

IEEE

Electromagnetic Compatibility Society



Newsletter



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EDITOR: ROBERT D. GOLDBLUM

A MESSAGE FROM SANDIEGO—EMC/1986

The 1986 EMC Symposium promises to be the most significant EMC technology event of the year. There are several reasons why the San Diego Symposium will be an EMC event:

The emphasis of the planning committee will be on service:

- .. Service to the EMC Society
- .. Service to the IEEE Members
- .. Service to the Exhibitors
- .. Service to the Accompanying Guests
- .. Service to the Electronics Industry

To achieve this exemplary service the planning committee was formed by people who have done it before.

The three key items of an EMC Symposium are:

1. Technical Program
2. EMC Exhibits
3. Arrangements

The technical program is being coordinated by the team of Ed Skomal and Joe Fischer.

Ed is in charge of technical papers. He is also Chairman of the Technical Committees of the EMC Society and will use the technical committees to select the papers. Joe will work with Ed to continuously shape the technical program as the papers are being selected and submitted.

The Exhibit Chairman is Jerry Rothhammer. The achievements of the technical community are brought to reality by our EMC industry. Consequently, the exhibits are the showcase of the EMC Society and the entire EMC Community. The San Diego Town & Country Convention Center is one of the most beautiful settings for the EMC exhibits. Jerry will assist all exhibitors with his experience since he knows how not to exhibit.

In San Diego the exhibits will not be upstairs, downstairs, and around the corner, in a tent, or in a hotel room. Everything will be on one floor: In the Giant Atlas Ballroom. Jerry plans for 150 exhibits and keeps space reserved for more. The social functions are planned around the exhibits to give maximum exposure to our exhibitors. (By the way, the first exhibitor, Reliance Comm/TEC has sent their check already. They deserve a prominent exhibit area.)

The Arrangements Chairman is Bill Johnson. Bill has also done it before — EMC 1979 in San Diego. The social functions and the arrangements are carefully coordinated with the technical presentations, committee meetings and exhibits. These events will be a world-class happening because EMC-86 will be in the spotlight of the World's EMC Community as reviewed below.

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6014849 SM
EDWIN L BRONAUGH
128 WOODHAVEN DR
SCOTIA

27N

HTI14

NY 12302

EDUCATION COMMITTEE NEWS

The following is a partial listing of some short courses and seminars on EMC related topics being offered this summer.

Syracuse University will offer a short course on *Electromagnetic Analysis of Integrated Circuits* on June 17-20 in Blue Mountain Lake, NY. For more information call (305) 892-6146.

TKC is presenting a course on *Digital Design For Interference Specifications* on July 14-16 and Oct. 27-29 in Clearwater Beach, FL, and on November 10-12 in San Jose. *PCB Layout For Minimizing Emissions* will be offered on July 17 and Oct. 30 in Clearwater Beach, FL, and on November 13 in San Jose. For more information call TKC at (813) 544-2594.

EMXX and CKC will present a series of EMC related courses in Ithaca/Lansing, NY during the month of June. *EMI/RFI/EMC Analysis Using Personal Computers* (June 16), *Grounding Bonding & Shielding* (June 17-18 & June 24-25), *FCC/VDE Commercial Applications* (June 19-20), *Military Applications* (June 19-20), *Product Safety* (June 16 & June 27), *DO-160 Avionics EMC* (June 26), *EMC Navy Shipboard Design* (June 26), *ESD/RF Susceptibility* (June 23). For more information call (703) 451-4619 or (209) 966-5240.

R&B Enterprises will offer the following short courses in Boston; *Fiber Optics Systems Design for EMI/EMP Control* on June 16-17, *Electromagnetic Pulse (EMP) Design and Test* on June 18-19, *Grounding, Bonding & Shielding* on June 10-11, and *EMI for Non-EMI Personnel* on June 9. In addition the following courses will be offered in Philadelphia; *The R & B EMI Training Institute* on August 11-22, *Understanding and Applying MIL-STD-461C* on June 11-12, and *Architectural Shielding* on June 9-10. For more information call R&B at (215) 825-1960.

Interference Control Technologies will be offering *Grounding and Shielding* on June 3-6 in Boulder, CO and on June 17-19 in Washington, DC, *Practical EMI Fixes* on June 18-20 in Washington, DC, *Introduction to EMI/RFI/EMC* on June 17-19 in Washington, DC, *Tempest Facilities* on July 22-24 in Sunnyvale, CA, *EMI Control in SMPS* on June 3-5 in Boston, and *ESD Control* on July 8-9 in Philadelphia. For more information call (703) 347-0030.

If you have any information that you would like to see included in this column, please contact me. To be included in the newsletter information must reach me by March 1 for the spring issue, June 1 for the summer issue, September 1 for the fall issue, and December 1 for the winter issue.

Henry Ott
Chairman, EMC/S
Education Committee

AT&T Bell Laboratories
Room 1E-212A
Whippany, NJ 07981
(201) 386-6660

NEWSLETTER STAFF

EDITOR

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

ASSOCIATE EDITORS

CHAPTER CHATTER

Charles F.W. Anderson
Martin Marietta
1716 Reppard Road
Orlando, FL 32803

BOOK REVIEWS

James S. Hill
The EMXX Corp.
6706 Deland Drive
Springfield, VA 22152

EMC PERSONALITY PROFILES

William G. Duff
Atlantic Research Corp.
5390 Cherokee Ave.
Alexandria, VA 22314

SEQUENCY UNION

Dr. G. Robert Redinbo
Dept. of Electrical & Computing
Engineering-Univ. of California
Davis, CA 95616

ABSTRACTS

Melvin J. Johnson
Southwest Research Institute
P.O. Drawer 28510
San Antonio, TX 78284

PHOTOGRAPHER

Fred J. Nichols
LectroMagnetics, Inc.
6056 W. Jefferson Blvd.
Los Angeles, CA 90016

EMC STANDARDS ACTIVITIES

Herbert Mertel
EMACO, Inc.
P.O. Box 22066
San Diego, CA 92122

EMCS EDUCATION COMMITTEE

Henry Ott
AT&T Bell Laboratories
Room 1E-212A
Whippany, NJ 07981

EMC-S BOD ACTIVITIES

Donald N. Heirman
AT&T Information Systems
Crawfords Corner Rd.
Building 41-112
Holmdel, NJ 07733

POINT AND COUNTERPOINT

Anthony G. Zimbalatti
Grumman Aerospace Corp.
M.S. B25/35
Bethpage, NY 11714

PAPERS, ARTICLES & APPLICATION NOTES

Edwin L. Bronaugh
Electro-Metrics
100 Church St.
Amsterdam, NY 12010

INTER-SOCIETY ACTIVITIES

Walt McKerchar
Electromagnetic Engineering, Inc.
P.O. Box 1888
Poulsbo, WA 98370-0269

The EMC-86 Symposium date has been carefully coordinated with two other events:

- .. The International Special Committee on Radio Frequency Interference (CISPR) will hold its annual meeting in San Diego the week prior to EMC-86 from 6 to 13 September 1986. Consequently, the regulatory EMC experts from around the world will be in San Diego. This will be a unique opportunity for the EMC Society and exhibitors to show the world's EMC experts what the EMC Society is all about.
- .. The American Radio Relay League will hold its National Convention prior to EMC-86 from 5 to 7 September 1986

and also at the Town & Country Convention Center. Walt Hicks (W6UZL), Tel.: (619) 292-7918, is the General Chairman. Many of the EMC Society members belong to the A.R.R.L. and vice versa and may therefore be interested in attending both meetings.

This message is intended to give the EMC Society members advance notice that the EMC-86 planning committee is preparing the foundation for a major EMC event. We hope that your plans and work schedule will allow attendance at EMC-86 in San Diego.

Cordially,

Herb Mertel
Chairman - EMC-86

George Ufen
Vice Chairman & Publicity

(Because part of this notice was edited out of the Winter 1986 issue, we reprint it here in its complete version.)

BOARD OF DIRECTOR'S MEETING IN ANAHEIM, CALIFORNIA

The first Board meeting for 1986 was held on Wednesday, February 5th, at the Grand Hotel in Anaheim, California. The meeting was the day before the Orange County EMC Chapter's Regional Conference and Exhibition at the same hotel. Ten of the 18 Board members were present as were organizers of the REGICON and Fall San Diego Symposium. The meeting accommodations were much appreciated. We thank Larry Caney, REGICON Chairman, for his support and help. The REGICON had close to 500 attendees, which is an excellent turnout for a local EMC activity.

President Knowles called the meeting to order at 10 am and introduced the attendees. A special moment of silent prayer was observed upon hearing the death of Ralph Taylor, a long time EMC Society Standards Committee member and "father" of our IEEE Standard 475 on Field Sensors.

The newly-elected Board members were announced. A 25% ballot return was received in the voting process which is an unheard of high percentage for IEEE elections. It was extremely encouraging to know that our members have such a high interest in the elections. The President received requests for Herb Mertel to represent Bob Goldblum, and for Jerry Rothhammer to represent Prof. Sato. Both Bob and Prof. Sato were unable to attend. The Board accepted the representatives. No requests for representation were received from the other absent Board members. The Secretary, Don Clark, presented the minutes of the last meeting in Wakefield, Massachusetts on August 19, 1985. With the

addition of a writeup on Dr. Tomyasu's presentation at the August meeting, the Board approved the minutes.

The following summarizes the major items discussed at the meeting:

1. Treasurer Len Carlson indicated that our Society's current net worth is \$261K and that the total active Society membership is 2664 with another 419 members with dues in arrears as of 10-31-85, which is the date of the latest printout. Len also presented several IEEE plans for long and short-term investment of our cash assets. Headquarters is considering investing in 60-day "T" bills for short term and 180-day investments with higher return for long term. The Board will await the development of these investment scenarios which are to be discussed at the next Technical Activities Board meeting. The Treasurer's report was accepted by the Board.

2. Bob Haislmaier, Technical Director for Communications Services, reported that the Newsletter was on time. He repeated the offer of Editor Bob Goldblum for the Board and Standing Committees to use the Newsletter to communicate with the members their activities. There was a suggestion to implement a Newsletter archiving service on a continuing basis. A general discussion on microfiche and other techniques was conducted. The result was an approval of up to \$2500 for expenses associated with archiving past issues of the Newsletter. Over 2800 pages will be microfiched with the possibility of selling copies to those interested in our history.

Dick Schulz presented his Transactions report. There will be approximately 240 pages published this year. Dick asked for topics for special issues. Three were mentioned:

- a. EMC Open Area Measurements
- b. Composite Materials/Shielding
- c. EM Environments

Those interested in working on these issues and providing papers, please call Dick at (214) 420-7919.

Gene Cory presented a brief report on future EMC Symposia. Herb Mertel reported that 80 of 92 papers submitted for San Diego were accepted. The paper review was done by the EMCS Technical Committees. This worked out very well and Herb suggested that this be SOP. 60 booths have been sold to date and 500 rooms have been blocked at the Symposium hotel. Herb requested that the Board take an increased role in discussing the competitive roles of other regional EMC conferences with the yearly international symposium. Gene Cory mentioned that the Society's symposium guide is being revised and that any comments or proposed policy matters in this regard should be entered now. Those who want copies of the guide should call Gene at (512) 684-5111, ext. 2711. It was noted that the Atlanta 1987 Steering Committee was also concerned with other EMC Conference conflicts. The Japan 1989 Steering Committee reported their first organizational meeting to be held this October. A preliminary budget for Washington, DC in 1990 is being developed. Finally, the Israeli EMC Chapter was seeking guidance on the possibility of a 1992 international symposium in Tel Aviv. The Board expressed a desire for Israel to first host a regional conference to see what can be expected prior to accepting any bid for an international symposium.

President Knowles presented to the Board a letter he wrote to the organizers of EMC Expo 86 in Washington, DC. His letter was to clarify that the EMC Society is not an exhibitor nor a sponsor of the private meeting and to so state in future advertisements. For further details, contact the Secretary, L. Gilda Haskins (newly elected) at (215) 752-4749 or Gene Knowles at (206) 773-1577. Finally, Jim Hill's report indicated that the society is cooperating with the Zurich 87 Symposium organizers.

3. Ed Bronaugh, Technical Director for Technical Services, introduced the Chairmen of the Standards and Education committees who gave their reports. Don Heirman, EMCS Standards Committee Chairman, reported that his committee continues to meet three times a year immediately preceding the Board meetings. The standards activity highlights include:

- a. A fourth draft prepared for Standard 139 on ISM emission measurement techniques.
- b. A second ballot for approval of the revision to Standard 140 in ISM mitigation techniques.

- c. A third draft of the revision to Standard 187 on open area testing techniques for TV/FM receivers is about complete.
- d. Change in working group chairmen handling the proposed standard on testing procedures for transfer impedance and shielding effectiveness of cable shields and connectors. Jim Parker, Apollo Computers, has assumed the chairmanship.

