

IEEE EMC SOCIETY

NEWSLETTER

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ROBERT D. GOLDBLUM, *Editor*



ROBERT D. GOLDBLUM
EDITOR

ine months ago, I notified the EMCS Board of Directors of my intent to retire as editor of the Newsletter after I completed my 120th issue encompassing the past 30 years.

Thus, this is my last issue as editor. By no means does this mean that I am retiring from work. I feel that I have taken my turn as editor and it is now someone else's turn.

The Board of Directors has selected my successor, Janet O'Neil, the daughter of Fred J. Nichols, who was an ardent supporter of the EMCS. Janet is vibrant, energetic, and deeply involved in many EMC projects and events. In fact, she served as an associate editor over the past year and her column can be seen on page 4 of this issue. Janet now appears as an associate editor on page 3. Her place at the top will begin with the next issue late this summer. I offer Janet my best wishes for success and longevity at this new and challenging undertaking.

It is difficult for me to relinquish this position since the IEEE EMCS has given so much to me. I became the editor in 1967 after Rex Daniels, editor for the first 10 years, searched for a replacement for at least two of those 10 years. Having accepted the Newsletter challenge, I was subsequently appointed Chairman of the 1971 EMC Symposium. Although I asserted that I was an "unknown," Dr. Ralph Showers reassured me that I would gain the required exposure as editor of the Newsletter. The planning and conducting of the Symposium, together with the preparation of the Newsletter, led to visions of a new publication totally dedicated to the EMC industry and provided the contacts necessary to establish the publication *ITEM* in 1971. One thing led to another, resulting in a rather successful career in the EMC business.

I mention these things because I know many other individuals who have voluntarily served on professional society EMC organizations and have experienced similar rewards. I want to encourage young EMC engineers who are still mapping their careers to volunteer and participate in EMC Society activities. Certainly, much of the return is self-satisfaction and increased self-esteem. These all contribute to optimizing a career.

There are a lot of people who I should thank and acknowledge. First are the associate editors. These are the people who have continuously submitted material for the Newsletter with a minimum of reminders, on time and without much acknowledgment. Unfortunately, my records on the associate editors are somewhat disorganized and I do not have all back issues of the Newsletter. (Who would have thought I would have had to go back so far to gather this information.) But with the help of recollections from most of the associate editors, I have compiled some stats which I believe to be relatively accurate.

Bill Duff, the associate editor for EMC Personality Profiles, told me recently that he first started as the associate editor for Problems and Solutions some 20 or 25 years ago. My copy of the October 1971 issue lists Bill as the associate editor for Steering Committee Reports. He and Ira (Marty) Berman were the first two associate editors. Marty resigned in 1973 when he left our industry. Bill Duff is still going strong and continues to profile notable members of our EMC Society for the Newsletter. Thus, I owe a special thanks to Bill for all his years of support and dedication.

It was in 1983 that Anthony Zimbalatti finally accepted my prodding to write a column on Point and Counterpoint. His arguments were always stimulating and often controversial, and I was sorry when he resigned in 1996. Bill McGinnis took over Abstracts in 1985 and continues the job as the Abstracts Associate editor. I have to thank Ed Bronough, who from 1973 to 1983, handled

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the EMC Abstracts and was responsible for Application Notes from 1983 to 1996. The best Don Heirman and I could piece together was that he started as an associate editor for the Newsletter around 1988. But my records show him writing the BoD reports in 1983. Norm Violette and Ray Perez started together as Book Review editors in 1990 and continue to do excellent work in reviewing and critiquing a full harvest of EMC books.

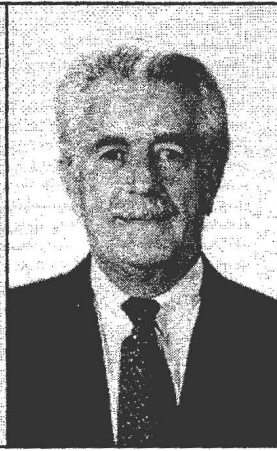
Next to join the staff was Todd Hubing, who took over Chapter Chatter in 1992. With his great sense of humor, Todd reminds me of Marty Berman. Stick with it, Todd. And now there are two relatively new associate editors, Bob Rothenberg and Janet O'Neil. Bob had repeatedly volunteered to participate and we finally got it together last year. Hopefully, Bob will continue to compile practical papers for the Newsletter. Janet started last year by reporting on EMC Board of Director activities, which I hope she will continue to do as Editor of the Newsletter. No, I haven't forgotten Dick Ford. It's just that neither of us can remember his first issue. Dick took over as the photographer for the Newsletter after Fred Nichols passed away in 1990, and reported on EMC BoD activities for awhile.

Before I sign off, I look closer to home and give special thanks to Michele Elkes, who served as my ghostwriter, English editor and associate editor point of contact. Thanks also to Chris Frost, who served as production manager for the past eight years by providing the coordination with the printers, IEEE headquarters and mailing houses, and to Patricia Shea for graphics, layout and typesetting. I must also thank my wife, Barbara, who gave me support and love as issue after issue blended into memories.

By chance of fate, I have come across a few older issues of the EMC Newsletter. Since we have some extra space in this issue, I would like to reprint some of the material as examples of how things have changed, and as examples of how things have not changed. This special section starts on page 23.

Congratulations Janet, your Dad would be proud.

President's Message



**BILL GJERTSON
PRESIDENT,
EMC SOCIETY**

1997 continues to be a great EMC year with the EMC Society membership at 5023 and growing. EMC activities are numerous, job opportunities for EMC Engineers are outstanding and the development of electronic products requiring EMC engineering continues at a phenomenal rate. Exciting work and professional growth for EMC engineers are everywhere.

The Zurich 1997 EMC Symposium was a huge success and the IEEE EMC Society Board of Directors and officers were there as a group to represent your international EMC Society and benefit from the experience. Actually, with regard to format, the EMC Zurich '97 Symposium was a typical EMC Symposium and many of the attendees were fellow EMC engineers you would

expect to see at any EMC Symposium. In fact many of our members, including Directors, presented papers at EMC Zurich '97. However, this EMC Symposium was at a non-U.S. location. So what's my point?

The IEEE is an international organization and the EMC Society is an international Society. You, the members, and your personal affiliations (companies, universities and other organizations) have enabled this transition from national to transnational, which I believe began years ago and which you have furthered each year. The EMC Zurich '97 Symposium was not an international IEEE symposium in name, although the IEEE EMC Society had made a cooperating agreement as we have done previously with EMC Zurich '97 and other "Outside-the-U.S." EMC Symposiums such as those held in Wroclaw, Rome, and the UK.

Engineering is international, EMC is international and our EMC Society is truly international. Ferdie Mayer, our Transnational Committee Chairman, the spearhead of our international activities within the Professional Services Directorate, was active at the EMC Zurich '97 Symposium, particularly at the IEEE EMC Society Booth. Another very involved chairman was Don Heirman of the EMC Standards Committee. The Standards Committee held a meeting at the Zurich Symposium and many visitors attended. Numerous EMCS Directors participated in the EMC Society booth and at various events associated with the EMC Zurich '97 Symposium. At the close of the EMC Zurich '97 Symposium, the EMC Society hosted a reception for invited EMC Zurich '97 participants and held a Board of Directors' meeting open to all. The EMC Zurich '97 event does focus our thoughts on international EMC and the activities of our fellow EMC engineers.

Are we one big happy international Society or are we challenged with issues we must face and undertake before we can rightly claim to be an international EMC Society? We all must make this assessment and act accordingly. Globalization is an IEEE goal and one we, the EMC Society, aspires to as we march forward. We need to benefit from the EMC Zurich '97 experience and implement some international initiatives to support globalization of our Society and the Institute.

At our Board of Directors' meeting, a number of ideas to benefit our members worldwide were discussed. They included scheduling a tutorial at the EMC Symposium in Austin to be presented by a Zurich instructor, investigation into financial assistance to symposium authors and other attendees, and financial support toward membership for selected areas and/or groups. We have always been able to identify areas where financial help would help. Now we need to become economists and use the EMC Society funds for the maximum benefit of the members. This is our mandate. We ask for your help. Again, volunteer time and funds! Your thoughts and ideas in really promoting and expanding the "International IEEE EMC Society" are requested and always welcome.

IEEE EMC Society Technical Committees

(Thanks to the new Chairman of the Technical Activities Committee (TAC), Kimball Williams for this article.)

The IEEE EMC Society is made up of several committees which oversee specific activities of the Society. One of these groups is the organization that we call the Technical Committees. These committees provide technical guidance to the Board of Directors and the general membership. Each of the nine technical committees provides expertise in a particular technical area.

Responsibilities of the technical committees include:

- Periodically sponsoring workshops or special sessions at the annual symposium
- Reviewing papers submitted for presentation at IEEE EMC Society-sponsored symposia
- Initiating or contributing to standards activity in their technical area
- Monitoring and informing the membership of new developments in their technical area
- Providing technical assistance and advice to the EMC Society Board of Directors

The committees are focused toward specific aspects of EMC engineering. These focuses are indicated by the committee names.

One regular meeting of each of the technical committees occurs in conjunction with the IEEE EMC Symposium. This year, these meetings will occur on Tuesday and Wednesday during the symposium week in Austin, TX. We invite all interested individuals to check for the meeting times and locations and drop by.

To help you select which particular committees might be of interest to you, the following is a description of the charter of each of the committees. If you have a special interest in the activities of a particular committee, please contact the chairperson now and begin to get involved in the committee's activities right away. There is no need to wait until August. We look forward to working with you.

TC-1 EMC Management

This committee is concerned with the management aspects needed to assist in the development of in-house EMC programs and in the development of management tools by which EMC requirements can be integrated into the various phases of system development. These phases include design, production and quality assurance. Applicable standards (commercial or military), control plans, test plans, design guides, and personnel on-the-job training are typical areas of concern for this committee.

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TC-2 EMC Measurements

This committee is concerned with the measurement and instrumentation requirements in EMC standards and procedures and how they are interpreted. The committee is also concerned with the adequacy of measurement procedures and measurement instrumentation specifications for radiated and conducted emission and susceptibility tests and the rationale for performance

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IEEE EMC Society Newsletter Publication Schedule

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JANET O'NEIL
ASSOCIATE EDITOR

The first meeting in 1997 for the EMC Society Board of Directors was held in Zurich, Switzerland on February 21. This meeting was scheduled in conjunction with the EMC Conference held biannually at the Swiss Federal Institute of Technology. In attendance were President Bill Gjertson, Vice-President Dan Hoolihan, Secretary Janet O'Neil, and Board members Kimball Williams, Andrew Podgorski, Andy Drozd, Dick Ford, Norm Violette, Todd Hubing, Len Carlson, Bob Hoffman, Bill Ritenour, Don Sweeney, Don Heirman, and Joe Butler. Absent Board members were Bill McGinnis, Jim Muccioli, Bill Duff, Warren Kesselman, and Herb Zajac. Guests present included Leo Makowski, Ed Bronaugh, Constance Brown, Patricia Fitzgerald, Gabriel Meyer, Mark van Helvoort, Barry Wallen, Dag Bjorklof, Diethard Hansen, and Albert Biggs.

President Gjertson called the meeting to order at 10:00 am. He thanked Dr. Meyer, Chairman of the EMC Conference, for the hospitality his committee had extended to the Board during its visit to Zurich. A round of introductions was made.

The agenda for this meeting was different than for previous Board meetings. Since the Board was holding an open meeting with guests, the agenda was tailored not towards specific reports, but rather towards presentations by the four Service Directors and the Vice-President to provide an overview of the activities of the EMC Society Board of Directors. Thus, Vice-President Dan Hoolihan spoke first about the Society's Long Range Plan which is reviewed every two years. The goals and objectives of the plan were addressed. It was noted that the long range strategy of the Society has not changed significantly over the past five years. Increased member benefits, expanding EMC education, and standards development continue to receive top priority. Joe Butler,

Director for Technical Services, spoke about the committees under his directorship and advised how they are specifically addressing the Long Range Plan. Leo Makowski, Representative Advisory

Committee (RAC) Chairman, discussed the many professional organizations with interests related to EMC. He described how the EMC Society liaisons with some of these organizations to further enhance mutual interests.

Todd Hubing, Director for Member Services, reviewed the activities of his directorship. He encouraged the formation of new EMC Society chapters internationally. The membership application process has been streamlined to make it easier to join both the IEEE and the EMC Society at the same time. The short term goal is to attract new international members from Regions 8, 9 and 10.

Len Carlson, Director for Communication Services, discussed the CD ROM project being undertaken by his directorship. This is their key contribution to the Long Range Plan as this project provides a significant member benefit. The CD ROM set of four discs will include the symposium records from all the past IEEE EMC Society symposia. This will be sold at a greatly reduced price to EMC Society members.

Norm Violette, Director for Professional Services, followed with his presentation. The current emphasis of his directorship is transnational activities. It was reported that 16 new members were signed up in Zurich at the IEEE EMC Society membership booth. The Society will participate as a co-sponsor with several upcoming EMC conferences in Europe. The IEEE EMC Society membership booth will be set up at these conferences to promote membership under the able stewardship of Ferdy Mayer who is based in France. Dr. Mayer's skill in four languages enables him to uniquely promote the EMC Society internationally.

Don Heirman, Standards Committee Chairman, next gave a report on the activities of his committee. He reviewed the agenda from their committee meeting which was held immediately prior to the Board meeting. Some 35 people attended this meeting. One of the reasons the Board decided to hold a meeting in Zurich was to encourage outreach efforts to international members of the EMC community. International volunteers were sought out to work with the EMC Society in developing standards and on various other committees. The goal is to enhance the global perspective of the activities of the EMC Society. At the morning meeting, the Standards Committee Organization Chart was presented. Mr. Heirman announced that over the past three years, the committee has gone from a strictly U.S.-based focus to a new global focus. The new organization structure reflects this shift to a global emphasis. Mr. Heirman

During the EMC Society Board of Directors' reception in Zurich, Board members Andrew Podgorski (l) and Kimball Williams (C) converse. Ryszard G. Struzak (r), a member of the International Telecommunications Union (ITU), Radio Regulations Board, Switzerland, is also pictured.



was very pleased with the international interest in the Standards Committee as evidenced by the many visitors at their meeting. He noted that the Europeans at his meeting were concerned with issues related to surge testing/power quality and also to the testing of modular computer components.

The Board then adjourned for lunch. This was a special treat as Dr. Meyer, of the Swiss Federal Institute, organized a private luncheon for the Board members and guests at the private faculty club which is located on the top floor of the Institute. The club features panoramic views of the city of Zurich, the lake, and the surrounding hills. Fortunately, the day was clear and sunny so the view could be enjoyed to its full potential.

