

Electromagnetic Compatibility Society



Newsletter

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EDITOR: ROBERT D. GOLDBLUM

EMC SOCIETY MEMBERS ELECTED FELLOWS

The IEEE EMC Society is pleased to announce that six of its members have been elected as Fellows of The Institute of Electrical and Electronics Engineers, Inc.

Dr. Yasuo Akao of Nagoya, Japan has been recognized for leadership in the field of electromagnetic compatibility and related contributions to research and education.

Dr. James R. Andrews of Picosecond Pulse Laboratories, Inc. of Boulder, CO, has been cited for his work in picosecond-domain pulse techniques and measurements.

Prof. Kamilo J. Feher of the Department of Electrical Engineering and Computer Science, University of California, Davis, has been honored for his contributions to digital communications research and for leadership in applied communications engineering education.

Prof. Kurt Feser of the University of Stuttgart, Stuttgart, West Germany, has received recognition for contributions to the generation and measurement of ultrahigh voltage and currents and for the development of associated apparatus.

Dr. Peter Kartaschoff of Cormondreche, Switzerland, has been honored for his contributions to the development of a cesium beam frequency standard and its use in precision time measurements.

Prof. Edward H. Newman of Ohio State University, Columbus, OH, has been noted for contributions to modeling the electromagnetic radiation and scattering from complex structures.

EDITORS' DEADLINES

The essential ingredient of a newsletter is informative and *timely* content. Mailing this NEWSLETTER and current information to all Society members depends upon prompt submission of all articles and features. All Associate Editors are reminded that the submission deadline for the summer issue of the *IEEE EMC Society NEWSLETTER* is

May 15, 1989.

Looking ahead, the deadline for the fall issue will be

August 16, 1989.

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FIRST

EDUCATION COMMITTEE NEWS

At their February 18, 1989 meeting, The Board of Directors authorized the extension of the terms of the first two Distinguished Lecturers (Roger Southwick and Herb Mertel) to the end of 1989 in order to provide more opportunities for organizations to take advantage of these lecturers' presentations. Additionally, two new lecturers will be selected for two-year terms starting in June. Therefore, we will have six Distinguished Lecturers between June and December of this year so let's take advantage of this wealth of opportunity! As we prepare to go to press (March, 1989), six lectures have been presented and three more are scheduled through June. All the lectures except one were presented at IEEE EMC Society Chapter meetings.

One of the goals stated in the January 1987 BOD resolution setting up this program was to "encourage presentation of lectures at other than EMC Society chapters and functions." This goal has not been achieved as yet. What can be done to increase the number of lectures presented outside the EMC Society? Is this goal something the Public Relations Chairman should be working on? One way to achieve this objective would be to enlist the help of Society members who belong to other organizations. They could inform fellow members of these organizations of the Distinguished Lecturer Program and encourage its use. All organizations are looking for good speakers so let's publicize this program! Anyone with comments or ideas should contact me or Distinguished Lecturer Program Chairman Dave Hanttula.

Recently I received a letter from Dr. Robert M. Nelson of the University of Idaho in Moscow, Idaho. After attending an EMC Seminar and after reading a copy of the "Experiments in EMC" booklet, he proposed the following: "... [modify] an existing beginning fields class to approach the whole course from an EMC viewpoint. In the process of looking at EMC problems and solutions, my hope would be to discuss all fields concepts that are currently covered. . . . I feel that this would help achieve the two purposes of introducing the students to EMC principles, as well as helping the fields course to be much more interesting and practical."

I think this is an exciting and novel approach to the subject. He has a plan that would add EMC to the curriculum without adding a course and in a way that would make a very theoretical subject much more interesting and practical while retaining all the theory. Anyone who thinks this is a good idea and who would like to encourage Bob in this project should contact him at (208) 885-6902 or should direct correspondence to the University of Idaho, College of Engineering, Moscow, ID 83843. I'm sure he'd appreciate insights and suggestions.

Henry Ott
Chairman EMCS
Education Committee

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IEEE

ELECTROMAGNETIC COMPATIBILITY SOCIETY

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Dear EMC-Member:

Walter D. McKerchar, of the EMC-S Board of Directors, and I are in the process of developing a public awareness program. Its focus will be the importance of electromagnetic compatibility and the efforts of the EMC engineer to control interference as a step toward providing an environment free of electromagnetic pollution.

As Chairman of the Committee, I am asking you to take part in this public awareness task.

One of the ways to accomplish this task is for EMC articles of interest to the general public to appear in the news media and in non-technical periodicals. If you have such an article, or would care to write one, please contact me. We will attempt to have your articles published in popular magazines and newspapers. All contributions will be appropriately recognized.

Thank you for your interest in promoting our EMC engineering field to the public.

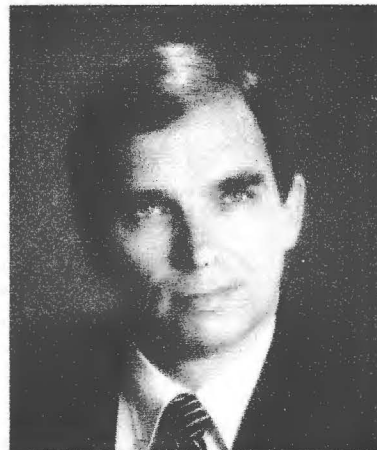
Sincerely,

Gerald P. Rothhammer

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

PRESIDENT'S MESSAGE

IEEE MEETINGS WASHINGTON, DC



from Donald E. Clark

This past February, I attended a number of IEEE meetings held in Washington, DC. I would like to relay the essence of these meetings. On February 17, the EMC Society held an all-day planning workshop, which was attended by all the officers and technical directors. First I would like to thank personally everyone who participated in this workshop. They performed a valuable service to the Society, and their contributions are sincerely appreciated. The purpose of this workshop was to establish objectives and goals in four programming areas—viz. Society Management, Society Services, Chapter Development, and Committee/Representative Activities. We started the workshop by assessing the Society's progress during 1988 and by reviewing the 1988 Plan-of-the-Year. Overall, we made good progress in some areas although in other areas progress was not so great. I think we all realized that it is easy to overestimate what can be accomplished over a year's time in a volunteer organization, especially when the BODs hold only three meetings a year. Some of the new ideas and observations to come out of the workshop include the following: (1) although not by design, the BODs are inaccessible to the membership, and steps need to be taken to provide opportunities for more interaction; (2) the chapter officers need to have available a source book about the IEEE organization, program resources, etc.; (3) the membership seems to desire more opportunities for attending tutorials, workshops and seminars, as opposed to attending technical lectures; (4) there is a need to network the university and college educators concerned with EMC education and research to encourage both the transfer of ideas and the teaching of EMC technology; and (5) the Society's USAB committees and its inter-society representation require restructuring so that activities are tracked and reported back to the

BODs. Workshop output is now being distilled into a Plan-of-the-Year for 1989. The plan should guide us all in a common direction.

On February 19 and 20, I attended the meeting of the Technical Activities Board (TAB) which is the governing body of the IEEE Societies. TAB consists of the President of each Society, the Divisional Directors, and Committee Chairmen. The Vice-President for TAB during 1989 is Professor Troy Nagle from North Carolina State University. Professor Nagle reorganized the TAB meeting format this year. At the outset, TAB members were organized into a number of areas. Issues included chapter/society/section interactions, transnational activities, administrative services, small society problems, division vitality, TAB OPCOM restructuring, and publication improvements. The workshops provided an excellent opportunity for the TAB members to interact in small groups and to get to know each other. After the workshops were completed and summarized, the presidents of each of the societies met in a Presidents' Forum. This meeting provided an opportunity for candid discussion of issues within the IEEE and for preparation of motions. The forum was very productive since a number of issues had already been highlighted during the workshops. After the Presidents' Forum, the TAB held a formal meeting with Professor Nagle presiding. During this meeting, the motions prepared in the forum were presented for formal voting. Overall, I found the TAB Meeting very beneficial, and I think the Society presidents can represent and serve the membership better using this new format.

BOD ACTIVITIES

BOARD OF DIRECTORS MEETING MEETING IN WASHINGTON, DC



by Donald N. Heirman

The first Board meeting of 1989 was held between 9:30 a.m. and 5:00 p.m. on February 18, 1989 at the J.W. Marriot Hotel in Washington, DC. This meeting was held in conjunction with various IEEE Board and Committee meetings. Board members present included Don Clark, Ed Bronaugh, Janet Nichols, Dick Ford, Bob Haislmaier, Don Heirman, Bob Hofmann, Dan Hoolihan, Al Mills, Gene Cory, Bill Duff, Don Weber, Len Carlson, and Walt McKerchar.

Members unable to attend were Charlotte Tyson, Gene Knowles, Herb Mertel, Chet Smith, Henry Ott, and Dick Schulz. Guests included Bob Brook, Tom Doepfner, and Charlie Anderson.

After approval of the agenda, Don Clark turned the meeting over to Secretary Janet Nichols, who discussed the minutes. After minor changes, the minutes were approved. The Treasurer's Report was presented by Dick Ford. Our Society's net worth as of October 31, 1988 was \$320K, down from the August 31 level. His report had been expanded to include separate budget lines for all technical directors' activities, as well as for office and administrative expenses. Dick expressed concern that our projected budget for 1989 shows a \$20K deficit. The Board discussed the deficit at length and asked Dick to make a special effort at tracking our expenses in the near term so as to assure that the projected numbers materialize. The Board was reminded that the annual dues have been set at \$7.00 for over a decade and that they should be increased as those of all the other societies have been during that time. The Board approved a dues increase to \$10.00, which is still the lowest among the Societies. The Treasurer's report was approved.

Ed Bronaugh, Vice President, then reviewed the Society's long range plan. He reported that several representatives to various outside societies may report to one of two directors to channel a report to the Board. Further details on this reporting system will appear in the next *NEWSLETTER*.

Len Carlson then discussed proposals for changes in our Bylaws. It is especially important to the Board that the Bylaws express current Society practices, including the terms of office for committee chairmen and members.

Major items discussed during the remainder of the meeting include the following:

1. Director Bob Haislmaier (Communication Services) presented his report. He indicated that Bob Goldblum, *NEWSLETTER* Editor, will list in the calendar of coming events those EMC courses for which he receives announcements. Of course, appropriate consideration will be given to member interest and to space limitations. Also he is seeking an associate editor to review new books on EMC. Further, he reported that Moto Kanda, *Transactions* editor, has announced the appointment of two new associate editors:

- Professor E. Kuester, University of Colorado, will review electromagnetic theory papers.
- Professor John Norgard, also of the University of Colorado, will handle papers on antennas.

