

# Electromagnetic Compatibility Society

Newsletter



ISSUE NO. 118

SUMMER 1983

(ISSN 0164-7644)

EDITOR: ROBERT D. GOLDBLUM

## ECAC TO BE RECIPIENT OF 1984 dB AWARD

The dB Society has announced that the 1984 dB Award will be presented to the Electromagnetic Compatibility Analysis Center (ECAC). ECAC is recognized for its fine management, leadership and support, and "Outstanding International Contributions to the Field of Electromagnetic Compatibility."

A fraternity of highly qualified and experienced engineers, the dB Society is devoted to excellence in the field of Electromagnetic Compatibility (EMC). The society admits individuals with 10 or more years of active contribution to the EMC field. Its objectives are to welcome and assist new engineers, suppliers and manufacturers to establish contacts in the EMC community. The society also assists engineering students in pursuit of education in the field.

The Electromagnetic Compatibility Center (ECAC) will be presented with a four foot traveling trophy, which then will be placed on display at a location chosen by ECAC. Past recipients of the Award include the National Bureau of Standards, the Federal Communications Commission, SAE, Inc., and the North Atlantic Treaty Organization.

## BOD ELECTION FOR THREE YEAR TERM JAN. 1, 1984 — DEC. 31, 1986

The Electromagnetic Compatibility Society By-laws provide that six members shall be elected annually to the Board of Directors to fill vacancies. The nominations listed on the ballot card were submitted to the Nominating Committee and biographical sketches are attached to the ballot.

Gene Knowles, Nominations Chairman, urged members to vote for *SIX* candidates immediately when the ballot is received and to return the ballot card *at once* in the return envelope. Ballot cards must be received no later than August 1, 1983. Any returns after that date will not be counted. Members outside the continental U.S. are requested to reply by air mail in order to meet the deadline. That deadline is important so that the successful candidates can be announced at the 1983 EMC Symposium in Washington D.C.

Nominated candidates on the closing date of June 15th were:

L. Gilda Haskins	Robert D. Goldblum
Richard B. Schulz	H. R. (Bob) Hofman
Don Heirman	Henry W. Ott
Edwin Bronaugh	George Kunkel
George Hagn	Walter McKerchar

IEEE ELECTROMAGNETIC COMPATIBILITY SOCIETY NEWSLETTER is published quarterly by the EMC Group of the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017. Sent automatically and without additional cost to each member of the EMC Group.

Second-class postage paid at New York, NY and additional mailing offices.

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## EDUCATION COMMITTEE NEWS

From February 28 to March 25, 1983, Dr. Heinz Schlicke was a Visiting Professor at the University of Cape Town, South Africa where he taught a postgraduate course on *Industrial EMC* to graduate students and engineers from industry. While in South Africa, he also gave a condensed presentation on the same subject to The Council for Scientific and Industrial Research in Pretoria, South Africa.

Several short courses on EMC related topics are scheduled for the summer and fall of this year.

The Center for Professional Advancement is sponsoring two 4-day courses on *Electromagnetic Compatibility Engineering* to be given in East Brunswick, NJ on September 26-29 and in San Mateo, CA on October 18-21. The instructors will be Henry Ott and Don Heirman. For more information, call the Center at 201-249-1400.

R&B Enterprises has scheduled a one-day seminar on *The Understanding and Application of MIL-STD-461B* in Washington, DC on August 26 immediately following the IEEE EMC-S Symposium. A roster of Fall course offerings is available. For more information, call 215-825-1968.

McGraw-Hill Seminar Center is presenting three 2-day courses on *Controlling Electromagnetic Interference*. They will be presented in Los Angeles on August 23-24, in Chicago on October 17-18, and in New York on November 7-8. The seminar leader is Ernest R. Freeman. For more information, contact McGraw-Hill at 212-687-0243.

Don White Consultants will be offering *Grounding and Shielding* in San Diego on September 20-23 and in Sunnyvale on Oct. 25-28. An *Introduction to EMI-RFI-EMC* is scheduled for Boston on August 9-11. *TEMPEST-Design, Control and Testing* will be offered August 15-19 in Sunnyvale. A course on *Electro-Static Discharge Control* will be offered in Washington, DC on August 22-23.

In order to be included in the newsletter, information on courses and seminars must reach me by December 1st for the winter issue, March 1 for the spring issue, June 1 for the summer issue, and September 1 for the fall issue.

Henry Ott  
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## WHY YOU SHOULD BECOME A SENIOR MEMBER

A member should always seek to hold the highest member grade he/she is qualified for in his/her professional Society. A Senior in the profession should be a Senior in his/her professional Society. Election to Senior Member grade is the Institute's significant acknowledgement of a member's professional accomplishments. An additional bonus is the sense of personal well-being and recognition by one's professional peers. A Senior Member pin on your lapel signals your achievements for all to see. Many employers consider Senior Member grade as recognition of professional achievement and a serious consideration in salary evaluation. Elevation to Senior Member can be a most rewarding personal and professional experience.

Additionally, only Senior Members are eligible for nomination to Fellow, IEEE's highest and most distinguished member grade, and only Senior Members and Fellows may hold certain regional and directorship offices. If you are interested in joining other organizations, many will accept only Senior Members and Fellows for application.

### Who Can Be a Senior Member?

For admission or elevation to the grade of Senior Member, a candidate should be an engineer, scientist, educator, technical executive or originator in IEEE designated fields. The candidate shall have been in active professional practice for at least ten years\* and have demonstrated significant performance over a period of at least five of those years. Such performance should include one or more of the following:

- a. Publications of engineering or scientific papers, books or inventions,
- b. Technical direction with evidence of accomplishment of important scientific or engineering work,
- c. Recognized contributions to the welfare of the scientific or engineering profession,

- d. Development or furtherance of important scientific or engineering courses in a "school of recognized standing,"
- e. Contributions equivalent to those of "a" to "d" above, in areas such as technical editing, patent prosecution or patent law, provided these contributions serve to advance progress substantially to IEEE designated fields

* A Baccalaureate Degree is equivalent to 3 years	3 Years
A Masters Degree - 1 additional year	1 Year
A Ph.D. - 1 more additional year towards the	
ten year requirement	1 Year
	Total 5 Years

The form has been simplified to make it easier for you to provide the necessary information. Primarily, it enables you to show evidence of a significant performance as an engineer over a period of five years. All questions should be answered completely, since your candidacy is judged only from the information you provide. Give dates, for they are important. If necessary, use extra paper with the application to expand on your qualifications. You are asked to name at least three Fellows or Senior Members as references. However, under exceptional circumstances, The Admission and Advancement Committee may accept other references than those.

All newly elected Senior Members automatically receive a personalized certificate with the compliments of the Membership Development Committee. New Senior Members, if they so desire, may have their employers notified of their new status. A letter from the IEEE President will affirm that "Senior Membership is the highest professional grade to which application can be made in the IEEE."

You should be proud of your career accomplishments — both personal and professional. You have earned the recognition. Why not apply for Senior Member Grade now? It's just one more advancement along the path to success.

## IEEE 1984 NATIONAL SYMPOSIUM ON EMC

The 1984 IEEE National Symposium on Electromagnetic Compatibility will be held April 24-26 in San Antonio, Texas. The theme of the Symposium will be "EMC in the Next Quarter Century." Cooperation between the EMC Society and the IEEE will be emphasized. Particular attention will be given to furthering the interests of the IEEE and supporting EMC in all industries.

A call for original, unpublished papers in all areas of EMC

has been issued. Topics may include technical areas such as EMP, ESD, lightning and radiation hazards or application areas such as biomedical, computers, consumer products, and robotics. Abstracts (50-70 words) and summaries (500-700 words), explaining contribution, originality and relevance should be submitted to William H. McGinnis by August 1, 1983. Mr. McGinnis' address is: Southwest Research Institute, P. O. Drawer 28510, San Antonio, TX 78284.





by Charles F.W. Anderson

# CHAPTER CHATTER

## CENTRAL NEW ENGLAND

Len Long, Chapter Chairman, Art Murphy, Vice President, and John Clarke, Secretary/Treasurer met recently to discuss the '83/'84 program. This was in preparation for the Boston Section's Chapter Coordination meeting at which each active Society Chapter's Chairman presents his group's tentative schedule. The objective is to minimize calendar conflicts and also to determine if any of the Chapters might have an interest in joint sponsorship of specific topics. These annual meetings are held in conjunction with a Section-hosted dinner. (Other Sections/Chapters, take note - sounds like a good way to avoid meeting conflicts and to get better acquainted with colleagues in other disciplines!)

The Chapter is planning an October meeting at which the speaker will be George Briggs (GTE-Sylvania/Needham). His topic will be "Lightning Environment," and will be, at least in part, an update of the talk which George and Art Murphy gave on the subject about five or six years ago. Tentative meeting topics for November '83, February '84, March and April have also been selected.