Don also reported that he sent to Headquarters an extensive list of all Society and other members of our EMCS Standards Working Groups. This list is to identify all who should be indemnified by the IEEE when working on standards. Finally, there has been identified a list of a dozen Wakefield Symposium authors who may have direct interest in volunteering their expertise to the appropriate standards working group. If there are further standards related questions, please call Don at (201) 834-3566.

Hank Ott reported that his Education Committee booklet on EMC experiments is still awaiting critiquing by the over 400 who have received the booklets. Please send your comments to Hank by phone at (201) 386-6660. Hank also indicated that an introductory EMC videotape is being prepared and should be available for viewing in San Diego.

4. Reports for member services were presented next. Regarding Chapter activities, Bob Hofmann reported that there were 27 EMC Chapters with the Phoenix Chapter becoming active. He also requested that a national lecturer list be established so that Chapters can avail themselves of getting speakers outside their IEEE sections for Chapter meetings. The Board approved up to \$5000 for the Education Committee to set up and operate a national EMC lecturer program. Hank would like to get inputs from each Chapter to identify who, based on their experience, should be on this list. Chapter Chairmen are asked to call Hank with your suggestions. Bob also has available a new EMC Board of Director and Chapter Chairperson's Directory. If you want a copy, call Bob at (312) 979-3627. Bill Duff reported that fellow candidates should get their paper work in as soon as possible. In 1986 and thereafter, there is a new allocation and more fellowships may be available. Contact Bill at (703) 642-4049.

5. There was no report on Professional Services.

6. Under old business, Herb Mertel reported that he needs more financial support for the 1986 CISPR Subcommittee meetings which will be held immediately preceding the San Diego symposium in another area hotel. Many of the CISPR delegates will be attending the EMC symposium (the CISPR subcommittee chairmen will be giving a tutorial on their activities on the first day of the symposium). The EMC Society has contributed \$5000. More may have to be raised.

Bob Brook reported further on his EMCS liaison activities with the Society on the Social Implications of Technology. He pointed out that an area of EMCS participation should be in coming up with standards for measuring the susceptibil-

ity of medical equipment. This would be a joint venture with the Committee on Man and Radiation (COMAR). If interested, please contact Bob at (516) 595-3136.

7. Under New Business, a long discussion was held on ways to strengthen the ties between the Board and the EMC Chapters. We have already discussed the national lecture program startup. The Washington, DC Chapter requested \$600 for publicity and other expenses associated with their March 13, 1986, Spectrum Management Day. The Board approved the request. Any other legitimate requests for similar support should be sent in writing with a complete explanation to the new Secretary, L. Gilda Haskins, Haskins Assoc., 2535 Sharon Court, Bensalem, PA 19020. In addition, the Board will provide a large IEEE EMC Society banner for us at Chapter meetings. Chapter officers should contact Gilda, in writing, requesting the banner. Finally, the Board approved sending a copy of the 1986 San Diego Symposium record to all Society members.

Several suggestions were made to promote international EMC. An ad hoc committee will soon be formed to prepare a policy on transnational EMC participation. The committee will first concentrate on seeking fellow candidates and writing personality profiles for the Newsletter for EMCS members outside the United States. For more information, contact the new President, Len Carlson at (206) 773-6297.

8. Finally, the new officers and technical directors were elected. By unanimous vote. The election results for 1986 are:

President:	B. Len Carlson
Vice President:	Don Clark
Secretary:	L. Gilda Haskins
Treasurer:	Dick Ford

Technical Directors:

Communications	
Services:	Bob Haislmaier
Member Services:	Fred Nichols
Technical Services:	Ed Bronaugh
Professional	
Services:	Bob Brook

9. President Knowles adjourned the meeting at 4:30 pm. The next meeting will be at the Parsippany Hilton in Parsippany, New Jersey on Thursday, May 22, 1986 at 10 am. For more information, contact Gilda Haskins at (215) 752-4749.

Respectfully submitted,

Don Heirman
Associate Editor
Board of Directors Activities



IEEE INTERNATIONAL SYMPOSIUM
ON
ELECTROMAGNETIC COMPATIBILITY
P.O. Box 231559 • San Diego, CA • 92123-0920



SPECIAL ADVANCE NOTICE INVITATION FROM THE EMC-86 ORGANIZING COMMITTEE

The Organizing Committee for the 1986 IEEE International Symposium on EMC in San Diego cordially invites you to come to San Diego to visit with your fellow engineers to learn and share your expertise on all topics related to Electromagnetic Compatibility. The local EMC Society Chapter, with help from the Los Angeles Chapter and the National EMC Society, has built the foundation for a significant EMC event. With your participation, this event is likely to be an outstanding International EMC Symposium. The international participation will be quite significant. EMC experts from many countries will attend the San Diego 1986 CISPR Meeting in San Diego during the preceding week, as well as contributing toward the EMC Symposium.

The Opening Session will emphasize this year's motto: "EMC ENGINEERING FOR THE FUTURE: BUILDING ON THE PAST." To achieve electromagnetic compatibility requires the understanding of classical electromagnetic laws. However, the interpretation and applications of these

laws is changing because of the multitude of new electromagnetic applications and the consequent side effects of this. In both the commercial and military areas of our EMC efforts, apparently divergent methods are merging because the same techniques and devices are used which must function in similar environments.

Our two Keynote Speakers will address the past, present, and future of EMC. Mr. G. A. Jackson, President of the CISPR, will review the commercial aspects, and Mr. Nigel Carter, Royal Aircraft Establishment, will review the military aspects of EMC.

The opening session will also include the Grand Opening of the Exhibits, where over 100 Exhibitors will display the products and techniques of the EMC Community.

The technical program includes 110 papers in four concurrent sessions. The papers were carefully selected by the EMC Society Technical Advisory Committee under the direction

of Ed Skomal. These papers were shaped into a very impressive program by Joe Fischer, as follows:

The Advanced Program will be mailed during April of 1986. It contains the following technical program:

Tuesday, 16 September

7:00am	Registration (Also: Monday 3:00pm)
9:00am	Opening Session (Session 1)
10:00am	Grand Opening of the Exhibit
11:00am	Refreshments
12:30am	Hosted Lunch
2:00pm	Session 2A Measurement Sets and Sensors
	2B Shielding
	2C EM Environments
	2D CISPR Tasks & Work Status
3:00-3:30pm	Coffee Break for 2A & 2B
3:30-4:00pm	Coffee Break for 2C & 2D
6:30pm	Reception & Food, Exhibit Area
9:30pm	Hospitality Suites Open

Wednesday, 17 September

8:00am	Registration
8:30am	Session 3A Shielding Measurements
	3B EMI Analysis
	3C EMC Modeling
	3D EMC Education
9:30-10:00am	Coffee Break for 3A & 3B
10:00-10:30am	Coffee Break for 3C & 3D
12:15pm	Hosted Lunch
2:00pm	Session 4A Electric Field Generation
	4B EMC Problems
	4C EM Environments
	4D EMC Measurements
3:00-3:30pm	Coffee Break for 4A & 4B
3:30-4:00pm	Coffee Break for 4C & 4D
6:00pm	Hospitality Suites Open

Thursday, 18 September

8:00am	Registration
8:30am	Session 5A Open Area Test Sites
	5B Specification & Regulations
	5C Shielding & EMP
	5D EM Environments, II
9:30-10:00am	Coffee Break for 5A & 5B
10:00-10:30am	Coffee Break for 5C & 5D
12:15pm	Hosted Lunch
2:00pm	Session 6A Modeling
	6B ESD
	6C NEMP & Transients
	6D Immunity & Field Reductions

The Arrangement Committee under the direction of Bill Johnson has planned all functions in the magnificent Town & Country Convention Center. Attendees will be treated to high quality technical presentations, exhibits, a hosted lunch each day, and a reception/smorgasbord on Tuesday evening. These, and many other attractions should make EMC-86 a memorable event.

The Technical Exhibit Committee under the direction of Jerry Rothhammer has ensured an effective showcase for the achievements of our EMC Community: The San Diego Town & Country Convention Center is a beautiful setting for the EMC exhibits. And Jerry will assist all exhibitors with his experience and skill regarding how to, and how not to, exhibit.

In San Diego the exhibits will not be upstairs, downstairs, around the corner, in a tent, or in a hotel room. Everything will be on one floor: In the Giant Atlas Ballroom. Jerry plans 150 exhibits, and has space reserved for more (at press time, 15 March 1986, 105 exhibits were sold).

The Hospitality and Tours have been arranged by Jill Mertel and her committee. The following tours will take place:

Tue 11:00am-4:00pm Guided Sightseeing Tour of San Diego

Wed 10:00am-4:00pm A Cultural, Sightseeing, Shopping Tour of Tijuana — San Diego's neighbor just south of the U.S. Border

Thr 10:00am-2:00pm Luxury Yacht Cruise

The Technical Presentations will start promptly at the specified times. Moreover, each speaker is allocated a specific time slot in one-half hour increments. Each Session Chairman will ensure that this time-table is maintained to allow "Session-Hopping" for those who want to "mix-&-match" presentations among sessions to precisely meet their particular interests. If a speaker fails to show, there will be a half-hour pause to maintain the schedule. In that event, the Session Chairman would make an announcement regarding when the Session would resume.

Coffee Breaks are staggered to minimize Queue-ups: Session A & B Coffee Breaks: 9:30 to 10am & 3 to 3:30pm; Session C & D Coffee Breaks: 10 to 10:30am & 3:30 to 4pm.

The Organizing Committee has enthusiastically accepted the EMC Society's Commission to host EMC-86 in San Diego.

We wish to express our appreciation to the exhibitors and authors for making this Symposium a reality, and we promise you a memorable experience during your stay in San Diego.

This message is advance notice to EMC Society members from the EMC-86 Planning Committee regarding this major EMC event. We hope this early notice will assist you in making your work schedule and plans to allow you to attend EMC-86 in San Diego.

We are at your service,

San Diego EMC-86 Organizing Committee

WILLIAM ELMER PAKALA, 1901-1985



On November 7, 1985 the Lord called home William E. Pakala, a Life Fellow of the IEEE and a founder of its EMC Society (then the Professional Group on Radio Interference). Bill had held a membership for almost fifty years and had become a Fellow in 1951. He served on the EMC Society Board of Directors in 1959-60 and 1962-64. Many Society members are familiar with his work.

Following graduation from Montana State in 1927, Bill became a Laboratory Engineer, Audio and Radio Frequency Measurements, with the Westinghouse Corporation. In 1935-36 he worked on the design of carrier current systems for power lines, and between 1936 and 1940 served as Research Engineer on vapor electric devices, ignitron tubes and ignitron firing circuits. During this period he was coauthor of several articles in the *Electric Journal*, and the April 4, 1937 *New York Times* carried Bill's picture with the memnoscope.

In the 1940s sixteen patents were awarded to Bill on inventions assigned to the company. He was co-inventor on five of the sixteen. The September 26, 1943 *Pittsburgh Press* showed Bill testing the arc stabilizer, which sped up work on aircraft. After World War II he received an award from the American Standards Association for work done in developing standards which rendered a valuable service to the Armed Forces. From 1945 to 1954 he served as Liaison Engineer, doing consultation primarily on radio interference with various commercial and governmental organizations.

From 1954 to 1966 Bill served as Advisory Engineer, except for the period from 1956 to 1962 when he was research instrumentation section manager (Westinghouse Central Research Technical Services). One contribution during this time was the ultrasonic corona detector. Bill was pictured with it on the cover of the March 1962 *Electrical Engineering*. In 1964 he served as chief U.S. delegate at the plenary meeting of the International Special Committee on Radio Interference (CISPR). Following "retirement" in 1966 he was kept on as a Westinghouse Consulting Engineer. From 1955 to 1972 Bill served as Vice Chairman or as Chairman of the American National Standards Committee on Radio-Electrical Coordination, C63. In 1972 he was honored by that Committee "in recognition of his many contributions to radio-electrical coordination during twenty-eight years of continuous membership."

Bill became a member of the AIEE in 1938 and was elected a Fellow in 1951. His Fellow citation reads "For research and development of ignitron tubes and their firing circuits, radio noise instrumentation and measurements of electrical apparatus and transmission lines, and prediction of radio noise from transmission lines." In 1972 he became a Life Fellow. He was a Registered Professional Engineer in Pennsylvania and was a life member of the National Society of Professional Engineers and the Pennsylvania Society of Professional Engineers.

Bill was a native of Montana, born at Red Lodge on July 2, 1901. He passed away quietly at his home in Titusville, Florida where he had moved in 1972. The funeral was held November 11 in Estelline, South Dakota. He is survived by his wife, Edythe, whom he met when they were both working at Yellowstone Park in 1927. They lived in Pittsburgh from 1928 until 1972. He is also survived by two sisters, a brother, a daughter, two sons and nine grandchildren.