2. Regarding the International Relations Committee, Bob Haislmaier announced that responsibility for activities has been transferred to the Transnational Committee, chaired by Herb Mertel. Gene Knowles will be handling travel arrangements to the Nagoya Symposium, scheduled for September 8-10, 1989. Call Gene at (206) 271-3396 for details. Bob also reported that the History Committee is now chaired by Chet Smith. Plans to microfilm BoD Minutes and back issues of the *NEWSLETTER* are nearly completed.

3. Gene Cory presented the Symposium report. He noted that the 1992 symposium scheduling has been changed to August 18-20. For 1995, the Atlanta Chapter has requested consideration as symposium sponsor. The Board also discussed the duty of maintaining high standards regarding the acceptance of papers and the necessity of rejecting papers of poor quality. The Society's Technical Committees are also involved in maintaining these high standards. The Board agreed that there is a need for effective communications between the Technical Committees and the Symposium Paper Committees.

4. Director Don Heirman, Technical Services, presented his reports. First, Don reported that Standard 139-1988 on *in-situ* measurement of emissions has been published.

(continued)

It is available for \$20.00 to IEEE members and can be ordered from the IEEE in Piscataway, NJ; phone (201) 562-3800. Also a tutorial on the issues raised in P1128 (absorber efficiency measurements) will be presented at the Denver Symposium. Don also presented Henry Ott's report on the Education Committee. This committee will publish an EMC bibliography this year, as well as an EMC experiments manual. The Board reviewed the Distinguished Lecturer Program. Members expressed a desire for more publicity—viz, a special *NEWSLETTER* article including photos and synopses of lecture topics. Because of uncertainty as to the effect of inadequate publicity, the Board voted to extend the term of the first four lecturers. This extension should compensate for any "down time" caused by lack of suitable publicity.

5. Wilf Lauber, Technical Advisory Committee Chairman, indicated that the TC's will present three tutorials at the Denver Symposium. He re-emphasized the concern that the services and suggestions of the TC's be utilized in reviewing papers for presentation at symposia.

6. Director Bob Hofmann (Member Services) gave his report. First, he presented Charlotte Tyson's nominations for EMCS awards. A secret ballot was taken. These awards will be presented at the Denver Symposium. The Board asked that quick action be taken to nominate EMCS members for IEEE Field Awards. Nominations are due by June. The EMCS Stoddart and Best Paper monetary awards have been increased to \$200.00 and \$100.00, respectively.

7. Regarding chapter activities, Dan Hoolihan reported that there were twenty-six active chapters and four unofficial chapters. Continuation of the Baltimore and San Gabriel Chapters is under scrutiny since they have reported no activity. The chapter "Angels" and Dan will be investigating. Dan and Bob Hofmann also indicated that there may be possibilities for a Beijing, China, and a Mexico EMC Chapter. Also plans are moving ahead regarding the establishment of the Paris, France Chapter. Bob will prepare a fact sheet on the role of chapter "Angels." This will be available to the chapter chairmen and to the "Angels" themselves, who can then double-check to make sure they are carrying out required duties consistently.

8. Next Bill Duff reported that we need more nominees for EMCS fellows. Last year only one nominee was submitted to the Fellows Committee for review. The Board felt that a Fellows Search Committee was needed. He requested the Board's help in finding qualified members. In this search, the Board could use the services and help of all Society members. Anyone with a suggestion should call Bill Duff at (703) 642-4049.

9. In a special presentation, guest Bob Brook described the activities of the Long Island Chapter. He described a lively meeting on the new NAVAIR program for EMC excellence. This chapter was also responsible for a session at IEEE/ELECTRO/89.

10. In further committee news, Director Walt McKerchar reported that Bill Johnson has accepted the post of Chairman of the Employment Analysis Committee, which conducts the employment surveys at EMCS Symposia. Anyone interested in making modifications to the survey, call Bill at (206) 244-0952. The Government Relations Committee has been eliminated until it is needed again as a separate function. Herb Mertel, Transnational Committee Chairman will assume the additional responsibility of handling the exchange of U.S. symposia records with those of other international EMC conferences. This plan had been discussed previously, and our next exchange will be with the Zurich Symposium. Don Weber has accepted the chairmanship of the Intersociety Relations Committee. Emphasis will be placed on interactions with the activities of the Electronic Industries Association, the Society of Automotive Engineers, the Radio Technical Committee on Aeronautics, etc. As a new associate editor, he will report these activities in our *NEWSLETTER*. Next, considerable discussion ensued on our new EMCS brochure, which is being prepared by Gerry Rothhammer, the new chairman of the Public Relations Committee. The Board approved the printing of 10,000 copies, which will be available for general distribution. For copies call Gerry at (213) 822-3061.

11. Next Bob Brook gave a brief report on the Society of Social Implications of Technology. SSIT studies, among other social issues, the ethical problems posed by technology transfer within the engineering profession. PACE (Professional Activities Council for Engineers) Coordinator Al Mills described many activities which, he felt, were important to report to the Board. For more information, call either Bob at (516) 593-3136 or Al at (619) 463-2123, as seems appropriate. On behalf of Society members, the President congratulated Walt McKerchar on revitalizing our professional services.

12. President Don Clark then reviewed old business. First, Director Don Heirman reported that he had communicated with Stephen Kahne, who is coordinating the introduction of the IEEE Academy. In essence, EMCS is in favor of Academy self-testing within our discipline so as to pinpoint areas of possible improvement of the technical and professional skills of participating members. However, the Academy will need input from our Society regarding the preparation and administration of tests. In January correspondence, Don mentioned concerns regarding the efforts and liabilities involved. Further reports on this Academy project will appear in future issues of the *NEWSLETTER*. For more information call Don at (201) 834-1801.

13. Don Heirman then moved that the "Product Safety Newsletter" be funded for \$3000.00 for 1989. This funding covers the percentage of total costs which goes to postage for copies to Society members and a one-time start-up fee. It will be recalled that at the last Board Meeting the Product Safety Society (PSS) became a technical

committee—TC-8. The process of “launching” an active technical committee continues. In approving the motion, the Board required that the IEEE logo be used, that IEEE publications policies be followed, and that every effort be made to have the PSS affiliate with the EMC Society. Affiliation can be achieved at a grade different (and less costly) than full Society membership. Of course, affiliation does not include access to all Society publications and services. The ideal route is to opt for full membership. In any case, the Board requires that all TC-8 members become EMC Society members by December 31, 1989. Any further funding for the TC-8 “Newsletter” is dependent on meeting the December 31 membership requirement. It was further pointed out that our *NEWS-LETTER* can carry TC-8 copy and that John McBain (PSS Secretary/Treasurer) has been invited to become an associate editor, representing TC-8.

14. Under new business, the Board approved the expenditure of \$200.00 to support the publication of student technical papers prepared in 1988. President Don Clark then discussed the Society's 1989 Plan-of-the-Year. This plan had been the subject of thorough discussion and preparation in a meeting of the officers and directors held the day before the Board meeting. For more details, call Don at (404) 894-4315. Based on the 1989 budget proposals submitted by the officers and directors, the Board approved \$41.7K to handle requests. Charlie Anderson asked that the American Radio Relay League have a representative report ARRL activity to the Board. Charlie was asked to prepare a job description detailing the scope and duties of this position. There was discussion regarding the present reporting mechanism for ARRL activities. There already exists a Society liaison with the American National Standards Accredited Committee C63, and ARRL is a member of C63 and has its delegate. The current reporting procedure and details of any new procedure require clarification. Questions should be directed to Charlie Anderson at (301) 733-3061.

15. During the meeting, the Board approved mailing the 1989 Denver EMC *Symposium Record* to all EMCS members, including members, senior members, fellows, and life members.

16. President Clark concluded by announcing Board meeting dates for the remainder of the year. The next meeting will be held at the Denver Symposium on Monday, May 22 at 9:30 a.m. The last meeting will be at Tarpon Springs, FL on either November 13 or 17. The EMCS Standards Committee will meet in the same room for ninety minutes preceding both Board meetings. For more information call Janet Nichols at 1-800-325-9814.

Respectfully submitted,
D.N. Heirman, Associate Editor

TWENTY-SIXTH ANNUAL CONFERENCE ON NUCLEAR AND SPACE RADIATION EFFECTS

July 24–28, 1989

The 1989 IEEE Twenty-Sixth Annual Conference on Nuclear and Space Radiation Effects will take place at Marriott's Marco Island Resort in Florida. It is sponsored by IEEE/NPSS Radiation Effects Committee and co-sponsored by DNA/DoD, SNL/DOE and NPL/NASA.

The site was chosen to complement the technical program with excellent recreational facilities. The program consists of eight to ten sessions of contributed papers, several invited papers, and a poster session. There will be a short course on radiation effects and hardening. Technical program categories will cover the following areas of interest:

- Basic mechanisms of radiation effects
- Dosimetry and energy dependent effects
- Hardness assurance and testing techniques
- Radiation effects on isolation techniques
- Spacecraft charging and space radiation effects
- Device radiation effects and hardening
- Integrated circuit radiation effects and hardening
- Single-event phenomena
- EMP/SGEMP/IEMP phenomena

The Technical Program Chairman may be consulted on questions related to papers; and although the deadline is past for submissions, special cases or problems should be brought to the attention of—

Peter S. Winokur
Division 2147
Sandia National Laboratories
1515 Eubank SE
Albuquerque, NM 87123
Telephone: (505) 846-2998

Questions on Local Arrangements should be directed to

Klaus G. Kerris
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2800 Power Mill Road
Adelphi, MD 20783-1197
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POINT AND COUNTERPOINT

THE SILENT CRISIS SCREAMS



by Anthony G. Zimbalatti

"The silent crisis screams!" That's how Kenneth Norton described the electromagnetic interference/compatibility (EMI/EMC) crisis during an executive session of the panel chartered in 1966 to review the Department of Defense (DoD) Mathematical Modeling in Electromagnetic Compatibility. The screaming has continued sporadically, and many crescendos have been achieved. More recently, a spate of news articles has suggested that EMI has caused serious problems in operational military aircraft and ships including failure to complete a mission; loss of a ship or aircraft; or even worse, loss of life.

Are these news articles an accurate reflection of the state of military EMI/EMC? Is there a crisis? Did the problems result from flawed technical requirements, procurement practices, or both? What should or could our Society do? Members thoughts and recommendations are needed!

