produce threat like responses. Direct drive testing using inductively coupled damped sine wave currents to test electronic assemblies is used to compensate for deficiencies in the simulator free field induced responses. In the mid-1980's, another type of EMP facility was designed and built at Kirkland.

INDEX TERMS: EMP, test facilities

WROCLAW SYMPOSIUM ON EMC

The Eleventh International Wroclaw Symposium on EMC will be held from September 2 to 4, 1992.

The Wroclaw EMC Symposium is organized as a biennial event open to all scientists and engineers throughout the world. In 1992, immediately after the symposium (i.e., 7-12 September) the meeting of the International Special Committee on Radio Interference (CISPR) will be held in Poland. This creates the easy opportunity for the CISPR meeting participants to take part in both events.

The symposium will cover all aspects of EMC theory and practice. EMC is understood in a broad sense as the ability of a device, equipment, or system to function satisfactorily in its electromagnetic environment without introducing intolerable disturbances to anything in that environment. A technical exhibition and an exhibition of relevant books and other literature are planned. The preliminary program is scheduled for March 1990. For more information, please contact Mr. W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland. Tel. +4871 481041, FAX +4871 483248.

NEM 1992 CALL FOR PAPERS

A call for papers has been issued for NEM 1992, which will be held from July 18-25, 1992, in Chicago, Illinois. As in recent NEMs, the evolution of EMP technology into closely associated areas will be included. The general heading of High-Power Electromagnetics (HPE) comprises EMP, High-Power Microwaves (HPM), close-in lightning and certain aspects of transient radar (especially antennas and pulsed power).

Various special sessions are being planned, some of them joint with APS and/or USNC/URSI commissions. To date there are plans for: Transient Radar (Joint With APS, USNC/URSI Commission B); High Power Microwave and System Test Results.

Authors can receive editorial guidelines by writing to: 1992 Joint Symposia, Technical Program Committee, P.O. Box 6805, Chicago, IL 60680-6805, USA.

EMC 1992

The 1992 Regional Symposium on Electromagnetic Compatibility will be held in Tel Aviv, Israel on November 2-5, 1992. The Symposium will provide excellent opportunities for EMC researchers and engineers to present the latest research results and exchange views and experiences. Authors are invited to submit papers on the current state of EMC technology. Papers on related topics are also acceptable. For information conact Rafi Rubinstein, Symposium Chairman. Tel: 972-3-7545628. FAX: 972-3-7545468.

ACES SYMPOSIUM

The 8th Annual Review of Progress in Applied Computational Electromagnetics will be held March 17-19, 1992, at the Naval Postgraduate School, in Monterey, California.

The purpose of the Symposium is to bring analysts together to share information and experience about the practical application of EM analysis using computational methods. Symposium papers, short courses, demonstrations and vendor booths will be featured. The NSF/IEEE CAEME (Computer Applications in Electromagnetics Education) Center will organize a special session of technical presentations on Computer Applications. For more information, contact Perry Wheless, University of Alabama, EE Department, P.O. Box 870286, Tuscaloosa, AL 35487-0286. Tel: (205) 348-1757.

IEEE RECOGNIZES LITERARY CONTRIBUTIONS

As part of the annual meeting of the IEEE-USA, which was held in September 1991, three awards were presented for literary contributions. IEEE-USA's Award for Literary Contributions Furthering Public Understanding of the Engineering Profession was awarded to Eleanor R. Adair of Yale University for "her scholarly and balanced paper titled 'Currents of Death Rectified.'" Dr. Adair's paper responded to a series of articles on the health effects of electric and magnetic fields appearing in *The New Yorker*.

In addition, IEEE-USA presented a second Award for Literary Contributions Furthering Public Understanding of the Engineering Profession to Richard Harris of National Public Radio for "his balanced five-part series on electromagnetic fields."

CALENDAR 1992

March 17-19	**8th ANNUAL REVIEW OF PROGRESS IN APPLIED COMPUTATIONAL EM** Naval Postgraduate School Monterey, CA	Contact:	Pat Foster Microwave & Antenna Systems 16 Peachfield Rd. Malvern, WORSC, UK WR14 4AP
May 17-22	**EIGHTH WORLD CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION** Montreal Convention Centre Montreal, Quebec Canada	Contact:	IRPA8 2155 Grey Street, Suite 820 Montreal, Quebec Canada H3H 2R9 FAX:(514)932-9419
May 25-27	**IEEE INTERNATIONAL SYMPOSIUM ON EMC** Fragrant Hills Hotel Beijing, China	Contact:	Prof. Zhanj Linchang EMC Research Section Northern Jiatong University Beijing, 100044, China
July 18-25	**NEM 1992** Hyatt Regency Chicago, IL	Contact:	1992 Joint Symposia Technical Committee Program P.O. Box 6805 Chicago, IL 60680-6805
August 18-20	**1992 IEEE INTERNATIONAL SYMPOSIUM ON EMC** Anaheim, Marriott Anaheim, CA	Contact:	Terry Cantine AVX Filters (818)767-6770
August 24-25	**ASIA-PACIFIC CONFERENCE ON ELECTROMAGNETIC COMPATIBILITY** Centre for Electromagnetics Madras, India	Contact:	Coordinator APC-EMC Sameer Centre for Electromagnetics CIT Campus, 2nd Cross Road Taramani, Madras 600113 INDIA FAX: (44)2350747
September 2-4	**11th INTERNATIONAL WROCLAW SYMPOSIUM ON EMC** Wroclaw, Poland	Contact:	Mr. W. Moron EMC Symposium Box 2141 51-645 Wroclaw 12, Poland
September 16-18	**14th ANNUAL ELECTRICAL OVERSTRESS/ELESTROSTATIC DISCHARGE SYMPOSIUM** Loews Anatole Dallas, TX	Contact:	Charvaka Duvvury Texas Instruments, Inc. 12840 Hillcrest, Suite 200 Dallas, TX 75230 214-917-7969 FAX: 214-917-7487
September 21-24	**8th INTERNATIONAL CONFERENCE ON EMC** Edinburgh Conference Centre Heriot - Watt University Edinburgh, Scotland	Contact:	Conference Services IEEE Savoy Place London WC2R 0BL U.K.
October 1992	**1992 INT'L AEROSPACE & GROUND CONFERENCE ON LIGHTINING & STATIC ELECTRICITY** Atlantic City, New Jersey	Contact:	Mike Cupples (609)484-5228 FAX: (609)484-4005
November 2-5	**1992 SYMPOSIUM ON ELECTROMAGNETIC COMPATIBILITY** Tel-Aviv, Israel	Contact:	Rafi Rubinstein, EMC 1992 Symposium Chairman Elisra Ltd. 48 Mivtza Kaddesh St. Benei-Beraq 51203 Israel Tel: (972-3)7545628 FAX: (972-3)7545468
December 2-4	**THIRD INTERNATIONAL CONFERENCE ON ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY (INCEMIC)** Calcutta, India	Contact:	Shri V.R. Katti Electrical Integration Group Indian Space Application Centre Vimanapura - Post, Bangalore 560 017 India

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