POINT AND COUNTERPOINT

E³ REQUIREMENTS PROLIFERATION AND ENGINEERING SHORTAGE

I see more and more advertisements for experienced E³ engineers, and I am constantly being asked to supply names of engineers with E³ skills applicable to governmental procurements and who are interested in changing jobs. Thus, I have concluded that there is a shortage of skilled engineers for implementing today's E³ governmental requirements. Concomitantly, governments are demanding that more analytical and experimental engineering tasks be accomplished and documented as proof of meeting today's E³ requirements. Meanwhile, E³ requirements are proliferating, say for example, Nuclear Electromagnetic Pulse and Lightning hardness requirements for subsystems and systems, which will pile on more tasks and documentation efforts. Worse yet, since the major buyer of E³ engineering services, the United States, has a policy of reducing its personnel, the remaining personnel must insist on more and better documentation to assure proper E³ engineering.



by Walt McKerchar

SAE Committee AE-4 on EMC

The next meeting of SAE Committee AE-4 on EMC will be on Tuesday and Wednesday, April 15 and 16 (starting at 9 am each day). The place is the Hyatt Regency New Orleans. This is right at the Louisiana Superdome. A block of sleeping rooms have been set aside for the SAE attendees at a special rate. You may contact the Hyatt Regency by phone at (504) 561-1234, or by mail to Poydras at Loyola Avenue, New Orleans, Louisiana 70140.

A new Committee AE-4 document is now available from SAE Headquarters (400 Commonwealth Drive, Warren-



by Anthony G. Zimbalatti

Has the time arrived to assess the efficacy of the E³ requirements with respect to the engineering analytical, experimental and documentation tasks needed to meet those requirements? If that assessment were to reveal that no significant reduction in engineering effort could be obtained, then, how do today's and tomorrow's E³ engineering shortages get filled? Or, if unfulfilled, can the government tolerate procurement of products that may not work as specified? I, for one, think that a reduction in engineering effort without impacting product performance is possible. And, I think that the time has arrived for using more para engineers (Bachelor of Engineering Technology or Equivalent E³ training and schooling) to solve the shortage problem. How, then, can the government encourage, perhaps by incentives, the use of paras? What are your thoughts?

INTER-SOCIETY ACTIVITIES

dale, PA 15096-0001-Attention Mr. Dave Bentley). This document is "Aerospace Recommended Practice #1972—Recommended Measurement Practice and Procedures for EMC Testing." This was published in December '85. Presently in the publishing process is "Aerospace Information Report #1700—An Upper Frequency Constraint on the Measurement of Shielding Effectiveness of Cables and Connectors." Indeed, this report may be ready at the time you read this. Contact the SAE as above. Another SAE document, "Aerospace Recommended Report #1870—Aerospace Systems Electrical Bonding and Grounding for EMC and Safety," is currently being reviewed by the Aerospace Council. Availability of this document will be reported upon in the next newsletter.

The dB Society

The dB Society, an independent fraternal organization of EMC engineers, has been invited to assist with registration at the '86 International EMC Symposium in San Diego. Look for those blue ribbons marked "dB Society Greeters." They will assist you in every way they can.

CHAPTER CHATTER

First, my apologies for there being no column in the Winter issue.

CENTRAL NEW ENGLAND

The Chapter's October 24 meeting featured Messrs. Maier and Sterk of Hewlett-Packard, whose topic was "Switching Power Supply Design and EMI." They covered sources of EMI, coupling paths and techniques of EMI reduction in switched-mode power supplies. FCC and VDE requirements were emphasized. There were 22 attendees, of whom 18 were EMC-S affiliates.

On December 5, V. F. Kajunski (EIC of FCC's New England Field Office) discussed FCC concerns about interference to computer systems from licensed RF emitters. After pointing out why computer systems designers and manufacturers should be interested in the problem and what their responsibilities were, he discussed the regulations governing RF radiation from computers contained in FCC Docket 20789. There were 23 in attendance, 16 being EMC-S members.

The topic for the March 25 meeting will be "Introduction to EMC," combined with a tour of the Chomerics facility. This will be the Chapter's Student Branch evening, and Hank Ott will be the featured speaker. Chairman Bob Berkovits helped arrange the meeting. On April 17, there will be a joint meeting with the Instrumentation Society Chapter. Joe Butler of Chomerics will present the topic "EMI in Instrumentation." (Thanks to John Clarke for the reports.) (Column Editor's query: How many *other* Chapters have active student branches?)

NEW JERSEY COAST

The NJC Chapter (joint with VT and AP) held their annual Holiday Party/Membership Drive on December 17. No details on the event; but there was a dandy door prize — a Brother EP-44 Portable Typewriter/Terminal! The February 7 meeting had as the speaker Dr. Y. Rahmat-Samli (JPL), who discussed "Large Deployable Reflector Antennas for Space Applications." On March 18, C. T. Swift (U. of Massachusetts) presented "Microwave Remote Sensing of Sea Ice." The April 15 meeting will feature an antenna propagation topic, with Prof. G. Whitman of the New Jersey Institute of Technology as the speaker. (Bob Davis of AEL edits the Chapter's Newsletter.)

SANTA CLARA VALLEY

On January 14, the Chapter had Mr. Marti-Volkoff (EIC of the FCC San Francisco office) as the speaker. His topic was "The FCC's Responsibilities in the Location, Identification and Suppression of EMI." For their February 11 meeting,



by Charles F.W. Anderson

Hank Ott (Bell Labs — Whippany) presented "EMI Shielding — Theory and Methods." The March 11 meeting featured Ron Land (Consultant to EKS/Norland), whose topic was "Gasketing Materials and Techniques." On April 29 and 30, the Chapter will sponsor a colloquium/exhibition at the San Jose Cultural and Convention Center. The theme will be "Electronic Co-existence Through EMC." There will be eight technical sessions, with a wide range of tutorial and pragmatic topics. Over 40 exhibitors are expected to display their products and services. Allan Johnson is chairing this event — for information, contact him at (408) 257-8614. (Ghery Pettit, Chapter Secretary, provided the above information.)

TOKYO

Our Japanese colleagues continue their excellent technical meetings. On September 11 and 12, 1985, a total of 25 papers was presented. Topics covered a wide range of practical and theoretical areas. (Abstracts will probably appear in this NL or the next issue.) There were 37 in attendance on the 11th and 57 on the 12th. Sixteen papers were given at the October 25 gathering. Again a diverse menu of topics was presented. One paper described an omnidirectional antenna for 0.5 and 40 MHz using both shortened dipoles and small loops, which seems as if it might be of use in EMI measurements. Another paper reported on modeling of the human head in connection with investigations of the "audible microwave emission" phenomenon which has been experienced by many people. Thirty-five were in attendance, of whom 15 were IEEE affiliates. At the November 15 meeting, seven papers were presented. One which might be of special interest to those involved in bio-effects describes experiments in which *Drosophila* pupae were exposed to dc high-voltage fields. Another paper reports on some theoretical considerations of noise originating in electrical machines. Attendees included 12 IEEE members with 15 guests. Fifteen papers were given at the December 12 meeting. The following were among those of particular interest:

- A report on the effects of plating thickness on the shielding characteristics of plated cloth.
- Results of investigations of the screening effectiveness of coaxial connectors.

- Use of holographic techniques for electromagnetic field pattern measurements.

Professor Akao (Aichi Institute of Technology) gave a report on the '85 EMC Symposium. Eighteen IEEE members plus 23 guests attended. (Thanks from your Column Editor to Professor Nagasawa, who is Tokyo Chapter Secretary, for the above reports.) The January 29 meeting featured ten papers. Topics included a discussion of EMI measurement errors based on tests of instruments for compliance with CISPR requirements and a proposed new model for radiated noise sources in digital systems. There were 35 attendees, of whom 23 were guests. (Thanks to Professor Echigo (Tokyo Chapter Treasurer) for the January report).

TWIN CITIES

The Chapter's first '86 meeting was held on February 19. Al Chiaravello (Schaffner Corp.) spoke on the topic "Powerline Disturbance Simulation." (More details in the next issue.)

LAST MINUTE ITEM!!

Yes, there will *finally* be a Central Florida area Chapter. Great efforts by Brian VanCata (Eaton-AIL) in beating the bushes to get EMC-S affiliates signed up have borne fruit, and I am happy to report that chartering is in process! Kick-off meeting in the not-too-distant future. More news in the June issue.

INTERNATIONAL CONFERENCE ON LIGHTNING AND STATIC ELECTRICITY

The FAA, Air Force and other members of the National Atmospheric Electricity Hazards Protection Program will sponsor the 1986 International Aerospace and Ground Conference on Lightning and Static Electricity, June 24-26, 1986.

During the conference, to be held in Dayton, OH, international experts will present over 100 papers on contemporary lightning and static electricity research. In addition, the latest methods of protecting aircraft, aerospace vehicles and ground facilities against atmospheric hazards associated with lightning and static electricity will be presented.

The conference is lead by the protection program's National Interagency Coordination Group, which also includes the Army, NASA and the National Oceanic and Atmospheric Administration. The Florida Institute of Technology also is participating in this conference.

Registration for the conference begins on June 23, 1986. For further details, write: Conference Chairman Larry Walko, U.S. Air Force, AFWAL/FIESL, Wright-Patterson Air Force Base, OH 45433; or call (513) 257-7718.

EIGHTH ANNUAL ELECTRICAL OVERSTRESS/ELECTROSTATIC DISCHARGE SYMPOSIUM

The Eighth Annual EOS/ESD Symposium will be held September 23-25, 1986 at the Hotel Riviera in Las Vegas, NV.

The symposium, dealing with electrical overstress (EOS) and electrostatic discharge (ESD) effects on solid state microelectronics, is being sponsored by IIT Research Institute and the EOS/ESD Association. The symposium will be devoted to the understanding of fundamental phenomena associated with transient electrical overstress and the application of this knowledge to the solution of problems in military, industrial, communications, consumer and automotive electronics.

Although the symposium is especially intended for the dissemination of results related to EOS/ESD problems in the design, fabrication, testing, handling and use of microelectronic circuits, and equipment containing these circuits, papers dealing with electrical overstress in other electronic components and equipment will be considered for the program. Papers will deal with work in the following or related areas:

FAILURE MECHANISMS

Modeling and Physics of Damage	Latent Failures
Breakdown in Solids	Second Breakdown

DESIGN FOR ELECTRICAL OVERSTRESS

Design Hardening	New Microelectronic
Transient Protective Devices	Structures
	New Materials, Processes, and Technologies

TESTING

Test Methods and Procedures	Simulation
Specifications and Standards	Failure Analysis Techniques

PRECAUTIONARY MEASURES

Facilities	Implementation
Line Transients	Procedures
	Packaging and Handling

For more information, contact Publicity Chairman, Michael E. Martin, 3M/Static Control Systems Division, 2111 West Braker Lane, Building 501, P.O. Box 2963, Austin, TX 78769-2963; or call (512) 834-3117.

EMC STANDARDS ACTIVITIES



by Herbert K. Mertel

Activities of the IEEE EMC Society Standards Committee

The following article was prepared by Don Heirman, Guest Editor and Chairman of the EMC Society's Standards Committee:

There are eleven IEEE Standards which the EMC Society is the sponsoring organization. Of these, six are being revised to bring them up to date with the latest technology. Table 1 lists these standards and indicates the subject matter by title.

1. Standard 139

This standard is in its fourth draft (third draft dated 7/19/85). This is a major revision to provide up-to-date techniques for inspecting industrial, scientific, and medical (ISM) equipment and for measuring RF energy emanating from this equipment. The frequency range includes the 10 kHz to 300 M Hz region as well as above 300 M Hz. These measurements are to be made on the user's premises. To capture the change in scope, a new title is proposed: "Recommended Practice for the Measurement of Radio Frequency Emissions from ISM Equipment installed on User's Premises." For more information, contact Dan Weinberg at (914) 684-4749.

2. Standard 140

This standard addresses ways to mitigate radiated interference from in-situ RF heating equipment. Much of the material is tutorial in nature and hence is a good reference for those EMC engineers with interference problems in a industrial area. This standard is being updated with the latest investigation techniques, including filtering and shielding. A committee ballot is presently out for vote. For more information, contact Jim Maw at (206) 383-1591.

3. Standard 187

Draft 3 of the revision to IEEE Standard 187 is underway. The revision will incorporate specific improvements in making measurements of radiated emissions. These improvements are in line with the OATS (open area test site) document presently under development by ASC C63. Other topics under study are the application of the standard to TV monitors and the harmonization of the standard with those of CISPR (Special International Committee on Radio Interference). For more information, call Sal Gentile at (619) 487-8500, extension 246.

4. Standards 213 and 214

These standards deal with the use of the 50 ohm, 5 μ Henry Line Impedance Stabilization Network used in measuring conducted emissions. This LISN is used when making such measurements on TV and FM receivers. The revision to these standards is being circulated for review within the IEEE and associated standards bodies for approval. Of particular interest is a follow-on project to standardize the use of the more common 50 ohm, 50 μ Henry LISN. For inputs, contact Mike Hart at (512) 835-4684.

