

IEEE

# EMC SOCIETY



Newsletter

ISSUE NO. 149

SPRING 1991

(ISSN 0164-7644)

EDITOR: ROBERT D. GOLDBLUM

## 1991 INTERNATIONAL IEEE EMC SYMPOSIUM

The 1991 International Symposium on Electromagnetic Compatibility will be held just outside of historic Philadelphia in Cherry Hill, New Jersey from August 12 through August 16. The theme of the program is "Radiating Compatibility from New Jersey." The symposium is jointly sponsored by the New Jersey Coast and Philadelphia Section EMC Chapters.

The core technical program will be the full three days of Tuesday through Thursday. Sessions begin promptly at 8:30 A.M. On Tuesday there will be no Plenary Session. Three workshops will be held on Monday afternoon, 12 August and three will be given on Friday morning, 16 August. No other technical sessions will conflict with the workshops, which will cover:

- The European EMC Environment
- Computer Analysis Techniques for EMC Problems
- Ultrawideband Technology and EMC Issues
- Proposed Changes to MIL-STD-461/2/3
- The Effects of Transient Overstress
- EMC Effects on Spectrum Management Decisions

The Society's technical committees were again very active in reviewing the papers. They will be sponsoring and chairing the vast majority of sessions and workshops.

Committee meeting arrangements have been extended to cover the full week starting on Sunday evening, 11 August, and ending on Saturday afternoon, 17 August. This will allow participants to have opportunities to meet with the Society and associated EMC organizations with a minimum of conflicts with the technical program and workshops.

For the remainder of the week, the more traditional three parallel technical sessions will be run each day on Tuesday, Wednesday and Thursday, 13-15 August. During session breaks and throughout the day, the exhibit layout on the main floor of the hotel will allow easy access and the opportunity to discuss the latest EMC technology services and products. A large turnout is expected.

FIRST CLASS MAIL

IEEE ELECTROMAGNETIC COMPATIBILITY SOCIETY  
NEWSLETTER

C 6014849 F 27N \*\*\* 27N  
li EDWIN L BRONAUUGH OFU26 'S,  
d C/O EMCO PU BOX 1546 TX 78767 ie  
S AUSTIN ie  
S y.

S. postage paid at New York, NY and additional  
mailing offices.

# NEWSLETTER STAFF

## EDITOR

Robert D. Goldblum  
R & B Enterprises  
20 Clipper Road  
West Conshohocken, PA 19428

## ASSOCIATE EDITORS

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

### IEEE NEWSLETTER PUBLICATION SCHEDULE

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

Editorial contributions for the August 91 issue should be received by June 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.

## CHAPTER CHATTER



**CHARLIE ANDERSON**  
**ASSOCIATE EDITOR**

My apologies for missing the Winter issue - a consulting stint in Quebec, the holiday season and a bout with a persistent flu bug all contributed to my missing the publication date.

### ISRAEL

(I'm starting with this Chapter to make amends to Elya Joffe and the other members for not getting their information into the Fall '90 column.)

As of earlier this year, the Chapter had about 50 members, of whom 25 to 30% are IEEE affiliates. They have been averaging about 20 attendees at their meetings. In July '90, a seminar was held, which was entitled "Europe 1992-EMC Directive and its Impact on Israeli Industry." Its success may be gauged from the fact that there were over 70 attendees, when only 40 had been expected! The major paper was presented by Mr. Laurence Green (U.K. Department of Trade & Industry) on the topic, "The Single Market and EMC: Achieving Compliance." Seven other papers were also presented. The Seminar received recognition in the November '90 issue of The Institute. The Chapter's August meeting had Elya Joffe giving a review of the Symposium in Washington. He also covered the work being done by the SAE-AE/4-R Committee, of which he is a member. Rafi Rubenstein (who is the '90/91 Chapter Chair) also gave a paper at that meeting. The other Chapter officers are Elya as Vice-Chair, and Rafi Miron as Secretary-Treasurer.

A Region 8 EMC Conference, to be held in Israel in 1992 is in the planning stages. Elya Joffe had some conversations with our French, Swiss and Swedish colleagues about this during the Zurich Symposium. (Hope to have more on this for the next issue.) This small but active Chapter is hoping to have additional EMCS/BoD support, possibly along the following lines:

- Sponsoring a Distinguished Lecturer visit to Israel
- Agreement for conducting an International EMC Symposium in Israel (target date: 2001)

Thanks to both Elya Joffe and Dick Ford for the above.

### CENTRAL NEW ENGLAND

The Chapter's September meeting was held at the Chomerics facility. A presentation by Timothy Dwyer of Eurotest Laboratories was entitled "Preparing for the European Market - RFI Testing and Approval." There were 14 attendees. The October meeting, also held at Chomerics, featured Fred Helene (Helene Industries) speaking on "Architectural Shielding

Concerns for Entire Structures/Buildings." He addressed such areas as shielding effectiveness, environmental concerns, requirements and cost considerations. There were 10 in attendance. The November meeting was addressed by Darrell Fernald (Cable Systems, Inc.), on the topic "Transfer Impedance - A Measure of Cable Assembly Shielding."

### HOUSTON

This chapter is now active, but I have no late word regarding their activities.

### MONTREAL

Very pleased to report that we now have an active Chapter in our big neighbor to the North - also disappointed to say that I heard about the November meeting the day *after* it occurred. (I would have been there, since I was consulting in the Quebec area at the time.) That meeting was held at the Centre de Recherche Industrielle du Quebec (CRIQ) in Montreal. The speaker was Major Marc Drolet of the Canadian DND Directorate of Frequency Spectrum Management. He reviewed the international and national frequency management structures and their relation to the ITU. In Canada, the Department of Communications (DOC) is the ITU liaison, and works with its member organizations such as the DND and the Ministry of Transport (MOT). The Radio Advisory Board of Canada, plus several other groups forward their inputs to the DOC. Major Drolet described typical battlefield communications difficulties, with emphasis on Arabian Gulf operations (e.g., the U.S. and the U.K. had over 350,000 radios and the Iraqis



Photo: Dick Ford

Members of the Israeli EMCS Chapter helped with the membership drive at the recent EMC Symposium in Zurich. Pictured are (left to right) Itzik Berger, Shabtai Shiran, Motti Erel, Laich Ben-Zion (front) Eli Recht, Ahikam Tehori and Elya Joffe.

had 500,000!) He cited several systems/equipments known to have EMC problems (one of which I did that above-mentioned consulting bit on). Major Drolet concluded with a discussion of the DND's approach to improving spectrum efficiency by use of Narrowband Speech Quadrature AM.

(Continued on page 4)



In February, Dr. Satish Kasdhyap (Defence Research Establishment-Ottawa) presented a lecture on nuclear EMP. He described the parallel-plate EMP simulator which will be placed in service later this year by the DRE. At the March meeting, Dr. Pavlasek (McGill University) discussed his research on electromagnetic ambients in urban areas. The Chapter plans to host a half-day seminar during the Montreal High Tech Show on April 30. Lecturers will include representatives of MPB Technologies, Societe Radio-Canada, CRIQ and ANCOM Electromagnetique.

Thanks to Messieurs Benoit Nadeau and Christian Duhe (Chair and Vice-Chair of the Chapter) for the information. Their bilingual newsletter makes for interesting reading (and might even help me improve my French).

### NEW JERSEY COAST

In September, Anatoly Tsaliovich (Bell Labs) spoke on "How to Test Electromagnetic Absorbers for RF Applications." There were 13 at the meeting. The combined AP/EMC/VT Chapter's holiday social was held on December 13. On December 18, John Osborne (EMCO) presented a paper on the GTEM cell.

### SANTA CLARA VALLEY

At the November meeting, Mike Hopkins (Keytek) had as his subject "Emerging European Standards - IEC-801." He discussed the problems which companies operating in the global marketplace will soon face with regard to all consumer, commercial and light industrial products to be sold within the European Community. He pointed out that in some cases the test-stress levels could cause components to explode!

In December, Ed Bronaugh (EMCO) was the speaker. His topic was "Horn and Log-periodic Antennas Above 960 MHz." He discussed horn and LPA characteristics and compared their respective performances in the ranges above 960 MHz.

The January meeting featured Stan Roberts (Manager, Engineering Services, Apple Computer) speaking on "ELF/VLF from Video Terminals." He mentioned that Sweden has recently drafted a new ELF/VLF emissions standard which will impact all video data terminals. He also gave an overview of the work of the IEEE ad hoc group on that subject, which he chairs. In February, the Chapter was heavily involved in RF Expo West (sponsored by *RF Design* magazine).

On March 12, the Chapter meeting had Gerald Fuller (CKC Labs) speaking on the subject, "The Effect of High-speed Logic on EMC Design." His talk explored the benefits to be gained by careful PC board layout. He also covered such aspects as the effects of greater device bandwidths and cavity resonances within metal boxes. Limitations of ferrite and chip capacitors in PC board filtering were mentioned, as was the importance of proper hardness testing.

Ed Bronaugh again addressed the Chapter meeting in April. His subject was "Testing Digital Devices; ANSI C63.4 versus FCC MP-4." He pointed out that, after the release of ANSI C63.4-1991, the FCC issued an NFPRM in Docket 89-44 which proposes to substitute that document for MP-4 and its proposed TP-5. The commonality between the procedures makes for a much more efficient standard if combined.

### SWEDEN

The following officers were elected: Peter Landgren (Bofors) as Chair; Bo Wahlgren (Saab-Scania) as Vice-Chair; and K. G. Lovstrand (Swedish Defense Materiel Administration) as Secretary. Because of the distance factor (mentioned in the Fall 1990 Newsletter), each meeting is to be planned as a mini-Symposium, to have the following content:

- Chapter information
- Several short technical papers on one or two themes
- Open-forum discussions
- Reports of seminars and symposia attended by members

Those present gave brief summaries of their organizations and their own backgrounds and interests.

### TOKYO

Our Japanese colleagues continue with their monthly meetings. The abstract lists which Professor Kami sends me are enough to make one wish to commute to Japan every month! If any of you would like to have copies of those lists, please write (or call 301-733-3061 - after 9:00 PM Eastern time, please) and I will arrange to repro and mail same at cost. One paper (EMCJ 90-37) covers an analysis of the CISPR-proposed orthogonal loop, which presumably could be used over the 9 kHz to 30 MHz range. From the abstract, it sounds quite good indeed.

### WASHINGTON/NORTHERN VIRGINIA

The topic for the Chapter's November meeting was "Measurements in the Modulation Domain." Dr. Henning Harmuth (Catholic University), Brit Meyer (Hewlett Packard) and Paul Roos (also HP) were the presenters. They discussed their work on modulation-domain measurements with application to communications and target detection. The HP MD analyzers, (based on a proprietary technology) allow acquisition of transient information on such dynamic signals as radar chirps, pulse trains and complex communications schemes. (Didn't make this meeting - was in Canada.) On January 17, Captain Ken Burgess (Deputy Director, Product Integrity Division, USN) spoke on "EMC Business Opportunities in the Soviet Union." Captain Burgess (a career fighter and attack pilot) gave high praise to electromagnetic technology for the quick victory in the war against Iraq. He made the point that quality is of greatest importance - "It has to work right the first time" should be the guiding principle. Among the many other points Captain Burgess made was "Think ahead - think Metric!"