A February 12, 1989 *New York Times* article "Defense Radar Must Turn Off as Planes Land: Air Force Fears System Could Trigger a Blast" stated that for fourteen months operators in central Georgia have interrupted defense warning systems operations to avoid accidental detonations of tiny explosive charges located on military aircraft landing at a nearby base. A February 2, 1989 article in the *New York Times* "House Panel to Hold Hearings on Ships' Anti-Missile System" asserted that declassified congressional reports suggest the potential vulnerability of some Navy frigates, such as the *Stark*. Purportedly when its anti-missile radar fire control system was tested in May, 1984, "Interference from other weapons, radars and active shipboard electronic countermeasures was not assessed."

The January, 1989 *Journal of Electronic Defense* article "TAWC to House Purple EMI Group" reported that the

Joint Electromagnetic Interference (JEMI) Group housed at the Tactical Air Warfare Center, Eglin AFB, FL, composed of sixty DoD people will spend thirty million dollars over two years to find ways to avoid EMI between elements of a single system and among joint service systems. Recent examples of single system mutual interference were cited. On the *HMS Sheffield*, its satellite communications system interfered with its radar self-protection system; and this problem precluded stopping an incoming missile, which sank the ship with loss of life. Also the existence of self-jamming problems aboard the B-1B has been reported.

A January 22, 1989 Knight-Ridder Wire Service article was entitled "Mixed Signals May Have Misguided US Weapons: Pentagon Probing Electronic Interference Also Suspected in F-111 Crash during Libya Strike." Because of EMI, numerous electronically-guided weapons may have gone astray damaging foreign embassies and diplomatic residences. Several aircraft missed their targets, and one F-111 crashed. The Pentagon was so alarmed that it initiated a three-year, thirty-five million dollar study to identify EMI and to prevent a reoccurrence of such incidents. Recent Pentagon studies have suggested that some US weapon systems could inadvertently bring down US planes by interfering with flight and fuel controls and thus causing uncontrolled turns or dives or failure of fuel supplies. Moreover, the Army has acknowledged that the UH-60 Black Hawk helicopter crash which killed twenty-seven servicemen may have been EMI-related, and a multi-million dollar radiation shielding effort on these helicopters has begun.

A January 30, 1989 *Defense News* article "DoD Denies Stray Electronic Signals Downed Fighter off Libya"

averred that Pentagon officials suspected that EMI had caused the loss of the F-111 during the Libya strike but that the DoD was playing down the Knight-Ridder article cited above because there is insufficient information to identify or to substantiate the EMI problems reported. Knight-Ridder stands by its story. Earlier, a July 30, 1984 *Aerospace Daily* article "Radio Station Transmissions May Have Caused Tornado Crash" reported that the first results of an investigation of the fatal July 6, 1984 crash of a German Air Force Tornado in southern Bavaria indicated that transmissions from a Radio Free Europe station located at Holzkirchen might have interfered with the aircraft's electronic control system.

Why is EMI the suspected cause of these disasters? Military procurement documents include Military Specification MIL-E-6051D "Electromagnetic Compatibility Requirements, Systems." This document states "This specification is mandatory for use by all Departments and Agencies of the Department of Defense." The overall requirements for systems electromagnetic compatibility are outlined, including control of the system electromagnetic environment, lightning protection, static electricity, bonding and grounding. The specification is applicable to complete systems including all associated subsystems/equipment. In section 6.1 "INTENDED USE" it is stated that the spec "is intended for use by the Army for procurement of airborne systems and vehicles; by the Navy for associated subsystems and aircraft; and by the Air Force for both aerospace and ground systems." It should be noted that ships are excluded from meeting this specification and that Army ground or boat systems are also excluded. However, the exclusion of these systems would seem to be contradicted by paragraph "6.2.7 SYSTEM." This paragraph defines system as "a composite of equipment . . . required for its operation to the degree that it can be considered a self-sufficient unit in its operational or support environment. A system may be aerospace, ground, or ship oriented." Certainly these contradictory paragraphs suggest that 6051 is flawed.

On the other hand, Specification 6051 clearly states that DoD aircraft systems procurement is to incorporate this specification which includes paragraph "3.2 SYSTEM REQUIREMENTS. The system and all associated subsystem/equipment, both airborne and ground, shall be designed to achieve system compatibility. . . ." Paragraph "3.2.1 SUBSYSTEM COMPATIBILITY" states "Compatibility shall be demonstrated between all subsystems . . . while the subsystems are . . . operated. Examples of subsystems to subsystem compatibility are aircraft formation; air vehicle to AGE (Aerospace Ground Equipment); aircraft to inboard missile; and launch facilities to air vehicles. . . ." Again the contradictions are noteworthy. A single aircraft is not necessarily a system and equipment on a single aircraft are not necessarily subsystems! This reasoning contradicts the paragraphs defining intended use, system, and subsys-

tems. "A subsystem is a major functional element of a system, usually consisting of several equipment that are essential to the operational completeness of the subsystem/system. Examples are airframe, propulsion, guidance, navigation, and communication." Clearly these contradictory paragraphs make 6051 a flawed specification.

Further, the EMC definition in 6051 should be examined. "The capability of systems and all associated subsystems/equipment to perform with required effectiveness, and without degradation, in the total electromagnetic environment encountered during accomplishment of the assigned mission." This environment is defined thusly, "The composite of electromagnetic energy including man made and natural sources, to which a system . . . will be exposed in performing its mission. When defined, the environment will be for a particular time and place." Perplexities abound! Exactly what is the system? What is the environment? Who is to define environment?

Since the definitional flaws regarding systems and subsystems have been examined, attention should be focused on the definition of electromagnetic environment. Elements mentioned in the crucial paragraph (3.2) include lightning, static electricity, EM hazards, external environment, etc. Paragraph "3.2.13 EXTERNAL ENVIRONMENT" mandates "consideration of the EME from sources not part of, and external to-the system. Consideration shall be given to the intended mission profiles, the available EME data, and the degree to which the EME can reduce the desired systems effectiveness." Clearly if the external EME is not specified, compliance with the intent of 6051 is impossible. Operational performance can be effected by EME; and operational problems, such as those mentioned above, cannot be precluded. Indeed, who is to define this environment prior to contract award?

These numerous problems and dilemmas demonstrate that EMI problems with military systems in general, and with aircraft in particular, are to be expected until necessary reforms are brought about. Specifically the contradictory requirements of 6051 must be resolved, external EME must be defined in the contractual documents, and then 6051 must be imposed correctly. Meanwhile the silent crisis screams.

EMC CERTIFICATION AND ACCREDITATION

PROGRESS REPORT



I have seen the certificates given to EMC technical personnel, and they are truly impressive. The certificate is light blue, with a crisp, modern border and gold-embossed lettering and seal. The colors balance and complement each other creating an eye-catching but dignified statement of credibility. I'll be proud to hang mine on the wall for all to see.

Certificates have been awarded to personnel who have provided all the necessary information, and they are starting to appear in offices throughout the country. Personally, I am still working on obtaining some missing data. I have just finished the letter to my alma mater requesting that my transcript be forwarded to NARTE.

Common elements which are missing from applications are peer endorsements and evidence of education. Applicants are required to submit three endorsements, but it is wise to request four. This precaution covers the difficulty of the colleague who just never gets around to the task. Transcripts validate one's claims to appropriate schooling. If one is "grandfathering" any of the educational requirements, there may be no need for transcripts. Of course, candidates applying under the grandfather provisions must submit ten questions for inclusion in the examination file.

Occasionally, there is some confusion regarding the fee structure. The charge for certification is \$20.00, and there is an additional charge of \$20.00 for the examination. If the check does not accompany the application, NARTE must delay processing until payment is received.

Laboratory accreditation is moving along nicely. NIST is in the final stages of preparing applications for mailing. Laboratory assessors have been selected and are being trained. The assessors are being chosen from the Navy support community. To qualify as an assessor, the candidate must have specific MIL-STD-462 test execution experience. An initial group of thirty-three possible assessors met at the Pacific Missile Test Center, Pt. Mugu, CA

on 1 February to finalize the critical elements and to develop laboratory assessment criteria. Smaller working groups are being formed as determined by geographic location. The assessors will meet again in April, 1989 to ready the checklist and to undergo indoctrination in NVLAP procedures by NIST. They will be ready to begin assessment in June.

I continue to be asked about the scope and impact of certification on individuals and on businesses. I'll try to respond to some of these questions. For example, is certification required only for new contracts? Would a new contract be one apart from any currently in force or would the term *new* include upgrades of current programs? What is the deadline for a contract which will require certification? When another branch of the armed services does not require certification for its EMC testing and when the government plant representative is Navy, will all EMC tests require certification regardless of the customer?

As I have stated before, certification applies to personnel. Accreditation applies to facilities. Both programs will be established as required through NAVAIR INST 2410.1D which had been targeted for issue 1 October 1988. It is currently in final review and is scheduled for release in the next two months. The instruction states that six months after the date of issue all final EMC acceptance tests must be performed in facilities accredited by NVLAP. Thus all new contracts awarded six months or more after the date of issue must include the accreditation provision. As a practical matter, the requirement will be added to new procurement requests shortly after the signing of the instruction. With the six-month lead time from procurement to request for bid, a reasonable anticipation would be that the requirement will start to appear in new con-

tracts from nine to twelve months after issue of NAVAIR INST 2410.1D. Ongoing programs buying new or different equipment or systems will be required to test in accredited facilities. Clearly this requirement applies to upgrades, modernization or modification of airframes in current programs.

Personnel certification will be required for those in responsible charge of work. Implementation of this requirement will follow the same timeline cited for laboratories. Certified personnel are not required of prime item manufacturers. However, certification is required when individuals' skills are offered *directly* by the prime manufacturer—e.g. "farming out" engineers as consultants.

While accreditation and certification are currently targeted only for NAVAIR, the Office of the Chief of Naval Operations has become interested in the requirement and intends to impose it Navy-wide. Eventually it is expected

that the requirement will become DoD-wide. For example, there is an Office of the Secretary of Defense-sponsored joint service EMI (JEMI) control test and evaluation project underway. Completion of JEMI in 1991 will result in an OSD or Joint Chiefs of Staff (JCS-level) office for continuous EMI control monitoring. It is reasonable to assume that this OSD or ICS office will impose an across-the-board, DoD-wide accreditation and certification requirement.

Ongoing policy considerations aside, the crucial issue for a manufacturer is what obligations are imposed by a particular contract. If a contract does not require either certification or accreditation as a performance issue, no problems or conflicts will arise regarding such requirements. In the final analysis, the program will be effectuated step-by-step as the crucial requirements are incorporated into individual contracts.

PCs FOR EMC

DO PCS MAKE YOU MORE PRODUCTIVE?