5. Standard 299

The purpose of revising Standard 299 is to make it more usable for those who use shielded enclosures, especially large rooms. The standard provides test procedures for measuring shielding between 14 KHz and 18 GHz, with guidance for measurements up to 95 GHz and down to

Table 1. Present Standards Under Cognizance of IEEE EMC Society

IEEE Standard-Year	Title
139-1952	Measurement of Field Intensity Above 300 MHz from Radio Frequency Industrial, Scientific, and Medical Equipments
140-1950	Minimization of Interference from Radio Frequency Heating Equipment
187-1951	Open Field Method of Measurement of Result of Spurious Radiation from FM and TV Broadcast Receivers
213-1961	Radio Interference: Methods of Measurement of Conducted Interference
214-	Output to the Power Line from FM and TV Broadcast Receivers in the Range of 300 kHz to 25 MHz.
299-1969	Measurement of Shielding Effectiveness of High-Performance Shielding Enclosures

100 Hz. A second draft is under preparation. Responses by industry and government as well as the military have been favorable to the extent that Standard 299 may be a suitable replacement for MIL STD 285. Call Dick Schulz for information at (214) 420-7919.

Several other projects are underway as shown in Table 2. To volunteer your expertise or to clarify the present and proposed work of the Society's Standards Committee, call the author at (201) 834-3566.

Table 2. IEEE EMC Society New Standards in Progress

PAR	Topics
P478/482/509	Measurement of Shielding Effectiveness of Cables/Connectors/Backshells
P626	Signal Grounding Practices

PLANS FOR TRIP TO THE IERE CONFERENCE AT YORK, ENGLAND

The Electromagnetic Compatibility Conference of the Institution of Electrical and Radio Engineers will be held at the University of York and is scheduled for the week of 29 September to 3 October. The United States is well represented with 9 papers on the program.

The following sessions are planned:

1. Case Studies
2. Printed Circuit Boards
- 3A. Education
- 3B. Biological and Safety Hazards
- 4A. Communications
- 4B. Coupling, Bonding and Screening
- 4C. Sources, Components and Grounding
- 4D. Aerials and EM Fields
5. Test Methods and Specifications

The conference manager, Mr. R. Larry, can provide information on registration and other details. Contact him at IERE, 99 Gower Street, London WC1E 6AZ. The telephone there is 01-388 3071.

Arrangements have been made with American Airlines for special fares to travel to the Conference with considerable flexibility to travel during a period of 21 September through 11 October. While allowing for group rates, there is no requirement to travel as a group. Each individual traveler can arrange his own itinerary with side trips and still take advantage of the special fares. These special fares will be the very lowest when ordered well in advance (at least 30 days), but even late bookings will be at 40% off regular coach fares. American Airlines has special fares for travel to their international departure terminals in Chicago and Dallas. Arrival in England will be at London's Heathrow Airport. Travel to York is optional air or rail. Some may want to take advantage of the Railpass to tour England and Scotland in conjunction with the IERE Conference. It is also possible to include a tour of the Continent in the trip package. For complete information on these arrangements call (800) 621-0852, Ext. 121 and identify yourself with the IERE trip. This office is in San Diego, so call during West Coast business hours of 9am to 5pm or call Jim Hill at (703) 451-4619.

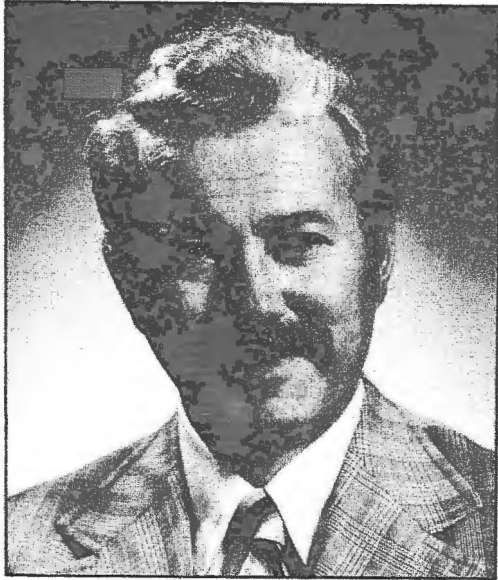
TEMPEST CONFERENCE ANNOUNCED

In a continuing effort to foster better understanding and cooperation, the joint DoD/Industry Automatic Target Recognizer Working Group (ATRWG) is sponsoring its Second Annual TEMPEST Conference. The session is planned for May 1 and 2, 1986, at the National Bureau of Standards, Gaithersburg, MD. Representatives from the National Security Agency, DoD Deputy Undersecretary for Policy, Defense Investigative Service and various military components will speak on their positions in the TEMPEST arena. A

discussion of critical technologies is also planned. The conference is limited to U. S. citizens presently holding a SECRET security clearance and having a Need-To-Know. Registration is limited to 700, so please register early.

For further information, contact the TEMPEST Conference Coordinator, Suzanne Schoch, at the Night Vision and Electro-Optics Center, Fort Belvoir, VA 22060-5677, or call (703) 664-3193.

EMC PERSONALITY PROFILE



B. LEONARD CARLSON

Len is presently at the Boeing Aerospace Company, in Kent, Washington, where he manages and directs the Electromagnetic Systems and Devices Technology Organization in the Engineering Technology Department. In this capacity Len has the responsibility to maintain and insure the technical expertise in the fields of EMC, TEMPEST, Power and Sneak Analysis for the Boeing Aerospace Company. In addition to supporting all the Boeing Aerospace Company programs, i.e., Airborne Warning and Control System (AWACS), Peacekeeper, Air Launch Cruise Missile (ALCM), E-6, Peaceshield, etc., he is also responsible for independent research and development in EMC, Power and Sneak Analysis. Efforts are currently directed at developing an effective three-dimensional (3D) field analysis tool for use on Computer-Aided Engineering (CAE) work stations to allow analysis of Electromagnetic Interference (EMI) coupling and High-Voltage (HV) design problems. Research is also being conducted on the use of knowledge engineering principles to develop an automated EMC test and analysis system. Len also manages work in the area of power research on regenerative fuel cells, lithium batteries and survivable solar systems. Additionally, Len has the responsibility for the EMC/EMP/TEMPEST and Power Test Laboratories.

Len is a native to the Pacific Northwest, having been born in Astoria, Oregon on December 7, 1930. He served in the U. S.



by William G. Duff

Air Force from 1948 to 1952 during the Korean conflict. In 1958 Len received his Bachelor of Science degree in electrical engineering from Oregon State University and joined the Boeing Company as an associate design engineer in Flight Control Systems on the X-IM99 A&B BOMARC program. He first became involved in EMC during 1960 when he performed MIL-I-6181 RFI qualification testing of the BOMARC flight control system and later the MIL-E-6501 EMC system testing of the complete missile.

Over the ensuing 26 years Len has been involved in the EMC/EMP design, analysis and testing on several major programs, including X-20 Dyna-Soar, Short Range Attack Missile (SRAM), Burner-II Minuteman, Airborne Warning and Control System (AWACS), Advanced Airborne Command Post (AABNCP) and Air Launch Cruise Missile (ALCM). Len has authored numerous reports and papers in the field of EMC/EMP Technology.

Len has been a member of the IEEE since 1956, which includes service at the Chapter and Section levels. He has served as Secretary, Vice Chairman and Chairman of the Seattle Chapter of Professional Group on EMC. He was the Finance Chairman of the 1968 IEEE International Symposium on EMC held in Seattle, Washington. In 1969 he was the Awards Chairman for the Seattle IEEE Section. He worked on the Registration Committee for the IEEE-ICC'73 Symposium held in Seattle. Len was Chairman of the 1977 IEEE International EMC Symposium held in Seattle. He was a consultant to the 1978 and 1979 IEEE EMC Symposi-ums. Len was elected to the IEEE EMC Board of Directors in 1982 and served as Technical Director for Professional Services. Len was re-elected to the IEEE EMC-S Board of Directors in 1985 and served as Treasurer until 1986 when he was elected President of the Society.

Len believes that the IEEE and its technical societies are for the benefit of the membership, and during his term as President he plans to work with the EMC-S Board of Directors to find new ways to increase and enhance benefits to the members.

Len and his wife, Fran, live on 10 acres in Carnation, Washington, where (5) sheep, (2) beef cows and (1) horse are co-tenants. Both Len and his wife enjoy cross-country skiing and gardening.

BOOK REVIEWS

We have been concerned about the flow of our technology to the Soviet Union. Our federal government has sought to control this through security restrictions on written material and by embargo on high-technology hardware. Publications and open meetings of the IEEE have been a special concern of the U.S. Department of Defense because the IEEE as a transnational organization recognizes no national limitations on the distribution of its publications or attendance at its meetings. What about the reverse flow of technology, the flow of Soviet Union technology into the United States? The book we are reviewing in this issue is an example. We can't evaluate its value or significance in the reverse flow. Can our readers comment on this? Recent comments on the Stealth Bomber program indicate that the Russian radar is at least 25 years behind the radar currently in use by the United States. Does this mean that Russian radar anti-jamming techniques are out of date? We think not. There is one caution, however, as with any translation we must be sure that the translator has been accurate in his translation.

As a little bonus we have included a review of an interesting little book that was published as a part of the IEEE Centennial program. Copies are available by request to IEEE.



by Jim Hill, The EMXX Corp.

RADAR ANTI-JAMMING TECHNIQUES

by M. V. Maksimov et al.

Published by

Artech House, Inc.

610 Washington Street

Dedham, MA 02026

Hardbound, 421 pages. 1979. \$52.50

Protecting various kinds of electronic systems from electromagnetic interference is one of the most important problems encountered in the development and operation of such systems. To ensure the normal operation of radio equipment under such conditions, it has become necessary in recent years to solve the problem of electromagnetic interference. Electronic countermeasure systems provide a means of protecting electronic systems from electromagnetic interference.

The Russians have devoted considerable effort to the development of electronic countermeasures and this book is a translation of a Russian reference on the subject. In writing the manuscript the authors considered that the developing theory of optimum reception most often assumes that useful signals are accompanied by additive noise. This assumption is usually valid in relation to receiver noise and certain kinds of man-made interference. However, the application of optimum reception is more a means of exploiting the capabilities of radio electronic systems than a means of increasing their noise immunity under conditions of jamming. The quest for optimum anti-jamming measures, which are extremely diversified in terms of structure and parameters, is made difficult by the fact that optimum reception systems depend to a great extent on the statistical properties of interference and useful signals. Therefore, anti-jamming techniques are analyzed in

this book in accordance with the specified structural and parametric differences that describe useful signals and interference.

The contents of this book may be divided into two related parts. The first part deals with natural, intentional and inadvertent mutual interference. A rather complete picture of the variety of known kinds of radio interference is presented from the standpoint of structure and parameters in an effort to determine the attributes that identify useful signals and interference in the interest of developing countermeasures.

The protection of radio electronic systems from radio interference is discussed in the second part of the book. The jamming immunity of any radio system is assumed to be determined by its capacity to prevent an enemy from jamming the receiver input, and by its noise immunity, which is its capacity to function properly under conditions when its input is acted upon by both natural and man-made radio interference.

The necessary initial concepts and definitions are followed by a brief description of methods of analyzing the jamming immunity of various kinds of radio electronic systems. Also basic information about mathematical models for radio electronic systems under conditions of electromagnetic interference is presented. Noise immunity (interference control) enhancement techniques are discussed in relation to both natural and intentional radio interference, and the optimization of radio signal processing.

The classification of jamming immunity enhancement techniques is based on signal and noise attributes (polarization, pulse repetition frequency, etc.), in accordance with which

the target signal can be counteracted or used in the interests of the system. Also examined are methods based on the principles of adaptation and the combined utilization of information from different sources.

Signal processing optimization is examined in application to signal detection and filtering. Of primary importance here is a discussion of ways to exploit the capabilities of a system in consideration of its performance under conditions of white noise. The latter may be regarded as a satisfactory model for internal receiver noise and especially for intentional nonselective interference. The advantages of optimum techniques are noted wherever possible. By and large, optimum processing theory is reduced in this book not to a set of procedures for finding the best systems, but to the development of a general guideline for seeking the optimum structures of radio systems. Indeed, the development of modern noise-immune systems obviously will continue to be for a long time largely an art in which the developer must exhibit both intuition and skill to combine heuristic techniques with recommendations derived from optimum signal processing theory.

The main results of the theoretical analysis presented in this book are illustrated by numerical examples, experimental research data, graphs and tables. All the numerical characteristics were borrowed from the open Soviet and foreign literature or were determined by the authors as the result of calculations based on existing theoretical formulas. The initial data for the calculations are hypothetical.

The book is intended for the large community of radio engineers, graduate students and scientists engaged in the development and operation of radar systems and installations. It may also serve as a textbook for graduate level electrical engineering courses.

Reviewed by:
William G. Duff

Atlantic Research Corp.
5390 Cherokee Avenue
Alexandria, VA 22312

IEEE HOLM CONFERENCE ON ELECTRICAL CONTACTS

A forum for the presentation and discussion of the latest findings and developments in the field of electrical contacts for practicing designers, engineers, physicists and research scientists both new to the field and experienced.

The conference will be held at the Copley Plaza, Boston, MA on October 27-29, 1986. There will be special hotel rates for attendees.