(Continued on page 8)



## EMCS BoD ACTIVITIES



**DON HEIRMAN**  
**ASSOCIATE EDITOR**

The first EMC Society Board of Directors' meeting of 1991 was held on February 8, 1991 at the Hyatt Hotel, River Walk, in San Antonio, TX. Board members present included Ed Bronaugh, Bob Hofmann, Dick Ford, Janet O'Neil, Don Clark, Dan Hoolihan, Al Mills, Joe Butler, Warren Kesselman, Dave Staggs, Don Weber, Walt McKerchar, Don Heirman, Bob Haislmaier, Gene Cory, and Gene Knowles. Members

absent included Herb Mertel, Pat Coles, Henry Ott, and Chet Smith. Guests present were John Osburn, Bob Hunter and Division IV Director, Martin Schneider.

President Ed Bronaugh opened the meeting at 10:15 A.M. The agenda and minutes were adopted with minor additions and changes. Next, Treasurer Dick Ford presented his report, which indicated that our Society's net worth as of 1 January 1991 was \$310K, with an operating surplus of \$17.8K. That is down from the last reporting period. The Board deliberated on the budget for 1992, with a view toward cutting expenses where possible. The Board approved the Treasurer's report and the new format for its presentation.

The Directors then delivered their reports. Bob Haislmaier (Communications Services) again encouraged the Board to use the EMCS Newsletter to inform the Society members and to solicit participation in Society activity. He also noted a continuing review of the Transactions activity in accordance with members' requests and comments. These comments were listed on page 18 of the Winter 1991 issue of the Newsletter, which carried the results of the attendee questionnaire distributed at the Washington, DC Symposium last August. Bob also asked the Board to review and make recommendations for changes to the publishing policy on the back page of the Transactions. Bob then turned to the History Committee report. He moved for Chet Smith, the History Committee Chairman, that the Board buy a microfiche reader and that \$4000 be authorized to microfiche all records for symposia financially sponsored by the IEEE EMC Society. He also included the original Armour Conference Proceedings in this group. The Board approved the motion. Director Haislmaier will work with Chet to accomplish this task and Gene Knowles will send the Armour Conference Proceedings to Chet to be included in the committee microfiche activity. Bob reported next on the IEEE Press activity in the area of pending EMCS-sponsored book candidates. The book closest to publication is one written by Ghose on "Interference Cancellation." We are looking for EMCS reviewers of such manuscripts. The criteria are willingness to review at a few

weeks' notice, consider the viability of the manuscript from a technical and marketing perspective, and point out changes that need to be made to make the book a worthwhile activity. Bob is also looking for a chairman or liaison representative from the Society to handle all IEEE Press interactions. If you have an interest, please call Bob at (703) 692-8600.

Gene Cory presented his Symposium Committee activity. We now have identified symposium locations through 1997. Bob briefly reviewed the wrap-up of the Washington, DC Symposium. Don Heirman, 1991 Symposium Chairman, presented his report. One hundred and nineteen papers (83 6-page and 36 2-page versions) were accepted out of 135 papers reviewed. A full week of activity, including workshops on Monday afternoon and Friday morning, is planned. Approximately 95 8' x 10' booths will be staffed by exhibitors. The advance program, which will include conference registration and hotel reservation material, will be out by May. For more details, call Don at (908) 834-1801. Next, Gene moved and the Board approved that only the annual IEEE EMCS-sponsored symposium shall be called the 19XX IEEE International Symposium on Electromagnetic Compatibility. This means that conferences co-sponsored by our Society with other non-IEEE professional societies will not include "IEEE" in their title. Instead, they can use such titles as "19XX International Conference on EMC" or "National" or "Regional" identifiers as appropriate. Gene also handed out an updated list of symposia-related Board actions or approved motions as of this meeting. This should be very useful for future symposia chairmen. Finally, a "straw vote" was held to help the 1997 Texas Symposium Committee. The vote indicated a preference for a single hotel for all symposium activity. The board also tended to favor San Antonio or Austin for facilities, but left that door open for future discussion.

Director Don Heirman (Technical Services) gave several reports. First, as Chairman of the Society's Standards Committee, Don mentioned that Standard 299 on Shielding Effectiveness of Shielded Enclosures was approved by the IEEE REVCOM subject to IAS coordination. (Subsequent to the meeting, IAS approved the standard.) This standard should now be available. He also reported that P1140 on Measurement of Near-Field Magnetic and Electric Fields was split into two parts: VDT applications went to P1253 (renumbered to P1140.1) and the rest stayed with our EMCS. The Computer Society took over P1140.1. The Board objected to this takeover of P1140.1 and directed Ed Bronaugh to write a letter so stating to the IEEE NESCOM, which met on March 20, 1991. We will report the results in the next issue. Next, Don indicated that Clayton Paul, Education Committee Chairman, reported much activity. Eight distinguished lecturer presentations were made in 1990. One hundred and twenty-five copies of the EMC experiments manual were distributed in Washington, DC and another 125 are still available from

*(Continued on page 6)*

Henry Ott, (201) 992-1793. The main goal for 1991 is to assist university faculty in setting up an undergraduate EE course on EMC. The final version will be discussed in Cherry Hill at the 1991 Symposium. Wilf Lauber's (Technical Advisory Committee) report showed that the Technical Committees are writing Newsletter articles to describe their work and solicit volunteers. The TCs reviewed 159 abstracts of papers submitted for consideration for the 1991 EMC Symposium. TC 2 (Measurements) and TC 4 (EMI Control) reviewed over a hundred of this total alone. All eight TCs were asked to review papers. The TCs are also involved with reviewing IEEE Press Book proposals and putting together a five-year plan of their activities. Finally, Joe Butler (Representative Advisory Committee) presented his report. He has filled several representative positions including the IEEE Committee on Defense R&D (Dick Ford), the EOS/ESD Association (Bill Rittenour), and the Committee on Man and Radiation (COMAR) (Dan Hoolihan). It was also suggested that liaison representatives be identified for the SAE Electromagnetic Radiation Technical Committee and the SAEEMI Standards and Test Methods Technical Committee. Much is happening here. If you feel that other representative linkages should be considered, give Joe a call at (617) 935-4850, Ext. 267.

Dan Hoolihan, Director for Member Services, discussed several activities. He reminded the Board that nominees for EMC awards were due. These awards will be presented at the Cherry Hill Symposium in August. Pat Coles is handling those nominations which include a new Founder Award. This award will honor those people who were instrumental in founding the EMC Society in 1958 and those who were responsible for starting a local EMC Chapter. The award will be a memorial plaque. The Board will approve the nominees presented for consideration by the Director for Technical Services. The possibility of subsidizing travel and living expenses for the recipient to the annual symposium was also suggested. Dan also reported that we broke the 4000 member level with 4042 active members as of December 31, 1990. That's a 4.9% annual growth rate compared to the 2.1% rate for the Institute as a whole, which now has 319,227 members worldwide. There are now 32 active chapters, eight of which are outside the United States. Five chapters pending include Austria, India, Spain, United Kingdom, and Buena Ventura (California). Chapter startup kits were sent to Stuttgart, Germany and Portland, Oregon. Dan announced that Dave Staggs agreed to chair the chapter coordination activity.

Director McKerchar (Professional Services) introduced his activity by discussing the use of our new EMCS logo. You will soon see it everywhere including our Transactions (it is already on the cover of our Newsletter - take a look). The seven-minute EMCS videotape about our Society is now available to chapter chairmen. Call Walt at (206) 779-7069 if your chairman has not received your copy. This tape and our new EMCS exhibit display were used at the Zurich EMC Symposium 12-14 March 1991. It was a real eye-catcher!

Walt reported on Jerry Rothhammer's health. Our Board's sentiments for a speedy recovery were expressed. Don Weber (Intersociety Relations) reported that his article on the SAE AE-4 Committee will appear in this issue and that Joe Butler (RAC Chairman) and he are working out any overlaps in activities. Herb Mertel's report for the Transnational Committee showed that final arrangements for our EMCS booth at the Zurich symposium were completed (we had the equivalent of three regular size booths right at the main door to an exhibit area!) and that 45 1988 and 1990 copies of the Wroclaw EMC symposium were received. One set was sent to the Southwest Research Institute Library as part of our archival agreement with SWRI and one 1990 volume set sold as a result of the EMCS Newsletter announcement. That leaves 43 still available! Call Herb at (619) 578-1480 to order copies. He is now planning for the EMCS booth activities in Cherry Hill. Henry Ott will be setting up the exhibit for the Santa Clara Colloquium in June. Next, Al Mills gave his report for PACE activities. He noted that there are four "hot" topics for PACE: Pension Portability, U.S. Competitiveness, IEEE Reorganization, and the Shortage or Surplus of Engineers. Finally, Bob Brook (SSIT) forwarded his report. First of all, congratulations are in order since Bob was elected Vice President of the Society for Social Implications of Technology. For more information on SSIT, call Bob at (516) 595-3136.

Under old business, President Bronaugh indicated that the latest changes to our bylaws have been approved by the IEEE. The new bylaws were printed in the Spring 1990 issue of the Newsletter. Dick Ford agreed to electronically scan the bylaw sheets so that a more readily available form can be used for the next revision. Bob Haislmaier was appointed the ad hoc chair to consider what portions of the steering committee activity for each symposium should be "institutionalized," i.e., made a permanent activity of the Board. Several symposium chairmen have indicated that the majority of the planning and execution of our symposia would be more effectively and



Photo: Dick Ford

Walt McKerchar (left) presents the new IEEE EMCS exhibit display to President Ed Bronaugh (right).

(Continued on page 16)



**SNEAK PREVIEW**

**RADIATING COMPATIBILITY FROM NEW JERSEY**

# **1991 IEEE EMC SYMPOSIUM HYATT CHERRY HILL CHERRY HILL, NJ**

**August 1991**

## **MONDAY, AUGUST 12**

### **AFTERNOON WORKSHOPS**

The European EMC Environment, Computer Analysis Techniques for EMC Problems, Ultrawideband Technology and EMC Issues.

## **TUESDAY, AUGUST 13**

### **TECHNICAL SESSIONS**

EMC Test Facilities, Cables/Connectors/Shielding, PWB EMC Analysis/Design, Lightning Effects, Shielding Rooms, EMC System Design.

## **WEDNESDAY, AUGUST 14**

### **TECHNICAL SESSIONS**

EMC Measurements, System EMC, Electromagnetic Environment, ESD, Antennas & Field Probes, Fast & High Intensity Fields, EMC Education.

## **THURSDAY, AUGUST 15**

### **TECHNICAL SESSIONS**

EMC Standard Development, Automotive/Shipboard/Military Applications, IC and Signal Analysis, RF Absorbers/Absorber Lined Rooms, Test Instrumentation/Automation/EMI Protection Devices, Conducted Emissions/Power Line Analysis.

## **FRIDAY, AUGUST 16**

### **MORNING WORKSHOPS**

Proposed Changes to MIL-STD-461/2/3, The Effects of Transient Overstress, EMC Effects on Spectrum Management Decisions.