After lunch, the meeting reconvened with the report of Kimball Williams, Chairman of the Education Committee. Mr. Williams is also the new Technical Activities Committee (TAC) Chairman. He advised that all the TAC Chairmen will meet during the symposium in Austin. A database of all TAC members will be completed by the Austin meeting.

Todd Hubing commented upon the recent IEEE membership conference in New York which he attended. He noted that the emphasis was on "GOLD," or Graduates Of the Last Decade. The IEEE is trying a new program to recruit and retain graduate engineers. Mr. Hubing also noted that

the proposed Distinguished Lecturer program for Europe is being evaluated. Obstacles to the program include language barriers, travel logistics, and conflicting topics of interest.

Under new business, a general discussion was held concerning the topic of assisting those engineers who could not otherwise attend the IEEE EMC Symposia due to financial limitations. It was noted that this issue is being addressed by the Austin symposium committee. For example, the call for papers to authors stated that financial assistance may be extended to authors whose papers are accepted and who require financial assistance to attend the symposium and present a paper. Also under new business, the Board discussed the possible need for a new Technical Committee to address the area of medical devices and EMC. Lastly, Norm Violette personally invited everyone present to attend the one day EMC conference organized by the Washington DC EMC Society chapter. This will be held on May 1, 1997.

President Gjertson concluded the meeting by once again thanking Dr. Meyer and his committee for all their efforts towards making the Board's visit to Zurich a tremendous success. The meeting adjourned at 5:00 PM.

Other Highlights of the Zurich Board Meeting

The EMC Society Board of Directors



Art Wall of the FCC addresses the "12th International Symposium and Technical Exhibition on EMC" attendees as the keynote speaker during the opening ceremony.

had two reserved tables at the Wednesday evening symposium banquet which was held at the Grand Hotel Dolder in Zurich. One of the most poignant moments for EMC Society members attending the conference occurred at this banquet. Leading EMC Society member Clayton R. Paul officially announced his retirement as Chairman of the Technical Committee for the Zurich EMC conference, a position he has held for many years. In his speech, he commented upon the lasting international friendships he has forged as a result of his participation with this conference. His able replacement will be Fred Tesche.

The Board hosted an informal cocktail reception at the Hotel Tiefenau on Thursday evening during the conference week. The purpose of the reception was to enhance dialogue between the EMC Society and those active internationally in EMC. This was an ideal opportunity to educate potential volunteers on the benefits of involvement in the EMC Society. More importantly, it was also an opportunity for the Board to benefit from the tremendous experience and unique perspective of the international EMC community.

On Friday evening after the Board meeting, several Board members could be seen shopping on the famous Bahnhofstrasse and later dining at the Raclette Stubbe, a restaurant as famous for its traditional Swiss fondue as for its location within the red light district of Zurich.



The EMC Society Board of Directors meeting was held immediately following the Zurich Symposium.



TODD HUBING
ASSOCIATE EDITOR

At an EMC Chapter meeting, you can trade war stories, catch up on the latest developments in your field, and tell that joke about the three-leaded bypass capacitor. Yes, chapter meetings are one place where even an EMC engineer can be the life of the party.

Sociologists and psychologists are just beginning to understand the complex role that EMC engineers play in our society. Newly released studies help to explain why we EMC engineers are the way we are. In one classic study, a thousand professional men and women were asked to describe an 8-ounce glass containing 4 ounces of water. Sixty-eight percent of the respondents described the glass as being half full. These people were optimists: up-beat people, often entrepreneurs, who could generally be described as "the life of the party." Thirty-one percent of the respondents described the glass as being half-empty. These people tended to be pessimists: practical people, always prepared for the worst, people who rarely attend parties because they don't expect them to be much fun. One percent of the respondents described the glass as being 6 dB below the limit. All of them were EMC engineers. People in this category are rarely invited to parties.

Other studies reveal that EMC is habit-forming. Few people start out wanting to be an EMC engineer. Usually a person's first experience in an EMC laboratory is the result of peer pressure or economic necessity. Although visits to the EMC laboratory may be unpleasant at first, successes in the lab cause endorphins to be released in the brains of unsuspecting individuals, giving them a sense of accomplishment and job security. These same individuals may become nervous or depressed when they are unable to obtain frequent EMC "fixes." Once a person acquires a reputation as an EMC engineer, they are called upon to spend more time in the lab - a vicious circle that consumes people who might otherwise have led normal interesting lives. Are you addicted to EMC? To find out, ask yourself the following questions:

- Do you have any children/pets with names like Maxwell, Faraday, or Sparky?
- Have you ever used the term "common-mode" in a social conversation?
- Have you added ferrite cores to any of your home appliances?
- Do you look for the FCC or CE mark on products when you shop?
- Do you wear anti-static clothing at home?
- Does your favorite StarTrek Voyager character wear a blue uniform?

If you answered yes to two or more of these questions, you may be an EMC junky. Do not panic however. Many EMC engineers are able to live nearly normal lives. The key is to get

out of the lab once in a while. Become reacquainted with your family. Develop other hobbies and interests. And above all, keep in mind the fact that most people don't want to hear about why their electronic devices are compliant. They would rather talk about more interesting subjects, like the weather. If you want to talk to like-minded people about EMC, I suggest you attend your local IEEE EMC Society chapter meeting. At an EMC Chapter meeting, you can trade war stories, catch up on the latest developments in your field, and tell that joke about the three-leaded bypass capacitor. Yes, chapter meetings are one place where even an EMC engineer can be the life of the party.

Atlanta

Bruce Crain, Chairman of the Atlanta chapter, reports that the November 1996 meeting was held at the Lockheed Martin Aeronautical Systems plant in Marietta, GA and featured EMCS Distinguished Lecturer Hugh Denny. Mr. Denny gave an excellent presentation about the evolution of EMI requirements and testing on medical devices. Mr. Denny is a forerunner in the area of RF susceptibility testing of medical pacemakers and offered a first-hand historical perspective of this fascinating topic. The formal presentation was followed by a spirited discussion among the attendees, who included several representatives from local medical device manufacturers. Thanks to Dave Millard of the Georgia Tech Research Institute, the Atlanta Chapter now has a home page on the World Wide Web: <http://seal.gatech.edu/EEED/ieee-emc-atl>

Central New England

Lee Hill, EMC Consultant and former IEEE EMC Society Distinguished Lecturer, was the speaker at the December meeting of the Central New England chapter. Lee's topic was "Ground Plane Gaps, Common Mode Voltages and Radiated EMI in Multi-Layer Printed Circuit Boards." The presence of common mode current on the external cables of electronic equipment is often a primary source of radiated electromagnetic interference. Segmented, gapped and/or narrow width ground plane geometries in multi-layer printed circuit board designs can reduce the magnitude of these currents. The presentation reviewed the results of recent research and experiments to explore and

develop a better understanding of the inductance, common mode voltage, and the fundamental mechanisms responsible for radiated EMI from the PCB introduced by ground plane geometries. The meeting in February featured John Osburn of EMC Test Systems in Austin, Texas. John's presentation was titled, "The GTEM! What is it? Where has it Been? Where is it Going?" The GHz Transverse Electromagnetic Cell, or GTEM, is a relatively new type of test instrument for making electromagnetic field measurements. In most cases GTEM is the preferred alternative to both the Open Area Test Site and the semi-anechoic Chamber. John reviewed the status of regulatory acceptance for GTEM cells.

Israel

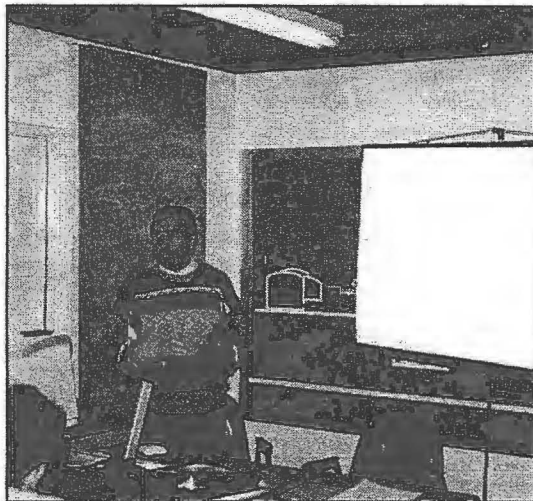
In December, the Israeli IEEE EMC Chapter held a one-day workshop on the topic of "Safety Aspects in EMC." Over 60 members and guests from all over Israel attended. The large attendance was not surprising, as the workshop dealt with "hot" issues like hazards of EM fields to personnel and to ordnance, and product safety considerations related to EMC. The workshop was hosted by TELRAD, the Israeli telecommunications company, for the second consecutive year and featured seven technical presentations. Dr. A. Vilensky, of Rambam Hospital, gave a presentation titled "One Hundred Years of Radio - One Hundred Years of Medical Hazards?" Dr. S. Diemant, of the Ministry of the Environment, spoke on "The Responsibility of the Ministry of Environment with Respect to Non-Ionizing Radiation." Mr. Oren Hartal, of RAFAEL/ADA, gave a talk titled "Limitations in Radiation Hazards Measurements." Mr. Michael Bron, of ITL, presented "Standards for ITE Product Safety." "Radiation Emission Standards for RF Systems" was the title of a presentation by Mr. Ra'anan Baruch, of the Israel Institution of Standards. Mr. Moshe Henig, of Telrad, gave a presentation on "Product Safety Requirements in FCC Part 68 for Telephony Equipment."

The workshop concluded with a presentation by Mr. Moshe Netzer, of RAFAEL/ADA, on "EMC in Electrically

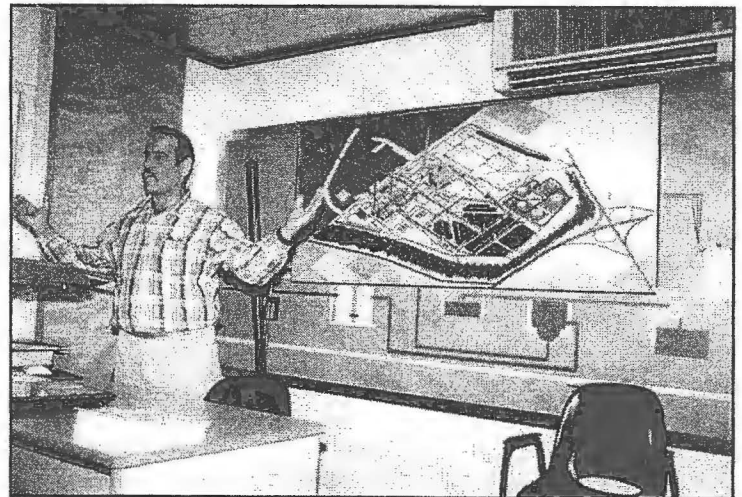
Initiated Explosive Devices - Initiation Circuits and Armament Systems." Also at this meeting, Mr. Rafi Rubinstein, one of the founders of the chapter, was presented a Certificate of Appreciation awarded by the IEEE EMC Society. This was a great opportunity for Mr. Rubinstein to reminisce about the first days of the Chapter and about the highlight of his term as chairman, when the chapter held the 1992 IEEE Regional Symposium on EMC, which opened the way to hosting the 2003 IEEE EMC Society International Symposium. The chapter held its first meeting of 1997 in March. This meeting featured a technical excursion to the newest and most modern electrical power station in Israel, the Orot Rabin ("The Lights of Rabin") named after the late Prime Minister Rabin. The visit was hosted by the Israel Electric Company. Thirty-five chapter members and guests participated in the tour, which included technical presentations by Mr. Yohannan Madar, of the Orot Rabin station and Dr. Yossef Pecker, a member of the chapter and engineer for the Israel Electric Company. Mr. Madar's presentation was titled "Electrical Power Generation in the



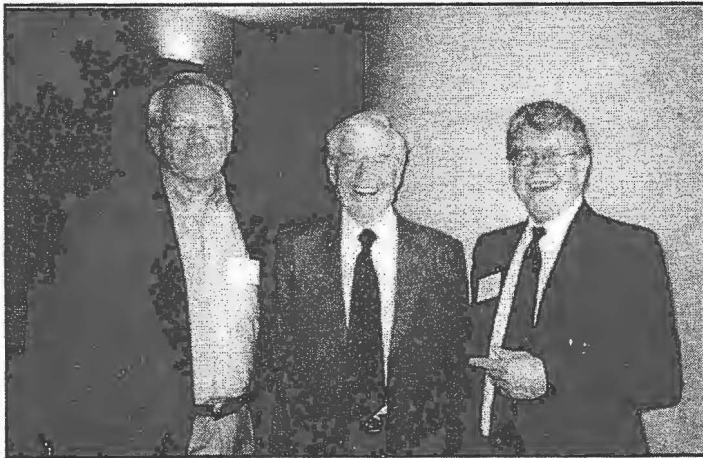
Mr. Rafi Rubinstein (l), EMC Chapter Past Chairman, displaying the Certificate of Appreciation awarded to him as Prof. Anthony Weiss (c) and Elya B. Joffe (r) and look on.



Dr. Yossi Pecker discussing EMI Issues in power distribution networks.



Mr. Yohanan Maddar of the Orot Rabin site, discussing the construction of the site.



Longtime friends Fred Motter (l) of Litton, Joe Fischer (c) of Fischer Custom Communications, and Derek McNally (r) of DJM Electronics, catch up on the old days of EMC at the Clayton Paul tutorial in Los Angeles.



Ed Nakauchi of Instrument Specialties (l), Eileen McNally of DJM Electronics (c), and John Stanford of Allied Signal (r) show off their St. Patrick's spirit with a touch of Greenery at the Clayton Paul tutorial on March 17. (That's a green shirt, green flower and green tie sported by these folks!)



Clayton Paul (l) with Dave Bernardin (r) of TÜV Product Service of San Diego, who displays an autographed copy of Mr. Paul's book.

Orot Rabin Coal Operated Power Station." Dr. Pecker's talk was titled "EMC Issues Related to Power Distribution Networks." Additionally, Elya B. Joffe was re-elected as Chapter Chair, Eli Milstein was elected Chapter Vice-Chair, and Moshe Henig was re-elected Chapter Secretary/Treasurer.