Three in-depth workshop special sessions will include one on RFI/EMI from the point of view of electronic connectors and other devices.

This summer a second announcement, including the complete technical program, will be distributed. If you would like additional information or want your name placed on the mailing list, contact the IEEE Holm Registrar, IEEE Components, Hybrids, and Manufacturing Technology Society, 345 East 47th Street, New York, NY 10017.

GENERATIONS OF GIANTS

An IEEE Centennial Performance
Produced by the *IEEE Spectrum* staff
Paperbound, 36 pages.

This theatrical production was presented at the banquet as part of the IEEE Centennial celebration held in Boston in May 1984. It is a fantasy bringing together 17 of the "Giants" in the field of electrical engineering. Franklin, the earliest, acts as a sort of master-of-ceremonies, exchanging comments on the highlights of the careers of the others. These others include Faraday, Edison, Bell, Steinmetz, Tesla and Von Neuman, all of whom are played by actors. The others (Morse, Babbage, Lord Kelvin, Maxwell, Roentgen, Westinghouse, DeForest, Marconi, Armstrong and Farnsworth) were projected on a screen. The screen show used 12 projectors and 600 35-mm slides in a multiscreen background presentation that illustrated the historic environments and inventive contributions of all the celebrated characters.

This book contains the script of the dramatic presentation acted out by Franklin and the six others from Faraday to Von Neuman. For each page of the script there is a full page of illustration, including a portrait and pictures of significant inventions, exhibits and publications of each Giant.

I had the privilege of attending the banquet and seeing this dramatic presentation and was impressed with the actors' ability to make these "Giants" come to life. There was even an actor of almost precisely the same height as Charles Steinmetz to create a remarkable likeness of this genius who once served as president of the AIEE.

If you are a history buff, this will give some interesting background on the Giants who have contributed to the science and technology of electrical/electronic engineering.

TECHNICAL PROGRAM:

- Electronic Connectors
- Vacuum Interrupters
- Reed Switches
- Circuit Breaker Contacts
- Contact and Relay Contacts
- Aluminum Connections
- New High Current Switching Materials
- Liquid Metal Current Collectors
- Arc Interaction with Device Wall Materials
- Silver Metal Oxide Review
- Developments in Contact Connector Lubrication
- Electrical Erosion Comparisons of Metal Oxide Systems
- Slip Ring and Commutator Contacts

PRACTICAL PAPERS, ARTICLES, AND APPLICATION NOTES

This time, we have a very helpful paper by Mr. Anatoly Tsaliovich. Mr. Tsaliovich brings up some points which are often overlooked, and gives me the opportunity to point out and correct a serious typographical error in ANSI C63.4-1981.

Mr. Tsaliovich earned his M.S. and Ph.D. in 1960 and 1966, respectively. His twenty five years of experience include research, development and testing in the fields of electromagnetic compatibility and telecommunications in the U. S. and U.S.S.R. He is an author of five technical books and more than fifty papers, articles and patents on EMC, electromagnetic shielding, and telecommunication transmission lines



by Edwin L. Bronaugh

and networks, electronic and telephone cables and connectors. Currently, Mr. Tsaliovich is a member of the technical staff at the AT&T Information Systems in Holmdel, New Jersey, responsible for applied electromagnetic compatibility research.

LISN DESIGN AFFECTS LOW FREQUENCY CONDUCTED EMISSIONS MEASUREMENT RESULTS

By Anatoly Tsaliovich
AT&T Information Systems
Holmdel, NJ 07733

ABSTRACT

Specific problems associated with conducted emissions testing using commercial LISNs in the frequency range between 10 and 150 kHz are discussed. An analysis is given of seemingly controversial practices which are recommended by the VDE and CISPR and used by different test houses to adjust conducted emissions data. Expressions are derived to calculate the correction factors which depend on the coupling capacitor value used in the LISN. Practical recommendations are given concerning correction factor applications.

1. INTRODUCTION

Though present domestic regulations⁽¹⁾ specify conducted emissions (CE) limits in the frequency band 0.45 - 30 MHz, the future trends as well as the pressures for international harmonization call for the frequency range well below. The CISPR^{(2)*} recommendations and the majority of European standards, in particular West German VDE** standards^(3, 4, 5) specify CE starting from 10 kHz. However, the performance of the tests in this range has certain specifics, which must be taken into account to avoid costly and embarrassing errors. In particular, the design of the line

impedance stabilization network (LISN) may affect CE test results, especially below 100 kHz. Since compliance with the West German electromagnetic emissions limits is a precondition for marketing products in that country and often in other European countries, further discussion will be related mainly to the VDE specifications.

2. DISCUSSION

Though the general goals and approaches of the VDE regulations are quite similar to the FCC regulations as outlined in the Code of Federal Regulations (CFR 47) and FCC recommended test procedures, there are significant differences in three major areas: scope and application of particular regulations, limit values and conducted emission frequency range. All three areas significantly affect equipment compliance and must be taken into account when performing the tests.

In VDE 0871, the conducted emission limits are specified in the frequency range from 10 kHz to 30 MHz, as compared to 0.45 - 30 MHz in FCC Part 15J (see Figure 1). This difference affects, along with other factors, the recommended test equipment and procedures.

Both the VDE and FCC specify the use of line impedance stabilization networks (LISN) (in Europe they are often

called artificial mains networks - AMN). However, the mains simulated impedance (output impedance of the LISN) [that is, the impedance seen by the equipment under test (EUT), Ed.] is specified by each organization differently in certain portions of the frequency range below 30 MHz (see Figure 2).

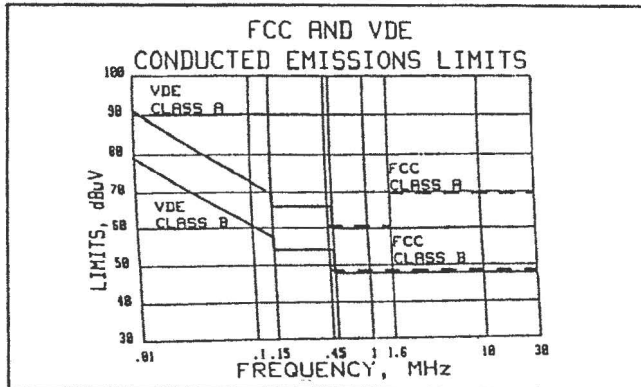


Figure 1. FCC and VDE Conducted Emissions Limits.

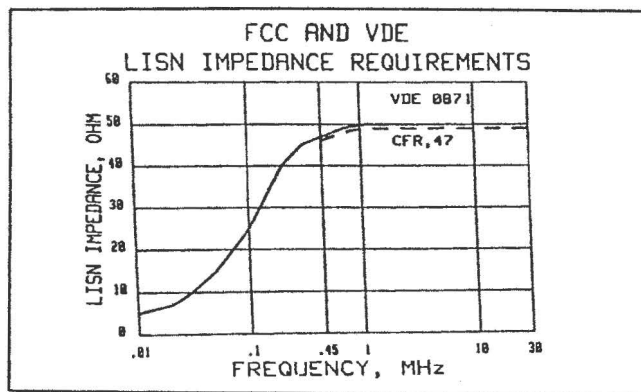


Figure 2. FCC and VDE LISN Impedance Requirements.

Moreover, VDE 0876 specifies *four* different LISN impedance characteristics, each of them applicable for particular frequency ranges (e.g., the VDE curve in Figure 2 corresponds to the 50 μ H AMN 10 to 150 kHz (30 MHz)***). On the other hand, the FCC document MP-4 specifies only *one* frequency range, i.e., 0.45 - 30 MHz.

To increase the confusion even more, American National Standard Institute document C63.4—1981⁽⁶⁾ presents different electrical schematics to provide the specified impedance (similar to the VDE curve in Figure 2) in *two* frequency ranges: 0.01 - 0.15 MHz and 0.15 - 30 MHz. A coupling capacitor of 0.1 μ F is utilized in the frequency range 0.01 MHz - 0.15 MHz and 0.25 μ F in the 0.15 - 30 MHz. These parameters are based on more diverse general requirements established by CISPR.

[Editor's Note: The pictures in Figures 3 and 4 of ANSI C 63.4-1981 were transposed by the printer, and ANSI has never seen fit to distribute a correction. The circuits are supposed to be approximately equivalent to the VDE 0876 LISN and the FCC MP-4 LISN, respectively, so that the coupling capacitors are opposite to the instant statement.]

Though neither the FCC nor VDE specify particular networks to obtain the required impedance, both give examples of circuits of practical LISNs. Electrical schematics of LISNs according to FCC document MP-4 (0.45 - 30 MHz) and VDE 0876 (10 kHz - 150 kHz (30 MHz)) are shown in Figure 3. Note that different capacitor values are used. Hence, as far as low frequency (less than 150 kHz) conducted emissions testing is concerned, one of the major differences between the VDE and FCC schematics is in the measurement instrument input impedance and EUT coupling circuit parameters. This difference is caused by series capacitor C1, which has values 0.25 μ F in the VDE standard, and 0.1 μ F in the FCC schematics both shown in Figure 3.

These values are not obligatory, so other values of capacitors may be used by different manufacturers.

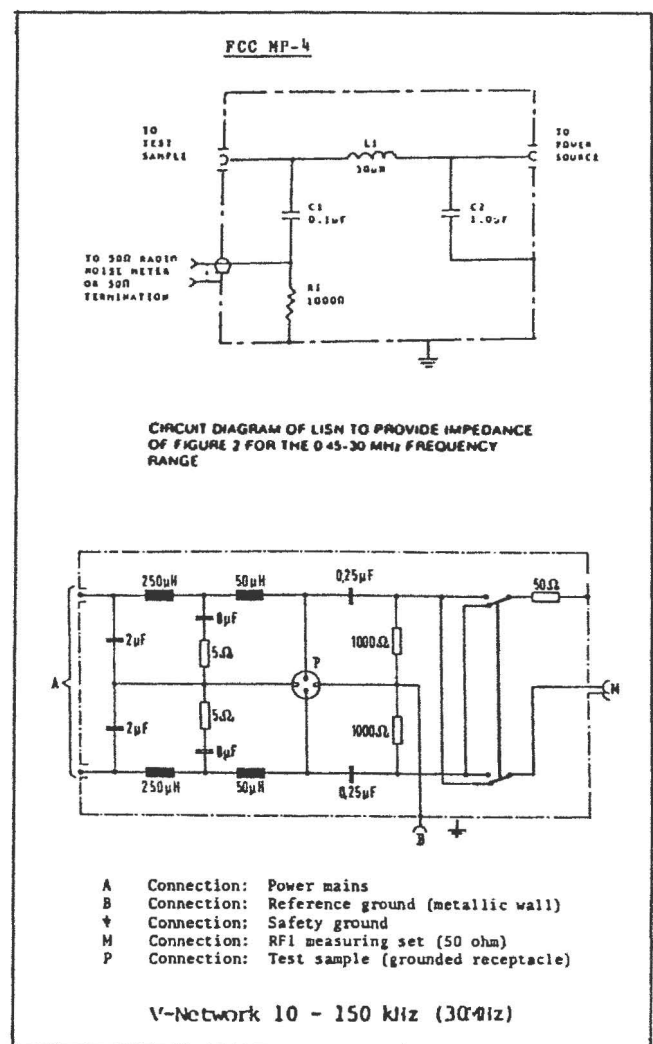


Figure 3. Example Schematics of LISNs.

If a 50 ohm load (the measuring instrument standard input impedance) is connected to the LISN which uses such capacitors, the insertion losses will be as shown in Figure 4. It is clear from the graph, that because the FCC limits start at 450 kHz, the effect of the coupling network is negligible even

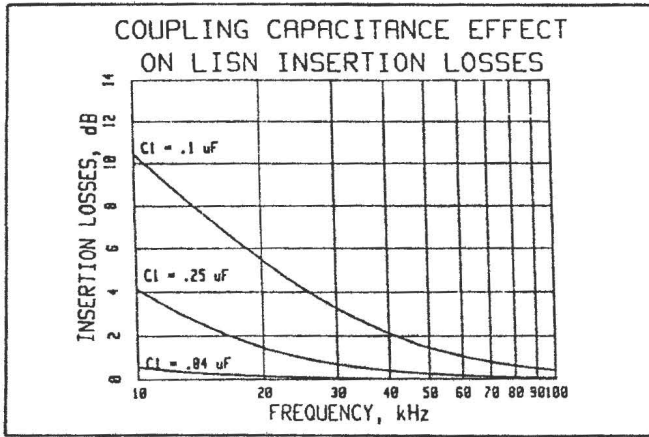


Figure 4. Coupling Capacitance Effects on LISN Insertion Losses.

when the coupling capacitor value is small enough. Not so for VDE testing, starting at 10 kHz. Obviously, the measured VDE results must be corrected with regard to these insertion losses. The actual conducted emissions will be equal to the sum of the measured value and the insertion loss at a particular frequency.

An important conclusion is that different correction factors must be applied if different LISN designs are used.