Chet Smith has reported that everything is proceeding smoothly with plans for the '85 Symposium.

John Clarke and Tony Mauriello will present a paper at the '83 Symposium titled "Radiated Electromagnetic Emission from Rail Transient Vehicles," which has also been accepted for the November issue of the EMC-S Transactions.

Thanks to John Clarke for his combined letter and phone report.

## CHICAGO

On May 24th, the Chapter held a meeting at the Belden facility in Geneva IL. J. Kincaid of Belden welcomed the 13 IEEE members and 23 guests who attended. Anatoly Tsaliovich presented a paper titled "Electronic Cable Shielding Techniques and Performance". Following the paper, demonstrations of shield evaluation techniques were given in the Belden Technical Research Center. Chapter Chairman Bob Hofmann presided at a short business meeting prior to the technical session. The Chapter's next meeting will be held on September 20th.

The above is from Bob Hofmann's announcement and meeting report.

## LITTLETON, CO

The Chapter held a meeting on April 21st at which officers for the '83/'84 term were elected.

Two papers were also presented. Dave Gonshor spoke on the topic, "Filter-pin Connectors for Interference Suppression." Stephen Clinger's paper was titled "Computer-aided EMC Design - Time-domain Cable Coupling." The latter paper was accompanied by a demonstration of the HP9020 engineer work station. Both authors are with Martin Marietta.

## LOS ANGELES

On April 21st, John Kemper of Kemtelcom, presented a talk on "Spectrum Management and EMC at the Crossroads - A Challenge." He discussed the impact on equipment design of changes in Federal spectrum management policies. These changes "may force self-policing by the electronics industry," he stated.

## NEW JERSEY COAST

The Chapter's April 26th meeting had Dr. George Brucker of RCA Laboratories speaking on the subject "Electromagnetic Design Constraints and Approaches for Systems Used in Radiation Environments." There were 30 member attendees plus two guests.

With the addition of Schaffner EMC Inc., the Chapter (joint with Vehicular Technology) now has nine sponsors for their Newsletter.

As of early April, the Chapter roster listed over 50 members.

On June 21st, Dr. William J. Riordan, of Bell Labs Technical Staff, spoke on "Cellular System Spectrum Engineering." Implications of newly developed design techniques to improve efficiency and minimize interference in the use of available radio spectrum for Cellular Mobile Telephone Service was discussed, with a look particularly at interference problems.

Officers elected for 1983-84 term were: Seymour Krevsky, Mitre Corp., Chairman; Charles Joey, Honeywell Inc., Vice Chairman; John Mumbauer, Honeywell Inc., Secretary/Treasurer.



### ORANGE COUNTY (CA)

On May 10th, the Saddleback Inn in Santa Ana was the locale of a joint Los Angeles/Orange County/San Diego Chapters meeting and exhibit. Diego Waser of Schaffner Inc. presented an overview of the present state of EMC Engineering standards and guidelines in Europe and the U. S. He also spoke on the topic "Electrostatic Charging and Simulation of the Discharging Process" with a demonstration of an ESD simulator. Various interference simulators were also demonstrated.

The meeting started with the opening of the exhibits at 4:00 P.M. Dinner was at 7:00, with Mr. Waser's talks and demonstrations following.

### SAN DIEGO

The April meeting of the Chapter, held at the IRT facility, was addressed by Dr. John Lavery, Staff Scientist at Scientific Applications Inc. His topic was "Effects of SREMP (Source-Region EMP) Induced Transients on Buried Insulated Wires."

The June 15th meeting had Edward Price of GD's Electronics Division as its speaker. He presented a talk on the subject "Commercial FCC Testing."

### TOKYO

The Chapter's monthly Research Meetings continue to include excellent papers on diversified topics in EMC/EMI. The announcements which Professor Takagi sends us include abstracts, which appear following this column. Examples of the topics covered in the March, April and May meetings include:

- Bio-effects of X-band on crayfish
- Use of synthetic-aperture array antennas for LF EMI location
- GHz range absorbing materials based on short-fiber ferrites
- 3-electrode over-voltage surge arrestors
- Summary of EMC research progress in Japan in 1981-82

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## IEEE PRODUCTIVITY SUBCOMMITTEE

The IEEE Committee on Communications and Information Policy, a joint endeavor of the IEEE Technical Activities Board and the U.S. Activities Board, created a Subcommittee on Industrial Productivity in mid-1981. The subcommittee is chartered to assist in the rational formation of policies intended to enhance industrial productivity through the application of communication and information sciences. The subcommittee will be concerned with improving productivity in any industry, manufacturing or service, or in the private or public sectors. The group will also be concerned with education, since one of the best means of achieving future productivity improvements may be to ensure that the coming generations have achieved computer literacy by the time they have finished their formal education.

In its first year and a half of existence, the subcommittee on industrial productivity has been involved in three projects:

1. It reviewed the Economic Recovery Act of 1981 and suggested a change.
2. The subcommittee also reviewed policies regarding the use of electronic message services, both as part of the U.S. Postal Service and as separate services. The group found no technical issues in the debate, so chose not to take a position in this area.
3. The subcommittee contacted the White House after Congress passed a bill to create a White House Conference on Productivity and offered support.

The subcommittee is seeking suggestions from all IEEE members regarding policy issues related to communications and information, particularly those that explore the technical background or suggest approaches for doing so. The Subcommittee on Industrial Productivity can be contacted by writing to the IEEE Washington Office, 1111 19th St. N.W., Washington, DC.

*(Reprinted from AESS Newsletter, April 1983)*

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# REPORT ON 5th SYMPOSIUM AND TECHNICAL EXHIBITION ON ELECTROMAGNETIC COMPATIBILITY ZURICH, MARCH 8-10, 1983

Increasing interest in EMC technology is confirmed by steadily growing participation in West European EMC Symposia (1975 and 1977 Montreux, 1979 Rotterdam, 1981 and 1983 Zurich). Of these, the recent event in Zurich achieved, with 650 participants, the largest growth rate of 20%.

The Symposium was held under the auspices of Mr. R. Trachsel, Director-General of the Swiss PTT and was sponsored by the Swiss Electrotechnical Association (SEV/ASE). A number of international and national professional organizations cooperated. Organization of the conference was under the direction of the Institute for Communication Technology of the Swiss Federal Institute of Technology Zurich (ETHZ). President of the Symposium was Prof. Dr. P. Leuthold (Zurich); Organizing Chairman, Dr. T. Dvorak (Zurich); and Technical Program Chairman, Prof. Dr. R. M. Showers (USA).

The technical program featured 18 sessions, 5 workshops, 3 technical excursions and a technical exhibition. A welcome cocktail party, dinner, authors' lunch and ladies' program offered further opportunities for professional and personal contacts.

Ninety six papers from 18 countries were given in 18 sessions titled: "Environment," "Interference Models," "Propagation and Wave Coupling," "Nuclear EMP," "Biological Effects of Exposure to RF Radiation," "Power Electronics," "NEMP Simulation," "Immunity," "Suppression Techniques," "Non-homogeneous Fields," "Shielding and Grounding," "EMC Standards," "Transmission Line Coupling," "Measurements," "EMC Computer Programs," "EMI in Microelectronics," "EMC Analysis and Design," "Spectrum Management."

The following outstanding papers received certificates of honor and monetary awards totalling 5000 Swiss Francs: J. J. Goedbloed, K. Riemens, A.J. Stienstra, "Increasing the RF Immunity of Amplifiers with Negative Feedback"; T. G. Dalby, "Linear Antenna Near-field Decoupling Using a Radial Transmission Line"; B. Demoulin, P. Duvinage, P. Cornic, P. Degauque, "Penetration Through an Interruption of the Shield of a Coaxial Cable"; K. Bullough, A. Cotterill, "Ariel 4 Observations of the Power-line Harmonic Radiation Over North America and Its Effect on the Magnetosphere"; L. E. Varakin, "Electromagnetic Compatibility of Cellular Mobile Communication Systems with Pseudo-noise Signals"; and, J. J. Max, A. V. Shah, "Distributed Lowpass Filters for EMI Filtering."

The workshops, organized by H. K. Mertel (USA) had tutorial character and were devoted to: "Lasting Effects of Transients" (special workshop offered by the URSI Commission E), "Systems EMC," "Design and Test for RFI Regulations of USA and CISPR," "EMP Simulation," "Predicting Radiation Emissions from Computing Devices and Controls."

Twenty nine exhibitors used the opportunity to introduce their products and to discuss technological, measurement and educational problems with their customers.

The conference proceedings, "Electromagnetic Compatibility 1983," (103 papers, 565 pages) is available at a net price of Swiss Francs 100, including mailing costs, from: Dr. T. Dvorak, ETH Zentrum-IKT, 8092 Zurich, Switzerland.