**PLUS** - Several Committee meetings, guest programs and exhibits throughout the week.

**ADVANCE PROGRAM AND REGISTRATION MATERIALS  
WILL BE MAILED SHORTLY**

**Chairman**  
Don Heirman  
908-834-1801  
908-741-7723

**Registration**  
Tony Noerpel  
908-758-2809

**Arrangements**  
Henry Ott  
Janice Hoffman  
201-992-1793

**Publications**  
Mike Daniele  
215-322-7444

**Exhibits**  
Bob Goldblum  
215-825-1960

**Technical Program**  
Dr. Anatoly Tsaliovich  
908-834-1808

**Vice Chairman**  
John Van Savage  
908-985-2084

**Secretary**  
Gilda Haskins  
215-322-7444

**Treasurer**  
Warren Kesselman  
908-842-3207

**Publicity**  
Bill Clegg  
201-386-2378

**1991 IEEE INTERNATIONAL SYMPOSIUM ON EMC  
P.O. BOX 609  
LINCROFT, NJ 07738**



# INTER-SOCIETY ACTIVITIES

## JOSEPH BUTLER ASSOCIATE EDITOR

### SAE SURFACE VEHICLE EMC STANDARDS ACTIVITY - EMI STANDARDS AND TEST METHODS COMMITTEE

SAE J1113 August 1987. The committee continues its effort to revise this module/component test document into multipart format.

The results of balloting within the committee on several parts of the document were reviewed at their meeting last December. Several parts of the document will be sent to the SAE Motor Vehicle Council for approval: Part 2 - Conducted Immunity 30 Hz to 250 kHz; Part 3 - Conducted Immunity 100 kHz to 400 MHz; Part 11 - Conducted Immunity - Transients; Part 13 - Electrostatic Discharge; Part 22 - Radiated Immunity - Magnetic Field (power lines). Other parts of the document still under committee discussion due to comments received or held pending ISO TC22/SC3WG3 work are: Part 1 - Introduction/Common Information; Part 4 - Common Mode Immunity; Part 12 - Coupled Transients; Part 21 - Radiated Immunity - Electromagnetic Field 30 MHz to 18 GHz; Part 23 - Radiated Immunity - Strip Line; Part 24 - Radiated Immunity - TEM Cell; Part 41 - Component RF Conducted, Radiated Emissions; and Part 42 - Component Transient Conducted Emissions. This committee also continues work on a vehicle susceptibility document.

### SAE AEROSPACE EMC STANDARDS ACTIVITY SAE AE-4 EMC

ARP 4242 on system electromagnetic compatibility is in the process of being redrafted in preparation for discussion at the upcoming committee meeting the week of May 6 in San Diego, CA. ALR 1423 on gas turbine engine electromagnetic compatibility is presently being prepared for a committee ballot. Work continues on ARP 1972, recommended practices for EMC testing, particularly in the area of damped sine wave equipment characteristics. ARP 4244 on insertion loss testing of EMI filters has been balloted once in the committee. Comments received are being reviewed. Proposed modifications to ARP 1705 on EMI gasket transfer impedance testing also continue to be addressed within the committee. A new fixture design is proceeding. The expansion of ARP 958 on antenna calibration to cover other antenna types has been proposed but work has not yet started. Work supporting MIL-STD-461/462 revision efforts has also been proceeding within the committee.

### SAE AE 4R RADIATED ENVIRONMENTS

The worldwide RF environment for commercial aircraft has been largely defined, but due to continuing concerns over the high levels, work continues toward realistically reducing them. At present, the focus is on the establishment of special

use areas around high level emitters where flight would be restricted. The FAA Advisory Circular for High Intensity Radiated Fields (HIRF), is expected to be finalized at the next meeting, to be held during the week of May 20 in Albuquerque, NM. The proposed final meeting for this committee is the week of September 23 in Seattle, WA.

## CALL FOR PAPERS

### A SPECIAL ISSUE OF THE ACES JOURNAL WILL BE DEVOTED TO THE ANALYSIS OF BIOELECTROMAGNETIC COMPUTATIONS

Papers will be considered in the following areas: whole body and partial body dosimetry; bioelectromagnetic/thermal interactions; analytic methods, including functional analysis; differential methods and coupling techniques; surface and volumetric integral equation techniques; quasi-static, resonance and high frequency techniques; graphics and computer I/O; and computer code validation.

Papers may also address applications including: biomedical applications; RF hazards; magnetic and electric near fields; body currents; high voltage power line effects and modeling; lightning effects; and standards.

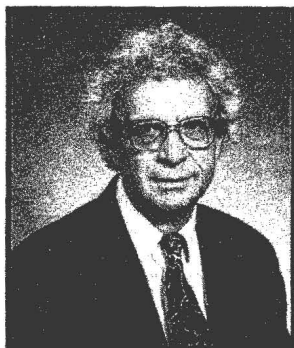
The deadline for papers is November 30, 1991. Send papers and inquires to: A. H. J. Fleming and K. H. Joyner, Telecom Australia Research Laboratories, 770 Blackburn Rd., P.O. Box 249, Clayton, Victoria, 3168 Australia. FAX 61 3 543 4859.

### CHAPTER CHATTER *(Continued from page 4)*

The March meeting speaker was Thomas Walsh (FCC Office of International Communications) whose topic was "Planning for the 1992 World Administrative Radio Conference." He discussed the issues to be addressed, and how U.S. positions are being developed. Some of the concerns will be satellite broadcasting, worldwide personal communications and mobile satellite systems. Another matter of concern will be minimization of terrestrial radar interference to the SARSAT/COSPAS satellites.

Chapter officers for the '91/'92 period will be:

- Eugene Lockhart, Chair
- Richard Engleman, Vice-Chair
- Norman Violette, Secretary/Treasurer



**MARTIN V. SCHNEIDER**  
ASSOCIATE EDITOR

At the beginning of this year I took over the responsibilities of Leonard Carlson as your new director and representative to the IEEE board. Len was very helpful in introducing me to the dedicated and zealous people on the board who care a great deal about the financial health of the IEEE and the quality of the services offered to the members. He has gone on to bigger and better things and is now Chairperson of the new RAB/TAB Chapters Committee, which

will focus its efforts on meeting the needs of our chapters. We wish Len good success in his endeavor and hope to hear from him through his continued contributions to the EMC Newsletter.

## MEMBERSHIP GROWTH

The Electromagnetic Compatibility Society showed a good growth rate in membership (4.9%) in 1990. The membership passed the 4,000 mark at the end of December and continues to increase. While working in Paris last December, I found that the growth rate in France and the surrounding countries was about 10%. I met with the local EMCS Chapter Chairman, Ferdy Mayer, and was informed that Central Europe and Region 8 are a potential gold mine for attracting new members, for organizing technical activities and for starting new chapters. Ferdy also has plans to form a Joint Chapter of the Electromagnetic Compatibility Society and the Magnetics Society. Since both Societies are in our division, this will increase communications and interactions between two Societies in Division IV.

## NEW FACES AT THE TOP

At the beginning of the year, Eric E. Sumner became President of the IEEE. As Vice President of Operations Planning at AT&T Bell Laboratories until the end of 1990, and recipient of the Alexander Graham Bell Medal in 1978, he brings a number of talents to his new job which will benefit the IEEE. I have worked with Eric previously on IEEE projects and have found him to be receptive and supportive of new projects that help the working engineer to achieve his or her professional objectives.

Our new Vice President of Technical Activities is Fernando Aldana, Vice President at the Universidad Politecnica de Madrid in Spain. Fernando is a dynamic, down-to-earth person who knows how to motivate his team. He and Eric Sumner visited industry leaders in Central Europe last December to gain their support in encouraging engineers to join and

become active in the IEEE. Fernando currently spends one week a month at the IEEE Service Center in Piscataway, New Jersey to work with the staff on all TAB related issues ranging from publications to sound financing.

## HIGHLIGHTS OF JANUARY 1991 BOARD MEETING

The IEEE Board of Directors and Executive Committee met in New York City from January 30 to February 1, 1991. The highlights of the meeting were as follows:

- IEEE General Fund reserves continue to decline. Liquid funds are \$1.7 million in 1991.
- Liquid fund reserves of the Societies are \$22 million.
- The IEEE membership showed a modest annual growth of 2.1%.
- Broadcast Technology and Consumer Electronics Societies will join Division IV in 1992.
- The direct mail campaign for gaining new members was successful. The requirement of obtaining reference signatures had been waived.

In order to improve the financial health of the IEEE, the Board endorsed targets for upcoming budgets and will hold the lid on spending. Future budgets will not only be balanced but will provide steadily growing surpluses beginning with \$1 million in 1992.

## 1991 DIVISION IV REPRESENTATIVES TO TAB

In order to be represented and participate in the Councils and Committees of the Technical Activities Board, the following members from Division IV have been appointed to various TAB and other IEEE entities:

Ronald J. Pogorzelski	TAB Periodicals Council
Chester L. Smith	TAB Publications Products Council
Charles Buntschuh	TAB Technical Meetings
Peter N. Clout	TAB Awards and Recognition Committee
Robert H. Brook	Social Implications of Technology Committee
Alton L. Estes	Membership Development Committee

I have contacted each of our representatives and encouraged them to submit contributions for publication in the IEEE EMC Society Newsletter. This will ensure that our members remain informed about new developments and services that will benefit their professional careers.

## EMC PERSONALITY PROFILE



**PETER RICHMAN**

Peter Richman was born in New York City, and in 1960 moved to Boston where he now makes his home. He received a BSEE from M.I.T. in 1946, and an M.S. in Mathematics from N.Y.U. in 1953. Mr. Richman is President of KeyTek Instrument Corporation in Wilmington, which he started in 1975.

Until 1984, Peter Richman was primarily responsible for the design of the company's surge and ESD simulator product lines, and automatic systems for testing surge arresters. Since then he has continued to play a major design role. Mr. Richman designed KeyTek's Model 424 and Model 711 surge generator product lines, the computer-controlled automatic Systems 3/T and 4, and the company's Series 2000 ESD simulators.

From 1984 through 1987, he presented a group of papers explaining the existence, characteristics of, and equivalent circuits for the super-fast current wavefronts in typical ESD events. He was instrumental in forming and chaired the first sessions of an IEEE working group characterizing ESD phenomena. The resulting standard is now nearing publication. Pete is involved with several national and international standards groups in the areas of pulsed EMI -- ESD, fast transients and surge.

Until 1975, Pete was an engineering, marketing and management consultant. His prior activities included co-founding Rotek Instrument Corporation in Lexington, from 1960-1964, and serving as Vice President of Engineering until it was acquired by Weston Instruments, Newark, NJ. He continued as Vice President of Advanced Development for Weston until 1967. He was the designer of Rotek's line of precision electronic sources, measuring and monitoring instrumentation.



**WILLIAM G. DUFF**  
**ASSOCIATE EDITOR**

Peter's career prior to starting Rotek included positions as Chief Engineer of Epsco, Inc. of Cambridge, MA (1958-1960), and Assistant Chief Engineer of Reeves Instrument Corp., Garden City, NY.

He has authored over 40 technical papers and holds over two dozen patents. He is a Fellow of the IEEE, Senior Member of the ISA, and member of Tau Beta Pi and Sigma Xi. He is a member of the EMC Society, and chaired a session at the 1990 EOS/ESD Symposium.

Peter's hobbies are music and the great outdoors, especially the seashore. His wife Vivian is a recognized artist. Their daughter Meredith is a mortgage originator and their son Jeremy is a software engineer.

## NOMINATIONS INVITED FOR 1992 IEEE EDISON MEDAL

The IEEE Edison Medal was established by our predecessor Society, the AIEE, in 1904. It is presented for "a career of meritorious achievements in electrical science or electrical engineering or the electrical arts." The award consists of a gold medal, small gold replica, certificate and \$10,000. IEEE members are strongly encouraged to submit candidates for consideration for this prestigious award and thereby support the Institute's program of recognition for outstanding technical achievement. Nominations must be received at IEEE Headquarters no later than July 1, 1991. Nomination forms and information may be obtained by contacting: Maureen Quinn, IEEE Awards Board Administrator, 345 E. 47th St., New York, NY 10017. Tel: (212) 705-7882; FAX (212) 223-2911.