If you're anything like me, you probably spend a good portion of your day sitting in front of, and staring at, your computer terminal. Among other ill effects attributed to this pastime are eyestrain and potentially dangerous radiation. I have no comment about the latter; and as far as the former is concerned, the slow change in my eyesight over time has led to the most annoying problem which even bifocals will not help. There is no convenient distance for reading my computer screen. I'm either backed up far enough so that my upper, far-distance lenses provide a sharp, but alas rather small, image; or I have my nose nearly pressed against the screen so that the lower close-work part of the lenses can be used. Having to peer out the lower half of my glasses at a screen at eye level is not the best arrangement for my neck, which always seem to be developing cricks as a result of these unusual contortions. Wouldn't it be neat if, in the spirit of the Xerox/Macintosh desktop screen format, your computer could be located more nearly level with the desk surface so as to provide a more natural viewing angle? Additionally wouldn't an easily "dialable" image size minimize the problems mentioned? Perhaps a projection system with a zoom lens would do the trick.

But there's another effect associated with using computers on a regular basis about which I've developed a theory. In particular, I refer to the fact that evidently more of us are using computers for word processing, organizing ideas and data, developing graphics and presen-



by Edmund K. Miller

tations, and a variety of other creative applications. In my own case, I began using a Mac for essentially all my writing and record keeping almost as soon as I acquired one early in 1985. Because I can type faster and certainly more legibly than I can write longhand, it seems to me that the raw volume of output which I can produce per unit of time is substantially greater, say by a factor of two or three. I've also noticed that I seem to be more tired at day's end than was the case in my pre-Mac life.

Even allowing for the fact that all of us are growing older monotonically, though perhaps some of us age with a smaller or greater scope, I believe there is a link between these two observations. If we assume that we have a certain amount of creative energy to expend on our activities, then it would follow that producing more output, albeit more efficiently, would use up more of our "creative energy budget" thus leaving us feeling more tired. If there's anyone whose had a similar experience or who strongly disagrees with this idea, I'd like to hear your reactions.

EMC PERSONALITY PROFILE



JANET NICHOLS

Janet Nichols is the Sales Administrator at LectroMagnetics, Inc. (LMI) of Los Angeles, CA. Born and raised in Los Angeles, Janet literally "grew up" in the EMC community. Her father Fred Nichols was one of the founders of Genistron (now Genisco) and later founded LectroMagnetics, Inc. She spent her childhood traveling with her father and the family to various IEEE EMC Symposia. During her teens, her father introduced her to the art of winding inductors for RFI/EMI filters. Although many of these inductors did not pass her father's strict quality controls (and thus made babysitting a more profitable activity), Janet's interest in EMC products and in the IEEE community was piqued.

Following her 1981 graduation from the University of California at Santa Barbara with bachelor's degrees in both business economics and English literature, Janet began working at LectroMagnetics under the careful tutelage of her father, other engineers, and department managers. With a special interest in filters, Janet became proficient in application engineering and in sales management.

Janet's professional involvement in the IEEE began in 1983 when she was elected secretary of her local Los Angeles Chapter of the EMC Society. Janet spent the next four years serving this Chapter, first as secretary, then treasurer, vice chairman, and chairman. She is currently the program chairman of the LA Chapter. Also, in 1988 she was honored with an appointment as Secretary of the IEEE EMC Society Board of Directors. She is most enthusiastic about her current volunteer role on the Board and is anxious to contribute to the society. Always



by William G. Duff

appreciative of the valuable experience she has gained as an active participant in the IEEE, she regularly encourages prospective members, especially students, to join the EMC Society. Janet enjoys the dynamic quality of the EMC field and working for a company which devotes considerable effort to progress in EMC technology.

When she is not attending IEEE EMC/S Board of Directors meetings, local Chapter meetings, and/or EMC Symposia, Janet can be found at the office correlating customer's specific EMC requirements to LMI's product line. Often she travels to visit various customers both locally and nationally to introduce them to LMI and its products. Her visits have included aerospace firms and equipment developers, instrumentation and computer manufacturers, and research centers. She especially enjoys follow-up visits to ensure customer satisfaction after a project has been completed. Most recently, she has been promoting the company's new LEX line of energy efficient power line filters, a development in which the company takes special pride.

Janet augments her considerable professional accomplishments by devoting her energy to other pursuits. She has attended extension courses on computer education at U.C.L.A. and management courses sponsored by the Electronic Industries Association. She is a member of the South Bay Waves, a Masters swim team in Los Angeles, and regularly competes in ocean swimming events during the summer months. She is also a member of the Junior League of Los Angeles, an association of professionally-trained volunteers which serves the Los Angeles community. During 1988/1989 Janet is serving as treasurer of the League's major fundraisers.

A final happy note is that in May of this year Janet will marry David R. O'Neil. Her fiancé is currently pursuing a master's degree in business administration. As a graduate of Georgia Tech with a master's in aerospace engineering, Dave is very supportive of Janet's career in EMC and her work with the EMC Society in particular.

CHAPTER CHATTER

ALL-CHAPTERS BULLETIN

This column editor attended the BOD meeting in Washington in February. Of course, Don Clark covers this topic, but I thought I would give a few highlights, particularly as developments concern the chapters. First, the Chapter "Angels" will be providing more support, encouragement, "hand-holding" and general help, especially to those chapters which seem to be having difficulties. Second, there was general agreement that our Society needs to promote student interest in EMC engineering. This resolve means that chapters must seek out and encourage students who indicate an interest in EMC/EMI. A new brochure emphasizing the advantages and privileges of student membership is being readied for print by Walt McKerchar. Third, names and addresses and other pertinent information regarding new EMC Society affiliates will be published in the *Transactions* and the *NEWS-LETTER* so that chapter officers will be able to contact newcomers.

CENTRAL NEW ENGLAND

On December 7, 1988, the Chapter had as its speaker Jim Havicek of Electro-Metrics. His topic was "Spectrum Analyzer or Receiver: Which to Choose for EMI Testing." He discussed the differences between an EMI receiver and a spectrum analyzer in terms of performance in EMI compliance testing. General Electric, Burlington, hosted the meeting which attracted sixteen attendees, including eight from the EMC Society.

The February, 1989, meeting featured Wade Selph of IRT/Maxwell Labs, San Diego. He spoke on "MIL-STD-461C Requirements for EMP Testing at the Box Level." Another meeting was to be held March 15, with Tony Genova of Chomerics speaking on "The Role of an EMI/TEMPEST Engineer." [Thanks to John Clark for the inputs.]

LONG ISLAND

Bob Brook, the EMC Society representative to the IEEE/USAB Social Implications of Technology Society, attended the January meeting, and your column editor is happy to report that the EMC Society is alive and well on "the Island." George Kunkel of Spira Manufacturing was the guest speaker. His topic was IEEE Standard P509 (transfer impedance measurement method for EMI gaskets and joints). There was also an animated discussion of the NAVAIR certification/accreditation program. Bob commented that this topic will continue to be the subject of debate. Several other meetings are planned, and five presentations by Chapter members are scheduled for Electro 1989.



by Charles F.W. Anderson

NEW JERSEY COAST

On January 17, this Chapter held a joint meeting with W/VT and AP. Henry Ott spoke on "Practical EMI Shielding." He focused on down-to-earth considerations in the design of shielding for commercial computer items including the importance of holes and seams and design for minimizing leakage.

The February meeting featured a discussion entitled "Multipath Fading and Diversity for Line-of-Sight Microwave Radio." The speakers were Sing H. Lin of Bell Communications Research and Ted G. Lee of Bellcore. They presented the results of a study in Mississippi which investigated the pattern, angle, and vertical space diversity. Apparently the last of these factors provided about an order of magnitude better improvement factor when compared with the others.

SANTA CLARA VALLEY

Fred Nichols was the speaker at the Chapter's January meeting. His subject was "The Role of Inductor Core Materials in Filter Performance." He detailed the advantages and disadvantages of the various "families" of materials available.

The February meeting featured Bill Wong of Apple Computers. Speaking on "ESD Test Standards," he discussed several published and draft-stage standards prepared by ANSI, IEC, SAE, IEEE Power Society, UL and others. His presentation was aimed at helping the "end user" who will eventually be obliged to adopt and to work with one or more of these documents when testing equipment.

TOKYO

Topics of papers presented at the December meeting covered a wide scope as is the norm for this Chapter. Topics included eddy currents induced in human bodies by overhead power transmission lines, anechoic chamber absorbing materials, and a variation of the Crawford Cell for testing the shielding of small items. A total of seventy-nine papers was presented in the course of 1988 by this very active Chapter! [Thanks to Chapter Chairman Toshiko Namekawa for the meeting reports and abstracts.]

(continued)

TWIN CITIES

On February 20, this Chapter held its first meeting of the year. Bill Kimmel of Kimmel Gerke & Associates spoke on the topic "VHF Radio Interference to Vehicular Electronics."

WASHINGTON/NORTHERN VIRGINIA

The January meeting was attended by your column editor who heard speakers Dan Macone and John Dawson of the NAVAIR Test Center, Patuxent River, MD. They de-

scribed the Air Combat Environment Test and Evaluation Facility (ACETEF), which is located at that base. The present facility has an anechoic chamber large enough to accept a complete fighter aircraft. Planning is underway for expansion which will include a chamber with four times the volume of the existing facility—large enough to accommodate the Navy's E-6A! The Chapter's annual Valentine Dinner was held February 18 and was a most enjoyable evening!

CALL FOR NOMINATIONS

Nominations are now being accepted for candidates for the IEEE EMC Society Board of Directors. In accordance with the Bylaws, nominations may be made by petition or by the Nominations Committee. The petition shown shall carry a minimum of 15 names of Society members, excluding those of students. Nominees should possess professional stature and significant technical skills in electromagnetic compatibility. They should have adequate resources and/or backing so as to be able to contribute actively to the Board of Directors, handling committee activities, correspondence, telephone calls, etc. Nominees must be full members of IEEE and members of the EMC Society. No member can serve for more than six consecutive years, including partial terms. All nominees are required to submit a biographical summary to the Nominations Chairman. The summary must not exceed one-half typewritten page and must be in the following format:

- | | |
|---------------|---|
| 1st paragraph | Name, title, place of employment, educational background |
| 2nd paragraph | Technical and professional experience |
| 3rd paragraph | IEEE service and activities including offices, committees, awards, etc. |

Petition forms and information can be obtained from the Nominations Chairman.

Please submit petitions and biographical summaries to the nominations chairman. Submissions must be postmarked no later than May 30, 1989.