Los Angeles

The Los Angeles Chapter was fortunate to host Clayton R. Paul for a special one-day tutorial entitled "The Fundamentals of EMC" on March 17, 1997. Over 120 people attended this tutorial on St. Patrick's Day at the Radisson Plaza Hotel in Manhattan Beach. Chapter Chairman Ray Adams was obviously pleased with the turnout. After all, this event was conceived over five years ago; it took that long to convince Clayton to travel to California to present the tutorial! The day began with a continental breakfast during registration. Attendees were able to enjoy a cup of coffee and review EMC product and service literature displayed in "The EMC Vendor Library." There was also a table for IEEE EMC Society information. Membership applications moved quickly, as did copies of *ITEM* 1996. Clayton began his program at 8:30 a.m. with the topic "EMC Requirements for Electronic Systems." He explained that "we will not, nor do we need to, cover difficult mathematics or abstract concepts; most of the important concepts needed to conduct sound EMC design result from how you view the problem. For example, once you learn not to automatically think in terms of the ideal behavior that you've been taught in your undergraduate electrical engineering courses, you'll be open to new vistas of opportunities." To prove the point, Clayton used an analogy from the movie "Cool Hand Luke" starring Paul Newman. In a famous scene from that movie, the prison warden stood over Paul Newman and told him "Luke, you've got to get your mind right." That is what Clayton intended to do with the tutorial, i.e., "get our minds right" regarding EMC. During the day, Clayton also covered the areas of non-ideal behavior of components, signal spectra, radiated emissions and susceptibility, conducted emissions and susceptibility, crosstalk, shielding, and system design for EMC. His presentation was peppered with humorous tales of mishaps related to EMC. In addition to providing sound instruction, he provided entertainment as well.

Fortunately, the weather was perfect that day so lunch was held outdoors under umbrellas on the hotel terrace overlooking the golf course. Janet O'Neil, Co-Chairman of the event, told the attendees that Tiger Woods had been sighted teeing off on the course. She then quickly followed this announcement with "That's a bit of Irish blarney for St. Patrick's Day!" A reception followed the presentation with scampi, fajitas, pasta, and dessert stations. Each attendee was treated to two drink tickets so this encouraged most people to stay for the reception. Clayton was also available to personally autograph copies of his book, *Introduction of Electromagnetic Compatibility*, which was purchased by some sixty people at the tutorial. It seemed like a Hollywood event with the

people lined up with their books while Clayton pleasantly sat and signed them all. The highlight of the reception was the raffle of a ScanEM EMI probe donated by Credence Technologies. This was won by chapter member Kaniaya Mahendra. At the conclusion of the day, all agreed that it was an excellent event. It was certainly a unique opportunity to spend an entire day with Clayton Paul and enjoy good food and drink in nice surroundings in sunny southern California.

Philadelphia

Finbarr O'Connor, of R&B Enterprises, was the speaker at the September meeting of the Philadelphia chapter. The title of his talk was "Electromagnetic Environmental Effects on Military & Commercial Equipment with Emphasis on Medical Equipment." The October meeting featured Joseph Calabria, of Computer Sciences Corporation, who spoke on "Electrical Bonding Resistance Variations in Carbon Fiber Composite Panels." At the November meeting, a presentation titled, "European Community Compliance of Industrial Control Equipment" was given by Michael Massaro, of EM&F Scientific.

Pikes Peak

Dr. John Will presented a very interesting and well-attended overview of his doctoral dissertation entitled "Complex Antenna Pattern Measurement Using Infrared Imaging and Microwave Holography" at the chapter's October meeting. Unfortunately, John followed with an announcement that he was leaving Colorado Springs to pursue bigger and better opportunities as a Senior EMC Engineer with Sun Microsystems in San Jose, CA. Our loss will certainly be Sun's gain; not only were his enthusiasm and dedication contagious, but John was also single-handedly responsible for the creation of the Pikes Peak EMC Society Chapter several years ago. We wish John all the best both with Sun and southern California! In the wake of John's departure, chapter elections were held. Jim Youngman, of Omnipoint

Corporation, is the new Chair, Gus Freyer, of USI, is the new Vice Chair, and the new Secretary/Treasurer is Haze Hutmacher, of Hewlett-Packard. Finally, at the November meeting Gus Freyer gave a very interesting and relevant presentation titled "Uncertainties in EMC Measurements." Many, many thanks to HP for hosting the meeting and providing both lunch and a tour of their in-house EMC measurement facilities.

Santa Clara Valley

The October meeting of the Santa Clara Valley chapter featured Douglas Smith of Auspex Systems. Doug's talk was titled "Demonstration and Measurement of the Effects of a Transient Suppression Plane on ESD." Edwin L. Bronaugh, of EdB EMC Consultants, spoke at the November meeting. Ed is an IEEE Fellow and former president of the EMC Society. His talk was titled "EMC Measurement of Uncertainty." In December, the meeting featured David Pommerenke, of HP Roseville, who spoke on the "Physics and Testing of ESD." Roger A. McConnell, of CKC Laboratories, gave a presentation titled "High Intensity Radiated Fields (HIRF) Testing" at the January meeting. The February meeting featured EMC Society Distinguished Lecturer, Hugh W. Denny. Hugh's talk was titled "Taking the Black Magic Out of Grounding."

Seattle

Editorial note: Janet O'Neil has moved. Los Angeles' loss is Seattle's gain. Janet provided the chapter information for both the Los Angeles and Seattle chapters in this issue.

The Seattle Chapter of the EMC Society held its first meeting after a hiatus of some 18 months. There was good reason to hold a meeting in January: EMC Society Distinguished Lecturer Todd Hubing was in town! Who would want to miss his entertaining and enlightening presentation? Todd spoke on the topic "An EMC Engineer's Guide to Electromagnetic Modeling Software."

The meeting began with Ghery Pettit of Intel in Dupont informally chairing the meeting. Ghery is a former Chairman of the Santa Clara Valley chapter. He was eager to get things up and running with the Seattle chapter and so was his IEEE friend, Janet O'Neil, who is a recent transplant to the Pacific Northwest from Los Angeles, where she was active with the chapter. Thus, the meeting began with nominations from the floor for chapter officer positions. Other details were handled such as setting a regular date, time and location for the meetings. It was agreed that the meetings would be held the last Tuesday of the month so that the Seattle chapter could "piggy back" speakers with the Portland, Oregon chapter. For example, Todd's trip to the Pacific Northwest included speaking at the Portland and Seattle chapter meetings on subsequent evenings. It was also agreed that a newsletter should be created specifically for the Seattle chapter to highlight meeting announcements, upcoming events, job openings, etc. With the business part of the meeting then concluded, Todd began his presentation. He reviewed the various types of EM modeling software available commercially and over the Internet. The objective was to help product developers and EMC engineers decide whether they can benefit from EM modeling software and learn which software packages are appropriate for a particular application. Todd also spoke of the early days of his EMC career when he was employed at IBM. He noted that in those days, adding money to any product design to address EMI was "discouraged." This contrasts to work he has done for Boeing where weight and reliability were the primary concerns. Todd spoke about EM modeling software and how it can be beneficial to design engineers of both types of companies. Twenty-five people attended this first meeting and all agreed it was worthwhile to get together again.

The Seattle chapter was fortunate to host another Distinguished Lecturer at its March 20 meeting. (That's two chapter meetings this year - each with a

Distinguished Lecturer of the EMC Society!) Norm Violette of Violette Engineering Corporation spoke on the topic of "Lightning and Transient Protection at the Equipment Level." The meeting began with EMC Society President and Seattle EMC Chapter member Bill Gjertson announcing the results of the recently held election of chapter officers. Ghery Pettit of Intel was elected Chairman, Janet O'Neil of Lindgren RF Enclosures was elected Vice-Chairman, John Kuras of Boeing was elected Secretary and Tom Lindgren of Boeing was elected Treasurer. Ghery immediately took the reigns of office and introduced the speaker. Norm announced that transient protection was "big business" and supported this claim by showing the 21 different IEEE standards which address this topic. The presentation concentrated on lightning, electric and magnetic field coupling (which are often overlooked) and ground impedance coupling (which is very important, especially when lightning strikes ground). First, Norm started with the basics of lightning. He commented, "We still really don't know how lightning is generated." Lightning is important for engineers as it is the single greatest contributor to power outages worldwide. Ben Franklin, who conducted the first known scientific studies on lightning in the mid 1700s with his famous kite flying experiment, was referred to as a "great engineer, but not a good conductor." (Actually, Ben was commended as he

conducted lightning experiments and lived to tell about them!) The presentation was lively and entertaining. There is a lot to know about lightning and Norm's presentation provided a good introduction to the topic. He mentioned that he normally teaches a three-day course on the topic and condensed this to two hours for the chapter meeting. So, there was a lot of material to cover! Norm wrapped up the evening by providing information about an interesting lightning project he was involved in with the Statue of Liberty. Before the meeting, chapter members joined the speaker (and his wife Bette) for dinner at a nearby restaurant. It was a good opportunity to socialize informally with the speaker and chapter members. Everyone is welcome to come to the newly revitalized Seattle EMC chapter meetings. Call Ghery Pettit at (206)371-5515 or Janet O'Neil at (206)868-2558 for more information.

Twin Cities

The EMC chapter of the IEEE Twin Cities section held an EMC Workshop on General EMC Measurements on Wednesday, March 19th at the Sheraton Metrodome. Six half-hour talks were presented in one afternoon aimed at EMC engineers and EMC technicians. Erik Borgstrom, of TUV Product Services, gave a presentation titled "High-Field Strength Testing for Commercial Avionics Requirements." Roger Kuhn, of 3M, spoke on "Radiated Field Immunity Testing to IEC 1000-4-3 Criteria." John Maas, of IBM, gave a presentation on "Electrostatic Discharge Testing of Electronic Products." Joel Schneider, of TUV Product Services, presented "Emission Testing to CISPR 22 Requirements." Paul Cook's presentation was titled "Radiated Emissions: Calculations Based on Circuit Design" and the meeting concluded with a talk by Dan Hoolihan, "A Summary of the 1997 Zurich EMC Symposium."



Norm and Betty Violette relaxing and enjoying a visit in Seattle after Norm's presentations on lightning protection to the Seattle and Portland EMC Chapters.

FDA/AAMI Conference on EMC/EMI

The U.S. Food and Drug Administration and the Association for the Advancement of Medical Instrumentation (AAMI) are holding a conference on EMC/EMI: Solutions for Medical Devices.

The program will be held from 8:00 AM to 5:00 PM on Thursday, June 12, 1997 at the Crystal Gateway Marriott, near Washington National Airport. The conference follows the AAMI Annual Meeting and Exposition, which will be held from June 7 to 11 in Washington, DC. The agenda is targeted to manufacturers, health care practitioners and regulatory professionals. For more information, contact Eileen Smith, (703) 276-0793, ext. 241.

Call for Papers

14th International Wroclaw Symposium and Exhibition on EMC June 23 - 25, 1998

A call for original, unpublished papers on all aspects of EMC has been issued. For information, contact the Symposium Organizing Chairman, Mr. W. Moron. Phone: +4871 728812 Fax: +4871 728878 E-mail: emc@il.wroc.pl Information is also available on www.emc98.wroc.pl

EUROEM '98

The 11th International Conference on High Power Electromagnetics will be held in Tel Aviv, Israel, June 14 to 19, 1998. For contact information see page 27.



KIMBALL WILLIAMS
ASSOCIATE EDITOR

The EMCS Education Committee mission is to "promote education related activities of the IEEE EMC Society." Its vision is "to provide opportunities for individuals and organizations involved with electrotechnology and products to become aware of EMC at levels consistent with their needs."

The committee has two fundamental goals:

- To establish an awareness of EMC fundamentals throughout industry and academia
- To enhance EMC education through the development of improved education techniques, materials, opportunities and communications

To accomplish these goals, the committee has established eleven subcommittees, each working on one or more related activities directed toward immediate and long-range objectives. The subcommittees are listed in alphabetical order by the last name of each of the chairman and described. As you read through these descriptions, ask yourself, "Can I help with this effort?" We would appreciate your participation and assistance.

Subcommittee	Chairman
Demonstrations	Larry Cohen
Experiments Manual II	Jim Drewniak
Video Productions	Dick Ford
University Grant	John Howard
Outline & Abstracts	John Mass
Tutorials	Maqsood Mohd
Student Activities	Jim Muccioli
Standards Education	Vichate Ungvichian
NARTE	Jim Whalen
Lifelong Learning	Kim Williams

Demonstrations

This subcommittee works with current and future symposium planning committees to provide demonstrations of EMC phenomenon during the symposium.

Experiments Manual - Volume II

The success of the *EMC Education Manual*, created by Clayton Paul and Henry Ott, prompted us to consider a follow-on Volume (II) that would use more sophisticated equipment and provide additional documented experiments to assist students and teachers. This committee is beginning the task of assembling this new set of experiments.

Video Productions

One of the most effective and easy-to-use methods of taking EMC information to students, the general public, other technical societies, etc. is through the media of video. This committee is working on producing such educational video materials.

University Grant

A continuing interest of the education committee has been the promotion of EMC education within traditional university curricula. This subcommittee is seeking universities that have no current EMC courses, and is offering to assist in setting up a 'first time' course at that institution. The first award will be presented at the EMCS Symposium in Austin.

Outline and Abstracts

This subcommittee has developed an outline and abstract for presentations on EMC to several different groups. At the present time, it is developing supporting visual aids and working on distribution methods.

Tutorials

At each symposium this subcommittee provides educational tutorials on the fundamentals of EMC technology. These tutorials are intended to help bring new engineers and technicians entering our discipline 'up to speed' and become well-grounded in the basics.

Student Activities

This subcommittee provides an outreach to the members of IEEE Student Chapters. Its main activities are providing speakers for Student Chapter meetings, promoting the Presidents' Memorial Scholarship Award and conducting the biannual student paper contests.

Standards Education

In cooperation with the EMC Standards committee, this subcommittee is developing methods of extending education about the IEEE standards process to EMC Society members and beyond. Its first project is a set of video lectures on standards from the Santa Clara symposium.

NARTE

At each symposium, Dr. Whalen conducts a workshop assisting EMC professionals to

Continued on next page

Continued

prepare for the National Association of Radio and Telecommunications Engineers (NARTE) examination as an EMC engineer or technician. At the end of the symposium, there is a NARTE exam opportunity. This subcommittee is responsible for scheduling both events.

Lifelong Learning

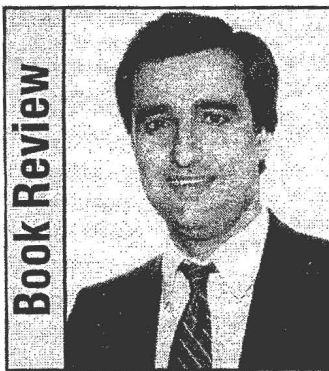
This is a liaison activity between the EMC Society and the IEEE Education Activity Board. The current focus is a new effort that will work with President Clinton's education initiative to bring technical literacy into the public school system and foster lifelong learning in young students.

Executive Board

The chairs of each of the subcommittees, the current main committee officers and the most recent past officers constitute the Education Committee Executive Board. Current activities of the executive board are directed toward updating the charters and long-range plans for each subcommittee to address the long-range plans of the Society.

Meeting Scheduled

The committee holds a major meeting of the executive board and all the subcommittees on Tuesday morning during the annual EMC Symposium. We welcome all who would care to see if there is a task you could help with that would be suited to your interests and talents. Please join us and find out.