The 6th EMC Symposium and Technical Exhibition is planned for March 1985 in Zurich. The Call for Papers is scheduled for February 1984.

## WROCLAW SYMPOSIUM EMC-84

The Seventh International Wroclaw Symposium on Electromagnetic Compatibility is scheduled for June 26-28, 1984 in Wroclaw, Poland, and is open to all engineers and scientists throughout the world. Papers will be presented in the English or Russian language, with simultaneous translation provided. Topics will include all aspects of EMC theory and practice. A plenary session and up to three parallel topic oriented sessions are planned. Oral sessions, as well as poster sessions (with non-commercial instrument presentation possible) will be organized. Visits to sites of technical interest are being scheduled.

The Symposium program will include a technical exhibition covering the following areas:

- Modern measuring instrumentation
- Interference and transient suppressors
- Screened enclosures
- Shielding and absorptive materials
- Suppressed and high immunity equipment

- Advanced aids for spectrum surveillance

The Spring 1983 issue of this Newsletter contained information on the submittal of original, unpublished papers concerning research on technological and operational aspects of EMC to be presented at EMC-84.

A Welcome Get Together Party and other social events, including a Ladies Program, will be organized. Post Symposium excursions to exciting places in Poland will be available. Wroclaw may be conveniently reached by plane from Warsaw, train or car. There are convenient connections between Poland and all European capitals.

Hotel accommodations, transportation, transfers, etc. will be arranged by the Congress Bureau of the Polish Travel Office ORBIS which cooperates with all major travel agencies throughout the world. The preliminary program is scheduled for spring 1984, but, for more immediate information, contact: W. Moron, EMC Symposium, Box 214, 51-645 Wroclaw 12, Poland; Telex: 0712118 ilw pl.



## PAPERS PRESENTED AT THE RESEARCH MEETINGS ON EMC JAPAN

March 28, 1983, Tokyo

1. "Low Level Modulated Microwave Biological Effects," by Teruhisa HOCHIN, Tetsuo IKEDA, Nagoya Institute of Technology. Report of Technical Group on EMC, IECE, and IEE of Japan, Vol. 82, No. 298, EMCJ 82-75, pp. 1-8.

**ABSTRACT:** To study the biological effects of low-level modulated microwave field, the first antenna of crayfish was exposed to sinusoidally modulated and unmodulated electromagnetic field. Carrier frequency is 9.45 GHz and modulating waves are 10 Hz and the frequencies that synchronize neutral impulse train. The irradiated microwave power was 1mW or 10mW as the input power of the waveguide. There was a difference between the intervals of the spontaneous discharge during modulating frequency at 10 Hz and the control.

2. "Fundamental Characteristics of Radio Interference Measuring Apparatus Employing an Average Detector," by Tetsuo OGUCHI, Akira SUGIURA, Hirojiro NAGATOMO, Radio Research Laboratorier, M.P.T. Report of Technical Group on EMC, IECE and IEE of Japan, Vol. 82, No. 298, EMCJ 82-76, pp. 9-16.

**ABSTRACT:** In connection with measurement of radio interference from data processing equipment, theoretical and experimental studies have been made of the recurrent impulse response of the measuring apparatus with an average detector. It is found that the responses to low repetition rate inputs are different from those specified in CISPR Publ. 16, if the predetector stage output has an oscillatory envelope. In high repetition rates, the meter readings depend on the selectivity of the apparatus. Some types of average detectors were examined on their compliance with the specification, and the results are described in detail.

3. "High Precision Open-site Attenuation Measurement and Site Correction Factor," by T. FUJIKAWA, T. ARAI, H. HARUKI, M. OKANO, S. TAKEYA, A. MAEDA, Matsushita Communication Industrial Co., Ltd. Report of Technical Group on EMC, IECE and IEE of Japan, Vol. 82, No. 298, EMCJ 82-77, pp. 17-24.

**ABSTRACT:** Attenuation at EMI measurement site has been thought to include only attenuation of the direct wave from the equipment under test to the receiving antenna, attenuation of the wave reflected from the ground plane, and their phase relationship. Precise measurements show that part of the received signal is re-radiated and again received after reflection from the ground plane. Inclusion of this factor in calculations improves their agreement with measurements.

4. "Search for Unknown Location of Electromagnetic Noise Sources in LF Band," by Junichi KIKUCHI, Motoyuki SATO, Yoji NAGASAWA, Risaburo SATO, Faculty of Engineering, Tohoku University. Report of Technical Group on EMC, IECE and IEE of Japan, Vol. 82, No. 298, EMCJ 82-78, pp. 25-32.

**ABSTRACT:** This paper proposes the method of search for unknown location of electromagnetic noise sources in LF band by using the Synthetic Aperture Array Antenna technique. Some numerical simulations show that this technique can be applied for the distributed noise sources.

5. "On the Statistical Measurements of Impulsive Noise in a City," by H. ECHIGO, N. HANDA, T. TAKAGI, and R. SATO, Faculty of Engineering, Tohoku University. Report of Technical Group on EMC, IECE and IEE of Japan, Vol. 82, No. 298, EMCJ 82-79, pp. 33-38.

**ABSTRACT:** Impulsive Noise Amplitude Distributions (INAD) were measured under the almost same condition as the previous measurements 3 years ago shown in the past technical report. The data results were almost the same as the earlier ones, therefore, the noise level has not changed much for the past 3 years. Adding them, data in both polarizations (vertical & horizontal) were compared. Averaged curves revealed no differences between them, but each 1 min. interval data showed that vertical polarization gave higher level for the ears.

April 26, 1983, Tokyo

1. "A Mechanism of Origin and Propagation of Radio Noise in Commutator Motor," by Shun SUZUKI, Kumio TAKAHASHI, Hitachi Koki Co., Ltd., Report of Technical Group on EMC, IECE and IEE of Japan, Vol. 83, No. 13, EMCJ 83-1, pp. 1-8.

**ABSTRACT:** At the frequency band of 0.15-5 MHz, we measure the pulse amplitude distribution of the radio noise voltage, in the universal motor. As the result of measurement, we estimate that the main origin of the noise is the current fluctuation which occurs in the coil, which is commutated later among amature coils in the same slot. Moreover, we estimate that in this frequency band, the coupling between the current fluctuation and the field coil affects the noise level, and we develop the equivalent circuit of the noise origin and propagation.

**KEY WORDS:** universal motor, radio noise voltage, equivalent circuit.

2. "Electric Fields Due to Lightning Return Stroke," by Tetsuji ABE, Hiroaki KOGA, Nobuo KUWABARA, Ibaraki Electrical Communication Laboratory, N.T.T.

Report on Technical Group on EMC, IECE and IEE of Japan, Vol. 83, No. 13, EMCJ 83-2, pp. 9-14.

**ABSTRACT:** We have two calculating methods to obtain the electric field due to lightning return stroke. One is obtained through the time dependent Maxwell's equations. The other is given by integrating the initial response electric field for the unit step return stroke current. This paper clarifies the calculable condition and application for return stroke current model, in regard to both methods. Horizontal electric fields are also calculated in case of perfectly and finite conducting ground, respectively. The relation between distance from lightning strike point and both horizontal electric fields is clarified.

**KEY WORDS:** lightning electric field, lightning surge.

3. "Electromagnetic Wave Absorber in GHz Frequency Range Using Ferrite Absorbing Materials Composed of Short Metal Fibers," by Kenichi HATAKEYAMA, Tetsuji INUI, NEC Corporation. Report of Technical Group on EMC, IECE and IEE of Japan, Vol. 83, No. 13, EMCJ 83-3, pp. 15-19.

**ABSTRACT:** Thin ferrite broadband absorber was achieved, e.g., more than 20dB absorption from 8GHz to 13GHz. The absorber consists of two layers, which operate as a low impedance resonator and as a transforming layer individually. Experimental procedures are shown in detail relating with the impedance characteristics of each layer which are composed of ferrite, short metal fibers and organic resin.

**KEY WORDS:** Electromagnetic wave absorber, ferrite, short metal fiber.

4. "Search for Unknown Location of Electromagnetic Noise Sources in LF Band Using the Synthetic Aperture Array Antenna Technique," by Junichi KIKUCHI, Motoyuki SATO, Yoji NAGASAWA, Risaburo SATO, Faculty of Engineering, TOHOKU University. Report on Technical Group on EMC, IECE and IEE of Japan, Vol. 83, No. 13, EMCJ 83-4, pp. 21-28.

**ABSTRACT:** The authors have proposed the method of search for unknown location of electromagnetic noise sources in LF band using the Synthetic Aperture Array Antenna technique. In this paper, we show some numerical simulations with cosine-pattern-antenna. Experiment in UHF band represents that this method can be used practically.