In the VDE 0876 a correction curve is given (Figure 26 in the original document) to account for the effect of the coupling capacitor. This curve is identical to the $C1 = 0.25 \mu F$ curve in Figure 4. However, neither the necessity of such a correction, nor Figure 26 itself, is ever mentioned in the text of the regulations. This is one of the reasons why some test houses never use this correction, while others apply it even if the capacity values are different from $0.25 \mu F$. It is important, therefore, to be able to calculate the correction in the general case for any value of the coupling capacity.

In Figure 5 a simplified circuit diagram is shown of a typical LISN. Using the designations of the Figure 5, correction factor F is:

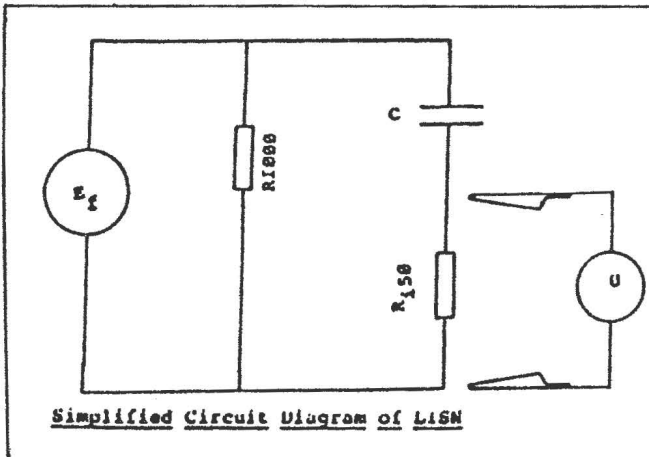


Figure 5. Simplified Circuit Diagram of LISN.

$$F = 20 \log \left| \frac{E_f}{U} \right|, dB \quad (1)$$

From the circuitry in Figure 5 follows:

$$U = \frac{ER_i}{R_i - \frac{j}{(\omega C)}} \quad (2)$$

Then, the correction factor can be calculated as follows:

$$F = 20 \log \sqrt{1 + \frac{1}{(\omega R_i C)^2}}, dB \quad (3)$$

If $R_i = 50 \text{ ohm}$, C - in μF , and f - in kHz, then

$$F = 20 \log \sqrt{1 + \frac{10}{(fC)^2}}, dB \quad (4)$$

Using equation 4, the effect of the coupling capacitor can be calculated, as shown in Figure 4. Now, any particular test conditions can be evaluated. Thus the middle curve in Figure 4 is applicable to LISNs with $0.25 \mu F$ capacitors, as for example in models built on the basis of the V-network 10 - 150 kHz (30 MHz), shown in the document VDE 0876 (see Figure 3). The top curve corresponds to LISNs with $0.1 \mu F$ capacitor which are common in the U. S.

In some newer versions of the LISN (e.g. Rohde & Schwarz AMN model ESH 2-Z5) this capacitor is replaced by a built-in high-pass filter shown in Figure 6. This filter effectively prevents the 60 Hz power voltage from entering the receiver input. For conducted emissions in the frequency range between 0.10 and 30 MHz this filter can be approximately represented as two $1.68 \mu F$ capacitors connected in

E_f — conducted emission voltage, V, at frequency f

$R1000$ — one kOhm resistor in the LISN circuit

$R150$ — test receiver input impedance (50 ohm)

C — coupling capacitor (.25 and .1 μF at the Fig. 3)

U — voltage at the receiver input, V.

series which yield a negligibly small insertion loss (see the bottom curve in Figure 4). In this case, no correction is necessary.

3. SUMMARY AND RECOMMENDATIONS

1. When performing conducted emission testing per VDE regulations, it may be necessary to apply a correction factor to account for the insertion loss of the LISN coupling circuit in the frequency range below 150 kHz.
2. The correction factor value depends on the values of coupling capacitors used in the LISN coupling network design. The frequency characteristic of the correction factor may be calculated using the formulas (1), (3), (4).
3. In some LISN designs, a special coupling network is used, which makes the use of a correction factor unnecessary. The EMC measurement engineer should verify if any corrections are needed when making CE tests below 150 kHz. A review of the LISN manufacturer's schematic should provide the necessary information with which to base such a judgement. A check with the appropriate regulatory agency is also suggested.

*Special International Committee on Radio Interference.

**VDE (Verband Deutscher Electrotechniker) is a non-governmental organization. Together with the German Standards Institute (DIN), VDE prepares regulations, which are also issued as DIN standards. These standards serve as a technical basis for the regulations issued by the FTZ (Fernmeldetechnisches Zentralamt), the Central Telecommunications Office, which is the technical agency of the Ministry of Postal Service and Telecommunications in West Germany. VDE also performs regulatory compliance testing.

***The designation "10 to 150 kHz (30 MHz)" used by VDE implies compliance with two CISPR frequency band requirements: 10-150 kHz and 0.15 - 30 MHz.

REFERENCES

- (1) FCC/OST MP-4 (1983), "FCC Methods of Measurement of Radio Noise Emissions from Computing Devices." FCC, Washington, D.C. 20554
- (2) CISPR Publication 16 (1977), "CISPR Specification for Radio Interference Measuring Apparatus and Measurement Methods."
- (3) VDE 0871, "Radio Interference - Suppression of Radio Frequency Equipment for Industrial, Scientific, and Medical (ISM) and Similar Purposes. Part 1: RFI Measurement Set with Quasi-Peak Detector and Accessory Equipment."
- (4) VDE 0876, "Radio Interference Measuring Apparatus."
- (5) VDE 0877, "The Measurement of Radio Interferences."
- (6) American National Standard ANSI C63.4-1981, "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 10 kHz to 1 GHz."

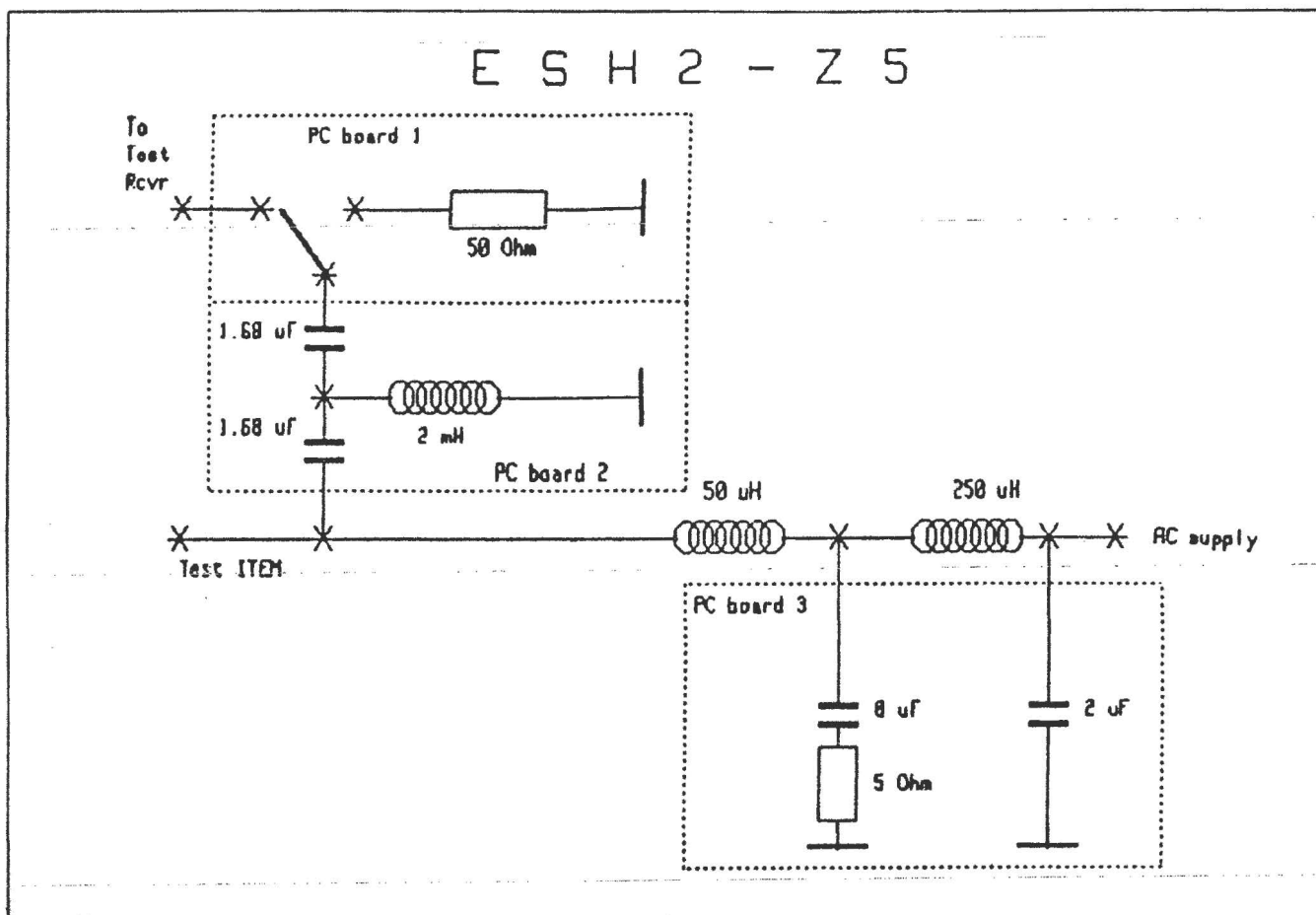


Figure 6. Basic Circuit Diagram of the LISN.

1986 NUCLEAR EMP MEETING

The 1986 Nuclear EMP Meeting (NEM 1986) will be held at the University of New Mexico in Albuquerque, NM on May 19-23, 1986.

The Headquarters Hotel for NEM 1986 is the Albuquerque Hilton Hotel, 1901 University Boulevard, NE. Registration will be conducted at the hotel Sunday evening, 6-10 pm and will be conducted at the meeting site each day thereafter. Please call the Hilton directly at (505) 884-2500 to make your reservation and indicate NEM 1986 to get the reduced rate. If sufficient interest is shown, rooms can be made available in a University of New Mexico dormitory. Please indicate such interest on your registration form or call Mike Harrison at (505) 844-9301. Information on lower priced motels can also be obtained at this number.

The technical program will run from Monday, May 19 through Thursday, May 22 with technical tours on Friday, May 23, 1986. The program includes:

Microcomputer Applications:

Graphics/Hardware/Software

Microcomputer Applications: Signal Processing, Expert Systems & CAD

Microcomputer Applications: Electromagnetic Modeling

Microcomputer Applications: Circuit Analysis

Simulation Facilities

Direct Drive Simulation

External Interaction

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Sensors and Data Processing

New EMP Programs

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SEM: Emphasis on Data Analysis

EMP and Electric Power Systems

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Transmission Line Networks

Probability Issues and Hardness Verification

Lightning

Bounded Wave Simulators

Standards & Specifications

Internal Interaction

System Hardening

Data Acquisition

Apertures

Microcomputer Demonstrations

A \$100.00 AZED Award will be given for the best example of an unprotected wire penetrating a shield surface. A common example is a ground wire brought inside a shielded enclosure. All submissions must be received by 5:00 pm, Tuesday, May 20.