B. Leonard Carlson
Nominations Chairman
516 Snoq. River Rd., S.E.
Carnation, WA 98014
(206) 773-6297

**NOMINATION PETITION
IEEE ELECTROMAGNETIC COMPATIBILITY SOCIETY
BOARD OF DIRECTORS**

I. NOMINEE'S NAME: _____

MEMBERSHIP NO.: _____

ADDRESS: _____

PHONE: _____

II. BIOGRAPHICAL SUMMARY: ATTACH TYPED COPY

III. SIGNATURES: (Minimum of 15 names.)

We, the undersigned, all of whom are current IEEE Electromagnetic Compatibility Society (EMC-S) members in good standing, nominate the above mentioned person to serve on the EMC-S BODS for a three-year term beginning January 1, 1990.

MEMBER'S NAME (PRINT)

SIGNATURE

MEMBERSHIP NO.

1. _____

2. _____

3. _____

4. _____

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17. _____

PRODUCT SAFETY

by John McBain

COMMITTEE REPORT

By now readers of this column have probably pondered the IEEE EMC Society sponsorship of the Product Safety Committee and have concluded, "Of course! Why didn't this happen long ago? The connection is obvious!"

Just in case someone found the connection not so obvious, let me try to clarify some of the reasons why our interests overlap. A brief description of the present structure and activities of the Product Safety Technical Committee (PSTC) follows.

COMMON GROUND

One of the first reasons we contemplated asking the EMC Society to help us join the IEEE was proximity. The several product safety engineers who first started meeting together in the fall of 1987 in San Jose, CA, were primarily involved in the computer industry. Usually they were working on projects along with an EMC engineer in the same department, section, or even cubicle. Quite frequently the same person held responsibility for both product safety and EMC compliance. So the questions arose, "Why do EMC engineers have all the fun? Why isn't there a group like the EMC Society for product safety engineers?"

The Santa Clara Valley Chapter of the EMC Society became somewhat of a role model for the start-up of the product safety group. We asked for advice on running meetings, group organization, publicity, locating technical speakers, joining the IEEE, and many other topics. We learned a lot from the "old hands." Special thanks is due Jim Duckett, presently Chapter Chairperson, for his encouragement. This encouragement took a very tangible form when the Chapter granted the local Product Safety Technical Committee two thousand dollars just after the EMC Society Board officially created the new Technical Committee.

The support we had received from our colleagues and friends who are IEEE EMC Society members "paved the way" for our asking for EMC Society sponsorship. The fact that many product safety engineers were also involved with EMC (or EMC engineers with product safety) made our request for sponsorship a certainty. There are technical and process oriented similarities between these two disciplines which constitute a large percentage of overlap, particularly for those of us in the computer industry.

A significant similarity is an interest in (or at least a responsibility for) the legal and regulatory aspects of our work. Although some might argue that such a concern is really not a part of electrical engineering, how many EMC engineers would be wandering around without jobs if the FCC and VDE regulations no longer existed? Also product safety engineers might well keep in mind the words of

an individual from one safety agency, "It's the law!" Probably few other areas of engineering are so intimately intertwined with the fluctuating requirements of rules and regulations, laws and standards as are EMC and product safety engineering.

However, there are more technical areas of shared interest e.g., the common ground. Different reasons, methods, test, and desired results must be accommodated by the same grounding on the same piece of equipment. Bypass capacitors versus leakage current has frequently been a "hot" topic of conversation at companies trying to comply with limits for both EMI and safety. Recent news stories have publicized the possible interaction between low-frequency electromagnetic fields and human health. In fact, a recent technical presentation by the SCV Chapter of the EMC Society on that topic was attended by a number of PSTC members. This list is not exhaustive, of course, but intended only to suggest that there may be more correlations between product safety and EMC than would first come to mind.

PSTC STRUCTURE

The organization of the PSTC is presently rather simple so now is a very good time to describe it. The EMC Society Board officially created this Technical Committee at their meeting in Seattle in August, 1988. Richard Pescatore was appointed the first Chairperson. At that time the Product Safety Group was already a growing association with four chapters and its own newsletter. However, the members desired affiliation with the IEEE. The Board has subsequently approved the following PTC positions: Vice-Chairperson, Jim Norgaard; Secretary-Treasurer, John McBain; "Newsletter" Editor, Roger Volgstadt; Paper Review Chairperson, Tania Grant; and an as yet unappointed Symposium Liaison Chairperson. The PSTC reports to the Board through Wilf Lauber and Don Heirman.

The activities of this group involve a lot of "learning the ropes" because of the recent start-up and the rapid growth of the PSTC. One major activity is the "Product Safety Newsletter," which is published bimonthly. The current mailing list contains approximately one thousand names. Anyone interested in product safety who would like to be added to the mailing list, should contact either Roger or me at the addresses listed below.

Local groups or PSTC "Sub-Chapters" are now active in eight locations: Cupertino, CA; Austin, TX; Chicago, IL; and Boston, MA. These groups hold technical meetings on a regular basis to explore such topics as "Product Liability," "Evaluation and Testing of Power Supplies,"

"SEMKO and UL," "How Safe Are Circuit Breakers?," "ETL, Present and Future," "Temperature Measurement in High RF Environment," and "CSA Update." These titles were taken from the "Calendars" printed in past issues of the "Product Safety Newsletter."

Each of these local "Sub-Chapters" is associated with its local EMC Society Chapter for administrative purposes, such as financing and reporting. However, each has its own chairperson who is considered a member-at-large of the main PSTC. In fact, Jim Norgaard, the PSTC Vice-Chairperson, is also the Chairperson of the Boston area group. Most of the local groups have already established or are establishing a local structure, based on the typical IEEE Chapter. This arrangement allows the division of tasks such as planning programs, sending out meeting notices, recruiting new members, reporting activities, etc. A simple chart of the PSTC organization is shown below.

ORGANIZATION

IEEE

EMC SOCIETY _____ PRODUCT SAFETY
TECHNICAL COMMITTEE
LOCAL EMC CHAPTERS _____ LOCAL PSTC GROUPS

I am sure that more complex charts could be drawn which would include more of the IEEE structure (*e.g.* Sections), but the fundamental relations follow the lines shown. What might the future hold? If I knew that I would be a lot richer; nevertheless, I will try to brush some of the dust off my crystal ball to explore some trends and possibilities in future columns.

To receive the "Product Safety Newsletter" contact

Roger Volgstadt
Tandem Computers
2550 Walsh Ave.
Santa Clara, CA 95051
FAX: (408) 748-2137

or

John McBain
Hewlett Packard
19447 Pruneridge Ave.
Cupertino, CA 95014
FAX: (408) 257-5034

CALL FOR IMPROVEMENTS AND SUGGESTIONS MIL-STD-462

Users of MIL-STD-462 "Electromagnetic Interference characteristics, Measurement of" are asked to provide the following information.

- What don't you like about it?
- What do you wish were better?
- What is missing, confusing, or ambiguous?
- What is just plain *wrong*?
- What could and should be better?

The G-46 (EMC Committee) of the Electronic Industries Association has taken on the task of soliciting comments, suggestions, and any other pertinent inputs relating to this outdated standard. All comments received will be consolidated by the G-46 Committee and submitted to the U.S. Air Force Office responsible for revision of this standard. G-46 then anticipates assisting in the preparation of a proposed MIL-STD-462A.

Users have both a unique opportunity and an obligation to participate in the generation of an updated standard useful to all. Please group comments into the following categories:

- Editorial corrections and updates of paragraphs 1 thru 5,
- Technical changes to paragraphs 1 thru 5,
- Proposed corrections of existing test methods,
- Proposed modifications or alternatives to existing test methods, and
- Proposed new test methods, and
- Proposed methods for improving tailorability and streamlining of requirements

Please state the exact notice and date of issue of the document upon which comments are based and the sections of MIL-STD-461C to which they should apply. Comments should be sent to the address below by May 1, 1989, or they may be brought to the G-46 meeting at the IEEE Symposium in Denver.

Arthur L. Haskins
Raytheon Company
Mail Code T25-L18
P.O. Box 1201
Tewksbury, MA 01876-0901

TECHNICAL COMMITTEES 1988 ACTIVITIES

by Wilf Lauber

The Technical Committees (TC's) of the EMC Society operate under the Director of Technical Services. Each TC is to promote activities within its area of technical competence by

- generating and reviewing papers for the *Transactions* and for symposia
- organizing and operating special sessions and tutorials at EMC symposia
- developing standards for its field of competence
- evaluating the "state of the art" within its field.

At EMC symposia, each TC holds an annual meeting open to all Society members. The next meetings are scheduled for Denver, CO in May, 1989.

TC-1: EMC MANAGEMENT

Russell Carstensen, Chairman

This Committee reviewed seven proposed papers for the 1988 IEEE International Symposium on EMC held in Seattle. Three proposed papers have been reviewed for Denver '89. The Committee presented a workshop on EMC Accreditation and Certification at the '88 Symposium. This workshop dealt with the draft operational and technical requirements of the National Voluntary Laboratory Accreditation Program for MIL-STD-462 EMC testing.

TC-2: EMC MEASUREMENTS

Don Heirman, Chairman

This Committee reviewed twenty-seven papers for the Seattle Symposium and thirty-three scheduled for Denver '89. In Seattle, they presented a tutorial on "Harmonizing Domestic and International RF Emission Measurement Practices." Presently they are organizing two tutorial sessions for Denver—"The New FCC Measurement Procedures for Computing Devices" and "RF Absorber Evaluation Techniques and Applications Experience."

TC-3: ELECTROMAGNETIC ENVIRONMENTS

Albert Smith, Chairman

This Committee reviewed eleven papers for Seattle and five for Denver.

TC-4: EMI CONTROL

Jim Parker, Chairman

This Committee reviewed twenty-four papers for the 1988 Symposium and fourteen for 1989. They have been quite busy with standards work this past year. A second draft for review is now available for P509 on "Transfer Impedance Testing of Gasketed Joints." Drafts are being consolidated for P478/482 on "Cable and Connector Shielding Characterization."

TC-5: EMP

Ed Vance, Chairman

In May, 1988, the Summa Foundation, in cooperation with the EMC Society and with the support of this Committee, organized the National EMP Meeting in Menlo Park. Three hundred participants from around the world attended this biennial meeting, the major unclassified EMP meeting held in the United States. They reviewed eleven papers for Seattle and seven papers proposed for presentation at Denver. In August 1988, C. Baum of this Committee presented a short course on EMP at the University of Michigan.

The Committee presented a workshop on "Standards and Standardization Issues" at Seattle. The workshop explored the problems of lack of experience and lack of feedback in EMP work, of delayed responses of digital circuits, and of test time comparable to MTBF. At their Seattle meeting, this Committee formed a new review committee consisting of five members. They also proposed to include high power microwave technology within the scope of this TC since much of the interaction and protection principles are similar to those for EMP.