**REINALDO PEREZ
ASSOCIATE EDITOR**

THE GUIDE TO THE EMC DIRECTIVE 89/336/EEC, 2nd EDITION By Chris Marshman IEEE Press, 1995 (paperback)

As the title states, this book is a guide to the European Economic Community (EEC) Directive and the relevant standards in electromagnetic compatibility. The book identifies the implications for such standards as it discusses each one of them and provides the necessary guidance for achieving compliance with the use of action items and the discussion of several examples. This book was first published in 1995, and by now, in the middle of 1997, many readers may already be familiar with such standards since they are already being enforced. For those readers, this book could be a review. For those just getting into the EEC market with their products and with very little knowledge in the area of EMC requirements, this book is a good place to start.

Though the language of the European EMC Directive standards is somewhat legalistic (like most government sponsored standards), an effort is made by the author to paraphrase the intent and methodologies of such standards. However, the author concludes that such effort and this book is not a substitute for the EEC EMC Directive itself, but an aid to a better understanding of the regulations.

A brief review of each chapter in the book is provided here, with a discussion of some of the salient sections in each chapter. Because of the nature of this book, readers would be better served if no interpretations are made by this reviewer beyond those already expressed in the text by the author. Instead, the reviewer will just provide the relevant information concerning the book's content.

The book is divided into twelve chapters and nine small appendices. Each chapter also has its own list of references, mostly about related standards. Chapter 1 is an introduction to the EMC Directive. It provides the EMC background and the requirements that led to the EEC EMC Directive. The unwanted electromagnetic emissions from electronic equipment and the immunity of such equipment are part of the enforceable controls stated by the EMC Directive for the European market. This chapter also covers the bureaucratic machinery established by the EEC in the development of such standards. Chapter 2 provides an "un-legal" understanding of the EMC Directive by providing an explanation of the most important protection requirements and the scope of the type of equipment and phenomena covered. The routes to compliance are described including self-certification and the technical construction file. The chapter ends with product certification and marketing requirements. Chapter 3 covers some key points in the interpretation of the EMC Directive. This is an important section for managers and gives them a better understanding of customized equipment, imports, second hand equipment, system installation and components. This chapter essentially provides a better understanding of the commission's intent behind the EMC Directive.

In chapter 4 the United Kingdom (UK) implementation of the EMC Directive is outlined. The regulations outlined in this chapter define the enforcement procedures adopted in the UK and the enforcement authorities. It is not until chapter 5 where the regulations themselves are discussed.

Chapter 5 defines what is meant by relevant or harmonized standards, product specific standards, and generic standards. A table of equivalent standards and a user's list of harmonized standards is provided. The shortage of product specific standards, immunity standards and standards for large installations are discussed. Design engineers must be knowledgeable of these standards since it is these harmonized standards for emission and immunity that the equipment must meet. Chapter 6 begins with an introduction of the harmonized emission standards. The implications concerning costs of testing and test facilities are covered. An overview is provided of examples of product specific emission standards such as EN 55-022 and EN 55-011, often referred to by their generic equivalent, EN 50-081-1 and 2. The author also includes a review of parts of other standards referenced by the generic standard. The issue of test repeatability is identified for both conducted and radiated emissions. Among the main issues identified in this chapter are:

- The need to have suitable test facilities and specialized instrumentation,
- Repeatability, a concern because equipment configurations are open to interpretation, there are differences in the calibration of test facilities and equipment, and the generic standards in measurement methods make reference to published standards and therefore have the same implications for manufacturers as those apparent from product specific standards.
- The generic standards allow flexibility to apply all or none of the

tests specified, which allow for differences in interpretations.

Immunity standards are reviewed in detail in chapter 7. The basic standards considered are IEC 801-2, 801-3, and 801-4. The generic standards are EN 50-081-1 (the generic immunity standard for residential, commercial, and light industry locations) and EN 50-082-2 (the draft generic immunity standard for the industrial environments). Several points are addressed in this chapter, including the need to have access to suitable test facilities, which could involve significant capital investment, and as with emissions, the considerable uncertainty in measurements due to repeatability in testing. The reasons for such a lack in the repeatability of testing are: equipment configuration which is open to interpretation; differences in calibration methods for test facilities and equipment; the subjectivity of the degree of performance degradation due to immunity testing with manufacturers selecting a suitable severity of immunity levels for their equipment; and the fact that the generic standards allow a manufacturer flexibility in applying all or some of the tests specified, which allow for a variety of implementations, such that for the same type of products it is possible that tests may be applied by different manufacturers.

Chapter 8 is concerned with the identification of the major types of test facilities required for performing EMC testing in accordance with the standards. Different interpretations of test facilities are illustrated and the relative costs implications are discussed. The requirements for open field test sites and their calibration are described along with practical open field site

implementations. Screens rooms are discussed, especially their limitations with respect to reflections and resonance. Anechoic chambers are considered, including the effects of absorber depth and costs issues. Chapter 9 focuses on some case studies connecting the problems faced by manufacturers of physically large systems when trying to comply with requirements of the EMC Directive. In chapter 10 an action plan for achieving compliance is presented in the form of a flowchart. The use of this plan along with an up-to-date list of harmonized standards is presented by using examples. At the end of the chapter, according to the author, the reader should be in a position to identify the route to compliance with the EMC Directive for a product.

Chapter 11 deals with the EMC Directive for large systems, particularly the problems and difficulties of demonstrating compliance with the EMC Directive, the use of the technical construction file, the applicable test methods, and the need for an EMC management plan. Chapter 12 is principally concerned with reviewing the U.S. FCC regulations, and the pre-directive regulations in Germany, the UK, and other EEC member states. An overview is presented of the FCC 437 CFR Parts 15, 18 and VDE 0871 and a comparison is made between the emission limits and the harmonized European standards.

This book is suitable for management and design engineers who want to have a broad overview on the nature of the EEC EMC Directive before applying themselves to the efforts of making their products comply with the specific standards.

**EMCS Conference Records
1955-1995 will be available
on CD-ROM at the
EMCS Symposium in Austin.**



WILLIAM G. DUFF
ASSOCIATE EDITOR

John Duncan McMillan Osborne graduated from the University of Texas at Austin in 1964 with a Bachelor of Science in Electrical Engineering. At the same time, he graduated from the Army ROTC and received a commission as a 2nd Lieutenant in the United States Army. John completed the requirement for a Master of Science in Systems Management from the University of Southern California in August of 1985.

His first professional employment was with White Instruments in Austin, Texas, where he designed and built custom acoustic measurement instrumentation. He joined the Electro-Mechanics Company in January of 1964. While there, he worked on a literature survey on electromagnetic shielded enclosures. He was the primary author of the final report on electromagnetic shielding and shielding measurements.

In November 1965, John reported for active duty, attending service schools in Ft. Benning, Georgia, and Ft. Devins, Massachusetts. Stationed in the Washington, DC area, he served in an engineering group at the National Security Agency. He was awarded the Joint Services Commendation Medal for engineering achievement for the design and modeling of a vertical provisioning system for cryptographic equipment.

Upon completion of his active duty obligation, John returned to EMCO where, as a follow up to the literature survey, he was the project engineer for designing and building a state-of-the-art magnetic shielding enclosure. The double-walled Hypernom enclosure produced 57 dB of shielding for magnetic fields at DC and in excess of 90 dB to 60 Hz.

In 1969, John joined White Electromagnetics, Inc., where for two years he operated the Technical Services Division. During this period, he was in charge of all contract EMC testing for the laboratories. John returned to Austin, Texas in 1971 to join Tracor, Inc. as the staff EMC/TEMPEST engineer. He worked on a number of programs for communications terminals, aircraft chaff systems and sonar systems.

He also worked for Don White Consultants and Interference Control Technologies as Director of Engineering, and for Martin Marietta - Denver Aerospace, where he was the lead EMC/TEMPEST engineer on the MX Missile project, and later on other complex aerospace projects. He worked for TANDEM Computer and is now the Principal EMC Scientist for EMC Test Systems, a new company composed of EMCO, Rantec and RayProof. At EMC Test Systems, he has been instrumental in the development of the GTEM as a practical measurement device, and has designed high power EMC test antennas for the U.S. Navy.

During these employments, he has successfully planned, directed and reported on over a hundred MIL-STD EMC tests, a number of TEMPEST tests leading to product listings on the PPL, and over a thousand commercial EMC tests to a variety of international standards. Interestingly, the EUT fundamental frequencies have spanned from 3,000 sec/cycle to 34 GHz.

John has authored or co-authored five books, more than seventy-five technical papers and a variety of popular trade journal articles. He is active in the IEEE EMC Society as General Chair of the 1997 International Symposium in Austin, Texas, a member of the EMCS Standards Committee, and current Chair of the Central Texas Chapter of the EMC Society. He also supports standards development for the American National Standards Institute and the Society of Automotive Engineers. He has been awarded three patents for EMC measurement technology.

John and his wife, Sarah, a Realtor, enjoy showing their pet Schipperkes and attending concerts. They are both readers of science fiction and mysteries, and Sarah shows a distinct preference for stories of her native Atlanta.



JOHN OSBOURNE

John has successfully planned, directed and reported over a hundred MIL-STD EMC tests, a number of TEMPEST tests leading to product listings on the PPL, and over a thousand commercial EMC tests to a variety of international standards.



BOB ROTHENBERG
ASSOCIATE EDITOR

This space, representing almost 10% of your Newsletter, has been allocated for the sharing of practical information on EMC related issues. Such information need not be archival or theoretically rigorous. New or unusual approaches to solving routine design, prediction, measurement or suppression problems need only be described in brief, narrative form. Your submittals will not be subjected to extensive peer review. If they are considered newsworthy, useful, credible and reasonably well-written in the opinion of this Associate Editor and perhaps an EMCS technical committee member, they will be published in this space. Submit drafts, preferably under 1500 words, to me at Parker-Chomerics, 77 Dragon Ct., Woburn, MA 01888 (or e-mail to rothenberg@compuserve.com).

Following is the second in a series of articles on EMC issues related to printed circuit boards. It is extracted from *Printed Circuit Board Design Techniques for EMC Compliance*, by Mark I. Montrose, IEEE Press, 1996. It presents some interesting and non-traditional ways of looking at EMI suppression at the PCB level, which should be useful to practicing engineers and designers.



MARK I. MONTROSE

EMC Suppression Concepts for Printed Circuit Boards Image Planes and Stackup Assignments

Mark I. Montrose

Within a printed circuit board (PCB), RF energy will exist based on Maxwell's equations. Maxwell describes the existence of both electric charge and magnetic fields under certain conditions. A mathematical or rigorous discussion of Maxwell is beyond the scope of this article. In addition to Maxwell, Kirchoff's and Ampere's laws describe the operation of a circuit or network. Kirchoff's voltage law states that the algebraic sum of the voltage around any closed path in a circuit must be zero. Ampere's law describes the magnetic induction at a point due to given currents in terms of the current elements and their positions relative to that point.

What these laws really say is that if a circuit is to function or operate as intended, a

closed loop network must exist. Figure 1 illustrates a typical circuit. When a trace goes from source to load, a return current must also be present, as required by both Kirchoff and Ampere.

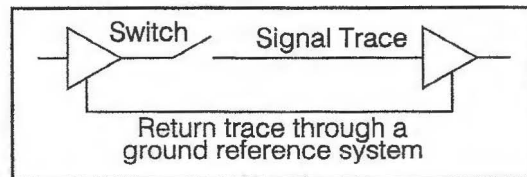


Figure 1. Closed loop circuit.

Consider a typical circuit with a switch in series with a source driver, Figure 1. When the switch is closed, the circuit operates as desired. When the switch is opened, nothing happens. This on/off condition exists in both the time and frequency domain. For time domain, the desired signal component travels from source to load. This signal component must have a return path to complete the circuit, generally through a ground return structure (Kirchoff's law). In the frequency domain, RF current travels from source to load and must return by the lowest impedance path possible, usually a ground trace or ground plane (also referred to as an image plane). The RF current that exists is best described by Ampere.

To review one fundamental concept of how EMI is created within a PCB, we examine the basic mechanism of how magnetic lines of flux are created within a PCB trace or transmission line. Magnetic lines of flux are created by a moving current flowing through an impedance, either fixed or variable. Impedance in a network will always exist within a trace, component bond lead wires, vias, and the like. In addition to the creation of magnetic lines of flux, other concerns are present that will be examined in this article. If magnetic lines of flux exist in a PCB, as defined by Maxwell, various transmission paths for RF energy must also exist. These transmission paths may be either radiated through free space or conducted through cable interconnects.

To eliminate RF currents within a PCB, two important words need to be discussed. These two words are *flux cancellation*. If we cancel unwanted magnetic lines of flux, then radiated or conducted RF currents cannot exist. The concept of implementing flux cancellation is simple; however, one must be aware of many pitfalls and oversights that may

occur when implementing flux cancellation techniques. With one small mistake, many additional problems will develop, creating more work for the EMC engineer to diagnose and debug. The easiest way to implement flux cancellation is to use *image planes*. The term image plane was popularized by prominent EMC engineers in a technical paper "Effect of an Image Plane on PCB Radiation" presented in 1990 at the IEEE International Symposium on Electromagnetic Compatibility.¹

Before a detailed discussion of image planes occurs, an examination of common-mode (CM) and differential-mode (DM) currents is presented. Figure 2 illustrates CM and DM currents as they exist within a PCB.

In Figure 2, the current source, I_1 , represents the flow of current that exists in a circuit from source, E , to load, Z . Current flow, I_2 , is current which is observed in the ground return system, usually identified as a ground plane or

ground return system. The measured radiated electric field of the common-mode currents is the summation of I_1 and I_2 . With differential-mode currents, the electric field component is the difference between I_1 and I_2 . If $I_1 = I_2$ exactly, differential-mode currents cannot exist, hence, no EMI. This occurs if the distance separation between I_1 and I_2 is electrically small. Design and layout techniques for cancellation of differential-mode currents is easily implemented in a PCB with an image plane or RF return path structure such as a guard trace. On the other hand, RF fields created by common-mode currents are harder to suppress. Common-mode currents are the main source of EMI. Differential mode currents are rarely observed as a radiated electromagnetic field.

An RF current return path is best achieved with a ground plane (or ground trace for single- and double-sided boards). The RF return current will approach zero (flux cancellation);

however, if the current return path is not provided through a path of least impedance, residual common-mode RF currents will exist. There will always be some common-mode currents in a PCB as a finite distance spacing must exist between the signal trace and return trace (flux cancellation almost approaches 100%). The portion of the differential-mode return current that does not get canceled out becomes a residual RF common-mode current. This situation will exist under many conditions, especially when a ground reference difference exists between circuits. This includes ground bounce, trace impedance mismatches, lack of decoupling, etc.