A variety of social events are planned. The three main Conference social events are:

For an advanced program with more hotel, tour and technical session information, write:

NEM 1986

% Terry Arnold

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|-------------|---|
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| June 9-13 | <p>Int'l IEEE A/P-S Symposium
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| June 23-27 | <p>Conference on Precision Electromagnetic Measurements (CPEM '86)
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September 29-October 3	<p>5th Int'l Conference on EMC University of York, England Contact: Mr. R. Larry IERE 99 Gower St. London, WC1E 6AZ England 01-388-3071</p>
October 27-29	<p>IEEE Holm Conference on Electrical Contacts The Copley Plaza, Boston, MA Contact: IEEE Holm Registrar IEEE Components, Hybrids, and Manufacturing Technology Society 345 East 47th Street New York, NY 10017</p>



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Adams, John W.
 Nat Bur Stds-MC 723.04
 325 Broadway
 Boulder, CO 80303
 (303) 497-3328 (Work)

Yasuo Akao
 Dept of Electronics
 AICHI Inst of Technology
 Yakusa, Toyota, Japan
 0565 48-8121

Anderson, Charles F. W.
 1716 Reppard Road
 Orlando, FL 32803
 (305) 356-2636 (Work)
 (305) 896-6649 (Home)

Berry, Leslie A.
 ITS
 325 Broadway
 Boulder, CO 80302
 (303) 497-5474 (Work)

Bronaugh, Edwin L.
 Electro-Metrics
 100 Church Street
 Amsterdam, NY 12010
 (518) 399-6142 (Home)
 (518) 843-2600 (Work)

Brook, R. H.
 9 Ruey Place
 Plainview, NY 11803
 (516) 595-3136 (Work)
 (516) 938-6991 (Home)

Capraro, Gerard T.
 1027 Mohawk Street
 Utica, NY 13501
 (315) 732-1955 (Work)
 (315) 733-3286 (Home)

Carlson, B. Leonard
 Boeing Aerospace Co.
 PO Box 3999, M.S. 3A-03
 Seattle, WA 98124
 (206) 773-6297

Clark, Donald E.
 4086 Shady Circle NW
 Lilburn, GA 30247
 (404) 894-3535 (Work)

Cory, William E. (Gene)
 Southwest Research Inst.
 P.O. Drawer 28510
 San Antonio, TX 78284
 (512) 684-5111 x2711

Dash, Glen R.
 Dash, Straus & Goodhue
 593 Massachusetts Ave
 Boxborough, MA 01719
 (617) 263-2662 (Work)

Denny, Hugh W.
 2528 LaVista Road
 Decatur, GA 30033
 (404) 894-3535 (Work)

Doeppner, Tom W.
 8323 Orange Court
 Alexandria, VA
 703-780-3983

Duff, Dr. William G.
 Atlantic Research Corp.
 5390 Cherokee Avenue
 Alexandria, VA 22312
 (703) 642-4049 (Work)
 (703) 250-2409 (Home)

Everett, W. W., Jr.
 S.C.E.E.E.
 Box 68
 Port Royal Square
 Port Royal, VA 22535
 (804) 742-5611

Ford, Richard T.
 6 Westcot Place
 Falmouth, VA 22405
 (703) 642-4238 (Work)
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Freeman, Ernest R.
 Sachs/Freeman Assoc., Inc.
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 Bowie, Maryland 20715
 (301) 262-4400 (Work)
 (301) 262-7294 (Home)

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 R&B Enterprises
 20 Clipper Road
 West Conshohocken, PA 19428
 (215) 825-1860

Grant, Peter
 Technit
 EMI Shielding Products
 129 Dermody Street
 Cranford, NJ 07016
 (201) 272-5500 (Work)

Hagn, George H.
 4208 Sleepy Hollow Road
 Annandale, VA 22003
 (703) 941-7663 (Home)
 (703) 524-2053 (Work)

Haislmaier, Robert J.
 3021 Gumwood Drive
 Hyattsville, MD 20783
 (301) 864-9395 (Home)

Hanttula, David M.
 Ridge Computers
 2481 Mission College Blvd.
 Santa Clara, CA 95054
 (408) 986-8500 x324 (Work)

Harmuth, Dr. Henning F.
 The Catholic Univ. of America
 Electrical Engineering Dept
 Washington, D.C. 20064
 (202) 639-5193

Haskins, L. Gilda
 Haskins Associates
 2525 Sharon Court
 Bensalem, PA 19020
 (215) 752-4749 (H&W)

Hairman, Donald N.
 AT&T-Information Sys-Bldg 41
 Crawfords Corner Rd.
 Holmdel, NJ 07733
 (201) 834-3566 (Work)
 (201) 741-7723 (Home)

Hill, James S.
 6706 Deland Drive
 Springfield, VA 22152
 (703) 451-4619

Hofmann, H. R. (Bob)
 AT&T-Bell Laboratories
 Room 2B-220
 Naperville Road
 Naperville, IL 60566
 (312) 979-3827 (Work)

Hoolihan, Dan
Amador Corp
Wild Mountain Road
Almelund, MN 55002
612-257-2074 (Home)
612-583-3322 (Work)

Iki, Tai
Sony Corp.
16450 W. Bernardo Drive
San Diego, CA 92127
(619) 487-8500 x332

Johnson, Melvin J.
Southwest Research Inst
P.O. Drawer 28510
San Antonio, TX 78284
(512) 684-5111 x2009

Knowles, Eugene D.
16954 Southeast 149th St
Renton, WA 98056
(206) 773-1577 (Work)
(206) 271-3396 (Home)

Kunkel, George M.
Spira Mfg Corp
12721 Satcoy St South
North Hollywood, CA 91605
(818) 843-5880

Krevsky, Seymour
69 Judith Rd
Little Silver, NJ 07739
(201) 741-4918 (Home)

Lambdin, William S.
Electro-Metrics
100 Church Street
Amsterdam, NY 12010
(518) 843-2600 (Work)

Lauber, Wilfred
Communications Research Ctr
P. O. Box 11490, Station H
Shirley Bay, Ottawa
Ontario, Canada K2H8S2
(613) 988-2377 (Work)

McHale, Michael R.
Honeywell Inc
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San Antonio, TX 78213
(512) 377-1710 (Work)

Mertel, Herbert K.
EMACO, Inc.
P.O. Box 22066
San Diego, CA 92122
(619) 578-1480 (Work)
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Nichols, Fred J.
Electromagnetics, Inc.
6056 West Jefferson Blvd.
Los Angeles, CA 90016
(213) 870-9383

Ott, H. W.
48 Baker Road
Livingston, NJ 07039
(201) 386-6660 (Work)
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Parker, J. C. Jr
Appollo Computer Inc
16 Elizabeth Drive
CHC 02RD
Chelmsford, MA 01824
(617) 256-6600 ext 3339

Parker, William H.
Genisco Technology Corp.
18435 Susana Road
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Rothhammer, Gerald P.
EATON Corp
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Sato, Risaburo
Tohoku Gakuin University
1-31-Chuo
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Schulz, Richard B.
XEROX Corp IPD - MS-122
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Showers, Dr. Ralph M.
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Skomal, E. N.
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Smith, Dr. Chester L.
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Thomas, Leonard W., Sr.
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Toler, James C.
ECSL/BRD - Baker Bldg
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Tyson, Charlotte R.
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Vance, Ed
Route 3, Box 268A
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(Continued on page 28)

SPECTRUM MANAGEMENT DAY

On March 13 the Washington/Northern Virginia Chapter conducted a day-long briefing on domestic and international aspects of radio frequency spectrum management. About 120 people attended, half of whom were IEEE members. The host facility was the Atlantic Research Corporation.

Top flight briefings by spectrum management authorities from NTIA, FCC, DOD and the Department of State revealed the mysteries of how the EM spectrum is allocated and assigned, the major issues in spectrum management, and how the non-expert can expedite the process of getting spectrum support to make, buy or use telecommunications equipment in an electromagnetically compatible manner.

The program was introduced by Dr. Robert J. Haislmaier, Chapter Chairman. An overview of the entire process was then given by Richard D. Parlow, Associate Administrator for Spectrum Management of the National Telecommunications and Information Administration (NTIA).

Government and non-government domestic processes were discussed by Lawrence Petak and Julius Knapp (Chapter Vice Chairman), both of whom are with FCC's Office of Engineering and Technology, by William D. Gamble (who, among other things, is Chairman of the Interdepartment Radio Advisory Committee) and Anthony M. Corrado,

both with the Office of Spectrum Management in NTIA and by William J. Cook, Director of EM Spectrum Management, Department of the Navy.

International aspects were covered by S.E. Probst (ex-chairman of IRAC, now with the private sector), Warren G. Richards of State Department's Office of International Radio Communications, and John J. Kelleher, a spectrum planning consultant (and Chapter Secretary/Treasurer).

Finally, sharing of spectrum resources was addressed by Robert J. Mayher, Director of Spectrum Planning and Policies, NTIA, and Richard G. Gould, President, Telecommunications Systems, Inc.

The presentations were recorded on videotape and will become available for sale following previewing and editing. Those interested in copies of the tapes should write John J. Kelleher, 3717 King Arthur Road, Annandale, VA 22003, or call him at (703) 560-4438.

The consensus of those who planned and represented the program was that, while the briefings achieved their objectives, they just scratched the surface of a complex and intensely interesting aspect of EMC. Chapter officers are considering the possibility of more detailed coverage of this subject beginning in the Fall of 1986.

EMCABS

In this issue, we are publishing 30 abstracts. These are abstracts on various EMC topics. We plan to continue publishing abstracts of papers from previous EMC Symposia and from other conferences. The EMCABS committee is composed of the members listed below. By way of introduction to the community, they are listed with their company affiliations.

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MELVIN J. JOHNSON

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EMCABS: 1-3-86

A Specifier's Guide to the Interference Control Industry

No Author Given

Microwaves & RF

Vol. 23, No. 10; October 1984; P 102-108

ABSTRACT: This article is a listing of 78 companies in the EMC field. The products and services available from each are described.

INDEX TERMS: EMC, vendors, EMC labs, EMC products, EMC consultants, EMC literature

EMCABS: 4-3-86

Minimize EMI in your Computer Design: Effective Control Means Careful

Planning at the Start

Jerry Bogar, Don Sterling

AMP Inc.

Electronic Products

11 January 1984, P 105-111

ABSTRACT: In the race to meet the FCC deadline, manufacturers used brute force methods to bludgeon equipment into compliance. These approaches showed that many designers do not understand the nature of EMI or the techniques for combating it. The designer must first minimize EMI by choosing the right system speed, logic family and PC board layout and by using balanced circuits.

INDEX TERMS: FCC, regulation, computers, data processing, commercial, EMI design, wave forms, spectrum, filter types, shielding

EMCABS: 2-3-86

Coping with Static Electricity-Part XLVIII Electrical Overstress Expo—An

Earth-shaking Success

Stephen Halperin

Technical Chairman

Evaluation Engineering

Vol. 23, No. 7; July 1984; P 110-117

ABSTRACT: A presentation of the history of static in high tech environments and an overview of the organization of a static control program was followed by one of the century's biggest earthquakes! 80 companies displayed their products.

INDEX TERMS: Static electricity, symposium, ESD products, exhibits

EMCABS: 5-3-86

Use Quadracoil Transformers to Minimize EMI Problems

Michael Donovan

California Systems, Inc.

EDN Magazine

Vol. 29, No. 20; October 4, 1984; P 239-242

ABSTRACT: For compliance with Rule 15 of FCC Docket 20780 as well as MIL-STD-461, VDE 0871 and MDS-201-004 many equipment manufacturers are turning to in-line filters to limit conducted electromagnetic interference (EMI). This article discusses the theory of operation, the advantages and the disadvantages of quadracoil transformers, which are an effective alternative to external filters. The article also examines the procedures involved in designing and specifying a quadracoil transformer to satisfy FCC or other designated limits.

INDEX TERMS: FCC, conducted interference, primary power, 4-coil transformer, quadracoil, suppression, isolation transformer

EMCABS: 3-3-86

Line Monitors Detect Common AC Problems: Power Conditioners Protect

Sensitive Electronics

Richard Caprigno

Sola Electric

Test & Measurement World

November 1983, P 54-68

ABSTRACT: Precisely controlled electrical power is a must for accurate operation of microprocessor-based electronics. Power conditioners can best eliminate irregularities after power line monitors provide a diagnosis of incoming AC power disturbances.

INDEX TERMS: Primary power, line conditioners, voltage transients, diagnosis, suppression, constant voltage transformer

EMCABS: 6-3-86

Conductive EMI/RFI Shielding Materials Answer Challenge Posed by FCC

Regulations

Robert M. Clarke

Assistant Editor

EDN Magazine

Vol. 30, No. 1; January 10, 1985, P 83-92

ABSTRACT: All electronic devices, especially computing devices, must comply with FCC EMI/RFI regulations. A wide variety of shielding materials is available, but to choose the right material for your product you must consider several factors, including shielding effectiveness, cost, bulk, weight, environmental tolerance and appearance.