TC-6: SPECTRUM MANAGEMENT

John Talbott, Chairman

This Committee reviewed twelve papers for the Seattle Symposium and three papers for Denver '89. Additionally for Denver they are organizing a tutorial session "Spectrum Authorization and Licensing."

TC-7: SEQUENCY UNION

Henning Harmuth, Chairman

This Committee reviewed fourteen papers for the *Transactions*. G.F. Sandy has continued work with CCIR Study Group 1A to develop standards for "frequency sharing," which is the technical term for the incorporation of nonsinusoidal waves into the RF spectrum assignments. They are at work organizing two sessions and a panel discussion for the 1990 IEEE International Symposium on EMC, scheduled for Washington, DC.

TC-8: PRODUCT SAFETY

Richard Pescatore, Chairman

This Committee is "concerned with the electrical safety of electronic products, safety engineering principles and their application, and the implementation of safety principles within organizations." They will be publishing a bimonthly newsletter.

REVIEWS

EMC '88 IN REVIEW

[Tom Herring has followed up his stint as papers editor for the EMC Symposium in Seattle by contributing the following summaries and comments. Tom reports he can't resist the opportunity to get in one last word on these topics.]

SESSION 2A

Power Reflection Method-Korstock—When is a pulse a pffft? In this ingenious, milestone method, it's controlled by FFT.

Finite Elements in a TEM Cell-Foo—This paper presents a neat, quick rough estimate of percent distortion of the field by the payload "to help predict maximum tolerable object dimension." Isn't the criterion a change in a cell current, rather than in field distortion?

Antenna Cable Error-DeMarinis—This topic had to be covered, and he's covered it. "Leakage power" might have warranted more extensive treatment.

On-Premises Testing-Coonce—This paper presents a compact, "how-to" method for handling the enormous EUT. The secret is to tune in on the clock (as in TEMPEST).

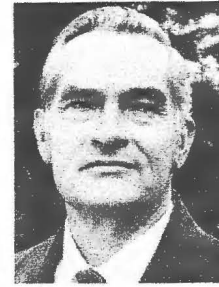
Diagnosis and Reduction of Conducted Emissions-Paul—This paper represents a good starting point for the concept of modes. It provides current and useful information and deals with LISN voltage; however, a current probe can resolve modes better than a voltage probe.

SESSION 2B

Response of Cable System to Transients-Garbe—This paper examines the transformation of frequency-domain response to the time domain.

Mode-Stirred Chamber for Cables-Crawford—This presentation is "solid gospel from the good guys of reverb." It improves the accuracy of stirred data and provides a straightforward examination of applicability.

EMP Coupling to Coax-D'Amore—This most useful paper compares two models. Read "Single Conductor Approach" as separate external and internal circuits, and read "Multi-Conductor Approach" as unified circuit.



by Tom Herring

Field-to-Wire Coupling to 18 GHz-Anderson—An anechoic chamber study of five cables and ninety situations is reported as effective area. A useful set of bounds is provided, and the derived shielding plot is fascinating (if believed).

SHF/EHF Field-to-Wire Coupling Model-Griffin—A bare wire is analyzed by the method of moments, and the results are simplified. The reason for transmission line modeling not working at these frequencies is explained succinctly. Lab verification concludes this thorough job.

(Reader awakes is now tested by comparing Anderson and Griffin at 10 GHz.

Here is the test:

In Anderson, bare wire, power received/incident density is -70 dB m^2 .

In Griffin, bare wire, current in 50Ω load is 0.1 ma due to an incident field of 1 v/m . That's $-63 \text{ dB watt received}$ from an incident density of $1/377$ or -26 dB watt/m^2 , which is -37 dB m^2 .

Test passed, reader is awake now.)

A Numerical System for Thin Wires-Dalke—The author presents a new general method with all the basics set forth and with good results. It resembles Benda's (See Session 3B) in that numerical integration over the surface of the wire is like an analytical boundary condition.

SESSION 2C

Rapid Wire-to-Wire Matrix Multiplication-Fellion—This paper presents a great improvement in calculation for twisted pairs. Multiplication should be read as "self multiplication."

Evolution of MININEC-Logan—The author explains both what MININEC can accomplish and where it can be obtained. "Mini" refers to a personal computer, not a mini-computer.

Enclosure Shielding by Finite Elements-Gravelle—A diffusion equation is shown to provide an elegant solution for a seamless box with holes. No frequency restriction is noted, but it would appear to be a low frequency solution. Can it do seams? The seam parameter would have to be put into the diffusion. This paper isn't for the picky. For example, in Figure 5 the magnetic field seems to be normal to the stripline plates; and in both Figure 3 and in Table 1, the test problems are cryptic.

(continued)

EMC Prediction by VAX-Kowalczyk—The author computes the ac magnetic flux linkage from transformers to circuit loops by solving the geometric problem.

Design of Matching Networks-Perini—Cleverly, a ladder network with arbitrary antenna load has been optimized by “numerical methods.”

SESSION 3A

Time-Gated Antenna Factors-Kashyap—This paper features site attenuation by network analyser.

Fields at a Measuring Site-Dvorak—After perusing this thoughtful, fertile essay, the reader should take each open site photon with the proverbial “grain of salt.”

Field Structure at an Open Site-Mishra—This paper covers very high resolution field mapping. The plots are iso-field lines in a plane and so they don’t overlay on Dvorak’s, which are plots of field vs position. However a comparison between the Acadian and the Alpinist is enlightening.

Scattering and Radiation Characteristics of RP Absorbers-Hansen—This paper includes some good experiments.

Absorbent Open Site-Tsaliovich—The monopole component of the EUT would pass through the rug; it just shortens the monopole height of the EUT. The balanced field would be in full space, and the monopole field would be in half space. However, there remains the matter of adequate absorption at 30 MHz, with a wavelength of forty feet.

SESSION 3B

Numerical Pulse Coupling-Bruns—The reader willing to “trudge through the idiom and the bumps” will find electricity made visible via a computer. The stop-time “photos” of current distribution are particularly nice. In particular, why do the resonances get bigger with frequency as shown in Figure 6?

Multiconductor Cable Response Modes-Beilfuss—The author makes an interesting attempt to resolve observed cable responses into modes by accurate extraction of spectrum peaks from short time data. Actually the purpose of the heavy math is to show that different modes have different propagation velocities and, therefore, unusual spectral peaks. This insight should spare the reader an attack of “inferioritis complexus.”

Radiation from a Transmission Line-Kami—The extraordinary pictures show a pulse leaving a mismatched line. The model is neat, but the analysis gets a little “hairy.” Can anything this complicated become part of our standard repertoire? Al Clark of Boeing read the “Summary” and advised checking *Morse and Feshbach*, p. 835. In summation, this paper is well worth reading.

Susceptibility of Cables in a Box to External Excitation-Rahman—The field in a wired cavity is solved by mathematics. I found a slip in the impedance between wires, but even so the results seem to condense out of math without precipitation by Maxwell. I noted a couple of problems:

In Equation 1 there’s no time; $e \exp j\omega t$ is “understood.” Thus the $\cos \pi x$ terms are standing on the wire. How can this add up to a traveling wave? In Equation 5 the “impedance per unit length on wire j ” is infinitely fat because it’s an infinitely thin wire. Lastly, in the same equation, isn’t the boundary condition at the wire surface on the total electric field?

Simple Shielding Effectiveness for Cables-Peel—This paper is a welcome attempt at a unified model. A particularly good point is that incident field coupling through braid apertures is significant. However, it seems inconsistent that this new coupling is measured, as in Formula 5, by conventional transfer admittance. A significant contribution is the set of simple S.E. formulas for a shielded, double-grounded wire with resistive load modeling the common mode response of multiple-wire circuits. Is this resistive assumption consistent with the ground rule of “useful up to the microwave region”? The first formula treats magnetic S.E. as a function of circuit loop impedance.

New Approach to Electromagnetic Coupling-Benda—At last, 88 years after Max Planck found the photon (or was it Caesar “ $h\mu$, Brutus?”) its shape has been revealed. It is Benda’s prolate spheroid! This paper is beautiful—i.e. complicated but elegantly done. Enter photon power; exit test functions for current distribution. Note the discussion of the dielectric constant in the (metal) segment? Otherwise this paper is most considerate of the reader.

SESSION 3C

Frequency Assignment for Land Mobiles-Delfour—The mathematical language in this paper seems perfectly suited to the chess-like problem of putting frequencies into cells.

Decongesting Navy Non-Tactical VHF-Dobberteen—Clearly, successful tactics have been employed in a comprehensive electromagnetic “catharsis” program. A good look at reality in radio communication.

Frequency Assignment Technique for Multiple Constraints-Green—The term “heuristic” has finally taken on meaning. Translate as “no linear algebra.” Actually the joke’s on me since I can understand neither Delfour’s algebra nor Green’s heuristics. The intriguing efforts of both authors merit further examination.

Spread Spectrum System with Adaptive Array-Tou—The author presents a concise tutorial on communication interference. There may be nothing new here; but more so than any other paper, this effort focuses on the direction which the EMC Society should take in regard to antenna-related front end EMC.

Selection of Optimum Modulation Indices for Simultaneous Range: Data-Nguyen—This paper features some marvelous developments. The reader arrives at Step 7 in the search procedure and finds that the modulation theme has thus far been left open. Whatever one might wish to know about modulation Nguyen knows!

Computation of Single-Tone Spurious Effects in Radios—Gavan—The author presents a practical and thorough guide to receiver design; it features the “forbidden list.”

SESSION 4A

Fields Radiated by Electrostatic Discharge—Wilson—This paper represents one of the very best efforts. The horn antenna is flat from 40 MHz to 1.2 GHz; and phase distortion in cabling is “deconvoluted out.” I lost the gist of the analysis where the electric field of charge in the arc was omitted (Equation 7). Also the arc model omits the conductor from the gap to the gun.

Avoidance of ESD Effects—Rhoades—Although not always smoothly written, this paper is a worthwhile melange of information and insight. I was taken by the point that an emission shield design does not necessarily provide ESD protection. In fact, it can aggravate it. The concept of reciprocity has been reexamined!

Test and Specification for Component ESD—Sperber—Here is a clear record of a clear-headed study. Rhoades’ question on latent damage doesn’t apply here; testing is designed “to kill.”

Standardization of Electrostatic Discharge Tests—Staggs—The message is that fourteen years of ESD testing has not produced consensus. Technology keeps changing.

SESSION 4B

System Modeling of ESD Penetration of a Two-Layer Plate—Chang—A transmission line analysis of a plane wave going through a laminate is done so well that the internal reflections never ripple the surface. As the curves are plotted only up to 2.5 megahertz, it’s not easy to relate this work to ESD. Also exactly what does the plastic layer accomplish?