What we want to implement in our PCB design is a minimal impedance in the current return structure. If we have an optimal return path, differential-mode RF currents will be minimal. An example of a return path is shown in Figure 3.

A multi-layer board with a solid power and ground plane provides excellent flux cancellation because of the proximity of the solid copper planes. Guard traces commonly found on older designs do not provide optimal flux cancellation under certain conditions. This is because the distance spacing between the clock trace and guard trace is sometimes physically greater than the distance spacing between the clock trace and ground plane, assuming that the PCB has a ground plane if a multi-layer board stackup assignment is provided.

For an image plane to be effective, *no signal traces can be located in this solid plane*. Violations do exist when a high speed signal trace is routed over a moat (or isolated area). If a signal trace, or even a power trace (e.g., +12 V trace in a +5 V plane), is routed in a solid plane, this plane is now fragmented into smaller parts. Provisions have now been made for a ground or signal return loop to exist for signal traces that are routed on the *adjacent layer* across this violation. This loop occurs by not allowing RF

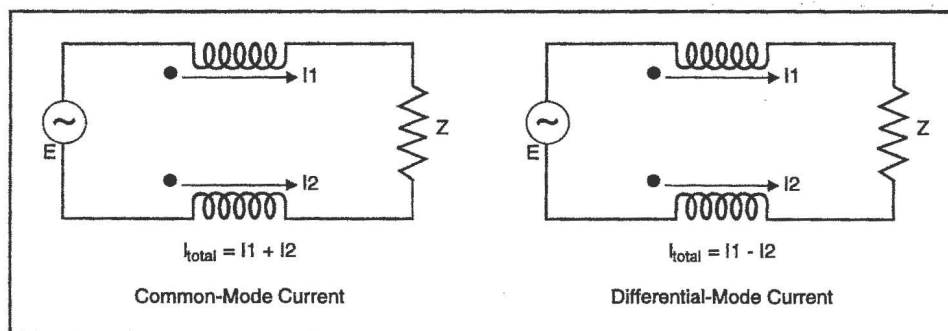


Figure 2. Common-mode and differential-mode currents.

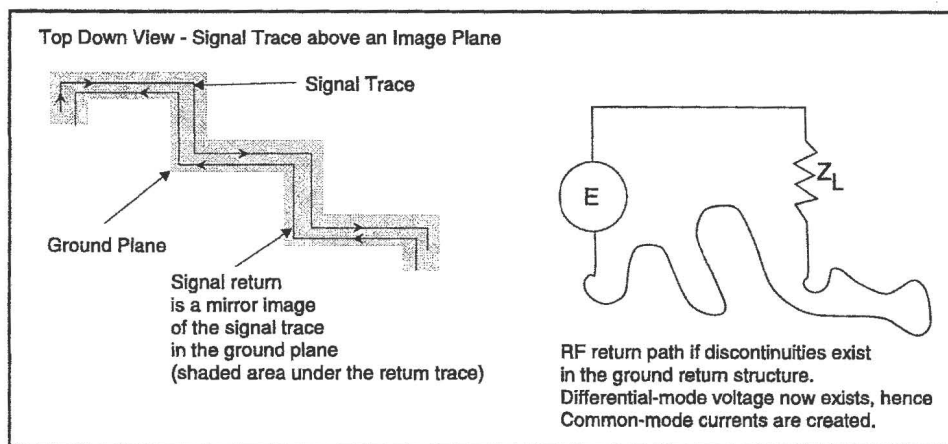


Figure 3. Image plane and return current path.

¹ German, R.F., H. Ott, and C.R. Paul. "Effect of an Image Plane on PCB Radiation." Proceedings of the IEEE International Symposium on Electromagnetic Compatibility. (New York: IEEE, 1990), pp. 284-291.

current present in the signal trace to seek a straight line path back to its source. These split planes can no longer function as a solid image plane to remove common-mode RF currents or perform optimal flux cancellation.

A poor method of implementing a ground plane for optimal return of RF currents is by routing a clock trace over a moated area. A moat is an absence of copper on the power and ground planes of a PCB. If a trace is routed over a moat, the RF current return path is not directed back to the source, and an RF current loop will be created, causing radiated EMI. This is detailed in Figure 4.

When three adjacent internal routing planes are provided (three adjacent stripline planes), with all three layers located between the power and ground planes in a multi-layer board, the middle signal plane (the signal plane not adjacent to an image plane) will couple its RF currents to the other two signal planes, thus causing RF energy to be transferred by mutual inductance and capacitive coupling. This coupling can cause significant crosstalk to occur, which may also cause non-functionality of the circuit.

Common-mode currents are generally observed in I/O cables. Rarely is common-mode noise (EMI) seen internal to the PCB. Differential-mode currents can also be created as a result of a voltage drop (IZ) that occurs between two points. These points may be between a source and load component. With an IZ drop, ground noise voltage is induced between these two circuits.

To properly implement flux cancellation within a PCB when using image planes, it becomes mandatory that all high-speed signal routing layers be adjacent to a solid plane, preferably at ground potential. The reason why ground planes are preferred over power planes is because various logic devices may be quite asymmetrical in their pull-up/pull-down current ratios. These switching components may not present an optimum condition for flux cancellation due to signal flux phase shift, greater inductance, poor impedance control and noise instability. The ground plane is also preferred because this is where heavy switching currents are shunted. TTL asymmetric drive is heaviest to ground, with less current spikes to the power plane. For ECL, the more noisy current spikes are to the positive voltage rail.

Examples of typical stackup assignments are provided in Figure 5. Stackup assignments for specific designs will most likely be different due to the number of routing layers, power and ground planes required, or special engineering design

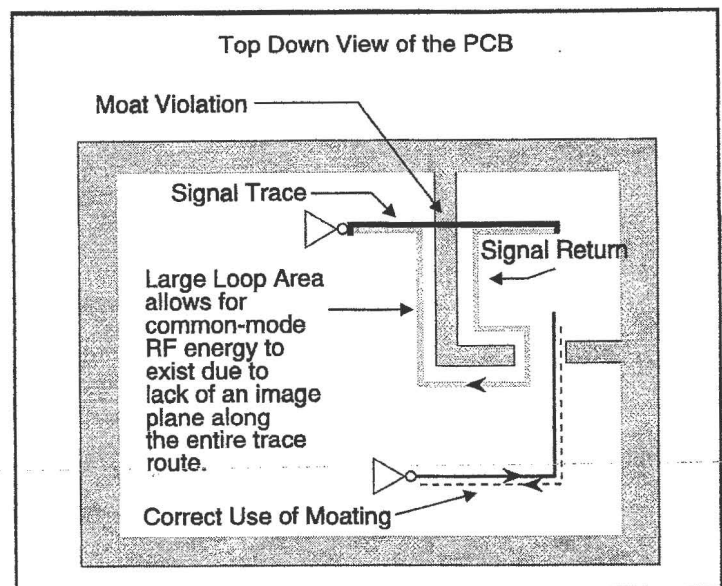


Figure 4. Violation of the moating concept.

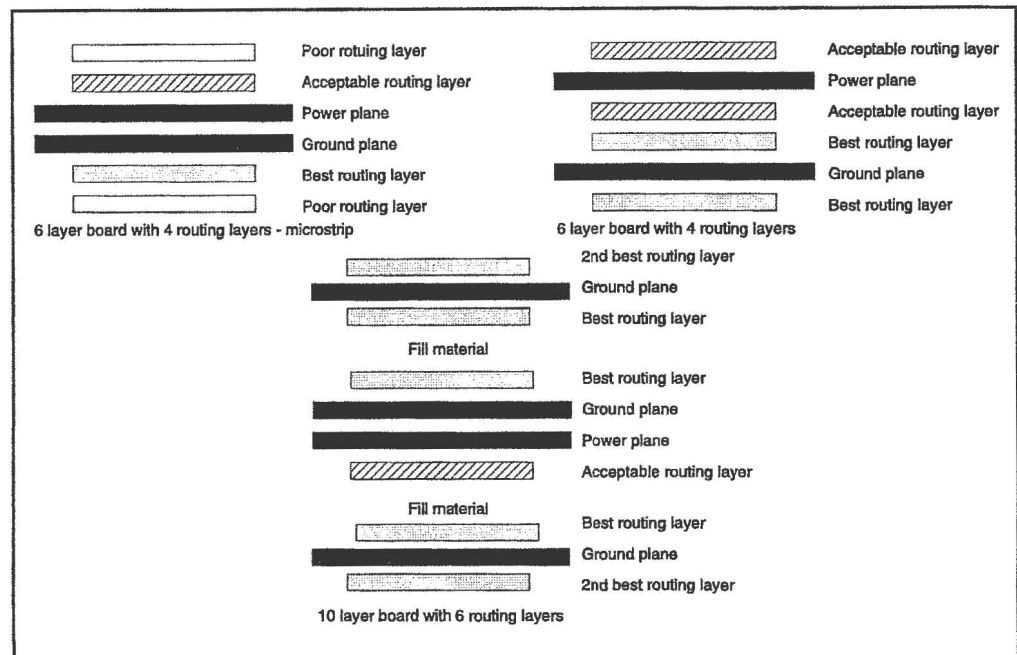


Figure 5. Typical stackup assignments for optimal use of image planes.

requirements. Adjacent to each ground (image) plane is a signal routing plane that must contain all clock signals and other traces rich in RF energy.

Generally, a one- or two-layer PCB will not contain a ground or 0V reference plane. As a result, flux cancellation using an image plane cannot occur. For a single- or double-sided stackup assignment, each clock trace or sensitive circuit must be completely surrounded by a separate trace (guard trace). This ground trace must be connected to the 0V ground reference. The "ground" trace must also be located as close to the "source" trace as physically possible based on the manufacturing process used to fabricate the board. This ground trace provides an alternate path for RF currents to return to their source if a solid ground plane is not provided.

limits for these tests.

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TC-3 Electromagnetic Environment

This committee is concerned with all aspects of electromagnetic environments and of manmade and natural electromagnetic noise. These include characterization techniques, measurement methods, instrumentation and characteristics of particular environments. Manmade noise sources include power generation and transmission facilities, broadcast and communication fields, ESD, automotive ignition systems, ISM equipment, office equipment and consumer electrical and electronic devices. Natural radio noise arises from atmospheric (lightning), solar and galactic sources.

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TC-4 Electromagnetic Interference Control

This committee is concerned with design, analysis, and modeling techniques useful in suppressing interference or eliminating it at its source. Bonding, grounding, shielding, and filtering are within the jurisdiction of this committee. These activities span efforts at the system, subsystem, and unit levels.

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TC-5 High Power Electromagnetics

This committee is concerned with the effects of EMP and hardening protection. High-power microwave technology, lightning processes, interaction with aircraft and the effects of transient electrical discharges on equipment are also within the jurisdiction of this

committee.

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TC-6 Spectrum Management

This committee is concerned with frequency coordination, management procedures for efficient spectrum use, band occupancy and congestion, federal regulations and their adequacy.

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TC-7 Nonsinusoidal Fields

This committee is concerned with the application of electromagnetic signals with large relative bandwidth, commonly referred to as non-sinusoidal waves, delineation of the differences between time-domain and frequency-domain principles, analytical and numerical treatments of the Maxwell postulates directly in time-domain, conceptualization, design, fabrication and testing of devices for ultra-wide bandwidth systems.

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TC-8 Electromagnetic Product Safety

This committee is concerned with the electrical safety of electronic products. Safety engineering principles and their application, the implementation of safety principles within organizations, as related to EMC, are typical areas of concern for this committee.

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TC-9 Computational Electromagnetics

This committee is concerned with broad aspects of applied computational electromagnetic techniques which can be used to model electromagnetic interaction phenomena in circuits, devices, and systems. The primary focus is on the identification of the modeling methods that can be applied to interference (EMC) phenomena, their validation and delineating the practical limits of their applicability. Included are low- and high-frequency spectral-domain techniques and time-domain methods.

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IEEE EMC Society Technical Advisory Committee (TAC)

To aid in the coordination of technical committee activities, and to provide the BoD with oversight, the individual technical committees are organized into the Technical Advisory Committee. The IEEE EMC Society Technical Advisory Committee is composed of the chairs of each of the nine Technical Committees and a TAC chair. The scope of the Technical Advisory Committee is to promote the technical advancement of the IEEE EMC Society as a whole and in particular:

- To coordinate the operations of the various Technical Committees
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Ham Radio Excluded from CB Enforcement Bill

(ARRL Headquarters, Newington CT) At the request of the Amateur Radio Relay League or ARRL, amateur radio has been specifically exempted from a bill submitted April 17 by U.S. Senator Russell Feingold (D-Wisconsin) that would give states and municipalities the authority to enforce the FCC's CB regulations. Feingold's bill, designated Senate Bill 608, originated with efforts by the Beloit, Wisconsin, City Council to pass an ordinance allowing local authorities to enforce FCC regulations. Council was responding to long-standing CB interference complaints by local residents. The bill is aimed at reducing radio frequency interference stemming from the use of unauthorized equipment or frequencies by CBers.

In presenting his bill, Feingold told his Senate colleagues that he has received RFI complaints over the past several years from numerous Wisconsin communities "in which whole neighborhoods are experiencing persistent radio frequency interference."

If approved by Congress, Feingold's bill would amend the Communications Act to allow state or local governments to enforce regulations that prohibit the use of CB equipment not authorized by the FCC (such as high-power linear amplifiers). As it now stands, no license is required to operate on the 11-meter Citizens Band, but the FCC does have strict requirements on the type of equipment that CBers can legally use. Feingold's bill would preserve the federal preemption of all other telecommunications matters. It would exclude FCC-licensed services, including Amateur Radio, from state or local oversight.

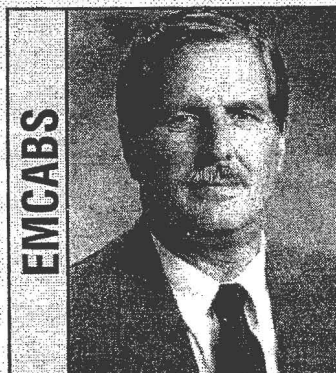
Also at the ARRL's request, the bill calls upon the FCC to provide "technical guidance" to states and municipalities in detecting and determining violations. Those affected by a state or local enforcement decision would be able to appeal to the FCC. ARRL asked Feingold to add this provision as final safeguard for amateurs who might be erroneously prosecuted despite the bill's other exemptions for amateurs. Feingold's bill would not preclude the FCC from enforcing its own regulations as they apply to CB.

Feingold called his bill "a common-sense solution to a very frustrating and real problem which cannot be addressed under existing law."

Thanks to Sandy Rotter (E-mail: rotter@worldnet.att.net) for keeping us apprised.