INDEX TERMS: FCC regulations, shielding, painting, spraying, conductive coatings testing, Helmholtz coil, plated plastics, plastic fillers, gaskets

(Continued from page 25)

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<p>TEMPEST Business Prospects Point to More Growth James B. Schultz Editor Defense Electronics Vol. 17, No. 1; January 1985; P 115-120</p> <p>ABSTRACT: Most TEMPEST equipment developers are realizing annual growth rates in excess of 30 percent, although some specialized equipment manufacturers are more than doubling their yearly sales with the award of a single contract. NASA is keenly concerned over reports of premature failure of TEMPEST-designed equipment.</p> <p>INDEX TERMS: TEMPEST, failures, non-compliance, degradation, NSA, RF gasket, conductive elastomers, corrosion</p>	<p>EMCABS: 7-3-86</p>	<p>Design Considerations and Connection Products for Meeting EMI and RFI Requirements Dennis Smith Thomas & Betts Corp. Electri-onics Vol. 30, No. 2; February 1984, P 69-72</p> <p>ABSTRACT: New electronic products must meet the EMI requirements established by the FCC. These requirements should be relatively easy to comply with when the product is operating inside an enclosure. There are an increasing number of applications where cabling and connectors do not afford adequate EMI protection.</p> <p>INDEX TERMS: FCC, EMI, commercial, Docket 20780, data processing, regulations, connectors, cables, flat cable</p>	<p>EMCABS: 10-3-86</p>
<p>Shield That Cable! Bruce Morgen Associate Editor Electronic Products Vol. 26, No. 4; 15 August 1983; P 75-80</p> <p>ABSTRACT: The configuration of cable shielding—both electrical and mechanical—is vital to the control of EMI/RFI emissions and susceptibility. Just how effective are the most popular cable shields and connection approaches?</p> <p>INDEX TERMS: Cables, shielding, FCC, transfer impedance, braid, optical coverage, foil, grounding, triaxial cable, twisting</p>	<p>EMCABS: 8-3-86</p>	<p>International Power Supplies Bob Margolin Contributing Editor EDN Magazine Vol. 29, No. 8; 19 April 1984; P 189-205</p> <p>ABSTRACT: As European markets grow, the need for power supplies that meet international safety and EMI standards will grow accordingly. Eventually most power supplies will comply, but for now take extra care in supply selection.</p> <p>INDEX TERMS: Power supplies, commercial, EMI, IEC 380, VDE 0804, IEC 435, VDE 0730, VDE 0806, VDE 0871, VDE 0875, safety</p>	<p>EMCABS: 11-3-86</p>
<p>Personal Computers to Spark Growth in TEMPEST Products James B. Schultz Associate Editor Defense Electronics Vol. 16, No. 1; January 1984; P 87-100</p> <p>ABSTRACT: The TEMPEST community is about to become inundated in both TEMPEST products and services. The development of TEMPEST-certified equipment is expected to climb from at least 20 to as much as 60% each year beginning in 1984 as the market becomes flooded with commercial desktop computers, office systems and telecommunications equipment redesigned to meet NACSIM 5100A, the classified standard developed by NSA.</p> <p>INDEX TERMS: TEMPEST, production, NACSIM 5100A, NSA, PC's, equipment, preferred products list, industrial TEMPEST program</p>	<p>EMCABS: 9-3-86</p>	<p>Cable Shield Performance and Selection Guide Belden Electronic Wire and Cable EDN Magazine Vol. 29, No. 8; 19 April 1984; P B1-B24</p> <p>ABSTRACT: This removable Belden pamphlet will help you define your interference problem, acquaint you with current FCC regulations, familiarize you with the types of wire and cable shields available and their general characteristics, explain standard shield attenuation test procedures and guide you in selecting the proper shielded wire and cable.</p> <p>INDEX TERMS: Wire, cable, shielding, test data, foil, FCC, braid, attenuation, twisted wires, transfer impedance, ESD</p>	<p>EMCABS: 12-3-86</p>

<p>Use Fast Fourier Transform Programs to Simplify, Enhance Filter Analysis R. F. Cobb Harris Corp. EDN Magazine Vol. 29, No. 5; 8 March 1984; P 209-218 ABSTRACT: FFT's can easily implement filter analysis on your personal computer and provide data that you won't find in reference books. This first article of a four-part series provides the basic FFT routines and examines lowpass filters. INDEX TERMS: Fast Fourier transform, filter attenuation, equations, computer programs, time domain, frequency spectrum, analysis</p>	<p>EMCABS: 13-3-86</p>	<p>Off-The-Shelf EMI Remedies Help Your Product Meet FCC Specs Robert Landon Western Editor END Magazine Vol. 28, No. 16; 4 August 1983; P 53-64 ABSTRACT: If your digital product can't pass the FCC's EMI regulations and time prevents an extensive redesign, shielded enclosures, conductive paints and coatings, EMI-proof foil and various types of gasketing schemes can provide enough EMI suppression to ensure FCC compliance. Many options are available. A list of EMI product vendors is provided. INDEX TERMS: FCC, EMI standard, shielded windows, RF gaskets, mesh, foil, conductive plastic, air vents, cable shields, arc-spray coatings, conductive paint, bonding fingers, CRT shields, ferrite beads, connectors</p>	<p>EMCABS: 16-3-86</p>
<p>Use a Spectrum Analyzer to Make EMI Measurements Henry Benitez Tektronix, Inc. Microwaves and RF Vol. 23, No. 4; April 1984; P 134-142 ABSTRACT: To measure radiated or conducted EMI, the first test requirement is to be able to observe a wide frequency spectrum to see what emissions are present, so that the frequencies of importance can be examined. A spectrum analyzer's sensitivity, frequency range and CRT provide this information quickly in the form of a single, signal amplitude-versus-frequency trace. INDEX TERMS: Measurement, test equipment, EMI, RF emission, FCC, VDE, spectrum analyzer, EMI site surveys, attenuation, data</p>	<p>EMCABS: 14-3-86</p>	<p>Cut Bus Reflection, Crosstalk with a Trapezoidal Transceiver R. V. Balakrishnan National Semiconductor Corp. EDN Magazine Vol. 28, No. 16; 4 August 1984; P 151-156 ABSTRACT: A trapezoidal bus transceiver can minimize the noise susceptibility of a high speed bus. But to use it to best effect, you must understand the sources of bus noise. INDEX TERMS: Crosstalk, characteristic impedance, grounding, PC board, trapezoid pulses, coupling, drivers</p>	<p>EMCABS: 17-3-86</p>
<p>Envelope Mode Scopes Exorcise Random Ghosts Clive Steward Tektronix Inc. Electronic Design Vol. 31, No. 19; 15 September 1983, P 159-162 ABSTRACT: Three types of instruments, each with particular limitations, are commonly used for analyzing intermittent failures: state-oriented machines, such as logic analyzers and data communications testers; CRT storage oscilloscopes; and conventional digital storage oscilloscopes. INDEX TERMS: Transients, intermittent displays, logic analyzers, storage oscilloscopes, envelop mode oscilloscopes</p>	<p>EMCABS: 15-3-86</p>	<p>Predicting Intermodulation Suppression in Double-Balanced Mixers Bert C. Henderson Watkins-Johnson Co. Watkins-Johnson Tech-Notes Vol. 10, No. 4; July 1983; P 1-14 ABSTRACT: Predicting intermodulation (IM) suppression in double-balanced mixers continues to be extremely important in the design and operation of microwave and RF systems. IM products generated by the mixer can masquerade as the down-converted IF signal, thereby reducing system effectiveness. This threat can be avoided if their frequencies and power levels are known. INDEX TERMS: Receivers, intermodulation, IM products, IM equations, IM suppression, references</p>	<p>EMCABS: 18-3-86</p>

<p>Automated Twisted-pair Wire Bonding D. E. Houser, K. J. Lubert IBM IBM Journal of R & D Vol. 27, No. 6; November 1983; P 598-606</p> <p>ABSTRACT: A need for highly dense and reworkable external interconnectors with controlled characteristic impedance on high-performance printed-circuit boards led to the development of the process and equipment described in this paper. 39-gauge twisted-pair wire is used. A solder-reflow process bonds the wires to the printed circuitry. Computer-controlled equipment installs twisted-pair wires at production rates.</p> <p>INDEX TERMS: Printed circuit boards, twisted wires, characteristic impedance, wiring machine, retrofit, production methods</p>	<p>EMCABS: 19-3-86</p>	<p>Designing the Right Enclosure David H. Freedman Hewlett-Packard Mini-Micro Systems Magazine Vol. XVI, No. 9; August 1983; P 229-242</p> <p>ABSTRACT: OEMS developing a new product often think of the enclosure as a last minute item thrown on to make the machine look good. The enclosure can and must do a great deal more. Choosing the materials and design that provide functions, such as cooling and electromagnetic interference shielding, requires a basic understanding of the available options.</p> <p>INDEX TERMS: Shielding, conductive plastic, enclosures, housings, sheet metal, shield attenuation data, cooling, FCC</p>	<p>EMCABS: 22-3-86</p>
<p>Power Corrupts ATE No Author Given Evaluation Engineering Vol. 22, No. 5; July 1983; P 57-63</p> <p>ABSTRACT: Transient disturbances, unstable voltage dips and surges, noise, brownouts and blackouts account for 94% of all problems found with electronic equipment. Power that appears to be adequate for other electrical equipment can be totally unacceptable to minicomputers and other small sensitive electronics. Asking your power company to clean up its act really won't solve the problem.</p> <p>INDEX TERMS: Primary power, transients, surges, spikes, power conditioners, disturbance monitors, power isolation, suppressors, motor generators, uninterruptable power supply</p>	<p>EMCABS: 20-3-86</p>	<p>Keeping Power Clean and Steady Emil B. Rechsteiner Isoreg Corp. Mini-Micro Systems Magazine Vol. XVI, No. 9; August 1983; P 245-252</p> <p>ABSTRACT: Power problems can come from utility-supplied power or internal power-demand fluctuations. Disturbances include voltage spikes, electrical noise, sags, surges, power glitches, frequency drifts and blackouts. All can have damaging effects on computer equipment and can be prevented only by installing additional equipment.</p> <p>INDEX TERMS: Primary power, voltage spikes, electrical noise, voltage sags, surges, computer malfunctions, isolation devices</p>	<p>EMCABS: 23-3-86</p>
<p>Coping With Static Electricity — Part XXXVIII C. Fred Mykkanen, D. R. Blinde Honeywell Underseas Systems Div. Evaluation Engineering Vol 22, No. 5; July 1983, P 90-100</p> <p>ABSTRACT: The room ionization system: an alternative to 40 percent RH. A system developed per Honeywell's specifications by Consan Pacific and Controlled Static is described.</p> <p>INDEX TERMS: Static electricity, ESD, room ionization, electrostatic decay</p>	<p>EMCABS: 21-3-86</p>	<p>Interference Technology: A Little Recognition, Please Barry Manz Senior Editor Microwaves & RF Vol. 23, No. 10; October 1984; P 64-109</p> <p>ABSTRACT: There was a time when grounding, shielding and filtering played second fiddle to every other aspect of equipment design. Those days are over.</p> <p>INDEX TERMS: EMI, testing, TEMPEST, shielding, compliance, military, commercial, honeycomb filter</p>	<p>EMCABS: 24-3-86</p>

EMCABS: 25-3-86

An Active EMC Community Struggles For Acceptance

Barry Manz
Senior Editor
Microwaves & RF

Vol. 23, No. 10; October 1984; P 67-74

ABSTRACT: Is the EMC business growing? Do most engineers embrace it? Are engineers available for hiring? This article is a response to a questionnaire to the industry.

INDEX TERMS: EMC challenges, awareness, EMC engineer availability, EMC market performance

EMCABS: 28-3-86

Even Satellites Aren't Safe From Electrostatic Discharge (ESD)

Christos Christou
Bradley Electronics Ltd. (London, England)
Microwaves & RF

Vol. 23, No. 10; October 1984; P 97-101

ABSTRACT: ESD is probably the least understood problem facing spacecraft designers. When discharges occur, RF energy couples into the electronics of the spacecraft and produces EMI, disturbing operation. Studies are underway to gain a better understanding of ESD, its causes and remedies.

INDEX TERMS: ESD, spacecraft, discharge effects, metal erosion, eclipse, high energy fields, NASA, sunlight effects

EMCABS: 26-3-86

Of Metrology and an Increasing EMI Awareness: A View From the NBS

Charles Miller
National Bureau of Standards
Microwaves & RF

Vol. 23, No. 10; October 1984; P 78-84

ABSTRACT: Is the task of creating standards becoming more difficult? Are measurement techniques behind the state-of-the-art? Are manufacturers putting too little emphasis on EMC? What about TEMPEST? Barry Manz interviews C. Miller.

INDEX TERMS: National Bureau of Standards, EMC, TEMPEST, measurement, EMI design, EMI regulation, EMP, grounding

EMCABS: 29-3-86

Simplified Solution of the Problem of Electromagnetic Coupling to Transmission Lines

D. C. Agouridis
Oak Ridge National Lab, TN
1985, 5p CONF-850711-14 Contract AC05-84OR21400

22nd Annual Conference on Nuclear & Space Radiation Effects

ABSTRACT: Electromagnetic waves induce distributed series voltage sources and shunt current sources in transmission lines. A solution of the response of the line driven by such sources is presented. This solution and the results are easy to understand and simple to use. The new solution has been applied to electromagnetic pulse (EMP) coupling problems.

INDEX TERMS: Electromagnetic coupling in transmission lines

EMCABS: 27-3-86

Effective Shielding Is More Than a Pretty Facade

Richard D. Scheps
Tecknit
Microwaves & RF

Vol. 23, No. 10; October 1984; P 85-91

ABSTRACT: The crowded electromagnetic spectrum, combined with increasingly sophisticated electronic systems, makes a thorough knowledge of shielding a necessity. Transmission line theory is used to develop the equations for shielding effectiveness.

INDEX TERMS: Shielding, equations, attenuation, reflection, magnetic field, E field, plane waves, RF gaskets, honeycomb vents

EMCABS: 30-3-86

Plastics and Elastomers: Electrical Conductivity. February 1985-December 1985

Citations From the Rubber and Plastics Research Assoc. Data Base
National Technical Information Service, Springfield, VA
Report for Feb-Dec 85

Dec 85, 241p Supersedes PB85-854396

ABSTRACT: This bibliography contains citations concerning research and development, properties and performance evaluations of the electrical conductivity of thermoplastics, thermosets and elastomers. Among the topics included are conductivity in filled and unfilled plastics and elastomers, curing by means of conductive fillers and better plating properties for conductive plastics. Applications for electrically conductive plastics and elastomers are included. (This updated bibliography contains 304 citations, all of which are new entries to the previous edition.)

INDEX TERMS: Electrically conductive plastics, electrically conductive elastomers, bibliography

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