Experimental and Numerical Results on Microwave Coupling into Cylindrical Enclosures—Turner—Here is a physically interesting experiment with a “mind-blowing” numerical prediction. I liked the cylinder; it’s cut clean in two—“cucumber slice fashion.” I once worked on a rocket nose cone which was threaded onto its body with hard-anodized threads. At the time, no one could calculate how thin the anodine had to be. Turner could have done it!

Megahertz Leak Detector for Aircraft Hardness Surveillance—Hoeft—The author sets forth an interesting and inexpensive way of exciting one of the world’s most beautiful structures, a Boeing airplane. The best mode was an apparent half wave on the fuselage (*i.e.* the 3 MHz one). The little spike visible on the verticle fin in Figure 1 is connected to an HF tuner covering the band of interest. For years, Boeing has used penetration by that HF for surveillance of fuselage shielding.

Performance of Aperatures—Casper—In this dandy job on holes, expression in terms of both power and effective area makes for a welcome uniformity. This paper definitely goes into my kit.

Test Methods for EM Shielding Materials—Kinningham—A lucid and thorough study which points to the NBS fix-

ture. One would hope that such evident talent would range beyond survey to invention. Dave Strawe and Lou Piszker in Seattle had worked the same problem and had settled upon a jewel of a solution, a cylindrical material sample. The world still awaits a small box test which really makes sense.

Shielding Effectiveness of the Magnex DC Composite—Abdelazeez—This useful data from a waveguide jig and additional interesting comments cause one to realize how the voids evident in the electron (how appropriate!) microscope affect the shielding by decreasing capacitance between the metal fibers. Think of the effect in the dielectric permittivity of the plastic!

SESSION 4C

Strategies for Spectrum Usage Measurements—Matheson—Here’s radio, folks. This excellent essay on churning in the ether could make anyone want to get a ham license. If Matheson drives as well as he writes, then his van probably got in and out of Seattle safely.

Occupancy Measurements in the RF Spectrum—Vaccani—This measuring system is so good that it almost beats Matheson’s anti-ubiquity theorem. It allows some of the “strategy” choices to be made after the data have been taken; one just changes the signal processing software.

Necessary Bandwidth of Digital Modulation—Cohen—Anyone who thought that this bandwidth was determined just by the bit rate has been indulging in wishful thinking. The practical “mud-ulation” facts are stated clearly here.

Spectrum Conservation Techniques for Fixed Systems—Farrar—One conclusion here is that the modulation and the antenna cannot be judged separately in all cases; the combined conservation should be judged. This paper also provides a good overview of the technical side of spectrum management.

Spectrum Conservation and Economic Tradeoffs—Webbink—Here is a good, eye-opening introduction to the significance of the spectrum in American life. Eyes may pop at the suggestion that private parties negotiate interference agreements and then notify the FCC.

Spectrum Efficiency of Spread Spectrum Systems—Baerwald—This paper gets off to a slow start, but eventually the author pulls off a dazzling essay.

SESSION 5A

Experiencing the New ANSI Normalized Site Attenuation—Farber—In this business-like job the initially measured attenuation was about 5 dB high at the low end and quite close at the high end. This regularity suggests that there may be a reason why those “antenna factory” factors did not work. I was reminded of c. 1960 when the standard went from “microvolts” to “per meter”—a deregulation of antennas. “Per meter” data obtained with big antennas is just not decently close to field strength. “Antenna factor” fudges.

Open Range Calibration at HF and VHF—McConnell—The data support adoption of proposed new standards.

(continued)

Antenna to Ground Plane Coupling-Bennett—Despite a “sand trap” and some “smoke”, I think his result is valid. His clever method is to keep the receiving antenna on the locus such that the field strength is independent of frequency. The “sand” occurs where he assumes far field, and the “smoke” is occasioned by the CRT screen photos at which I refuse to squint.

Note Five-Maeda—This fine and practical paper consists of a CAT-scan of Dvorak’s field shapes.

Quality Control of Open Site Calibration-DeMarinis—This paper is a lesson on how computer literacy may help blow away “the pile of feathers” swirling around open site testing.

Use of Wood in Open Area Test Sites-Dash—The discussion covers the use of wood and plastic for walls. I was hoping it would include “two-by-fours.”

SESSION 5B

Models for Circuit Simulators to Analyze Everything for Wires-Caniggia—Voltage sources are surrogates for wiring data in this candidate for best paper, or is Clayton Paul’s “Simple Spice” the best? (See below.) Both papers begin with Branin’s method, and both are exact solutions for multi-wires in the time domain using “Spice.” Paul makes the extension to multi-wire with an elegant mode idea and closes with a simple example. Caniggia makes the extension in a paragraph and proceeds on to many things.

Probe for Measuring Interference at ISDN Line Interfaces-Kuwabara—Here’s a modern try at one of the oldest stickers in EMI. Specifically how does one measure noise on signal interconnect lines? This is a valuable paper because it’s a competent step taken early in a new technology. The bibliography contributes fresh material to our common resources. A reader might have some problems with the paper. For example, voltage was picked over current because “maximum current points should be searched.” Well, current probes are better than voltage probes. In the clever simulation (and in general), it’s difficult to tell whether “input” is to the left or to the right. The references to electric field strength are irrelevant and confusing. Also I never did find out how they separated signal from noise. I’ve concluded that most of the difficulties are caused by idiom and that the basic idea is sound. *N.B.* Page 19 of Clayton Paul’s study is similar. Also, I thought he should have used current.

Effect of Bus Driver Devices on Transmission Line Emissions-Braxton—A welcome explanation of the EMI difference between logic driver families is provided. In the (large) system level experiment, the improvement brought about by substitution of the better logic family was almost completely obscured by some unchanged noise. The exact nature of that problem is not addressed. *Cf.* Coonce-Session 2A.

Suppression of Spurious Signals in Multi-Wire Transmission Circuits by Compensation Methods-Gottwald—Here’s a clever bag of tricks. One hangs out a lot more wires than needed and then decides which ones merit lis-

tening. This arrangement resembles spread spectrum; however, the wires weren’t very multiple until they were fixed.

Simple Spice Model for Coupled Lines-Paul—Here is another solid contribution—a method which can be put to use readily. The author presents a pellucid explanation, and decoupling the multi-wire equations using modes is accomplished elegantly.

Control of Power Supply Ripple Sidebands-Edelman—RF designers will welcome this practical treatment of power quality.

Radiation of Microstrip Transmission Lines-Simpson—The first part treats the open site field of a wire, and the second part takes up the title subject. I’d like to read the original master’s thesis, including magnetic *current* and *vector* electric potential. Did Heaviside do that?

SESSION 5C

Intermodulation Distortion Caused by Transient Protection-ter Haseborg—This paper is a good introduction to a rare system approach to antenna protection. Does the example design favor signal performance over transient performance?

Use of Non-linear Figures of Merit for Assessing Receiver Specification Compliance-Spina—This work is an able mathematical derivation of the relation between measures of non-linearity.

Atmospheric Noise Implementation in an HF Simulator-Cohen—This paper is not available.

Equipment Modeling for EMC-Sargent—Sundry antenna interaction softwares are presented in a very modern, graphic incarnation. The idea, not the squinty illustrations, looks just great!

SATCOM versus Radar Interference Model-Foreman—On the communications fringe of EMC, one finds this adroit and attractive handling of messy variables.

RF Barrier Effectiveness-Riggs—This beautiful stuff isn’t radio noise. Radio noise oozes; it doesn’t diffract as in this crystal clear display. There’s some good work involving hot spots behind the barrier, but what does this privacy screen do to the pattern of the transmitter?

Attenuation of 400 MHz in a City-Chandra—This good field work contains the explanation for the squawks emanating from taxi radios. The consonants go left round the highrise while the vowels go right, and they don’t quite come back together.

SESSION 6A

Writing EMI Test Automation-Sikora—Here speaks the voice of experience and to everyone’s benefit!

Design of a Broadband Field Sensing System-Berger—This engineering complements Dr. Kanda’s vision nicely.

NBS Calibration of Dipole Antennas-Camell—Testers will be glad for this contribution. In the standard antenna method the source is separated by “at least two wave-

lengths at the receiving antenna." Is a rethinking of some of those papers on site attenuation warranted?

Effect of Ground and Walls on Antenna Impedance—Mishra—The prize cameo of EMC '88 hangs here. These pictures are going to be used extensively!

EMC Measurement Technique for Communitronics Equipment—Kohlbacher—The latest idea from the driest laboratory in the U.S. is a winner. In closed loop testing of open loop systems, the modulations can have it out in a full dress rehearsal, and only the coupling requires some guessing.

SESSION 6B

Power Line Field Measurements in an Office Building—Nielson—The power line put 5000 v/m on the roof and not much inside. The magnetic field inside was 10 a/m.

Automotive Conducted Transients—Cangellaris—The spec candidate susceptibility pulse is developed from auto transient data so that the spectrum of that test pulse lies just below the spectrum of the data pulse. In Figure 5 the two spectra are plotted as dBv/Hz versus linear frequency.

Conduit Ground Adaptor—Dixon—The subject is threads, and I'm beginning to realize that getting a good bond across threads may not be as simple as it seems.

Unique Bonding Methods for Spacecraft—Fos—The author explains the technique for achieving a thermally-bonded joint.

Radio Noise Caused by Railways—Lin-Chang—This paper is a "gem" filled with information and a real delight to read. Cumbersome, yet effective, instrumentation is followed up by sweatware to yield a sophisticated statistical noise analysis. Readers may do a "double-take" on the way the fall-off data are obtained. The theory is that the fall-off rate is altered by the presence of the steel rail. At 1 MHz, the computed fall-off is $r \exp -1.3$ and the measured rate is $r \exp -1.4$.

Statistical Radio Interference 750 kV Transmission Lines—Timashova—Weather, line condition, and fall-off with distance are described most thoroughly. At 500 kHz, the measured fall-off was $r \exp -1.6$, standard deviation 0.16. The Chinese trolley noise fell off thusly—(1 Mhz) as $r \exp -1.4$ and (200 kHz) as $r \exp -1.8$. Maybe the Russians have steel-reinforced earth.

SESSION 6C

Avoiding Imposition of Immunity Regulations—Heirman—The calm tone belies the strength of the forces in this evolving social drama. What does it mean that our EIA is concerned with TV receivers made elsewhere?

EMC of Commercial Equipment for Military Use—Bronaugh—Valuable perspectives which procurement officers should get their hands on, and the crisp writing should assure that they do. In particular, the fix list says a lot.