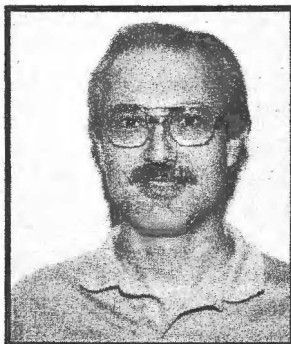
## dB SOCIETY PICNIC

The dB Society will hold its annual picnic during the 1991 EMCS Symposium in Cherry Hill, NJ. The picnic will be held on Wednesday, August 14, at 6:00 PM. The site will be the Mummers' Museum located at 2nd and Washington Streets in Philadelphia. The entire Museum has been rented for this affair. Included will be elaborate displays of Mummers' costumes, both new and old, as well as colorful exhibits.

Dinner will include an ethnic Italian buffet, as well as an open bar for the evening. Videos will be shown during dinner, after which a Mummers band will entertain. All attendees will be official strutters after the evening is over.

Attendance at this fantastic affair will be limited. For additional information, contact Mr. John Merrell, TMC, 2408 Texas Drive, Irving, TX 75062. Tel: (214)255-1877, FAX (214)255-4661.





**JOHN MCBAIN**  
**ASSOCIATE EDITOR**

### PRODUCT SAFETY

Does it sometimes amaze you how fast time goes by? More than two years have passed since the formation of TC-8 and more than three years since the first publication of the Product Safety Newsletter. If you have been "meaning to get around to" inquiring about the former or subscribing to the latter - why wait any longer? The recent absence of news in the EMC Society Newsletter about TC-8

does not mean that nothing is happening. We are busier than ever!

### A FEW CHANGES

The most dramatic change is that Rich Pescatore is stepping down as Chairman. Committee officers generally have a two-year term of office in the EMC Society. By the time you read this, I expect the EMC BoD will have confirmed the new officers for TC-8, but since it is not yet official I will only mention that I hope to be back as Secretary/Treasurer. (On the other hand, if some ~~other poor sucker~~ wonderful, helpful volunteer should happen to be able to take over as Treasurer, splitting the position would certainly make my life easier!)

Seriously, participating in an organization such as this is a very rewarding experience, both personally and professionally. If product safety is part of your job, then time spent here is time well spent. You can learn from your peers, make valuable contacts, increase your professional recognition, influence the future of product safety standards and processes, and even have fun. Does this sound a little like a sales pitch? Well, it is one! If you would like to hear the rest of my spiel, feel free to call me at (408) 447-0738.

The Product Safety Newsletter is really steaming along now that Ken Warwick has taken over the layout and production role. An issue every five or six weeks at first has caught us up to our regular schedule. Contributors are very welcome - articles, news items, letters and more - we are glad to be able to provide a forum for product safety. Contributions also are very welcome. If your company could benefit from an Institutional Listing and would like to support the publication of the Product Safety Newsletter, please let us know.

One important note: if you have been missing your issue of the Product Safety Newsletter lately, maybe you forgot to send in your subscription renewal notice. Better check!

### STANDARDS AND MORE

Standards are presently hot topics for product safety engineers, especially those concerned about the harmonization of standards in Europe for 1992. The question that our Standards Subcommittee is addressing is *not* "How do we make another flavor of IEC 950?", but rather "Are there some areas where a new standard would help product safety?" If you have opinions about this topic, and suggestions that a Working Group could sink its teeth into, Tania Grant (408-957-7877) wants to hear from you.

In another area of Technical Committees - Conferences and Symposia - I have some good news and bad news to report. The good news is that the regional Colloquium sponsored by the Santa Clara Valley Chapter of the EMC Society in June will have a session on product safety. The bad news ... excuse me, the *opportunity* is that we have a position to fill for Liaison with the EMC Society National/International Symposium. This vacant position, ably handled last year by John Knecht of Underwriters Laboratories, prevented our planning a separate product safety session for New Jersey in August. Please call Brian Claes (408-285-4768) now if you can help with the National Symposium in Los Angeles in 1992! (And what about Texas in 1993?)

Various local groups are becoming more (or occasionally less) active, as the Santa Clara Valley regional Colloquium might suggest. The Central Texas (Austin) group is coordinating meetings with the local EMC Society Chapter after a lull in activity when the original organizer, George Jurasich of TUV Rheinland, transferred to Singapore. The Northeastern group in Boston decided to try forming a separate incorporated Society immediately, instead of working up through Technical Council status to form a Society within the IEEE. Of course, individual members are still members of the IEEE and the EMC Society and continue to participate in TC-8 activities. The new San Diego group has developed strong local interest, meeting topics and attendance, and is off to a great start.

### WHAT'S NEXT?

Most of our activities for the next year have already been mentioned, but perhaps I can sum it up. First, the Product Safety Newsletter should become stronger, both technically and financially. This will let it become the forerunner of the technical journal we intend to publish after becoming a Technical Council. Second, support should be sought from other IEEE Societies to form a Technical Council for Product Safety. The EMC Society BoD formally approved that goal at their August 1990, meeting. Third, standards activities should be increased and organized. Fourth - or perhaps first - more participation is needed to be able to achieve the other three goals. Join us!



**REINALDO J. PEREZ**  
**ASSOCIATE EDITOR**

## **ELECTROSTATIC DAMAGE IN ELECTRONICS: DEVICES AND SYSTEMS**

William D. Greason, Research  
Studies Press, Letchworth,  
Hertfordshire, England, 1987.  
Distributed in the U.S. by John  
Wiley & Sons Inc. \$69.95

For the second consecutive time  
this Editor reviews an Electrostatic  
Discharge (ESD) book. The choice  
is not based on personal preference,

but instead relies on the need to present a different view of this subject, emphasized by this book, which may appeal better to some of our readers. About half of the book is devoted to analyzing the physics of electrostatic discharge in electronic systems using mathematical expressions which provide a quantitative "feeling" for this phenomena. This is especially true in the several example problems in the first few chapters.

The book emphasizes the fundamentals of ESD rather than providing an extensive view of the subject. The first half of the book is dedicated to describing such fundamentals while the second half describes more practical issues such as damage failure modes, protection networks, test standards, and ESD control programs. Though the book is well organized from the publishing point of view, it is devoid of several features that sometimes we take for granted in other books. For example, all figures seem to be hand-drawn (though they are neat and well-labeled) and usually are shown in two-dimensions. No photographs are present of any ESD type of failures/damages (a rarity for this kind of book) and the text seems to be laid out for "camera-ready" copying as is usually done for conference papers. The author assumes the reader has very little prior knowledge on the subject.

The book is organized in twelve chapters (no Appendices). The first five chapters are devoted to describing the fundamentals and physics of ESD, including different charge generation processes and analyses of several types of ESD events. The rest of the chapters in the book (Chapters 6 through 12) present, at the introductory level, some of the most common issues that are always related to ESD. These are outlined below.

A brief introduction to the book is provided in Chapter 1. Chapter 2 then proceeds with the basic principles of electrostatics. Much of the concepts explored are similar to those found in most electromagnetic textbooks. However, the author presents the material such that it will be tied into

the theory of electrostatic discharge. Numerous examples are discussed which bear significance to ESD. Of all the sections in this chapter, the treatment of the Green reciprocity theorem stands out as the fundamental approach to the solution of electrostatic discharge problems involving a multitude of conductors.

Before an ESD event occurs there has to be a charge generation process, and Chapter 3 reviews the two main processes: triboelectrification and induction charging. The author also mentions corona charging but provides very little information on that subject. Triboelectrification is briefly described in terms of "work functions." Unfortunately, the concepts of work functions are not really explained and readers are forced to look for that information elsewhere.

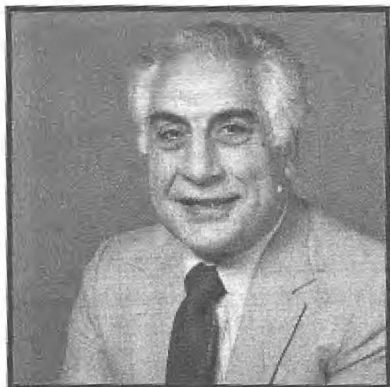
Chapter 4 reviews analytical techniques used in ESD problems which are based on the solution of equation systems before and after the discharge event. The methods of solution are at the quasi-static level. The solution of this system of equations will yield static potentials and charge distributions. Two models are developed: approaching a charged source to an initially uncharged object, and approaching a charged source to a grounded object. The objects used are simple spheres, not only because they will usually yield worst case solutions, but because it is easier to develop analytical expressions for the capacitance coefficients (which are a function of geometry) needed to solve the aforementioned system of equations.

Chapter 5 however presents the "dynamic" approach (i.e., time dependency) to ESD using Laplace transforms. The two basic models discussed in Chapter 4 are subsequently discussed again in Chapter 5 which describes with several examples how the transient discharge current is dependent on the knowledge of the equivalent electrical circuit representation of the objects involved in an ESD event.

Direct, indirect and latent failures in semiconductor devices caused by ESD are reviewed in Chapter 6. The chapter covers the two general types of direct failures (also known as hard-failures because damage is irreversible): power-dependent, characterized by a high amplitude current pulse and voltage-dependent, characterized by the presence of strong electric fields causing dielectric breakdowns. Several models of direct failure are reviewed analytically, including the Wunsh-Bell model (power-dependent) and the capacitance-divider model (voltage-dependent). Indirect failures, caused by conducted and radiated EMI, are described in principle but without much insight.

To protect semiconductors from failures, built-in protection

*(Continued on page 17)*



**ANTHONY G. ZIMBALATTI**  
ASSOCIATE EDITOR

## HARMONY OR CHAOS

**Resolved:** Should there be harmony between Military Specification MIL-E-6051, System Electromagnetic Compatibility, and Military Standard MIL-STD-461, Electromagnetic Emission and Susceptibility Requirements For The Control of Electromagnetic Interference.

To show the chaotic relationship between the aforesaid specification and standard, I will examine only some of the requirements of these documents as applied to a military aircraft. Consider that 6061 system compatibility requirements include control of own-subsystem equipment emission and susceptibility characteristics for attaining compatibility among this equipment and with emissions originating in the electromagnetic environment. These environments can be characterized by atmospheric lightning, static electricity and nuclear electromagnetic pulse. When 461 is examined, one notes that subsystem equipment control limits are delineated for only certain types of emissions and susceptibility. For example: limits are delineated for controlling equipment susceptibility to transients induced by nuclear electromagnetic pulse, whereas there are no limits for controlling equipment susceptibility to transients induced by lightning or static electricity. One could argue that chaos is prevented and harmony is achieved because 6051 references the use of specifications applicable to lightning, static electricity, or worse to the guidance of military handbooks. But, if referencing is harmonious for lightning or static electricity, then why not delete the nuclear pulse requirement from 461! However, if the purpose of 461 is to provide controlled equipment emission and susceptibility characteristics for use in a system, then it is wrong to delete the nuclear requirement and to exclude the lightning or static electricity requirements. And if the purpose of 461 is to include only certain controlled equipment characteristics, then how is chaos to be avoided? Isn't it ironic that the electromagnetic compatibility documents are chaotic?

# IEEE EMPLOYMENT ANALYSIS SURVEY

**BILL JOHNSON**

The IEEE EMCS employment analysis survey was again conducted at the 1990 EMC Symposium in Washington, DC. Two-hundred-twenty-four respondents to the survey indicated their age, experience, professional information and other data which can be used by the EMCS membership for information and by the Board of Directors to continue to provide the services required by the membership. This number of respondents was the highest in recent years and provides an excellent sample through which valid statistics are obtained.