BACK ISSUES OF THE EMC SOCIETY NEWSLETTERS ON MICROFICHE

We still have a few sets of the microfiche copies of the back issues of the IEEE EMC Society Newsletters from the present to 1955, when it was called "Quasies and Peaks." The price is \$25.00 postpaid. Sets can be ordered from: Dr. Chester L. Smith, EMC Society Historian, 2 Jonathan Lane, Bedford, MA 01730.



WILLIAM H. MCGINNIS
ASSOCIATE EDITOR

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

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Also, the steering staffs of the Japan Technical Group and the EMC-J Tokyo chapter have offered to act as a central point for requests of papers abstracted here. Most of the papers will be available in Japanese only. Abstracts of papers from EMC-J will be clearly identified. The steering staff will assist in routing your request to the author(s) but will not translate the papers. The contact person is Professor Osamu Fujiwara, Department of Electrical and Computer Engineering, Nagoya Institute of Technology, Gokiso-Cho, Showa-ku, Nagoya 466, Japan. e-mail: fujiwara@odin.elcom.nitech.ac.jp

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

As the EMC Society becomes more international, we will be adding additional worldwide abstractors who will be reviewing articles and papers in many languages. We will continue to set up these informal cooperation networks to assist members in getting the information or contacting the author(s). The library at Southwest Research Institute, 6220 Culebra Road, San Antonio, Texas, 78228-0510 has agreed to catalog, shelve, and have available for interlibrary loans proceedings from symposia and meetings which are donated to the library. Any such donations can be sent to me at the above address and I will review them for suitable articles and then forward them to the SWRI library. We are particularly interested in symposium proceedings which have not been available for review in the past. Thank you for any assistance you can give to expand the EMCS knowledge base.

JOINT DESIGN METHODOLOGY BASED ON THE ELECTROMAGNETIC SHIELDING EFFECTIVENESS CAPABILITIES

EMCABS: 01-05-97

Behzad Mottahed and Souran Manoochehri
AT&T Laboratories, Whippany, NJ and Stevens Institute of Technology, Hoboken, NJ
IEEE Transactions on Components, Packaging and Manufacturing Technology - Part B
Vol. 19, No. 1, February 1996, pp. 238-247

Abstract: The objective of this paper is to provide guidance for the design of enclosure joints to maximize shielding effectiveness (SE). Six geometries are investigated experimentally by using a two-cavity arrangement for measuring SE. The 38 references cited in the paper provide a good survey of the literature. The effects of gap size and joint tolerances are investigated. Some attention is paid to the test protocol for measuring shielding effectiveness.

Index terms: Shielding effectiveness (SE), joint design, gap size, joint geometry, tolerances

PREDICTION OF FAR-FIELD EMI SPECTRA EMITTED FROM A SIGNAL LINE ON A DIGITAL PCB BASED ON NEAR-FIELD EMI

EMCABS: 04-05-97

Makoto Torigoe, Takuya Miyashita, Osami Wada, Ming Wang,
Ryuji Koga, and Tetsushi Watanabe
EMC-Japan meeting at Kikai-Shinko-Kaikan, Tokyo
July 19, 1996, EMCJ 96-20

Abstract: In EMI standards, far electric field is the object of regulation. The measurement of far electric field requires a large measurement system and high cost, whereas the near-field measurement requires small equipments and lower cost. If it is possible to predict far electric field based on the near magnetic field, we can reduce the effort and expenses associated with the measurement of EMI. In this report, the EM emission from a signal line on a printed circuit board (PCB) is discussed. The relation between near magnetic field and far electric field is shown in this report. Our result of prediction and measurement coincide within the error of 3 dB.

Index terms: Digital circuit, EMI prediction, near-field EMI, far-field EMI, transfer function

A PROCEDURE FOR DESIGNING EMI FILTERS FOR AC LINE APPLICATIONS

EMCABS: 02-05-97

Fu-Yuan Shig, (1) Dan Y. Chen, (2) Pan-Pei Wu (3) and Yie-Tone Chen (4)
Dept. of Electrical Eng., National Taiwan Univ., Taipei, Taiwan (1) & (3)
Department of Electrical Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA (2) Department of Electrical Engineering, National Yunlin Institute of Technology, Tou-Liu City, Taiwan (4)
IEEE Transactions on Power Electronics
Vol. 11, No. 1, January 1996, pp. 170-181

Abstract: The authors use the "noise separator" documented by T.Guo, D. Chen and F.C. Lee ("Separation of Common-mode and Differential-mode Conducted EMI Noise," Proc. High Frequency Power Conf., Apr. 1994, San Jose, CA) to separately define the common-mode (CM) and differential-mode (DM) filtering action of typical line filters with practical component values. The design procedure addresses the low-frequency range (below which parasitic elements do not control) in detail and broadly treats the high-frequency range as being "beyond the scope of the paper." The procedure uses network theorems to separately design CM and DM (and joint) component values in a practical way. Two design examples, one for a flyback converter and one for a forward switching power supply, show how the filters designed meet the low-frequency VDE limits for conducted noise.

Index Terms: Noise separator, low-frequency design of line filters, conducted noise measurement, switch mode power supply noise

A PROPOSAL AND CALCULATION OF EMC MODELING

EMCABS: 05-05-97

Takehiro Takahashi, Yuji Tarui, and Noboru Schibuya
EMC-Japan meeting at Kikai-Shinko-Kaikan, Tokyo
July 19, 1996, EMCJ 96-24

Abstract: In this paper, common EMC modeling for the electromagnetic noise simulation tool is proposed. A typical EMC calculation model is efficient for using the high functional simulation tool. The model is more efficient than making a complex EMC model. If the calculation data of the specific model is stored, it helps to make a noise reduction rule and to educate the noise behavior. For an example of the modeling, the effect of a shield which has a hole and attached line is calculated.

Index terms: EMC modeling, electromagnetic noise simulation, shielding effect

SUSCEPTIBILITY OF THE MULTILAYER PRINTED CIRCUIT INSIDE THE EQUIPMENT HOUSING

EMCABS: 03-05-97

Hiroaki Kogure, Hideki Nakano, Kohji Koshiji, and Eimei Shu
EMC-Japan meeting at Kikai-Shinko-Kaikan, Tokyo
July 19, 1996, EMCJ 96-19

Abstract: It is useful to analyze characteristics of printed circuits by modeling three dimensional structure. This paper deals with the electromagnetic field analysis for susceptibility of the multilayer printed circuit inside the equipment housing using EM analysis, KCC "Micro-Stripes" by the Transmission-Line Modeling Method. This algorithm offers useful basic information for the evaluation of susceptibility and coupling to the circuits inside the equipment housing through a thin slot. An electromagnetic induction from a cable led to inside the housing is also analyzed.

Index terms: Printed circuit, electromagnetic field analysis, TLM Method, susceptibility

AN ANALYSIS OF NORMAL-MODE NOISE CAUSED BY BRAIDED SHIELD CURRENT OF COAXIAL CABLE ATTACHED BY A FERRITE CORE

EMCABS: 06-05-97

Takeshi Ichikawa, Hiroyuki Kawada, and Osamu Fujiwara
EMC-Japan meeting at Kikai-Shinko-Kaikan, Tokyo
July 19, 1996, EMCJ 96-26

Abstract: Coaxial cables are commonly used for the electrical connection between digital information equipments because they have excellent characteristics for electromagnetic shields. For the shield layer of the coaxial cable, however, braided wires are used, and thus the high frequency current flowing on the braided shield can induce voltage (normal-mode noise) between the internal conductor and the braided shield through electromagnetic coupling, resulting in electromagnetic interference. On the other hand, common-mode current flowing on the braided shield emits an electromagnetic noise, whereas it can be successfully suppressed by ferrite core attachment. In order to examine if the core attachment can be effective in reducing the above normal-mode noise, we analyze the normal-mode noise induced by the braided shield current of the coaxial cable in relation to the location of the ferrite core attachment. A theoretical equation for reduction effect of the normal-mode noise by the ferrite core attachment is also given, which is confirmed experimentally.

Index terms: Coaxial cable, braided shield, normal-mode noise, ferrite core, analysis

SAR OF HUMAN MODELS

Takashi Nakamura, Shinobu Tokumaru, and Kazuyoshi Uchida
EMC-Japan meeting at Kikai-Shinko-Kaikan, Tokyo
July 19, 1996, EMCJ 96-30

EMCABS: 07-05-97

Abstract: As applications of electromagnetic waves such as handy phone systems increase, biological effects of EM waves are cause of concern. Many studies about SAR of a human model have been reported, but there are few reports about a case in which plural models are exposed to the EM waves. In this paper, we calculated the SAR of two cylindrical human models which are exposed to a plane TM wave and to a TM line source. The results show that the SAR of two models in the EM field would be estimated at about two times that of the case of only one model.

Index terms: Biological effects, plural human bodies, cylindrical human model, SAR, integral equation method

A STUDY OF REDUCING SAR OF THREE LAYERED CYLINDRICAL HUMAN MODEL

Shinichiro Nishizawa, Osamu Hashimoto, and Wataru Tsuchida,
EMC-Japan meeting at Tohoku Gakuin University, Miyagi
Oct. 18, 1996, EMCJ 96-44

EMCABS: 10-05-97

Abstract: In this paper, the shielding effect of a three-layered human model which has an elliptical cross section using dielectric lossy material is investigated. By numerical calculation, we use the method of moment which is assumed to be the polarization current for the model part. The results indicate the possibility for calculating the model which has an ellipse axis ratio b/a , near the real human cross section. Also investigated was the shielding effect and variation of the SAR (Specific Absorption Rate) value at the frequency of layering resonance which shows the highest SAR value of the model.

Index terms: 3-layered cylindrical human model, shielding effect, Method of moment

A PROBLEM OF CHECKING HOMOGENEITY OF THE FIELD AT IMMUNITY TEST TO RADIATED ELECTROMAGNETIC FIELD

Tetsushi Watanabe
EMC-Japan meeting at Industrial Technology Center of Okayama Prefecture, Okayama
Sept. 13, 1996, EMCJ 96-32

EMCABS: 08-05-97

Abstract: The immunity test to radiated electromagnetic field is more important than ever. The test rule, regulated by IEC 1000-4-3, requires homogeneity of the field checked by measurement at every 0.5 m in the reference plane. But this measurement method is not sufficient to check homogeneity. Field strength pattern is periodic, but the pattern cannot be observed this way. Therefore, strength level will vary with measurement point. The reason is shown for periodic strength pattern with consideration given to waves reflecting from room walls, and this is verified by experiment.

Index terms: Immunity to radiated electromagnetic fields, homogeneity of field, electromagnetic anechoic chamber

QUANTITATIVE RELATIONSHIP BETWEEN SAR AND TEMPERATURE-RISE INSIDE EYE FOR 1.5GHZ-MICROWAVE EXPOSURE

Kiyofumi Takai, and Osamu Fujiwara
EMC-Japan meeting at Tohoku Gakuin University, Miyagi
Oct. 18, 1996, EMCJ 96-45

EMCABS: 11-05-97

Abstract: For investigating the biological effects of a localized SAR (specific absorption rate) deposited in a human body for electromagnetic wave exposure, it is indispensable to analyze a temperature-rise inside a human brain including the control center of the body temperature. This paper numerically analyzes a temperature-rise inside an eye of our developed realistic head model for 1.5 GHz microwave exposure, using the FD-TD (finite-difference time-domain) method. The computed results are validated in comparison with the data obtained by Taflov and his colleagues. In order to examine the quantitative relationship between the localized SAR and temperature-rise, we also obtained a tissue amount over which the localized SAR should be averaged so as to reflect the temperature-rise distribution inside the eye.

Index terms: Microwave, biological effects, realistic head model, localized specific absorption rate, temperature-rise

A NEW EQUIVALENT CIRCUIT FOR A SMALL DIPOLE ANTENNA

Mitsuharu Hoshino, Kenji Kubota, Yoshifumi Oba, and Risaburo Sato
EMC-Japan meeting at Tohoku Gakuin University, Miyagi
Oct. 18, 1996, EMCJ 96-40

EMCABS: 09-05-97

Abstract: This paper describes a new representation of the equivalent electrical circuit of a small electric dipole antenna. By means of circuit theory, the equivalent circuit can be represented by the network of series capacitance C connected with a parallel circuit of resistance R and inductance L . Expressions of R , L and C are given as a function of the length and radius of the antenna wire. The input impedances of some vertical monopole antennas on the ground plane have been measured. As the values of reactance in low frequency agree with the calculated values of equivalent circuit, we determined the expression of C . Consequently, calculated and measured values are in agreement.

Index terms: Small dipole antenna, circuit theory, equivalent circuit, input impedance

BASIC PROBLEMS OF EMC TEST SITE

Shigekazu Shibuya, Haruo Ishizuka, Toshio Kinoshita, Kazuaki Yoshimura, Hideya Ando, Akinori Kameshima, Takashi Suzuki, Juiti Kaku, & K. Unno
EMC-Japan meeting at Tohoku Gakuin University, Miyagi
Oct. 18, 1996, EMCJ 96-46

EMCABS: 12-05-97

Abstract: For the past ten years, CISPR has continuously taken up "the rationalization of the test method of EMI (to radiated disturbance)" as the most important problem. However, it has remained yet unsolved. That is, in the EMC Symposium held at Zurich Switzerland in 1991, IBM officially announced basing on the results of comparative tests by the 3-m method carried out at 34 excellent sites chosen out of all over the world, and disclosed that the values of EMI field strength obtained exhibit a out of all over the world, and disclosed that the values of EMI field strength obtained exhibit a dispersion of 10 dB or so. Germany pointed out in Beijin Conference 1994, the inadequacy of CISPR test method on actual data collected at 6 sites, giving a dispersion, greater than 10 dB. In the latest Durban Conference 1995, each country was requested again to cooperate in theoretical studies on problems relating to EMC test site and method. This paper addresses these problems and explains theoretically that the CISPR recommended sites including the 1 by 3-m method give an uncertain correlation factor that is liable to generate an error exceeding 10 dB, and also shows that this problem is solved only through making a free space of the test site and of the limits for radiated disturbance.

Index terms: EMC, test site, basic problem, free space, radio disturbance, correlation factor

FDTD ANALYSIS OF TRANSIENT ELECTROMAGNETIC FIELD CAUSED BY BETWEEN CHARGED METALS

Kei Kawaguchi, and Osamu Fujiwara
EMC-Japan meeting at Daido Institute of Technology, Nagoya
Dec. 21, 1996, EMCJ 96-49

EMCABS: 13-05-97

Abstract: Transient electromagnetic fields caused by the electrostatic discharge (ESD) between charged metals can be affected by the presence of the metal itself, but the effect has not been examined. This paper analyzes the occurrence electromagnetic fields due to the spark between spherical metals, using the finite-difference time-domain (FDTD) method. The numerical computation reveals that the presence of the metals increase the ESD field level from our previously proposed ESD source model, which consists of numberless image dipoles that give the equipotential condition on the spherical metal surface.