**KEY WORDS:** searching technique, distributed noise sources, LF band, Synthetic Aperture Array Antenna, scale model experiment.

## May 24, 1983, Tokyo

1. "Design Method of Induction Over-voltage Reduction for Telecommunication Lines by 3-electrode Arresters," by Hiroshi YAMANE, N.T.T. Mitsuo HATTORI and Hiroaki KOGA, Ibaraki Electrical Communication Laboratory. Report on Technical Group on EMC, IECE and IEE of Japan, Vol. 83, No. 38, EMCJ 83-5, pp. 1-6.

**ABSTRACT:** This paper describes a reduction design method of induction over-voltage from high power transmission lines for telecommunication lines by using 3-electrode arresters. We found a new parameter in 3-electrode arrester discharge characteristic, and clarified that the parameter is one of the important factors for the design of the over-voltage reduction method. Simplified design conditions for the earth resistance are clarified, taking account of the 3-electrode arrester discharge characteristic.

**KEY WORDS:** Arrester, Induction.

2. "Distributed Constant Circuit Theory Under the Electromagnetic Environment (IX)," by Yoshio KAMI, Jr. Tech. College of Electro Communications and Risaburo SATO, Faculty of Eng., Tohoku University. Report on Technical Group on EMC, IECE and IEE of Japan, Vol. 83, No. 38, EMCJ 83-6, pp. 7-14.

**ABSTRACT:** To clarify a coupling mechanism of transmission lines and external waves, forcing terms of the line equations have been studied by an investigation of those physical meanings. Experimental results, measurements of an induced power in a terminated load at end of lines of finite length suspended above the perfect ground plane illuminated by external plane waves polarized parallel and normal to the incident plane, show to be in good agreement with the theory under certain restrictions. To extend the applicable region, a compensation method is proposed.

**KEY WORDS:** externally excited transmission line, line equations

3. "Brief Report on the 5th EMC Symposium (Zurich)," by Tasuku TAKAGI, Tohoku University. Report on Technical Group on EMC, and IEE of Japan, Vol. 83, No. 38, EMCJ 83-7, pp. 15-22.  
The outlines of the schedule, contents, organization and others of the above symposium are briefly reported. Over 100 papers were presented through 18 sessions (A R) and covering the following points of view: (1) Organizing efforts to hold a high quality symposium, such that over 1/2 session chairmen have been invited; (2) All timely topics and recent advancements have been reported; (3) Room arrangements and related facilities were perfect; (4) Program was well arranged.
4. "EMC Research Progress in Japan, 1981-82," by Yasuo AKAO, Nagoya University, Faculty of Engineering. Report on Technical Group on EMC, and IEE of Japan, Vol. 83, No. 38, EMCJ 83-8, pp. 23-30.

**ABSTRACT:** Articles, which were reported at the monthly meetings of EMC group and in the Journals and the Transactions of the IECE of Japan in the past two years, are reviewed and classified. The biological effects of both RF and ELF fields are studied. The noise characteristics of various contact switches are intensively analyzed. Various kinds of RF absorbing materials are developed. A new protection method against surge voltage due to lightning discharge and a result of balloon measurement of harmonic radiation from power-line are also reported.

**KEY WORDS:** review of EMC articles, research progress.



**Richard B. Schulz**  
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## TECHNOLOGY-ALERTING INDEX

This index lists recent manuscripts received (but, not yet accepted) for publication in the EMC Transactions. New indexing symbols are included to indicate the subjects treated. For details on the meaning of these symbols, refer to the paper, "Coding Scheme for EMC-Technology Indexes," which is appearing in the Silver Anniversary issue of the EMC Transactions, August 1983. Draft copies of the manuscripts may be available, upon request, from participating authors.

- B1f 83-8 Correlation Between the Quasipeak Value of Noise Measured by Aiya's Noise Meter and the rms Value Measured by the ARN-2 Recorder - R. A. Agarwala, Department of Electronics and Communications Engineering, Regional Engineering College, Kurukshetra 132 119, India. Telephone: 83 Bld.
- J9c 83-9 Absorbing Boundary Conditions for the Finite-Difference Approximation of the Time-Domain Electromagnetics-Field Equations: A Second Look - R. Fisher, Electro Magnetic Applications, Inc., P.O. Box 8482, Albuquerque, NM 87198; Tel.: 505-265-3538. J9d, B10d.
- I16g 83-10 Nonsinusoidal Waves in Rectangular Waveguides - H. F. Harmuth, Dept. of Electrical Engr., The Catholic University of America, Washington, DC 20064; Tel.: 202-635-5193. I16d, P99d.
- P1d 83-11 P-Ary Sequency and Orderings of the Chrestenson Functions - Z. Gongli, Dept. of Information Engineering, Northeast Telecommunication Engineering Institute, Xi'an, Peoples Republic of China.
- P1d 83-12 Two Complete Orthogonal Sets of Real Multiple-Valued Functions - (see 83-11).
- D3e 83-13 Estimation of Crosstalk in Three-Conductor Transmission Lines - C. R. Paul, Dept. of Electrical Engineering, University of Kentucky, Lexington, KY 40506. Tel.: 606-257-1644.
- P2d 83-14 Dyadic Symmetry and Its Application to Walsh Transform Theory - W. K. Cham and R. J. Clarke, Dept. of Electronics and Electrical Engineering, Loughborough University of Technology, Loughborough, Leicestershire, U.K. Tel.: 0509 63171. P3d.
- A3f 83-15 The Use of Screened Rooms for the Identification of Radiation Mechanisms and the Measurement of Free Space Emissions from Electrically Small Sources - A. C. Marvin, Dept. of Electronics, University of York, York, YO1 5DD, England. A6b.
- G8e 83-16 Threshold Detection in Non-Gaussian Interference Environments: Exposition and Interpretation of New Results for EMC Applications - D. Middleton, 127 E. 91 St., New York, NY 10028; Tel.: 212-831-8565. G10d, B3e, B1e.
- A99c 83-17 The Dual Measurement Procedure for Eliminating Systematic Interference - H. M. Shen, R. W. P. King, and T. T. Wu, Gordon McKay Lab., Harvard University, Cambridge, MA 02138; Tel.: 617-495-4468. A9k, A3k.
- A9c 83-18 The Matching Between an EMP Simulator and the Pulse Generator - (see 83-17). A3k, A2k.
- D3f 83-19 Experimental Characterization of Multiconductor Transmission Lines in the Frequency Domain - J. Dagher.
- P99d 83-20 The Ordering Methods of Walsh Functions - C. Wei-ren, Dept. of Computer Science and Engineering, Nanjing Institute of Technology, Nanjing, Jiangsu, Peoples Republic of China.
- A2k 83-21 Properly Applied Antenna Factors - W. S. Bennett, Ft. Collins System Div., Hewlett-Packard Co., 3404 E. Harmony Rd., Fort Collins, CO 80525; Tel.: 303-226-3800. A2d.



# Book Reviews



by Jim Hill, EMXX Corporation.

We review two books in this issue of your newsletter. One book is hot off the press, a book whose author is acting as publisher and sales representative. Norm Violette called recently to offer this review of Ken Keenan's *Digital Design for Interference Specifications* which was released in February. The second book is actually an IEEE Standard issued in book form. This IEEE Standard 518-1982, published in November 1982, is a revision of ANSI/IEEE STD 518-1977 and is sponsored by the Industrial Control Committee of the IEEE Industrial Applications Society. Every IEEE Standard is subject to review at least every five years for revision or reaffirmation. When a document is more than five years old, and has not been reaffirmed, it is reasonable to assume that its contents, although of some value, do not wholly reflect the present state-of-the-art. Thus, this standard may be regarded as state-of-the-art. The IEEE Standards Board solicits comments on the standards and will respond to requests for interpretations addressed to:

Secretary, IEEE Standards Board  
345 East 47th Street  
New York, NY 10017

Two members of our EMC Society, Heinz M. Schlicke and Ralph M. Showers, were members of the Industrial Control Systems Subcommittee of the Industrial Control Committee at the time it approved this guide. Furthermore, The EMC Society is represented on the IEEE Standards Board by Art Wall.

## ***Digital Design for Interference Specifications***

by

*R. Kenneth Keenan, Ph.D.*

*Published by The Keenan Corporation (TKC)*

*421 Mill St., S. E., Vienna, VA 22180*

*Tel.: 703-938-5582*

*Copyright 1983*

*Reviewed by J. L. Norman Violette, Ph.D.*

*JLN Viollette & Associates*

*6927 Tyndale St., McLean, VA 22101*

*Tel.: 703-790-1364*

This new book is intended for engineers whose primary function is the design of digital circuits and systems. The main emphasis is on the electromagnetic interference (EMI) generated by digital circuits and systems which must pass FCC and VDE conducted and radiated emission testing. The emphasis is on interference specifications relevant to commercial equipment in both the United States and Europe.