While the survey is an accurate cross-section of those attending the symposium it cannot be construed to represent the entire EMC engineering community. Nonetheless, the data obtained does provide an interesting profile of the EMC symposium attendees which can be compared with data from previous years to identify trends. Figures 1, 2, 3 and 4 present graphical comparisons of annual base salary, highest degree earned, years of professional service, and membership grade, respectively.

The fictional average attendee at this year's Symposium was 43.25 years old, was an IEEE member, held a Bachelor's degree with some graduate level work, had eighteen years of professional experience and was earning \$55,000 per year. Average salary is up 5% from 1989 while the average age in 1990 was slightly lower than in 1989. The number of engineers with advanced degrees has noticeably increased; 29% have Master's degrees and 15% have Doctoral degrees. This statistic may have been influenced by the location of the symposium.

Other data obtained: 41.5% of the respondents were active in a local EMC chapter; 90% of the respondents considered the annual symposium useful to them; 60% felt the *IEEE Transactions on EMC* is useful; and 54% felt that the *EMC Society Newsletter* is useful. This general affirmation would indicate that the IEEE is providing useful services to most of its membership.

The normal engineer's optimism seems not to have slipped this year with only 12% of the respondents foreseeing a reduction in force while over 42% see an increase.

An exciting statistic for those involved in the NARTE certification program is that over 56% of the respondents who are "full-time in the EMC" business stated that they either have already applied or intended to apply for certification through the NARTE program.

(Continued on page 14)



SALARY 1990	0-5	6-10	11-20	20-25	25+
Under 30	10.5%	0.0%	0.0%	4.0%	2.5%
30-40	55.0	15.5	4.0	0.0	0.0
40-50	27.5	42.5	23.0	9.0	6.5
50-60	7.0	39.0	29.0	35.0	20.0
60-70	0	3.0	25.0	35.0	29.0
70-Up	0		19.0	17.0	42.0

Table 1. Comparison of Salary vs. Years of Service.

Table 1 lists the 1990 salary comparison based upon years of experience.

A salary comparison was made between those working predominantly in commercial EMC against those working predominantly in DoD EMC. The overall average salary for

those in the commercial field was 3.5% higher than their military counterparts. It was even more interesting to review the distribution of DoD salaries. It might be expected at a Washington, DC symposium that a large number of senior engineers might distort the averages. This was proven by the large number of respondents in the DoD category with maximum salary range. By eliminating the highest salary range from the calculations, we found nearly a 12% difference in salary, with the engineers in commercial EMC averaging about \$6,000 per year more than those involved in military EMC.

Salaries can also be skewed because of geographical areas. In the future, IEEE employment surveys will include questions on geographical areas so we will be able to present regional comparisons.

Data in Figures 1-4 and Table 2 compare previous years survey results with 1990.

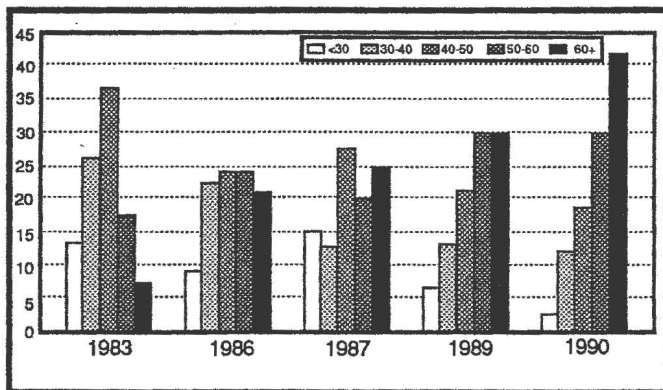


Figure 1. Annual base salary, percent of those surveyed.

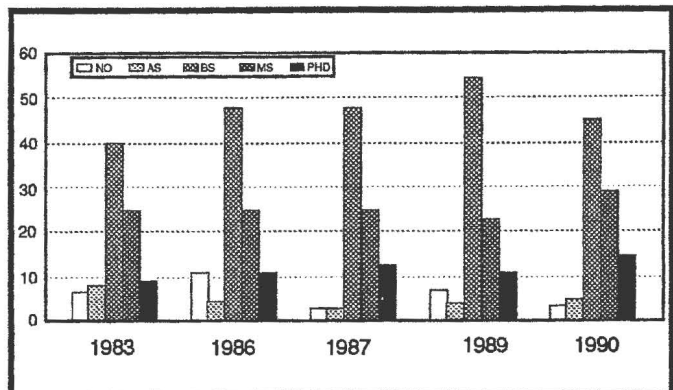


Figure 2. Highest degree earned, percent of those surveyed.

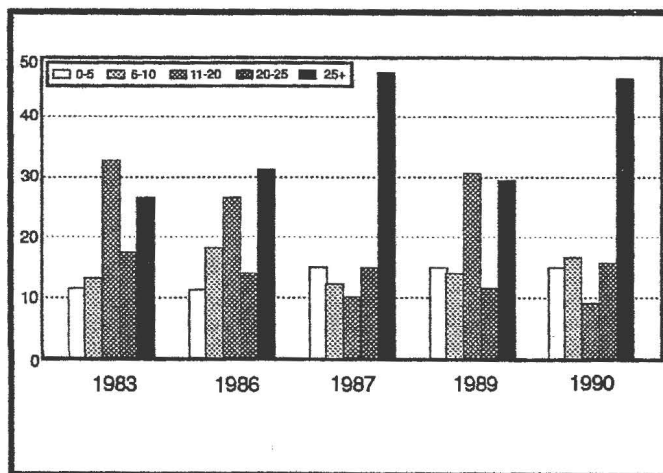


Figure 3. Years professional service, percent of those surveyed.

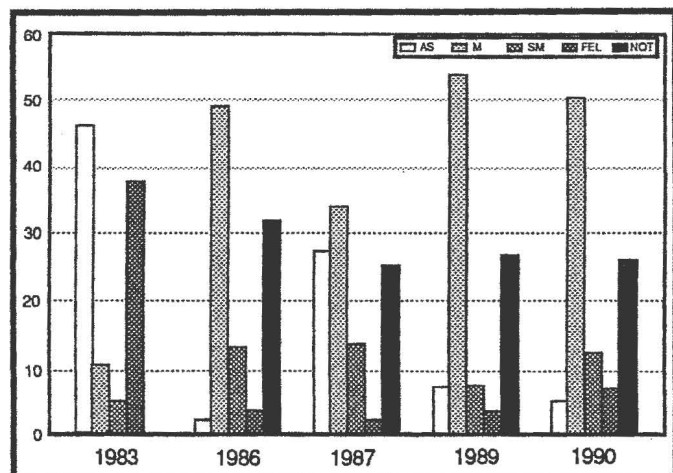


Figure 4. Membership grade, percent of those surveyed.

CATEGORY	1983	1985	1987	1989	1990
<b>AGE</b>					
20-30	14.0%	16.0%	14.5%	13.1%	14.0%
30-40	22.0	25.0	19.0	21.0	21.0
40-50	34.0	30.0	22.5	36.2	29.5
50-60	24.0	18.0	35.0	21.0	21.5
60 & Over	6.0	11.0	12.0	8.7	14.0
<b>EMPLOYMENT STATUS</b>					
Full-time in EMC Area	60.0%	76.0%	62.5%	73.0%	66.5%
Full-time in Other Area	17.0	7.0	12.5	7.2	12.5
Part-time EMC	21.0	11.0	20.0	16.0	15.0
Involuntarily Unemployed	0.0	0.0	0.0	0.0	0.0
Voluntarily Unemployed	0.0	3.0	0.0	0.0	0.0
Retired, Not Available	0.0	0.0	0.0	0.0	0.0
Retired Available	1.0	1.0	2.5	1.9	2.0
Self-Employed	1.0	2.0	2.5	1.9	3.0
<b>REGISTRATION/ORGANIZATION REPRESENTATION</b>					
Registered Prof. Engineer	22.0%	19.0%	22.5%	20.0%	25.0%
Engineer in Training	9.0	14.0	7.5	8.0	8.0
Certified Engrg. Technician	1.0	2.0	2.5	1.5	4.0
Member Prof. Bargaining Unit	1.0	2.0	2.5	0.75	2.0
None	67.0	63.0	65.0	68.0	61.0
<b>NO. OF EMPLOYEES IN YOUR COMPANY OR INSTITUTION</b>					
1-99	9.0%	13.0%	20.0%	16.7%	17.0%
100-499	15.0	16.0	12.5	13.8	7.0
500-4999	35.0	23.0	30.0	24.0	31.0
5000 Up	41.0	48.0	37.5	49.0	45.0
<b>NO. OF EMC EMPLOYEES IN YOUR PLACE OF WORK</b>					
1-4	46.0%	51.0%	50.0%	46.0%	38.5%
5-9	22.0	23.0	30.0	20.0	25.0
10 & Over	32.0	26.0	20.0	34.0	36.5
<b>WHICH OF THE FOLLOWING ARE USEFUL TO YOU?</b>					
Symposium Held in the U.S.	35.0%	35.0%	40.0%	96.0%	90.0%
Symposium Outside U.S.	5.0	5.0	20.0	4.0	18.0
EMC Transactions	28.0	24.0	16.0	58.0	60.0
EMC Newsletter	24.0	24.0	24.0	46.0	53.0

Table 2. Employment Analysis Survey.

# MEMBERSHIP DRIVE AT ZURICH SYMPOSIUM SUCCESSFUL

## DICK FORD ASSOCIATE EDITOR

Our EMC Society Transnational Committee, chaired by Herb Mertel, staffed an EMCS information booth at the 9th International Zurich Symposium & Technical Exhibition on EMC. The Symposium, held 12-14 March, was well attended despite concerns about the economy and the status of the "gulf conflict." Thanks to this large attendance, as well as the generous, strategically placed, complimentary booth space provided by the Symposium organizing committee, Herb enjoyed a successful IEEE EMCS membership drive. He extends his thanks to the Zurich symposium committee and

the IEEE members who help staff the booth. Don Heirman, Clayton Paul, and Dick Ford were among several who made major time contributions. As has been the recent custom, new members were given a complimentary copy of the recent IEEE EMCS Symposium record. This was the first time the new EMCS promotional video was shown and the new compact EMCS display booth was used at a symposium. They received several compliments. Fifteen new members signed up from eight different countries as indicated below.

A warm welcome to the following new transnational IEEE EMCS members!