Index terms: Charged metal, ESD, transient electromagnetic fields, FDTD method, image dipoles

A STUDY ON A METHOD OF CHANGING THE MATCHING FREQUENCY CHARACTERISTICS USING OPEN-HOLE FERRITE

Atsushi Maeda, and Youji Kotsuka
EMC-Japan meeting at Daido Institute of Technology, Nagoya
Dec. 21, 1996, EMCJ 96-59

EMCABS: 16-05-97

Abstract: This paper describes a method on simply changing the matching frequency characteristics of an EM-wave absorber and improving the matching characteristics using an open-hole ferrite material. As the result of experimental and theoretical investigation, the ferrite with cross-shaped holes shows the ability to change the matching frequency characteristics broadly. As for the theoretical analysis of matching characteristics, the Spatial Network Method has been introduced. It is clarified that the matching frequency is changed from 2 GHz to 4 GHz using the ferrite material with Cross-shaped holes.

Index terms: Open-hole ferrite, matching frequency characteristics, cross-shaped open holes, Spatial Network Method

FUNDAMENTAL STUDY ON BIOLOGICAL EFFECTS OF STRONG ELECTRIC FIELD (PART 3) - DEPENDENCE OF DETECTION THRESHOLD ON DIFFERENT PARAMETERS

Masaaki Sakamoto, Hisae Odagiri, and Kenji Misawa
EMC-Japan meeting at Daido Institute of Technology, Nagoya
Dec. 21, 1996, EMCJ 96-52

EMCABS: 14-05-97

Abstract: Fundamental study has been conducted on the biological effects of ELF (extremely low frequency) electric field. A perception threshold was measured with human subjects and the results were analyzed. The perception threshold was lower in an AC field exposure than in a DC field exposure. One of the causes of individual difference in the threshold was found to be the difference in the physical conditions of body hair. The psychological conditions of a subject were forced to be changed by giving different amounts of information on the field exposure. The threshold was also dependent on the psychological conditions. However, these variances in the threshold were far smaller than the variance caused by the change in relative humidity.

Index terms: Human effect, AC & DC electric field, safety standard, detection threshold, electromagnetic compatibility

ANALYSIS ON DISTRIBUTED CONSTANT FILTER

Toshio Inomata, Shuichi Nitta, Atsuo Mutoh, and Yoshiro Sato
EMC-Japan meeting at Kikai-Shinko-Kaikan, Tokyo
July 19, 1996, EMCJ 96-25

EMCABS: 17-05-97

Abstract: A noise filter made up of lumped inductance and capacitance has many problems like poor cut-off characteristics in the range of high frequency. In order to solve the above problems, a distributed constant filter has been proposed. However, its analysis and design methods have not been established yet. In this report, it is concluded that equivalent circuit is presented and in the vicinity of first parallel resonance of $f-|Z|$ curve, is in agreement with measured value.

Index terms: Distributed Constant Filter, Distributed Constant Circuit Theory, cable

RADIO ABSORPTIVE PROPERTIES OF G-Fe₂O₃ AND TiO₂ COMPOSITE MATERIALS (PART 3)

Masaru Chino, Yoshio Nikawa, Kazuo Kikuchi, Takashi Yamamoto, and Ario Yamamoto
EMC-Japan meeting at Daido Institute of Technology, Nagoya
Dec. 21, 1996, EMCJ 96-57

EMCABS: 15-05-97

Abstract: Radio absorptive properties in (g-Fe₂O₃/TiO₂)=(90/10) weight ratio composite materials for VHF, UHF and GHz bands have been investigated. Permittivities and permeabilities of (g-Fe₂O₃/TiO₂) composite materials are discussed for optimum trial design for radio absorptive sample that are indispensable for protection of electric equipment from external noise. The absorption properties of the sample with 0.2 cm in thickness demonstrates 681 MHz in bandwidth centered at 4.45 GHz as an experimental example.

Index terms: Fe₂O₃ TiO₂, composite material, radio absorptive, permittivity, permeability

APPROXIMATE FORMULA OF SHIELDING EFFECTIVENESS OF AN INFINITE PLANE FOR A DIPOLE FIELD

Yoshifumi Amemiya, and Takashi Yamaguchi
EMC-Japan meeting at Kikai-Shinko-Kaikan, Tokyo
July 19, 1996, EMCJ 96-27

EMCABS: 18-05-97

Abstract: This paper shows approximate formulas of transmitted fields through an infinite plane for a dipole field. In the magnetic/electric dipole field, the transmitted field is in inverse proportion to the fourth/second power of distance from the dipole, shielding effectiveness of the plane is in direct/inverse proportion to the distance, and for vertical dipole equals/doubles it for horizontal dipole. The value of shielding effectiveness from the above formulas and that from expression involving integral computation agree well over a wide range of the distance, and the under/upper limits which make the difference between them lower under 1dB are shown.

Index terms: Shielding effectiveness, near field, magnetic dipole, electric dipole

Issue #62 December, 1969

From the PEOPLE IN THE NEWS Feature HOLLICE FAVORS GOES INDEPENDENT

Hollice A. Favors has recently left the employ of Litton Data Systems Division early this year to become an independent EMC consultant. He has been very active and generous in his services to the IEEE and the G-EMC in particular. He is a Senior Member of IEEE (1958) and has presented many papers. Mr. Favors is a past chairman of the Los Angeles G-EMC Chapter (1965) and was Head of the Technical Papers Review Committee for the 1964 EMC Symposium held in Los Angeles. In 1966 he served with the Technical Papers Review Committee for the 1964 EMC Symposium held in Los Angeles. In 1966 he served with the Technical Papers Review Committee for the San Francisco G-EMC Symposium.

IRA M. BERMAN JOINS FAIRCHILD

Ira (Marty) Berman recently left the Re-entry and Environmental Systems Division of General Electric Company to join Fairchild Electro-Metrics, 100 Church Street, Amsterdam, N.Y. 12010. Marty is known to our Newsletter readers as the editor of Chapter Chatter, as well as other special features. As a result of many complications in changing jobs and location, Marty's column does not appear in this issue of the Newsletter. Chapter Chairmen will be notified of the change so that we can again keep our members up to date on the Group activities throughout the country. All persons wishing to report on local or chapter activities are invited to correspond with Marty at his new address.

CHOMERICS FILES SUIT

(CAMBRIDGE, MASS.)--Chomerics, Inc., an Arlington based manufacturer, has filed suit in Massachusetts Superior Court against Ercon, Inc. and one of its employees, a former Chomerics' corporate officer, both of Massachusetts. Also named in the suit were Technical Wire Products, Inc. (Technit) of New Jersey and the Parker Hanifin Corporation of Ohio. The suit concerns the misappropriation of Chomerics' confidential information.

The dispute involves electrically conductive plastic gasket and sheet materials. The suit requests an injunction to prevent the further use of Chomerics' confidential information.

HARADEN PRATT DEAD AT 79

Haraden Pratt, a distinguished pioneer in the field of radio communications died at Pompano Beach on August 18. Mr. Pratt was also a leader for many years in the affairs of the Institute of Electrical and Electronics Engineers (IEEE) and one of its two predecessor societies, the Institute of Radio Engineers (IRE).

Mr. Pratt served as president of the IRE in 1938; Secretary, from 1943-1962; and Director from 1935 - 1962. At the formation of the IEEE in 1963 he continued as Director and Secretary until his appointment as Director Emeritus in 1966. As a life member of Veteran Wireless Operation Association, he was awarded the Marconi Medal of Achievement in 1951. He was a Fellow of the IRE, the IEEE, the American Institute of Electrical Engineers, and the Radio Club of America, an Associate Follow of the American Institute of Aeronautics and Astronautics (formerly the Institute of the Aeronautical Sciences) and an honorary life member of the Institution of Radio and Electronics Engineers, Australia. In 1944, he received the IRE's Medal of Honor and in 1960 its Founder's Award. (Also, he was the guest banquet speaker at the 1968 EMC Symposium in Seattle.)

SPARK GAP SIMULATES A-BOMB EMP

Security wraps were peeled off a hush-hush Army nuclear-simulation project in mid-August revealing the existence of a 'super' electromagnetic pulse (EMP) facility at Orlando, Fla. The facility was designed and built by Martin Marietta Corp's Orlando Div. under the guidance of Dr. Carl D. Pierson Jr. and Elliott R. Valkenburg, both members of the research and engineering dept. at the Orlando Div.

The facility consists of a 1000-ft. dipole antenna with a spark gap at its center. High-voltage power supplies, generating 250 kV, charge the antenna within 0.1us through 20 MΩ resistors. Upon discharge, up to 20,000 A flow across the spark gap. While the Martin Marietta installation apparently is the most powerful in the U.S. right now, a site is being built at Albuquerque N.M., by EG&G Inc., Bedford, Mass., that will produce even stronger EMP radiation.

HUGE FARADAY CAGE CLEANS UP LA POWER

Electromagnetic pollution caused by increased use of heavy electrical equipment is filling radio and television channels with noise, particularly around large industrial cities. Los Angeles, however, is taking a step which should quiet at least one possible noise source. The potential offender is a

power grid intertie station at the southern end of 750,000-V dc lines bringing hydroelectric power to the city from dams on the Columbia river. To contain the electron magnetic radiation emitted by the station, LA is erecting a huge Faraday shield around the entire complex.

Design specs for the shield indicate that the radiated energy in the range of 150 kHz to 300 MHz should not exceed 50 μVm outside a perimeter 1,500 ft. from the intertie station. Without the Faraday cage, this isoelectric perimeter would occur at a distance of about 2 miles from the station and would enclose nearby suburban homes. Radio interference attenuation is planned to be approximately 30 dB. Among the components being shielded are the mercury-arc inverters, damping resistors, dc/ac transformers, reactors, and filter capacitors. Experience with similar type installations indicates that radiation of RF from power lines should be negligible, but that radiation could be expected from the converter station and its auxiliary facilities.

RESULTS OF ADCOM ELECTION BALLOT

The ballot for the election of five EMC Group AdCom members was issued on July 25, 1969. Constitutional amendments since issuance of the ballot permit the election of six AdCom members. The ballots returned have been counted and the following six members have been elected for a three-year term beginning January 1, 1970.

W. R. Free
J. J. Krstansky
J. J. O'Neil
H. M. Schlicke
R. B. Schulz
L. W. Thomas, Sr.

JTAC CHANGES ITS NAME

JTAC changes its name after 21 years to Joint Technical Advisory Council (formerly Committee). This cooperative endeavor of IEEE, an *engineering society*, and Electronic Industries Association (EIA), - a *trade association*, is a prime example of how engineers can pool their knowledge and give unbiased opinions in a social sphere, namely, conservation of the natural resource which is the electromagnetic spectrum.

Issue No. 70, October, 1971

G-EMC TO CHANGE ITS NAME?

Again, the AdCom is considering changing the name of the Group on Electromagnetic Compatibility nec RFI. In the opinion of many, EMC lacks in popularity and stature.

Continued on next page

During the AdCom meeting during the 1971 EMC Symposium, the following names were suggested:

- Spectrum Control
- Spectrum Engineering
- Spectrum & Compatibility Control
- Spectrum Pollution Control
- Electromagnetic Spectrum Control
- Spectrum Electromagnetic Ecology
- Spectrum Environment Control
- Spectrum Pollution Interference Control Engineering
- Spectrum Management
- Spectrum Sciences Group
- Interdisciplinary Spectrum Management
- Electro Spectrum Control
- Spectrum Conservation
- Spectrum Utilization
- R. F. Utilization

After the AdCom meeting, "Radiation Spectrum Imagineering" was suggested. Radiation defines the type of spectrum to the electromagnetic and extends from DC to cosmic rays. It, therefore, encompasses gamma and x-rays which create EMP during nuclear effects problems. Imagineering replaces the term engineering which is already covered in IEEE and has the restrictive word engine in it. Imagineering can be any of the new and positive forward-reaching disciplines as well as the old and present ones.

CORY IS CANDIDATE FOR DELEGATE/DIRECTOR-1972-73

William E. Cory, an outstanding member of the G-EMC, is a candidate for IEEE Regional Delegate/Regional Director, 1972-73, in the Southwestern Region, Region 5. Known as Gene to many of our Group members, he is the Director of Electronic Systems Research at the Southwest Research Institute in San Antonio, Texas.

ANNOUNCEMENT AND CALL FOR PAPERS

**PURDUE 1972 SYMPOSIUM
ELECTROMAGNETIC HAZARDS,
POLLUTION
AND ENVIRONMENTAL QUALITY**
May 8-9, 1972

Purdue University
Lafayette, Indiana 47907

The theme of the Symposium is to explore the effects and new application areas of electromagnetic fields. Specific topics to be examined include:

- 1) Hazards of, and effects of, exposure to electromagnetic radiation.
- 2) Noise and interference due to power lines and other high power equipment.
- 3) Interactions of electromagnetic radiation and our environment, and pollution monitoring by electromagnetic means.

SYMPOSIUM RECEIVES SUPPORT

International Symposium on Electromagnetic Compatibility, which was held in Philadelphia on July 12-14, is now history. Whether or not it was successful depends upon your point of view.

AS AN ATTENDEE, success was based upon the technological reward. The papers and workshops were certainly varied in both subject and technical level. Also, many of the exhibitors displayed new products and distributed material and goodwill freely.

AS AN EXHIBITOR, success was based upon exposure and potential sales. We cannot comment on potential sales, but approximately 500 persons including competitors passed through the exhibit area.

AS A GROUP MEMBER, the full papers were printed in the Symposium Record and sufficient copies were printed for all those who are truly interested. Copies are still available through New York at \$6.00 each.

AS AN ADCOM MEMBER, the financial picture looks very promising. Up to \$6000 may be forwarded to the Treasurer to help finance the Transactions, Newsletter and Abstracts.

TO THE SYMPOSIUM COMMITTEE, success was realized by the smiles, comments and congratulations offered by many of those who attended. Additional rewards were obtained in the fellowship which was shared and lasting friendships established between committee members.

TO THE CO-SPONSORS, success was just the knowledge that their support was needed and appreciated. And indeed it was! At past symposiums, the donations made by co-sponsors were usually earmarked for the cocktail party. However, the Symposium Committee was reluctant to commit the total contributions to the party due to economic pressure. Thus, the co-sponsors this year also contributed to the welfare of our Group. To the twelve cosponsors go our sincere thanks.

U. S. PARTICIPATION IN INTERNATIONAL STANDARDS ACTIVITIES

The IEEE gave its support to a proposed bill, S. 1798, before the Foreign Commerce and Tourism Subcommittee of the United States Senate. The purpose of the bill is "to foster fuller United States participation in international trade by the promotion and "support" of representation of United States interests in international voluntary standards activities, and for other purposes." The IEEE indicated its strong belief that the bill would serve a useful and valuable purpose in strengthening the participation of United States interests in international standardization.