Militarizing a Personal Computer—Bernstein—This paper is both ingenious and professional. Why can't this customer tolerate screen emissions? Spare Bush's budget!

Selling EMC—Braxton—The author notes, "Each organization is different . . ." As I read this constructive essay, I thought how very true—especially regarding TV makers or any maker of a product having the EMI spec boiler-plated onto it.

Transient Protection for Traffic Control Equipment—Denny—This overview makes intriguing reading for those interested in traffic control or in transients.

EMC Practice for Launch Vehicles—Li Yiming—It's interesting to learn how it all seemed to a distant observer.

Anyone needing additional copies of the *Symposium Record* of the IEEE 1988 International Symposium on Electromagnetic Compatibility should write—

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UPDATE ON BANGALORE

Those planning to attend the EMC Workshop in Bangalore, India, September 12–16, 1989, (see *NEWS-LETTER* Calendar Section) should take special note of the following dates.

Mailing of author's kits	April 15, 1989
Last date for submission of camera ready manuscripts	June 15, 1989
Workshop Dates	Sept. 12, 13, 1989
Conference Dates	Sept. 14, 15, 16, 1989

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Please send all corrections and changes to H. R. Hofmann.

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Feb 28, 1989

EMCABS



by William H. McGinnis

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<p>Investigation of Electromagnetic Interference from Industrial Radio-Frequency Equipment Hideo Tanaka, Akiumi Kuriyama NTT Electrical Communications Laboratories EMCJ87-20 Meeting June 26, 1987</p> <p>ABSTRACT: Noise voltages are frequently observed on inside cables and wires when industrial radio frequency equipment is used nearby. These noise voltages interfere with telephone sets and other communication devices. This paper shows the measurement results of the induced voltage on the cable and the method used to reduce the noise.</p> <p>INDEX TERMS: Radio-frequency equipment, induction voltage, EMI, EMC</p>	<p>EMCABS: 01-04-89</p>	<p>The Detection Performance of Rayleigh Fluctuating Targets in Correlated Gaussian Noise Xiu-Ying Hou,¹ Norihiko Morinaga² ¹NW Telecommunication Engineering Institute, Xian, China ²Faculty of Engineering, Osaka University, Suita-shi, Japan EMCJ87-28 Meeting July 20, 1987</p> <p>ABSTRACT: This paper presents the derivation of the detection performance of a receiver (with post-detection integrator) for a Rayleigh-correlated fluctuating target in a correlated Gaussian noise environment. Analytic expressions describe detectability as a function of SWR. The number of pulses integrated is given. The correlation matrix of both noise and signal fluctuation are obtained. A set of plots gives the numerical results for a first order Markov exponentially correlated model of noise under Swerling 1 and 2 and for partially-correlated fluctuating target assumptions, respectively. The correlation loss is approximated by a unified empirical formula.</p> <p>INDEX TERMS: Radar signal detection, noise correlation</p>	<p>EMCABS: 04-04-89</p>
<p>Leakage of Electromagnetic Waves from the Door Mesh of Microwave Ovens Jun'ichiro Ishihara, Masao Haga, Tetsuo Ideda Nagoya Institute of Technology EMCJ87-19 Meeting June 26, 1987</p> <p>ABSTRACT: This paper describes the leaking characteristics of the doormesh of the microwaveoven. The authors measured the microwave power which passed through the punched metal of the oven.</p> <p>INDEX TERMS: Microwave oven, leaking microwave power</p>	<p>EMCABS: 02-04-89</p>	<p>Polarization Characteristics of Thin Type Absorbers Obtained by the Spatial Network Method Yasuhiro Kakimi, Norinobu Yoshida, Ichiro Fukai Faculty of Engineering, Hokkaido University EMCJ88-15 Meeting June 24, 1988</p> <p>ABSTRACT: An electromagnetic wave absorber is used to reduce scattering. In order to design an effective absorption system, it is important to estimate the angle and polarization of the incident wave. Using the Spatial Network Method, numerical analysis is applied to the absorber under test.</p> <p>INDEX TERMS: Thin type absorber, scattering, polarization, oblique incidence, Spatial Network Method</p>	<p>EMCABS: 05-04-89</p>
<p>Experimental Freespace Propagation of Infrared Rays Using the Spread Spectrum System Naoyuki Yamada, Tetsuo Ideda Nagoya Institute of Technology EMCJ 87-6 Meeting May 22, 1987</p> <p>ABSTRACT: This report shows that freespace propagation characteristics of infrared rays can be improved in the noisy and weak infrared signal environment by using Spread Spectrum system. The authors have shown one investigation of data signal coding in baseband direct sequence.</p> <p>INDEX TERMS: Spread Spectrum, infrared rays</p>	<p>EMCABS: 03-04-89</p>	<p>Measuring Electromagnetic Field Strength with a Small Sensor Tatsuichi Kawana,¹ Junichi Komuro,² Koichi Makino³ ¹Radio Equipment Technical Certification Institute ²Communications Research Laboratory, M.P.T. ³Tokyo National College of Technology EMCJ88-30 Meeting June 29, 1988</p> <p>ABSTRACT: An instrument with a small sensor was developed for measuring the three-dimensional distribution of electromagnetic fields. The sensor's measurement range is 0.1 mV to 100 mV. Characteristics are described for a sensor using a small antenna, which can be positioned precisely by remote control to alleviate interference caused by an operator's body or by other instruments.</p> <p>INDEX TERMS: Positioner, sensor, electromagnetic field</p>	<p>EMCABS: 06-04-89</p>

<p>The Canada Gazette Part II—SOR/88-475 RADIO ACT—Radio Interference Regulations, Amendment Her Excellency the Governor General in Council <i>The Canada Gazette</i>, Part II SOR/88-475 Minister of Supply and Services Canada 1988— Queen's Printer for Canada, Ottawa, 1988 Vol. 122, No. 20; pp. 3956-3965</p> <p>ABSTRACT: Canadian Regulations are published as Part II documents in <i>The Canada Gazette</i> (cf. the U.S. <i>Federal Register</i>). The first public notice of the "proposed rule" appeared in the <i>Canada Gazette</i> Part I in March 1986. The Part II amendment of the Radio Act was prompted by increasing instances of interference (noise) signals from digital apparatus (clock signals in excess of 10 MHz). The proliferation of such equipment and the fact that equipment not meeting FCC Rules for Computers in the U.S. was being dumped in Canada are the probable causes. The subject regulation went into effect on January 31, 1989.</p> <p>INDEX TERMS: Canadian regulation of emission, computer emissions, Canadian test method for measurement of emissions</p>	<p>EMCABS: 07-04-89</p>	<p>Discharged Current Characteristics from the Hane Type Noise Simulator Yoji Nagasawa Faculty of Engineering, Kagoshima University EMCJ87-33 Meeting July 20, 1987</p> <p>ABSTRACT: In this report, the author discusses the high frequency noise currents associated with electrostatic discharge. Noise current spectra below 200 MHz were observed. In this range, the maximum and minimum spectrum appeared at 10-20 MHz and 35-45 MHz, respectively. The frequency where the maximum or the minimum spectrum appeared moved with changing discharged objects, discharging points on the objects, the height of the discharge cable from the ground plane, or the grounding points of objects.</p> <p>INDEX TERMS: RSD, discharged current, spectrum of noise currents</p>	<p>EMCABS: 10-04-89</p>
<p>Voltage Fluctuations at Electric Contacts during Closure K. Kawamata,¹ S. Minegishi,¹ K. Ohnuma,¹ A. Haga,¹ R. Sato,¹ T. Konno,¹ K. Isawa,² S. Ohhira,² K. Suzuki² ¹Tohoku Gakuin University, ²Tohoku Electric Power Co. EMCJ 87-26 Meeting June 26, 1987</p> <p>ABSTRACT: Voltage fluctuations at electrical contacts during closure were examined for low AC voltage at atmospheric pressure. A model was constructed which consisted of a slide transformer, contacts as a disconnecting switch, and a flexible coaxial cable which was open-circuited. Based on this model, an experiment was carried out to determine voltage waveforms between the inner conductor and the outer conductor (ground) of the cable in the case of contacts which are closing. It became clear that the waveform consists of multiple reflections of the impulse voltage caused by discharge and transient response of the model systems after the contacts are closed.</p> <p>INDEX TERMS: Disconnecting switch, voltage waveform, discharge, multiple reflections, transient response</p>	<p>EMCABS: 08-04-89</p>	<p>EMC Assurance: System or Circuit Issue? Daniel J. Kenneally Rome Air Development Center Wescon 88</p> <p>ABSTRACT: Today's electronic systems whether military or commercial, are prodigious users of complex, semiconductor integrated circuits (IC's). The dual goals of cost effective design and electromagnetic compatibility can be elusive. Achieving and verifying EMC can involve multidimensional design parameters. Traditional EMC design methodologies may no longer offer the best approach. Alternative approaches based on micro-hardening at the PC board and IC device levels merit serious consideration. Circuit aspects of competing EMC strategies are examined.</p> <p>INDEX TERMS: EMC, susceptibility, vulnerability, environments, design microcircuits</p>	<p>EMCABS: 11-04-89</p>
<p>An Experimental Study on the Noise Suppression Effect of a Toroidal Core Masayuki Kobayashi,¹ Hisoshi Inoue² ¹Hokkaidenshi Co., Ltd., ²Akita University No. EMCJ88-43</p> <p>ABSTRACT: The toroidal core of a noise filter which suppresses high frequency components are studied. Properties of the cores used include nonlinearity of inductance, core loss, and measured frequency characteristics of impedance. The experimental effects on noise suppression were obtained using a simple 4 MHz squarewave generator. The noise suppression effect is changed significantly by the core material and by the number of the turns of the coil.</p> <p>INDEX TERMS: Noise filter, toroidal core, noise suppression</p>	<p>EMCABS: 09-04-89</p>	<p>MMIC EMI Test Procedures John P. Rohrbaugh and Brian R. Farris Georgia Tech Research Institute Wescon 88</p> <p>ABSTRACT: On a current Air Force program, Contract No. F-30602-87-R-0117, "RF MMIC Test Methodology Definitions" states the Georgia Tech Research Institute (GTR) is developing methods of performing conducted electromagnetic interference tests within the framework of existing functional tests for monolithic microwave integrated circuits (MMIC's). Tests applicable at the wafer, packaged IC, and module levels of fabrication are being investigated.</p> <p>INDEX TERMS: MMIC, test methodology</p>	<p>EMCABS: 12-04-89</p>

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July 24-28

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August 14-17

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- August 22-25 1989 International Symposium on Antennas
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Swiss Federal Institute of Technology
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