Kurt Aeberly  
c/o IMEDCO AG  
Industrie Strasse 210  
4600 Olten  
Switzerland

Raymond J. Cook, Ph.D.  
c/o National Physical Laboratory  
Teddington, Middlesex  
United Kingdom TW11 OLW

Joachim F. Nedtwig  
Donauhalde 22  
7900 Ulm/Donau  
Germany

Cornelis VanRij  
Bernhardstraat 81  
3291 BC Strijen  
Netherlands

Wolff Bernard  
c/o Souriau (Filter Department)  
3 Av. Du Marechal Devaux  
91550 Paray Vielle Poste  
France

Recht Elyahu  
c/o KFAR Gibbton Near Rehovot  
76910 Rehovot  
Israel

Jens KR TV Olesen  
Erhvervsvej 2A  
8653 Them  
Denmark

Barry J. Wilmot  
60 Gosling Grove  
Downley, High Wycombe  
Bucks, England  
United Kingdom MP13 5YS

Mart J. Coenen  
c/o Philips Semiconductors  
Department: PCALE-BE/5  
P.O. Box 218  
5600 MD Eindhoven  
Netherlands

Karlheinz Gonschorek, Ph.D.  
c/o Technical University Hamburg  
Dept. Theoretical Electronics  
Harburger-Schloss Strasse 20  
2100 Hamburg 90  
Germany

Werner Sackreuther  
Feldberg Strasse 10  
6056 Heusenstamm  
Germany

Peter Wilson  
Honey Cottage  
All Clannings, Devizes Wilts  
United Kingdom SN10 3PA

Rudolf E. Harms  
Isarstrasse 93  
W-2800 Bremen 1  
Germany

Terje Schroder  
c/o Morgenstjerne & Co. AS  
P.O. Box 15 Bogerud  
0621 Oslo 6  
Norway

Bert Wouters  
Keltenweg 36  
CH 6312 Steinhausen  
Switzerland

## EMCS BoD ACTIVITIES (Continued from page 6)

efficiently handled by a core committee of the Board who might rely on professional conference planners, such as those used for SOUTHCON, MIDCON, and Electro. If any of you past symposia committee members have ideas, please pass them to Bob at (703) 692-8600.

Martin Schneider, Division IV Director, attended our meeting and gave an in-depth presentation on the duties and activities of his directorship. (He succeeded Len Carlson.) He noted a significant cost control activity Institute-wide. A TAB Quality Engineering Council was created, as well as a restructuring of Division III resulting in the transfer of the Broadcast Technology Society and the Consumer Electronics Society to our Division in 1992. The Board expressed its thanks for Martin's interest in our work, for meeting with us, and for the latest Institute activity update.

President Bronaugh closed the meeting at 5:00 P.M. He thanked the Central Texas Chapter for its hospitality at the

meeting and at the dinner meeting the previous evening, during which Gene Cory presented a talk on his recent trip to China and his visit with the organizing committee of the 1992 Beijing EMC Symposium.

The next meeting will be held on 17 May at the Palmer House in Chicago, the site of the 1994 symposium. The night before, the Board will meet with the Chicago EMC Chapter. The EMCS Standards Committee will meet between 8 and 10 A.M. on the 17th, and the Board meeting will start at 10:15 A.M. and extend the rest of the day. The Board asked Secretary Janet O'Neil to block the Board's hotel rooms and ask that the reservations be held until two days before the meeting and all successive meetings. To cover this arrangement, the Board approved indemnification of the secretary's costs if by error he/she is held liable for room costs by booking in advance on his/her credit card. For more details on meeting arrangements, contact Janet at (213) 870-9383.



# BoD VISITS CENTRAL TEXAS EMCS SECTION

**BILL MCGINNIS**  
**ASSOCIATE EDITOR**

The IEEE Electromagnetic Compatibility Society Board of Directors met with the Central Texas IEEE EMCS Section on February 7, 1991, at the Hyatt Regency Hotel in San Antonio, TX, site of the 1984 EMC Symposium. The section business meeting was preceded by a social period where the section met and talked with the various board members. This opportunity was well received and appreciated by all. Most of the attendees knew Ed Bronaugh since he is now a part of the central Texas section but they had not met other Board Members such as Bob Haislmaier, Don Heirman, and many others. The calm meeting atmosphere was very conducive to the exchange of options, ideas, and experiences.

Following this period, the business meeting was called to order by Bill McGinnis, SWRI, past chairman of the section. The evening's speaker was William (Gene) E. Cory. Gene delivered an extremely interesting talk and slide presentation of his recent experiences in China where he was the keynote speaker at the EMC-90 National Symposium, Beijing. In China he lectured at several education organizations as the EMC Board of Directors' representative and had a special project status in the society's distinguished lecturer program. His presentation covered the increasing EMC interest and opportunities in China today.



Photo: Dick Ford

Bob Haislmaier (left), EMCS Director of Communications, exchanges views with Bob Hunter (center), Texas Instruments and Bill McGinnis (right), Southwest Research.

BOOK REVIEW (Continued from page 12)

of IC chips must be provided. Chapter 7 pursues this topic by dividing its content into two parts. The first half of the chapter covers the basic requirements in terms of fabrication and electrical characteristics that a protection network should have. The second half of the chapter provides a summary of practical protection structures that have been developed for bipolar, NMOS, and CMOS integrated circuits. Only "input" protection networks are covered.

Because of the predominance of VLSI circuits in today's electronics and their enhanced susceptibility to ESD, a separate chapter (Chapter 8) is dedicated to electrostatic discharge problems in VLSI. Though the chapter is theoretical in nature it describes the failure modes and some protection circuits for VLSI. The last section concentrates on latch-up problems in VLSI and methods to avoid them.

Chapter 9 goes one step further by addressing ESD protection at the system level. The chapter is intrinsically related to many EMI issues because at the system level electrostatic discharges cause either conducted (called by the author direct) or radiated (called indirect) interference. Familiar EMI concepts such as capacitive/inductive couplings and electric/magnetic field couplings are also addressed.

Test methods (or testing models) and standards are reviewed in Chapter 10 at both the device level and system level. At the device level the author covers the two most popular ESD testing models: the human body model and the charged device model, which includes the floating and the field-induced models. At the system level modified versions of the human body model are covered and they consist of either spark-gap discharging or high-voltage-approach testing models.

Finally, descriptions of basic static control programs are shown in Chapter 11. Chapter 12, the last chapter in the book, contains only a brief summary of the material presented in the previous chapters.

A salient feature of this book is the large number of references quoted throughout. Though the book is introductory in nature it gives the reader a large number of references to expand on many of the subjects covered. The book can be recommended as a reference for those "getting started" on the subject of ESD. In principle the book could be recommended as a textbook for teaching ESD at the academic level because of its analytical approach, but it needs more illustrative examples and assigned problems for students to exercise their understanding.

# PETITION FOR USE OF RADIO WAVES FOR COMPUTER DATA TRANSMISSION

Apple Computer, Inc. has proposed that the FCC initiate a rulemaking to allocate 40 MHz in the 1850-1990 MHz band to a new radio service to be used for high-speed, local area data communications services ("Data-PCS") between and among personal computers.

According to Apple, the development of computer technology over the past two decades has been characterized by two primary features:

- Computers have been networked, using cabling and common carrier facilities, to give users access to information from a variety of sources.
- There has been a steady movement towards placing the power of the computer directly into the hands of the user, wherever the user may be.

As personal computer technology now moves from the desktop to the briefcase, Apple believes that the networking and portability features will become mutually inconsistent unless the networking capability becomes as personal and portable as the computer itself. With such a networking capability, a person could communicate with his or her peers and could access files, peripherals, and the gateways of wired and wireless data networks, all within a "local area" of 50 meters.

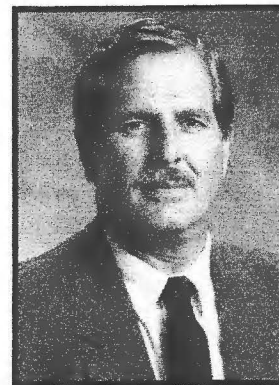
However, neither technologies nor radio services are presently available to create the shared electronic space necessary for collaborative computing, principally because no existing technology or service can assure consistent, high-quality, high-capacity data communications in a spectrum-efficient manner. Apple, therefore, proposed the creation of a new radio service to be devoted exclusively to local area, high speed data communications to support collaborative computing and spontaneous networking.

In particular, Apple urged the Commission to allocate 40 MHz between 1850 MHz and 1990 MHz for Data-PCS, preferably 1850-1890 MHz, because these frequencies have optimum propagation characteristics for local area, in-building use. Such an allocation will allow several networks with data rates of, for example, 10 Mbps to coexist in the same location.

Apple recommended that the Commission model the basic regulatory structure for Data-PCS on Part 15 of the Rules, relying on manufacturers and the equipment authorization process rather than on individual licensing, to assure compliance with regulatory requirements.

## EMCABS

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:



**WILLIAM H. MCGINNIS**  
**ASSOCIATE EDITOR**

Mike Crawford, National Bureau of Standards  
Bob Hunter, Texas Instruments  
R. M. Showers, University of Pennsylvania  
Yoshio Kami, University of Electro-Communications  
Daniel Keneally, Rome Air Development Center  
Diethard Hansen, Asea Brown-Boveri, Switzerland  
Sha Fei, EMC Research Section, Northern Jiatong Univ.,  
Beijing, China 100044

### "HOW CAN I GET A COPY OF AN ABSTRACTED ARTICLE?"

The answer to this frequently asked question follows:

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.

<p><b>AN APPROACH TO REDUCING THE SUSCEPTIBILITY OF ELECTRONIC SYSTEMS</b> N. W. Feldman EMC Technology November/December 1990</p> <p><b>ABSTRACT:</b> This article describes a low cost approach to reducing susceptibility of electronic systems by reducing RF cross-talk/coupling. The approach uses resistive termination of the RFI while minimizing effects on DC control signals. A description of how the approach could be used to improve the immunity of the Black Hawk Helicopter is given as an example of one possible application.</p> <p><b>INDEX TERMS:</b> RF Cross-talk, Coupling, Susceptibility Reduction</p>	<p><b>EMCABS: 01-05-91</b></p>	<p><b>THE CHARACTERISTICS OF ASYMMETRIC TEM CELL IN EMC TEST</b> Jiang Quanxing<sup>1</sup>, Liu Jie<sup>2</sup>, and Lu Renoing<sup>1</sup> Southwest University<sup>1</sup> and Nanjing Research Institute of Electronics Technology<sup>2</sup> EMC-90 National Symposium, Beijing, China September 1990</p> <p><b>ABSTRACT:</b> This paper presents the transmission characteristics of an asymmetric TEM cell and the development in expanding the upper limit operation frequency by restraining the resonance of higher order modes. (Please direct information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> Asymmetric TEM Cell, Higher Order Mode, Equipment Under Test</p>	<p><b>EMCABS: 04-05-91</b></p>
<p><b>CALCULATION OF DISTRIBUTED CAPACITY IN TEM CELL</b> Bai Tungyum, China Institute of Metrology EMC-90 National Symposium, Beijing, China September 1990</p> <p><b>ABSTRACT:</b> This paper first advanced a new method of calculating the capacitance per unit length and characteristic impedance of a TEM cell. The formula for calculation is derived by means of dual energy methods, which is different from the conventional methods. The calculation procedure is simple and easy to use. (Please direct information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> TEM Cell, Distributed Capacity, Characteristic Impedance, Dual Energy Methods</p>	<p><b>EMCABS: 02-05-91</b></p>	<p><b>COMPUTERIZING EMI AND RFI TESTS</b> D. Romanchik, Technical Editor Test and Measurement World September 1990</p> <p><b>ABSTRACT:</b> This short article outlines what an automated EMI/RFI test system can do to assist the EMI test engineer in performing measurements. Automated tests described include: conducted emission, 0.45 to 30 MHz and RFI measurements using an absorbing clamp. Alternatives of developing one's own software verses purchasing software packages are also discussed.</p> <p><b>INDEX TERMS:</b> Automated EMI/RFI Testing</p>	<p><b>EMCABS: 05-05-91</b></p>
<p><b>CALCULATION OF RADIATED EMISSION FROM ELECTRON BEAM IN CRT</b> Han Fang, Lin Deyun, Shi Changsheng, Microwave Div., Dept. of Elect. Eng., Tsinghua EMC-90 National Symposium, Beijing China September 1990</p> <p><b>ABSTRACT:</b> As a key component of a computer VDU (video display unit), a CRT (cathode ray tube) is one of the major sources of radiated emission. The paper describes the radiation model of an electron beam in a CRT and gives an analytical solution to the radiation which could be utilized to compute the radiated field at both near and far field. (Please direct information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> CRT, Radiation</p>	<p><b>EMCABS: 03-05-91</b></p>	<p><b>CRITIQUE OF THE LITERATURE ON BIOEFFECTS OF RADIOFREQUENCY RADIATION: A COMPREHENSIVE REVIEW PERTINENT TO AIR FORCE OPERATIONS</b> Louis W. Heynick, SRI International USAF School of Aerospace Medicine (R&amp;P), Human Systems Div. (AFSC) Brooks AFB, TX USAFSAM-TR-87-3, June 1987, 691 pages</p> <p><b>ABSTRACT:</b> This report presents the analysis of research results and other pertinent information on the biological effects of radiofrequency radiation (RFR). The frequency range of primary interest is 10 kHz to 300 GHz. The main purpose of this report is to serve as a basic reference for other documents dealing with the environmental impact of proposed or currently operating USAF emitter systems with regards to health and safety aspects of exposure to RFR. The report is divided into 7 sections. More than 600 references from international literature are cited.</p> <p><b>INDEX TERMS:</b> Radiofrequency Radiation, Bioeffects, Nonionizing, Electromagnetic Radiation, Microwaves</p>	<p><b>EMCABS: 06-05-91</b></p>