The book's Introduction sets the stage: the book does not, nor is it intended to be, a "tome on digital design." However, it guides the digital design engineer to consider step-by-step the RF interference generated by digital signals. The implication (assumption) of the author is that the digital design engineer, whose sphere of activity falls primarily within the

time domain, is not perceived to be familiar with RF phenomena to tie digital signals to RF emissions, the latter phenomena essentially falling within the frequency domain. The Introduction includes background information on conducted and radiated emissions, specifications, and a brief description of system susceptibility. The author has written the book with full emphasis on the emissions aspect of digital system EMC, with occasional reference to susceptibility.

A chapter on fundamentals is presented which describes the spectra of random and periodic signals. Dominant sources producing both conducted and radiated emissions are identified. Examples of the derivation of the spectra of periodic and random signal waveforms and how the two apply to digital waveforms are included. Photographs of typical radiation spectra are presented and representative parameters of typical logic families are tabulated. Digital current waveforms in printed circuit board traces and cabling are described, including waveforms associated with clock signals and power supplies. The effects of the all-important circuit capacitances (intentional and parasitic) are fully introduced, including the effects of resistive and capacitive circuit loading. The author illustrates how nonlinearities can lead to underestimation, and sometimes overestimation, of radiated field intensity if the former are not properly accounted for.

Radiated emissions form the topic for one chapter. A general method is presented for determining the amplitudes of radiated emissions with numerical examples included to support the development. FCC/VDE test conditions are described, with military emissions testing briefly noted. The author emphasizes the importance of applying practical judgment when conducting tests, including a careful definition of what constitutes the system to be tested.

Radiated field configurations (radiation patterns) are described with the basic radiating loop used as a model from which the author develops concepts and equations for determining (i.e., predicting) radiation field intensity. The emphasis is on determining the maximum electric field strength for both "small" and "large" loops based upon loop dimensions (geometry) and the frequency of interest. Transmission line theory is introduced and tied in as a means of viewing radiating loops. The effects of radiation patterns of resonant frequencies, i.e., poles and zeros associated with a transmission line distributed parameter model, are illustrated. The radiated E-fields for different loop configurations and loading are given. An example is presented of a printed circuit board layout, identifying likely radiating loops and the potential for large estimation errors if resonance phenomena are not properly accounted for. Actual computer printouts are provided of the radiated field patterns derived from the circuit models developed as a function of "hard" and "soft" clock drives and loading. Examples of backplane and cable radiation are also provided. The effects of circuit impedance termination and PCB permittivity on radiation intensity are qualified.

Methods of minimizing radiated emissions are presented and compared. The techniques described include shielding, layout, wire twisting, signal waveform design, and circuit balancing. The author compares the E-field radiation patterns and magnitudes obtained before and after certain "fixes" are implemented. The author covers techniques involving minimizing radiation from coaxial cable configurations, apertures in enclosures, shielded cables, and the avoidance of ground loops. Methods to minimize radiation from power cords are also included. Analytical techniques are demonstrated and aptly rationalized throughout the

development. A summary of design considerations is provided.

Clock-related and power-supply-related conducted emissions are addressed. The approach is essentially divided into the analysis of linear-regulated, primary-side, and secondary-side switching power supplies. The many parasitic capacitances are identified and illustrated as the paths via which conducted emissions find their way into power-lines. Suppression techniques are presented and illustrated. Conducted emissions testing techniques are described, including the use of line impedance stabilization networks (LISN). The performance of various types of capacitors is described, including an illustrated example of capacitor suppression of conducted emissions as a function of frequency, for selected capacitors of varying quality. Filter applications are described and different filter types and isolation transformer applications are illustrated.

Developmental testing is outlined for the determination of compliance with FCC and VDE emission specifications. The author provides guidance on how to use a relatively inexpensive AM/FM broadcast band radio receiver and calibrated signal generator for conducting informal testing during product development. It is emphasized here (and by the author) that the procedure is inadequate for formal testing throughout the entire frequency range required by the FCC and VDE. However, the procedure can provide an indication of potential emission problems early and inexpensively during product development.

The book is very well written and organized with many examples and five Appendices. The author has taken great pain to document thoroughly reference sources for convenient cross-referencing where more detail may be desired in given subject areas covered. This is one of the strong points of the book after the meticulous technical detail. The Bibliography contains 92 relevant references. The emphasis throughout is on the determination and suppression of emissions within the frequency range from 10 kHz to 1 GHz, which is the range required for FCC and VDE specification compliance. The book is highly recommended as a reference and working text to anyone working or managing in the digital design area where FCC and VDE emission limits must be met.

**IEEE Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources**

*Sponsor*

*Industrial Control Committee of the IEEE*

*Industrial Applications Society*

*An IEEE publication distributed by John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10016*

*Copyright 1982*

*Hardbound, 160 pages, \$19.95*

*Reviewed by James S. Hill.*

*The EMXX Corporation.*

The IEEE Standard 518-1982 (Revision of ANSI/IEEE Std 518-1977) is one that the IEEE Standards Board has chosen to issue in hardback book form. Quoting from the Foreword: "The rapidly expanding use of computers and solid-state controllers in industry requires consideration of many factors not previously important in the design, installation, and operation of other forms of controllers. Many portions of the control circuits of computers and solid-state controllers designed for operation at low-energy, low-voltage signal levels are susceptible to disturbances by excessive electrical noise. Erratic controller operation may result unless suitable precautions are taken. The following recommendations are intended as an installation guide for industrial controls involving low-energy-level equipment to minimize electrical noise inputs from external sources. The electrical noise guide is comprised of six sections. Sections 1 and 2 state the scope

and service conditions. Sections 3 through 5 provide the technical foundations for the recommendations given in Section 6. Section 6 is intended to stand alone as the working section of the electrical noise guide."

Section 2, Service Conditions, makes this statement: "This guide is limited to techniques for the installation of controllers and control systems so that proper operation can be achieved in the presence of electrical noise. This guide is not intended to be a guide for the internal design of electrical controllers or for the prevention of the generation of electrical noise resulting from their operation."

The book deals with all types of electrical noise, including lightning and nuclear electromagnetic pulse. Measurement methods for susceptibility are described as a prelude to the determination of the extent of protective measures.

It is interesting to note that ten of the figures in the book have been borrowed from Heinz Schlicke's "Electromagnetic Compossibility (Applied Principles of Cost-Effective Control of Electromagnetic Interference and Hazards)," second enlarged edition. This includes the FATTMESS concept devised by Schlicke. FATTMESS is the acronym for frequency, amplitude, time, temperature mode, energy, size or structure, and statistics describing the parameters involved in a system analysis. This book is well illustrated, includes excellent bibliographies and a comprehensive index. It offers good fundamental advice to the installer of electrical equipment used in conjunction with controllers.

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### **THREE USAB POSITION STATEMENTS APPROVED**

USAB has approved three position statements: Technology Transfer in the United States, Age Discrimination by Employers of Engineers, and Licensure and Registration. On Technology Transfer, USAB said that public policy should be designed "to foster U.S. leadership in scientific and technological development, to increase productivity and innovation, and to support and maintain essential national security," but policy should not "impede such growth through excessive limitations on the flow of information within the technological community." Nine specific guidelines for U.S. policy are recommended in this paper.

The Age Discrimination Position states, in part, that employers should "give proper recognition and promotions based on merit, regardless of age," and that they should "recognize that

experience acquired during a career has considerable value to the enterprise." On Licensure and Registration, it is USAB's position that these activities "contribute to the efforts of the profession to protect the health, welfare and safety of the public by ensuring that practitioners meet minimum recognized levels of education, experience, and competence." USAB, however, does not support "any program with the objective of legislating or mandating registration or licensure for all engineers."

In addition to the approval of these three statements by USAB, the IEEE Board of Directors approved a USAB-originated statement, "Engineering Manpower in the U.S.," as an IEEE Position Paper. Copies of these positions are available from the IEEE Washington Office.



## SECOND EMCS/BOD MEETING 1983

It was a nice spring day in May in Silicon Valley where the second Board of Directors Meeting of the year was held. The meeting took place on 4 May during the Test and Measurements Exposition at the San Jose, CA Convention Center. We want to thank the Expo organizers for the use of the meeting room and for a discount for those Board members who attended the various technical workshops held.

President Duff called the meeting to order at 1:05 P.M. Twelve of the 20 Board members were present, with three other EMCS committee chairpersons/symposium members present. The Secretary distributed the minutes from the 20 January meeting. Later in the meeting, the Board approved the minutes, with minor corrections.

The highlights of the meeting are as follows:

1. Treasurer's report was presented by Don Heirman, since Warren Kesselman was unable to attend. The pre-audit net worth of the Society as of 1 January 1983 was \$109.6K which represents a surplus of about \$31K. It was noted that the surplus from the 1982 symposium was not received. Andy Nalbandian stated that most of the surplus soon will be forwarded to the Treasurer. A contingency fund will be kept to pay final bills.