PENSION PLANS DO NOT PAY OFF

A survey by Senate investigators indicates that the dream of retirement pensions usually turns out to be a nightmare. A study of payouts by 34,000 different pension funds operated by private industry - with assets of \$125 billion - indicates that millions of workers who go to work under pension plans never collect a cent in benefits. Unrealistic terms, layoffs, plant failures or "technicalities" will intrude to disappoint a high percentage of workers - as high as 90% in some industries, one Senator said.

(Editor's note: A follow up newspaper item indicated that "Employers get most benefit." The article indicated that funds that do not find their way into the pockets of retired workers are used instead to prop up the employer's business. It told of using tax exempt pension funds to purchase property when bank loans are not available and the practice of getting the pension funds to purchase the employer's stock when he issues same for new capital or to prop up the market price of the stock. One communications company showed over 320,000 persons participating in a pension plan for over the past 20 years. Over 230,000 employees have left the firm without collecting a penny - about 6,000 of these had over 15 years service and nearly 13,000 had more than 10 years with the firm. From Miles Benson, "Pension Plan Study Indicates Employers Get Most Benefit," *Long Island Press*, Tuesday, April 6, 1971.)

EMC PROBLEMS AND SOLUTIONS

The last issue of the EMC Newsletter introduced a new reader participation feature titled EMC PROBLEMS AND SOLUTIONS. Although the response was not overwhelming, there were a few good questions regarding Federal Communication Commission Regulations

If you have EMC related problems that you would like to present to "EMC experts" that read the EMC Newsletter, please submit them. All of the problems received will be reviewed by the editorial staff and those judged appropriate will be printed in future issues of the Newsletter. Hopefully, some of our readers will be able to offer excellent solutions or suggestions to your problem, and the Newsletter will print those solutions or suggestions that are considered to be most promising. If space is available, several alternative solutions will be presented. Thus, all of the readers will profit from the exchange of problems and ideas. In addition, copies of all solutions, suggestions, or comments received will be forwarded to the reader who submitted the problem ...

From the IEEE EMC Society Newsletter, Summer 1973



Samuel Perry



Carl Frederick



Marty Berman



Dr. Ralph Showers



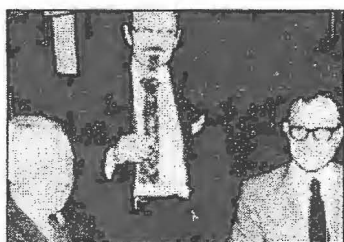
Richard Schultz



Joseph Fischer



Andy Anderson



Rex Daniels, Herman Garlan, and Albert Kall



Leonard Thomas, Jr., Jackie Janosky, and Howard Wolfman

William G. Duff, Atlantic Research, A Division of The Susquehanna Corp.
Shirley Highway at Edsall Road, Alexandria, Virginia 22314

I.F.I. INTRODUCES NEW EMI METER

I.F.I. introduced a new broadband direct-reading EMI meter at the 1971 EMC Symposium. Designated as model EFS-1, the meter reads directly in volts per meter from 10 kHz to 220 mHz. During a susceptibility test, the meter is placed in the right position and the radiated power increased until the meter indicates the desired level; for instance, 10 v/m. The meter can also be used as a system component since the signal, which is proportional to field strength, can be fed back to the leveling circuit of the source so that a constant field strength can be maintained automatically as frequency is swept or stopped. For additional information, contact: James D. Fahnestock.

FOR NEW A-D SCHEME CUT OUT THE NOISE

You can't buy a Triphasic analog-to-digital converter yet, but when you do, you'll be buying a change in design philosophy as well as a new sort of converter, according to Harold S. Goldberg, operations manager of Data Precision, an affiliate of Gordon Engineering Inc., Wakefield, Mass.

To dampen noise, Paul Lucas, Data Precision's project manager, used an inverse feedback loop, something common in other fields, but apparently not in converters. In the Triphasic converter, noise is picked up at the output, integrated, and fed back into the converter at an earlier stage, 180° out of phase with the original output noise signal. This makes noise removal a simple matter of cancellation. The company says noise is a tenth that of equivalent devices made the old way; for example, yearly drift with the technique measured in thousandths of a percent.

[Excerpted from *Electronics*, June 7, 1971]

Issue No. 78, Summer, 1973

Mr. Robert Goldblum
Editor, EMC Newsletter
Dear Mr. Goldblum:

I read with interest your April Newsletter and compliment you for turning out a group newsletter that is distinctly better than the average.

The letter from your loyal reader, quoted on page 3, was of particular interest. In response to a questionnaire, he noted that "G-EMC should repair part of IEEE." I thoroughly agree! We need a great deal of repair. The only question is where G-EMC would like to begin. Let me suggest maintenance of the IEEE standards in electromagnetic compatibility. You doubtless know of other areas to work in as well.

Good luck!

Sincerely yours,
(Sgd.) Bruce B. Barrow

CHANGES IN ORGANIZATION AT WRIGHT-PATTERSON AFB

The Aeronautical Systems Division (ASD) is now the focal point of all Air Force EMCE work while the A. F. Avionics Laboratory is no longer in the EMC business. All EMC work is now controlled by the ASD office under the direction of Sam Skolnick and EMC efforts at ESD are now coordinated with ASD. They have an AFSC Program Direction to develop a systems approach to the control of lightning and precipitation static. The program plan which is being developed identifies tasks that are needed toward the EMC of missiles, ground systems and aircraft. Completion date is set for April 15, 1973. Dr. Robb, LTRI, and Plumber, GE, are working up suggestions to revise MIL-B-5087B for submission to ASD. Others are invited to submit comments relative to lightning protection. ASD is also working in the TEMPEST field and EED radiation hazards and is currently cataloguing EEDs for sensitivity to radiated fields. They are not involved in biological hazards or EMP studies.

EMC FIGURE-OF-MERIT SEMINAR

A one-day seminar on EMC Figure-of-Merit for receivers and transmitters will be held on Thursday, October 18th, at the Electromagnetic Compatibility Analysis Center, Annapolis, Md. Discussions will be held on work to date by, and future plans of, an ad hoc committee. This seminar should be of particular interest to receiver and transmitter manufacturers as well as certain government agencies. Attendance may be limited to the earliest applicants by available meeting space. If you wish to attend, please notify Mr. M. L. Lustgarten, Electromagnetic Compatibility Analysis Center.

CHAPTER CHATTER

by Ira (Marty) Berman

In the beginning the frequency bands were unformed and void, with no intelligence on the receivers of sound and music, and naught save static was heard through the land. A voice came from the deep saying "Let there be EMC," and there was EMC, and it was good. And EMC separated the intelligence from the static and the noise, and the people rejoiced in their cities and their tents.

ATLANTA

And Atlanta spoke unto the Newsletter saying, verily we have meetings, and we are prospering. On the 16th day of the 10th month of the previous year, Dr. R. W. Larson, who is an Associate Professor at the Technical Institute in Georgia, did lecture on the Electrical Car program at the Institute, and 14 did hear and approve...

PHOENIX

And it came to pass in the first month that this Chapter chose to select its new officials, and they are Dwayne Awerkamp of Motorola as Leader; Harold Niles of General Communications as Assistant Leader; Ron Leland of Motorola as Scribe; Jim Martin of Arizona Public Service as Keeper of the Gold; and John Matteson of Honeywell as Master of Arrangements and Publicity. And these officials were chosen by ballot on the 13th day of the last month of the previous year, when one score and four heard Dr. Don G. Dudley present EMC Effects on Communication Equipment...

LOS ANGELES

And there was a watering place in the valley in the desert, where the maidens would come in the evening to water their camels and sheep. And so it is with the tribe in the

basin of Los Angeles, but there is the refreshing of the spirit. For on the 16th day of the 11th month, a number of the elders of the tribe gathered to prophesy What's New in EMC for 1973 to the amazement of two score and 12; and on the 18th day of the last month the tribe did celebrate with a party for the holiday season. On the 25th day of the first month the sage, Herb Mertel, of General Dynamics, San Diego, did expound on EMC for Rapid Transit Systems, which could cause the silver chariots that carry multitudes from city to city to run askew. And yet this problem does not occupy the attention of the prophets who predict greater use of the chariots. The leader of the tribe did state that the sage, Herb Mertel, will lead a council in its discussions at the mighty EMC convocation in the sixth month, wherein control of the silver chariots that run on two bars of iron laid upon the ground may be effected by means of connection of many small filaments of metal. And the leader does state that the tribe from the City of Los Angeles does flourish. In these days of woe, such news is surely as welcome as manna from Heaven.

SEATTLE

And there was a mighty city where the traditions were passed from the warriors with skin the color of bronze to the tribe of EMC. And when the tribe met in convocation they did choose Thomas H. Herring as Leader, and Jerry M. Carter as Assistant Leader, and Richard F. Holtman as Scribe and Keeper of the Gold. The leader has called the tribe to meetings, and on the 20th day of the ninth month of the previous year only four and 10 did hear Alfred Eckersley of the clan of Boeing speak on a Test Jig for Shielding Effectiveness...

SAN FRANCISCO

And the members of the tribe of EMC who abide where the ground shakes and mighty bridges span the water near the city have met on the 20th day of the 11th month, and one score and ten were enlightened when William Berger of the clan of Philco-Ford WDL did speak on Semiconductor Failure Analysis. And the sages Dick Krasner of the clan of National Semiconductor, and Alan K. Johnson of the clan of LMSC did assist the man William in his speaking. And on the 18th day of the second month still another group lead by Dr. Roy Amara who is also the Leader of the clan of the Institute of the Future, and Fred Nichols who is the leader of the clan of LectroMagnetics, and Dr. Harold Gumbel of the clan of Philco-Ford WDL did teach on Technological

Forecasting and Assessment and the Status of the EMC Engineer. Thus it was that the tribe of EMC does not let the occasional shaking of the ground cause them to falter.

WASHINGTON, D. C.

And it came to pass on the 17th day of the fifth month that the members of the tribe of EMC who assist the leaders of the nation did convene and hear Mr. David B. Colby of the Office of Telecommunication Policy. And the sage David was very wise, for he was able to explain "OTP Circular 11 - A Policy to Assist Planning for Use of the Spectrum Space." ...

METROPOLITAN NEW YORK

And in the greatest city there was a mighty grouping of the tribe, and they do convene one time every new moon. And in the multitude of their meetings they do tap new sources of wisdom, and in their wisdom they all do become wise men. And their meetings were held on the 15th day of the 11th month, in which they learned Radiation Hazards Measurements, and their teacher was E. E. Aslan of the clan of Narda, and on the 13th day of the 12th month the teacher, A. G. Zimbalatti taught on the methods of conducting the Great Symposium in the summer, and on the 17th day of the first month the tribe did consider the protection of the materials of the tribe from the great electric spark in the sky, and on the 21st day of the second month the tribe did ponder the Philosophy of Tests...

And thus it came to pass that this is the last column I will be writing. It's been a wild five years - FIVE YEARS - that has seen me through three jobs, and has seen the rise and fall of EMC Chapters all around the country. But now I'm just about out of the EMC Business, and it's really tough to follow it as closely as a Group Newsletter column requires. With a fairly firm hand (but with just a trace of catch in my throat) I pass the guidon to the new Associate Editor. To all who have sent me news and stuff--thank you. To all who have sent best wishes--thank you too. And best wishes from here for bigger and better EMC!

GEORGE UFEN LEAVES SIGNALITE

George R. Ufen has resigned effective June 1, as Western Manager of Signalite to become president of the recently incorporated G R U Asso. in Glendale, Ca. George was previously Western Manager for Fairchild Electro-Metrics and prior to this he was co-owner of an electronic manufacturers' representative group.

EMC Related Conferences & Symposia

1997

June 12

FDA/AAMI
CONFERENCE ON
EMC/EMI:
SOLUTIONS FOR
MEDICAL DEVICES

Arlington, VA
Crystal Gateway Marriott
Eileen Smith
(703)276-0793, ext. 241

September 23-25

19TH ANNUAL EOS/
ESD SYMPOSIUM

Santa Clara Convention Ctr.
Koen Verhaege
Tel: (609) 734-2344
Fax: (609) 734-2565
e-mail: kverhaege@sarnoff.com

1998

June 14-19

11th INTERNATIONAL
CONFERENCE ON
HIGH-POWER
ELECTROMAGNETICS:
EUROEM '98

Tel Aviv, Israel
The Secretariat Euorem '98
Tel: 972 3 5140000
Fax: 972 3 5140077
E-mail: euroem98@kenes.com

IEEE Administrative Meetings

August 17 & 21

EMC SOCIETY BoD
Hyatt Regency, Austin, TX
Janet O'Neil, (206) 868-2558

August 18 & 20

EMC SOCIETY
STANDARDS
COMMITTEE
Hyatt Regency, Austin, TX
Dave Traver, (619) 673-2601

November 7

EMC SOCIETY
STANDARDS
COMMITTEE
Marriott Marquis
Atlanta, GA
Dave Traver, (619) 673-2601

November 8

EMC SOCIETY BoD
Marriott Marquis, Atlanta, GA
Janet O'Neil, (206) 868-2558

EMCS Cooperating Symposia

U.K. Biannually, even years, in September.
Zurich Biannually, odd years.
Wroclaw Biannually, even years, in June.

*The IEEE EMCS Newsletter welcomes contributions
for this calendar page. Please send information to:*

Editor, IEEE EMCS Newsletter

fax: (206) 868-2558

e-mail: j.n.oneil@ieee.org

IEEE EMCS Symposia Schedule

1997

Austin, TX
August 18-22
Austin Convention Ctr.,
Hyatt Hotel
John Osburn: (512)835-4684
e-mail: 97.emc.symp@emctest.com

1998

Denver, CO
August 24-28
Adam's Mark Hotel
Barry Wallen
(303)682-6600

1999

Tokyo, Japan
(International IEEE)
May 17-21
S. Nitta
e-mail: nitta@cc.tuat.ac.jp

1999

Seattle, WA
(National IEEE)
August 2-6
Westin Hotel
Bill Gjertson
(206)773-3482

2000

Washington, DC
August 21-25
Washington Hilton
Bill Duff
(703)914-8450

2001

Montreal, Canada
Montreal Convention Ctr.
Christian Dubé
(514)653-6674

2002

Minneapolis/St. Paul
Hyatt Regency, Minneapolis
Dan Hoolihan
(612)638-0250

2003

Tel-Aviv, Israel
(International IEEE)
Elya Joffe
fax: 972-9-765-7065

2003

Boston, MA
(National IEEE)
Mirko Matejic
(508)549-3185

2004

Santa Clara, CA
Franz Gisin
(408)492-3543

Institutional Listings

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

AMPLIFIER RESEARCH

160 School House Road, Souderton, PA 18964-9990

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