<p><b>DEALING WITH EMI/RFI: SHIELDED CABINETS/ENCLOSURES</b> J. Miya, Zero Enclosures, Burbank, CA Evaluation Engineering December 1990</p> <p><b>ABSTRACT:</b> This article provides information to help users develop an effectively shielded system design with price as a primary consideration. The need to avoid overspecification of shielding requirements is discussed along with factors in cabinet design that influence their cost. Techniques used for measuring the shielding effectiveness of cabinets/enclosures are described.</p> <p><b>INDEX TERMS:</b> Shielded Enclosures, Shielding Effectiveness</p>	<p><b>EMCABS: 07-05-91</b></p>	<p><b>DISCUSSION OF NEAR-FIELD GAIN OF A PYRAMIDAL HORN AND AN OPEN-ENDED WAVEGUIDE: COMPARISON BETWEEN THEORY AND EXPERIMENT</b> Du Shimin and Wu Yi, Beijing Institute of Radio and Measurement and No. 2 Radio Instrument Factory of Beijing EMC-90 National Symposium, Beijing, China September 1990</p> <p><b>ABSTRACT:</b> This paper discusses the comparison between theoretical and experimental results of near-field gain of a rectangular pyramidal horn and an open-ended waveguide (OEG). The discrepancies among the several calculating methods to predict near-field gain of a pyramidal horn and OEG are briefly reviewed, and the problems for the measurement of near-field gain are then described below. (Please direct information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> Open-ended Waveguide, Pyramidal Horn, Near-field Gain</p>	<p><b>EMCABS: 10-05-91</b></p>
<p><b>DEVELOPMENT OF STANDARD OF RF ELECTROMAGNETIC FIELD (HIGH LEVEL) STRENGTH</b> Yang Shengyang, Wu Fan, and Ma Jun National Institute of Metrology, EMC-90 National Symposium, Beijing, China September 1990</p> <p><b>ABSTRACT:</b> This paper describes the first national standard for a RF electromagnetic field (high level) strength in China. The standard installation consists of three TEM cells (big, middle and small respectively) and electronic instruments including power source, synthesized signal generator, RF digital voltmeter and digital power etc. This standard has closed construction, no radiation of electromagnetic energy to space, wide frequency band (DC-700 MHz), large field strength range (10<math>\mu</math>V/m-330V/m). The field strength value can be easily controlled and its uncertainty is +1 dB. (Please direct information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> TEM Cell, Standard of RF Field Strength, Setup of Standard Field, Impedance of Time Domain</p>	<p><b>EMCABS: 08-05-91</b></p>	<p><b>FACILITIES FOR IMPROVING EVALUATION OF ELECTROMAGNETIC SUSCEPTIBILITIES OF WEAPON SYSTEMS AND ELECTRONIC EQUIPMENT</b> M. T. Ma and M. L. Crawford, NIST, 325 Broadway, Boulder, CO 80303-3328 NISTIR 89-3928 November 1989</p> <p><b>ABSTRACT:</b> A preliminary design of an improved testing facility for evaluating the electromagnetic susceptibility of weapon systems and electronic equipment is presented. This facility features a combination of the transverse electromagnetic (TEM) cell for low-frequency testing and the reverberating chamber for high-frequency operation. As a system, a coverage of the wide spectrum from 10 kHz to 40 GHz is possible. The TEM/reverberating combination is designed for an input impedance of 50, 75 or 100 ohm to generate a continuous-wave electric field up to 200 V/m, or a pulsed electric field up to 50 kV/m with an approximate rise time of 10 ns. The average field for the reverberating mode of operation is described in a statistical sense. Theoretical characteristics for a case study, to meet a given set of requirements, are given.</p> <p><b>INDEX TERMS:</b> EM Pulse Testing, Radiated Susceptibility, Reverberating Chamber, TEM Cell</p>	<p><b>EMCABS: 11-05-91</b></p>
<p><b>DEVELOPMENT OF VERSATILE EMP SIMULATOR</b> Zhou Bihua and Chen Zining, Nanjing Engineering Institute EMC-90 National Symposium, Beijing, China September 1990</p> <p><b>ABSTRACT:</b> The versatile EMP simulator is composed of a miniature high-voltage pulse generator and a set of modular electric field radiators. The facility can be conveniently used in either mobile or stationary mode, generating the optional electric field of vertical or horizontal polarization. In this paper, the design of such a simulator is outlined. The character and the major technical parameters of its Marx generator are explained, the erecting of electric field radiator and structure chosen are discussed in detail, the simplified calculation method of EMP amplitude is presented and the experimental results of our first-stage work are indicated. Finally, a plan of our further investigation is also included. (Please direct information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> EMP Simulator, EMP</p>	<p><b>EMCABS: 09-05-91</b></p>	<p><b>MEASUREMENT OF EVALUATION OF A TEM/REVERBERATING CHAMBER</b> M. L. Crawford, M. T. Ma, J. M. Ladbury, and B. P. Riddle NIST, 723.03, 325 Broadway, Boulder, CO 80303-3328 NIST TN 1342 July 1990</p> <p><b>ABSTRACT:</b> This report summarizes the measurement and evaluation of a 1/10 scaled model TEM/reverberating chamber developed as a single, integrated facility for testing radiated electromagnetic compatibility/vulnerability (EMC/V) of large systems over the frequency range 10 kHz to 40 GHz. The facility consists of a large shielded enclosure configured as a transverse electromagnetic (TEM), transmission line-driven, reverberating chamber. TEM mode test fields are generated at frequencies below multimode cutoff, and mode-stirred test fields are generated at frequencies above multimode cutoff. Both the chamber's cw and pulsed RF characteristics are measured and analyzed.</p> <p><b>INDEX TERMS:</b> CW and Pulsed RF Testing, Radiated EM Compatibility and Vulnerability Measurements, Reverberating Chamber, TEM Cell</p>	<p><b>EMCABS: 12-05-91</b></p>

<p><b>A NEW METHOD FOR CALCULATION OF SAFETY AREA OF AN ANTENNA</b>  Xu Desen and Yank Zhiyou, Shijiazhuang Communications Laboratory  EMC-90 National Symposium, Beijing, China  September 1990</p> <p><b>ABSTRACT:</b> A new method to calculate field values around an antenna is presented. According to this method, a safety area around a high power antenna is easily determined and the actual damage zone is very much less than those calculated by other approaches.</p> <p><b>INDEX TERMS:</b> Antenna, EMC, Damage Zone</p>	<p><b>EMCABS: 13-05-91</b></p>	<p><b>SAFE THRESHOLD LIMIT VALUES FOR ELECTROMAGNETIC RADIATION</b>  Bao Xiewen, CSSC 704 Institution  EMC-90 National Symposium, Beijing, China  September 1990</p> <p><b>ABSTRACT:</b> With extensive research and numerous experiments, the save threshold limit values for electromagnetic radiation have been studied. Emphasis is placed on the relation between limits and radiofrequency current, protection and sensitive equipment to which humans are sensitive. This paper presents four new general save threshold limit values for electromagnetic radiation, which are fitted to various jobs and working areas. (Please route information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> Electromagnetic Radiation</p>	<p><b>EMCABS: 16-05-91</b></p>
<p><b>RADIOFREQUENCY RADIATION DOSIMETRY HANDBOOK (FOURTH EDITION)</b>  C. Durney, H. Massoudi, and M. Iskander  Electrical Engineering Dept., University of Utah  USAF School of Aerospace Medicine, Aerospace Medical Division (AFSC)  Brooks AFB, TX 78235-5301  USAFSAM-TR-85-73, October 1986, 510 p.</p> <p><b>ABSTRACT:</b> This extensive report is an excellent radiofrequency radiation dosimetry reference. It addresses field characteristics; absorption characteristics; dielectric properties; theoretical, and experimental dosimetry; VLF and MF dosimetry; thermal responses of man and animals; and RF radiation safety standards. It includes data from the first three editions and adds new data. The result is a comprehensive text dealing with both theoretical and experimental dosimetry.</p> <p><b>INDEX TERMS:</b> Radiation Biology (Dosimetry, Health Physics), Thermodynamics</p>	<p><b>EMCABS: 14-05-91</b></p>	<p><b>THRESHOLD OF EXPOSURE TO RADIO FIELDS IN FREQUENCY RANGE FROM 100 kHz TO 300 GHz</b>  Ye Zonglin, China Electronics Engineering Design Institute  EMC-90 National Symposium, Beijing, China  September 1990</p> <p><b>ABSTRACT:</b> This paper emphasizes the methods and bases to establish threshold, including risk assessment and determination of EM energy absorbed in the whole body, biological consequences of EM radiation and population exposure. (Please route information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> Irradiation, Absorption Threshold, Radiation Effects, Risk Assessment</p>	<p><b>EMCABS: 17-05-91</b></p>
<p><b>RECENT IMPROVEMENTS IN TIME-DOMAIN EMC MEASUREMENT SYSTEMS</b>  J. Adams, A. Ondrekja, K. Cavceyi, J. Cruz, H. Medley,  and J. Grosvenor, NIST, 325 Broadway, Boulder, CO 80303-3328  NISTIR 89-3827  November 1989</p> <p><b>ABSTRACT:</b> Improved techniques for determining critical resonant frequencies and the current response of internal wiring due to external fields for rotary-wing aircraft are given. The measurement method uses a train of low-level, radiated pulses. These do not disturb other spectrum users, nor do other spectrum users significantly disturb these measurements. The fields are low, a distinct advantage from both cost and personnel hazards standpoints. The problems that should be addressed before the full potential of the technique can be realized are discussed.</p> <p><b>INDEX TERMS:</b> EMC Measurements, Time-domain Measurements</p>	<p><b>EMCABS: 15-05-91</b></p>	<p><b>TWO KINDS OF TEM CELL: THEORY, RESEARCH AND COMPARISON</b>  Huang Zhixun, Chi Ziaozi, Li Yi  Dept. of Microwave Eng., Broadcasting Institute  EMC-90 National Symposium, Beijing, China  September 1990</p> <p><b>ABSTRACT:</b> Because of its enclosed structure, the TEM cell cannot pollute the ambient or affect the operator's health. Therefore, it is better than the Stripline Test Cell. The characteristic impedance equations of the two kinds of TEM cell are presented. The useful upper frequency limit experimental equation is derived. (Please route information requests to Sha Fei.)</p> <p><b>INDEX TERMS:</b> TEM Cell, Useful Upper Frequency Limit</p>	<p><b>EMCABS: 18-05-91</b></p>

# NEW STUDIES EXAMINE EFFECTS OF ELECTROMAGNETIC RADIATION

The IEEE is trying to clear up some of the confusion resulting from misunderstanding and misinformation of the potential health effects of exposure to electric and magnetic fields (EMF). The public was jolted in 1989 by publication of a series of articles in the New Yorker magazine that alleged a cover-up of health hazards from low level exposure to the non-ionizing portion of the electromagnetic spectrum. Author Paul Brodeur cited studies purporting to show strong links between magnetic fields from electric power distribution lines and childhood cancer and also a high incidence of abnormal pregnancy outcomes associated with extended use of Video Display Terminals (VDTs). Brodeur's subsequent book, Currents of Death (Simon & Shuster), expanded on these environmental events that may have adverse health effects.