2. The Silver Anniversary issue of the EMCS Transactions is nearing completion and will be available at the August Symposium. There will be author and subject indices for both the Symposium Proceedings and the Transactions, going back to Volume 1, 25 years ago! We are really looking forward to this collectors' item and Dick Schulz's fine efforts.

3. Gene Cory presented a review of future symposia, including a summary of the 6 recent symposia financial reports and attendee statistics (Santa Clara results are not in as yet). Andy Nalbandian reported on the progress in closing out the books for the 1982 Symposium. Gene then presented the 1983 preliminary budget. A concern was raised as to the Board-approved, 2-tier registration fee structure for IEEE and non-IEEE registrants at the Washington, DC Symposium. The difference in fees approved at the 20 January Board meeting was to be applied to IEEE membership for those non-members who were qualified to join. In a split vote, the Board rescinded the 2-tier structure previously approved in favor of an approach with less difference in the fees for IEEE member and non-member. President Duff and Gene Cory were to come up with a procedure and fee structure that may have less differences in registration prices. Since the advance program was in the process of mailing, the new fee structure may have to be adjusted at the time of registration. The call for papers for the 1984 national symposium in San Antonio was handed out. The due date is 1 August to get abstracts to the technical program chairman. Contact Bill McGinnes (512-684-5111, Ext. 2721). A report from Tei Iki on the 1984 international symposium in Tokyo was made. Every effort is being made to keep the costs down with local subsidies so that the conference expense will be comparable with that in the U.S., less transportation. Negotiations with JAL airlines for group discounts to Japan are well underway. For more information, contact Tei Iki, Sony Corp., 1650 W. Bernardo Drive, San Diego, CA 92127. It

was suggested that the 1988 location for the symposium be in Seattle and the 1989 location be back in Washington, DC. The Seattle location is yet to be confirmed. There is also an outstanding request for the return of our symposium to Boulder. 1990 may be that date.

4. Ralph Showers presented his report on Technical Services. He reported the continuing efforts of Don Heirman, Standards Chairman, in trying to increase the pace on standards activities. Several standards that were proposed are in need of volunteer support. Contact Don (201-834-3566) for further information. Next, Herb Mertel presented the revised charter for the Technical Advisory Committee of the EMCS, which he chairs. The charter has been reviewed by all the technical committee chairmen indicated in the spring 1983 Newsletter. Of particular interest is the adoption by the Board of a policy on fees for workshop notes. After deliberation, the Board approved a policy that those who attend the workshop will be charged a nominal fee for the notes. The local symposium committee will collect the fees. A limited number of notes will be available at the conference on a first-come, first-served basis. Educational activities were discussed. The Board again reiterated its policy to urge local EMCS entities such as Chapters to propose specific EMCS educational activities that the Board might help subsidize. It was also brought to the attention of the Board that such proposals should first or in parallel go to the local IEEE Section which is charged with financial assistance for such activities, consistent with their fiscal budget.

5. Fred Nichols reported on Membership Services. The Orange County (California) Chapter formation paperwork was found and President Duff approved the petition and sent it back to IEEE Headquarters. An Ottawa Chapter that would be joint with Microwave Theory and Techniques and Antennas and Propagation was also approved by Bill and forwarded to Headquarters. Our friends in France are considering formation of a chapter there. Contact President Duff for more information.

6. Don Clark presented Jim Toler's reports on membership development and awards. The net membership increase in the past year was only 2.2 percent which was less than half that of the Institute as a whole. To increase the percentages, Jim has put into motion a procedure whereby IEEE Headquarters will send about 900 letters to members of the MTT, COM, VT, AP, AES, and COMP Societies (Can you interpret these symbols?), which have indicated EMC interests in their technical interest profile. That's an excellent start, but the real pay dirt will be personal contact by you, our membership, to get those working in EMC areas who are not members to sign up. Don then presented Jim's flow diagram that detailed how we will handle free EMCS membership for those who sign up at the Washington, DC, symposium in August. To avoid extending out the rebate time for months, only those who fill out the paperwork at the IEEE booth at the symposium will receive the rebate.

7. A discussion on a new award to commemorate the Silver Anniversary of our Society was held. The awards committee proposed a special plaque to be given to the originating

founders of the Society, 25 years ago. The committee was directed by the Board to further investigate the basis for selecting the recipient. The Board wanted to ensure that the selection would be based on an equitable process. Another award will be available next year to celebrate the Institute's 100th Anniversary. The Institute has authorized 8 centennial medals to be given by the EMCS to deserving persons who have contributed to the Society. The Board was requested to submit nominations for the medals which will be given out at next year's national symposium. If you have any suggestions, please call Jim Toler on 404-894-3964. Finally, the Fellows nomination committee requested and received approval for the Board endorsement of Ed Bronaugh, Gene Knowles, and Ernie Freeman for nominations for Fellow in 1984. The endorsement was forwarded to Headquarters by June 15, 1983.

8. Hugh Denny described the proposed Constitution and Bylaw revisions he is assembling. Hugh received comments from the Board members after the last meeting. (A review of the proposed revisions is contained in this column in the last issue of the Newsletter.) He proposed the following target dates: mail the revised text to the Board by 15 June; request final comments by 15 July; and mail smooth text to the Board by 30 July so that the changes can be voted on at the 22 August Board meeting.

9. Gene Knowles reported that there was a full slate of candidates for the Board of Directors for the 3-year term beginning 1 January 1984. The ballots will be mailed so that we can get the results back prior to the August Board meeting. This will allow installation of the new Board members at the last meeting of the calendar year. PLEASE VOTE!! Let's try to have at least 1/3 of the voting members of our Society participate, which is a goal that should be achievable. Don't forget that some members have been elected to the Board by the slimmest of margins since only the 6 highest vote getters are elected. The seventh on the list has missed by as few as a dozen votes in the past. So your vote counts; please exercise it!!

10. Don Heirman was appointed by President Duff to chair an ad hoc nominations committee to prepare a slate of

candidates for the Executive Committee of the Board. The committee includes President, Vice-President, Treasurer, Secretary, and the 4 Technical Directors. Except for President and Vice President, the Executive committee can be formed from the general Society membership. The Board will elect these officers from the slate at the 22 August 1983 meeting.

11. Leonard Carlson presented his report for professional services. Of particular interest was the continuing activity of Bob Brook in representing our EMC interests with the Society of Social Implications of Technology.

We want to thank Bob for his continuing interest and timely reports at each Board meeting since he was appointed as EMCS representative to SSIT. Leonard reported that he will be preparing a summary of the scope of the activities under his cognizance: intersociety relations, public relations, and EMCS representation to the IEEE Technical Activities Board.

12. President Duff reported the proposed realignment of the Divisions of the Societies of the Institute. The EMC Society would be placed in the new "Electromagnetics and Radiation" Division of about 19,000 members. The 5 societies in the new division will be ours, AP, Magnetics, MTT, and Nuclear Plasma Physics. The Board concluded that the division structure made sense and authorized President Duff to approve the proposal.

13. A final discussion centered around a recent position paper on the controversy on whether video display terminals (VDT) were harmful to the user's health. The Board was briefed on the controversy and several resource documents were indicated. One such document chronicles the developments on VDT. It is titled VDT and can be ordered from the editor of Microwave News in NY City, Louis Slesin. His address is: Microwave News, P.O. Box 1799, Grand Central Station, New York, NY 10163.

The meeting adjourned at 4:55 P.M. The next meeting will be at 1:00 P.M. on Monday, 22 August 1983, at the Hyatt Regency in Crystal City next to Washington, DC, National Airport in Alexandria, VA.

Respectfully submitted,

Don Heirman

### **ANTHONY G. ZIMBALATTI ASSUMES RESPONSIBILITY OF EMC-S NEWSLETTER ASSOCIATE EDITOR**

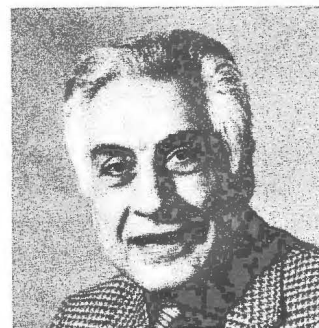
Anthony G. Zimbalatti (M '50 - SM '82) is Principal Engineer, Electromagnetic Environmental Effects (E<sup>3</sup>), at the Grumman Aerospace Corporation. He has been involved in EMC engineering since receiving his BEE degree from New York University in 1949. While a civilian at the U. S. Army Signal Laboratories from 1950 until 1958, he designed and tested EMI suppression systems for all types of army equipments. From 1958 until 1960, he designed suppression systems for Air Force and Navy subsystems and conducted EMC studies among Navy Shipboard Systems while at the Sperry Gyroscope Company. Anthony joined Grumman in 1960, became Group Head for EMC in 1962, and developed the group from 18 to 65 EMC engineers. Prior to his present

position, Anthony had been Group Head for System Integration, supervising a group of 40 EMC and integration engineers.

A founding member of EMC-S, in which he retains an active membership, he also is a member of the SAE AE-4 EMC committee, and has served on the EMC-S Board of Directors as Membership Chairman. His previous experience includes New York Chapter Chairman and member, 1965 and 1973, EMC International Symposium Committees. Two IEEE papers on System EMC Engineering have been authored by him, and he has prepared and presented the EMC lecture for a System Engineering course at the New York State College at Stonybrook.

# POINT AND COUNTERPOINT

by Anthony G. Zimbalatti



We are listening! Let us know your opinions on topics of timely interest to the EMC-S. Topics may deal with administrative or technical issues, and even may be controversial. Readers may be stimulated to respond to your opinion. Others, including the opinion column editor, may not agree. That's the point and counterpoint of the column. Opinions need not be lengthy, and if you want to remain anonymous, just say so in your letter to the editor. Although not mandatory, it would be desirable to identify your credentials so that the basis for your opinion can be identified in the column. It also is advisable to furnish your phone number so the editor may reach you.

Now that we are off and running, it is my opinion that the name of the Electromagnetic Compatibility Society (EMC-S) should be changed to EEE-S (Electromagnetic

Environmental Effects Society). This change provides a more descriptive name to better describe and relate to the activities of most EMC-S members. For example, some of our activities do not necessarily have an obvious connection with EMC. One such activity is designing protection schemes to prevent atmospheric electricity (lightning) from causing structural damage to air frames or avionics equipment. Let's hear your opinion on the name change - or some other topic that interests you.

Please address your correspondence to:

Anthony G. Zimbalatti  
IEEE EMC-S Associate Editor  
Grumman Aerospace Corp.  
M. S. B25/35  
Bethpage, New York 11714

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## INTERNATIONAL WORKSHOP ON ELECTROSTATICS

### THE MANAGEMENT OF ELECTROSTATIC PROBLEMS, HAZARDS AND APPLICATIONS

September 28, 29, 30, 1983

Llandudno, North Wales

Static electricity arises in many aspects of life. It can be used to advantage in various aspects of industry — but it can cause problems and disasters. The aim of this national workshop is to provide an understanding of the ways in which electrostatics can be used and how the problems and risks of shock, fire and explosion can be understood and controlled.

The latest research and development work in this field will be described by speakers expert in their own particular fields, and who can contribute to the discussion of problems from wide practical experience. The first day is optional and is devoted to providing a basic educational background in electrostatics, followed by two days of lectures and discussions about a variety of practical topics.

The workshop will be of interest to people concerned with the manufacture and handling of plastic powders, the pumping and filtering of liquids in the petrochemical industry, the handling of chemicals and explosives, the handling and processing of pharmaceutical powders, the bulk handling and

storage of foods, the manufacture and handling of textile yarns and materials, and micro-electronic equipment. It will also appeal to those concerned with powder coating and paint spraying, air cleaning and atmospheric pollution, and to people in the printing industry.

The workshop is organized in conjunction with Industrial Development Bangor (University College of North Wales) Ltd. and is the eighth in the series of Summer Schools which have been arranged on alternate years by IDB at Bangor and by the Applied Electrostatics Group at Southampton University. There will also be a small exhibition of electrostatic instruments and equipment.

Enquiries for Workshop and Exhibition should be addressed to:

Miss Helen Raquet, Assistant Organiser  
Oyez Scientific and Technical Services, Ltd.  
Bath House, 56 Holborn Viaduct, London EC1  
Tel.: 01-236 4080; TLX 888870



# EMC DIRECTORS

This directory is provided to permit letter and telephone contact between Society officers, committee chair and chapter chair. Use it when you have questions or discussion on society matters. It is up to date as of June 1, 1983.

Since BOD and many chapter elections will take place in the next months many names will change. This is as it should be in a moving society.

We plan to update this directory again after the BOD and chapter elections. This directory is only as good as we make it. You can help by calling or writing me concerning changes. Otherwise I shall find you.

## FUTURE EMC SYMPOSIA

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1983 - Washington, DC, October 24-26	A.H. Sullivan, Jr.
1984 - Tokyo, October 16-18	R. Sato
1984 - San Antonio, TX, April 24-26	E.L. Bronaugh
1985 - Boston, MA, August 20-22	C.L. Smith
1986 - San Diego, CA, September 9-11	H.K. Mertel

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## USAB IS ACTIVE BEFORE CONGRESS

During the past several months, representatives from USAB have testified and/or made statements before several committees and subcommittees of Congress.

Copies of the following are available from the IEEE Washington Office:

- Statement on Fusion Energy Research by Dr. Allan T. Mense on behalf of the Research and Development and Energy Committees of the Institute of Electrical and Electronics Engineers, March 16, 1983. Delivered to House Subcommittee on Energy Research and Production, House Science and Technology Committee.
- Statement on Electric Energy Systems by Lester H. Fink on behalf of the Research and Development and Energy Committees of the IEEE before the Subcommittee on Energy Research and Production, House Science and Technology Committee, March 17, 1983.
- Statement of Dr. Russel C. Drew before the Subcommittee on Commerce, Justice, State, the Judiciary, and Related Agencies of the House Committee on Appropriations, April 7, 1983. Subject, Proposed Funding for National Bureau of Standards and Related Parts of the Department of Commerce.

tions, April 7, 1983. Subject, Proposed Funding for National Bureau of Standards and Related Parts of the Department of Commerce.

- Testimony of Dr. Harvey C. Nathanson before the Senate Appropriations Committee Subcommittee on Defense, April 19, 1983. Subject, Defense Research and Development.
- Statement of Dr. Russell C. Drew before the Subcommittee on Commerce, Justice, State, the Judiciary, and Related Agencies of the Senate Committee on Appropriations, April 20, 1983. Subject, Proposed Funding of NBS and related parts of Department of Commerce, FY84.
- Statement of Theodore R. Simpson before the Subcommittee on HUD and Independent Agencies of the House Committee on Appropriations, April 20, 1983. Subject, FY84 NASA Budget.
- Testimony of John A. Casazza on behalf of the IEEE Energy Committee before the Energy Water Development Subcommittee of the House Appropriations Committee, March 24, 1983. Subject, Energy Efficiency.



## DEVELOPMENT OF CARRIER-FREE RADAR AT THE TECHNICAL UNIVERSITY GRAZ, AUSTRIA

BY FRANZ NEUBAUER  
INSTITUTE FOR ELECTRONICS  
TU GRAZ



Submitted by  
Dr. G. Robert Redinbo  
Associate Editor,  
Sequency Union

The Institute for Electronics at the Technical University Graz is active in the development of electronic equipment for monitoring of snow conditions in the alpine regions, and of equipment that can help the alpine rescue service in finding people buried in snow avalanches.

Several projects are being worked on:

1. The avalanche rescue equipment Pieps
2. Ultrasonic equipment that measures the depth of snow
3. Measurement of the equivalent water layer of snow by means of cosmic rays
4. A pulse radar for sensing of snow movements
5. Single pulse (= carrier-free) radar systems for snow and glacier soundings

These points cover all the activity at the Institute for Electronics in this area.

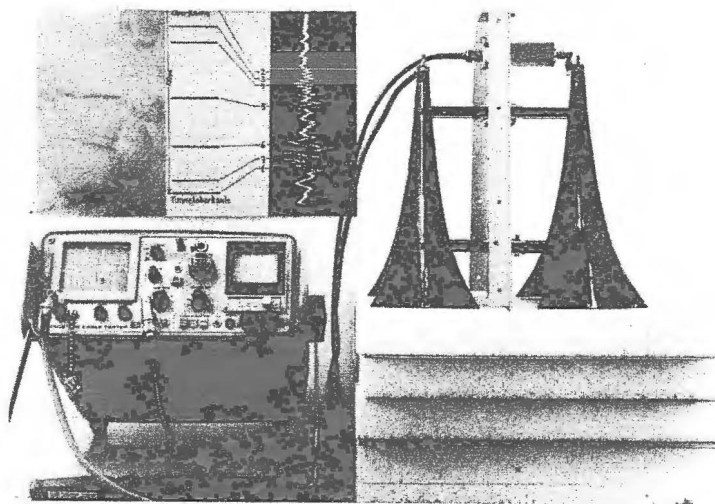
The development of carrier-free radar systems at the Institute started during the seventies. First, a radar with exponential surface antenna was built that used a 1 ns wide single pulse (= carrier-free pulse). This radar could detect layers and foreign objects in the snow to depths up to 4 m. The resolution was about 25 cm. Originally, it had been planned to use this equipment to locate people buried in avalanches. However, the difference between bodies and homogeneities of the snow or other inclusions was too small to be useful.