One phase of the IEEE effort is a critique of the Brodeur book issued by the IEEE's Committee on Man & Radiation (COMAR) in January 1991. In August 1990, IEEE also released COMAR statements on the biological effects of electric and magnetic fields from VDTs and on human exposure to microwaves and other radio-frequency electromagnetic fields which summarized the current state of knowledge in those areas.

Since that time two other studies have been released and the results publicized, but a clearer understanding of the issues has not inevitably resulted. In fact, both studies were accompanied by controversy over what the actual findings were, what the press reported as actual findings, and whether industry sponsorship colored the results.

A new [USC] scientific study concludes that there is "no support for a relationship between measured electric field exposure and leukemia risk, little support for the relationship between measured magnetic field exposure and leukemia risk, some support for the relationship between wiring configuration and leukemia risk, and considerable support for a relationship between children's electrical appliance use and leukemia risk." The appliances used were hair dryers, black and white televisions, curling irons, and electric blankets.

The study was conducted by an epidemiology professor at the University of Southern California but some findings were publicized by the Electric Power Research Institute (EPRI), which had sponsored that portion dealing with EMF. The USC study looked at childhood leukemia in Los Angeles County and compared 232 healthy children with an equal number suffering from leukemia.

The USC study results have not been formally promulgated because the peer review process is continuing, but EPRI decided to announce the finding that there is no association

between childhood leukemia and exposure to electric fields. Like several previous studies, it found some association between neighborhood power lines and the risk for childhood leukemia. According to EPRI, this "baffling" discovery may occur because power lines emit sporadic field fluxes that are not properly measured.

Electric and magnetic fields are routinely produced when electrical current passes through a wire or common household appliance.

A study by the Environmental Protection Agency was completed in December but the final edition has not yet been published. The draft report concluded that there is enough statistical evidence of a possible link between cancer and low level electric and magnetic fields from power lines and appliances to warrant new research.

COMAR's comments on the draft were conveyed to EPA's Science Advisory Board on January 4. In this letter, COMAR Chairman Dr. James C. Lin reminded the Board of the difficulties of conducting studies on relationships between cancer and the subjects' work and home environments. It is difficult to study "the varied experiences encountered throughout the life span of an individual in modern society" and to separate "the individual contributions of many factors to an observed health effect," Lin said. He recommended continuing research on health effects in four major areas: 1) animal studies to ascertain causal relationships between power-frequency fields and health effects; 2) cell culture studies to help elucidate mechanisms of interaction; 3) studies of induced fields in human and animal bodies to allow extrapolation of human effects from laboratory results; and 4) studies of health records of humans exposed to EMF but with special emphasis on "confounding factors and established cancer-causing agents that may be present in the same environment."

Lin is head of the Bioengineering Department at the University of Illinois-Chicago.

COMAR undertook its evaluation of Currents of Death in an effort to examine and rate "extant literature on the biological effects of EMF and report this information to both the engineering community and the public at large." COMAR decries Paul Brodeur's "unbalanced one-dimensional portrait of the conflicts of environmental science as applied to EMF ..." The book does not provide a complete or balanced account of the research, it disregards scientific principles that guide the research and analysis process, and omits any discussion of "established, prudent regulatory practices."

[Source: IEEE USA Legislative Report, February 26, 1991]



# CALENDAR

## 1991

- |                 |  |  |
|-----------------|--|--|
| June 11-13      | <b>INTERNATIONAL MICROWAVE SYMPOSIUM</b><br>Hynes Convention Center<br>Boston, MA                              | Contact: Peter Staecker M/S 704<br>MA-COM<br>52 South Ave.<br>Burlington, MA 01803<br>(617)272-3000, Ext. 1602                         |
| June 24-28      | <b>NORTH AMERICAN RADIO SCIENCE MEETING &amp; INTERNATIONAL IEEE/AP-S SYMPOSIUM</b><br>London, Ontario, Canada | Contact: Mrs. D. Ruest<br>National Research Council Canada<br>Ottawa, Ontario, Canada K1A 0R6<br>(613)993-9009                         |
| August 13-15    | <b>IEEE 1991 EMC SYMPOSIUM</b><br>Hyatt Cherry Hill<br>Cherry Hill, NJ   | Contact: Ed Bronaugh<br>IEEE 1991 Intl. Symposium on EMC<br>P.O. Box 609<br>Lincroft, NJ 07738<br>(800) 253-3761                       |
| September 23-26 | <b>13TH ANNUAL ELECTRICAL OVERSTRESS/ELECTROSTATIC DISCHARGE SYMPOSIUM</b><br>Riviera Hotel<br>Las Vegas, NV   | Contact: Terry Welsher<br>AT&T Bell Laboratories<br>600 Mountain Avenue, Rm. 3B-321<br>Murray Hill, NJ 07974<br>(201) 582-5279         |
| September 24-26 | <b>DESIGN 91</b><br>Meadowlands Convention Center<br>Secaucus, NJ  | Contact: Kristen Lindberg<br>Expocon Management Associates, Inc.<br>7 Cambridge Drive<br>Trumbull, CT 06611<br>(203)374-1411, Ext. 105 |
| October 13-15   | <b>13TH PIEZOELECTRIC DEVICES CONFERENCE</b><br>Western Crown Center<br>Kansas City, MI                        | Contact: Components Group,<br>Electronic Industries Association,<br>2001 Pennsylvania Ave., N.W.<br>Washington, D.C. 20006             |

## 1992

- |           |  |  |
|-----------|--|--|
| May 17-22 | <b>EIGHTH WORLD CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION</b><br>Montreal Convention Centre<br>Montreal, Quebec<br>Canada | Contact: IRPA8<br>2155 Grey Street, Suite 820<br>Montreal, Quebec<br>Canada H3H 2R9<br>FAX:(514)932-9419       |
| May 25-27 | <b>URSI/IEEE/CIE INTERNATIONAL SYMPOSIUM ON EMC</b><br>Beijing, China  | Contact: Prof. Zhanj Linchang<br>EMC Research Section<br>Northern Jiatong University<br>Beijing, 100044, China |

# INSTITUTIONAL LISTINGS

The IEEE Electromagnetic Compatibility is grateful for the assistance given by the firms listed below and invites application for Institutional Listings from other firms interested in the electromagnetic compatibility field.

**AMPLIFIER RESEARCH, 160 School House Road, Souderton, PA 18964-9990**

Telephone: (215) 723-8181, TWX: 510-661-6094, FAX: (215) 723-5688

Broadband RF power amplifiers, 1 W to 10 kW, 10 kHz to 1 GHz; Antennas and accessories for RF susceptibility testing; broadband E-field monitors and fiberoptic links.

**ARK ELECTRONICS CORPORATION, 1325 Industrial Highway, Southampton, PA 18966**

Telephone: (215) 322-6510, FAX: (215) 322-4231

RF shielded enclosures, custom-manufactured shielded doors, RF filters, waveguide air vents, EMI laboratory testing, EMC consulting; a complete EMC capability.

**COMPLIANCE ENGINEERING, 629 Massachusetts Ave., Boxborough, MA 01719**

Telephone: (508) 264-4208, FAX: (508) 635-9407

Complete source for EMC: Publications and Annual Design Handbook, Bimonthly Seminars, International Standards.

**FAIR-RITE PRODUCTS CORP., P.O. Box J, 2 Commercial Row, Wallkill, NY 12589**

Telephone: (914) 895-2055, FAX: (914) 895-2629, TWX: 510-249-4819

Ferrite EMI suppressor elements for cables, ferrite beads on leads for circuit board insertion, ferrite beads for surface mount technology, ferrite sleeves for filter pin connectors.

**INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779**

Telephone: (516) 467-8400, FAX: (516) 467-8558

Anechoic shielded rooms, turnkey systems, EMC/susceptibility measurement systems, broadband amplifiers, leveling pre-amps, TEM cells, E-field sensors up to 40 GHz, radiation hazard monitors, E-field generating antennas.

**MAXWELL LABORATORIES, INC. - MAXWELL/ELGAL, 8888 Balboa Avenue, San Diego, CA 92123**

Telephone: (619) 576-3737, FAX: (619) 277-6754

Products, consulting, testing and training for all electromagnetic disciplines and technologies.

**OMEGA SHIELDING PRODUCTS, 1384 Pompton Avenue, Cedar Grove, NJ 07009**

Telephone: (201) 890-7455, FAX: (201) 890-9714

EMI/EMP/ESD shielding materials, gaskets and contact strips, both standard and custom designed.

**PATTON & ASSOCIATES, INC., 4718 West El Camino Drive, Glendale, AZ 85302**

Telephone: (602) 934-5458, FAX: (602) 242-7700

Worldwide Telecommunication design assistance, consultation, and product submittal.

**R&B ENTERPRISES, 20 Clipper Road, West Conshohocken, PA 19428**

Telephone: (215) 825-1960, TWX: 510-660-8120, FAX: (215) 825-1984

EMI testing/consulting. Full-threat EMP simulation. EMC training/publications. EMP test equipment.

**SPECTRUM CONTROL, INC., 2185 West 8th Street, Erie, PA 16505**

Telephone: (814) 455-0966, FAX: (814) 455-2550

Complete EMC, FCC/MIL consulting, testing, repair, mfr. RFI filters, RFI gaskets, D-subminiature connectors. Surface mounted devices; chip capacitors, capacitor networks, HIC and QUAD fastbus line drivers.

**TECKNIT, INC., a TWP Company, 129 Dermody Street, Cranford, NJ 07016**

Telephone: (201) 272-5500

EMI/EMP/ESD shielding materials, gaskets, vent panels, windows, and conductive coatings and adhesives.

An Institutional Listing recognizes contributions to support the publication of the IEEE NEWSLETTER and TRANSACTIONS ON ELECTROMAGNETIC COMPATIBILITY. Minimum rates are \$75.00 for listing in one issue; \$200.00 for four consecutive issues. Larger contributions will be most welcome. No agency fee is granted for soliciting such contributions. Inquiries, or contributions made payable to the IEEE, plus instructions on how you wish your Institutional Listing to appear, should be sent to Marilyn Prusas, 445 Hoes Lane, P. O. Box 1331, Piscataway, NJ 08055-1331, Technical Activities Department.