The development of carrier-free radar at TU Graz is discussed in two PhD theses: "Single-Pulse Radar Method for the Detection of Inhomogeneities in Snow" by G. Hartner, and "Probing Radar for Snow and Ice" by F. Osterer; both theses are in German.

At about the same time, the development of a single pulse radar with a pulse width of about 20 ns was started. It used a wire antenna terminated with a resistance. With this radar, one can probe the thickness of glaciers. Measurements were made at the Hallstatt glacier in Austria. The useful range of the radar was found to be about 80 m.

During the last years, a radar for the sounding of snow layers was built at the Institute that is a further development of the previous carrier-free radar with a pulse duration of 1 ns. This equipment, called a stratimeter, uses, again, an exponential surface antenna. A step recovery diode serves as the power source. The power source produces a pulse of 150 ps duration with a voltage of 20 V across a 50 ohm load. The equipment contains analog and digital signal processors. The signal processing permits the elimination of ringing caused by the antenna from the received signal, and, thus, provides cleaner return signals from the snow layers. This equipment can detect layers in snow to a depth of 3 m and provides a resolution of 5 cm. Work is continuing on this project.

The illustration shows an experimental set-up of the equipment. Two antennas - for radiation and reception - are located on top of layers of materials with varying permittivity and conductivity that simulates snow layers. A modified cable tester drives the step recovery diode module in the box connected to the antenna on the right. The antenna on the left is the sensor. The diagram behind the equipment shows a cross-section of snow with the surface (2), five interfaces between snow layers (3 - 7), and the top of a tunnel at a depth of 1 m below the snow surface (1); these features are related to the recording of the carrier-free radar on the right.



## LICENSED EEs SOUGHT TO DEVELOP QUESTIONS FOR PROFESSIONAL ENGINEERS EXAM

The Institute of Electrical and Electronics Engineers, Inc. (IEEE) United States Activities Board (USAB) is seeking licensed Professional Engineers, electrical and electronics, who may or may not be IEEE members, to develop questions for the electrical engineering portion of the Professional Engineering (PE) examination. Honoraria will be given for questions accepted by the National Council of Engineering Examiners, preparers of the PE exam.

Licensed professional electrical and electronics engineers can obtain further information by requesting the *Question Writer's PE Packet* from Joel B. Snyder, P.E., Co-Task Force Leader, IEEE/USAB Licensure and Registration Task Force, c/o IEEE Washington Office, 111-19th Street, N.W., Suite 608, Washington, DC 20036; or, call the IEEE Washington Office at 202-785-0017 and request the *PE Packet*.

## FOURTH INTERNATIONAL CONFERENCE ON ELECTROMAGNETIC COMPATIBILITY CALL FOR PAPERS

The Fourth International Conference on Electromagnetic Compatibility will be held at the University of Surrey in Guildford, Surrey, Great Britain, from September 18-20, 1984. The conference, organized by the Institution of Electronic and Radio Engineers, is a forum for the exchange of views on problems, methods of analysis, and solutions associated with EMC control.

A call for original papers has been issued. Suggested topics include EMP, lightning, TEMPEST and electrostatics, which may be discussed in terms of systems and equipment design, regulations, standards and specifications, RF hazards and biological interactions, and project management.

Synopses of not more than 300 words must be submitted to the Conference Secretariat by October 1, 1983. Final papers, of 8 typed sides or less, are required by February 1, 1984. Other information and registration forms are also available from the Conference Secretariat, Institution of Electronic and Radio Engineers, 99 Gower Street, London WC1E 6A2, England.

## EMCABS

In this issue, we are publishing 42 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

**"HOW CAN I GET A COPY OF AN ABSTRACTED ARTICLE?"** The answer to this frequently asked question follows.

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

Design and Testing of Joining Sleeves for Trailing Cable Ground and Pilot Wires  
Walter Frank, Jr.  
Brundy Corp., Norwalk, CT  
PB82-205725, PC A06 MF A01, Open File Report, Jun 77-Jul 79,  
Aug. 79, 129p. BUMINES-OFR-55-82, Contract H0377042, See Also PB-266-027

**ABSTRACT:** The purpose of this work was to develop a ground and pilot connector that will significantly improve mine trailing cable splice performance. The connector design includes connectors for splicing ground and pilot conductors. A distinction is made between connectors suitable for splicing round and flat ground and pilot conductors. A discussion on the suitability of round cable for trailing cable applications is included. A field test was conducted to confirm ground and pilot connector laboratory data. The tests proved the viability of the connector designs, and recommended installation techniques in a mine environment are included.

**INDEX TERMS:** cable grounds, pilot wires mines

**EMCABS: 1-6-83**

Investigation of Shorebased Powerline Transients, Phase II.  
Sachs Freeman Associates, Inc., Bowie, MD  
AD-A115 707/2, PC A08 MF A01, Final Rept.  
Sep 81, 175p, Contract N00421-79-C-0183

**ABSTRACT:** The purpose of this investigation was to determine the extent of power-line transients at operational Navy shore facilities. This was done by conducting extensive measurements using various power-line monitoring and recording equipments. The effort constituted the second phase of a multiphase effort to measure power-line transients on Navy ships, shore facilities, and aircraft. This report presents the results of measurements performed at thirteen (13) Navy shore facilities over a period of approximately two years. The measurements provided a large amount of data (about 27,500 transients over approximately 134,700 instrumented test hours) that were analyzed to determine the frequency and severity of power-line transients at these sites. The approach used in the performance of this investigation was first to reduce the data which was collected by NESEA and then analyze this data with respect to several pertinent parameters. Over 94% of the data compiled by NESEA for the project was acquired using Dranetz Model 606-3 Power-line Disturbance Monitors; the remainder of the information was obtained using the Nicolet Model 2090-3 Digital Storage Oscilloscope.

**INDEX TERMS:** power-line transients, Navy facilities

**EMCABS: 4-6-83**

Calculation of Radiated Signals from High-Altitude Nuclear Detonations by Use of a Three-Dimensional Distribution of Compton Electrons  
Cullen M. Crain

RAND Corp., Santa Monica, CA  
AD-A114 738, 8, PC A04 MF A01, Interim Rept., Contract MDA903-81-C-0471

Mar 82, 51p, Rept. No. RAND-N-1845-ARPA

**ABSTRACT:** This note presents essential details of a three-dimensional method of calculating the radiated electromagnetic signal caused by magnetic deflections of a distribution of Compton electrons produced in the upper atmosphere by prompt gamma radiation from a high-altitude nuclear detonation or series of detonations. The method differs from that previously developed in that the solution is obtained from summing radiation fields from individual electrons in a three-dimensional volume, instead of combining the individual electron motions to determine a time-and-space-dependent current from which the radiation field is evaluated using a one-dimensional approximation to the solution of Maxwell equations. The effects of time characteristics of the source gamma output, the effects of atmospheric scattering in reducing the coherent radiation from the Compton electrons, and the effect of residual atmospheric ionization (preionization) in reducing the observer signal amplitude are developed and illustrated numerically. The three-dimensional characteristics of the source are brought out in illustrative numerical examples.

**INDEX TERMS:** EM signal Compton electrons calculations and dimensional method

**EMCABS: 2-6-83**

Electromagnetic Pulse (EMP): Phenomena, Simulation, and Hardening.  
1975-June 1982 (Citations from the International Information Service for the Physics and Engineering Communities Data Base).  
National Technical Information Service, Springfield, VA.  
PB82-869181, PC N01 MF N01, Supersedes PB81-868176  
Rept. for 1975-Jun 82, Jun 82, 149p

**ABSTRACT:** This bibliography contains citations concerning natural and nuclear electromagnetic pulse (EMP) phenomena. Analyses and simulations of EMP interactions and coupling with various susceptible objects and devices and their responses are covered. Protective methods and technology are also considered along with test techniques and results. Attention is also given to computer aided EMP analysis. (This updated bibliography contains 133 citations, 29 of which are new entries to the previous edition.)

**INDEX TERMS:** EMP bibliography, phenomena simulation hardening

**EMCABS: 5-6-83**

Child's Guide to Fiber Optics for Nuclear Test Diagnostic Systems: Helpful Facts, Formulas, and Hints  
F. Roeske

Lawrence Livermore National Lab., CA  
DE82005600, PC A04 MF A01, Microfiche only after original copies are exhausted.

17 Aug 81, 73p, UCID-19068, Contract W-7405-ENG-48

**ABSTRACT:** The use of fiber optics as a data transmission medium in the nuclear test diagnostic field is dramatically increasing and is anticipated to accelerate in the near future. Therefore, as new experimental systems using fiber optics are designed, tested, and even used in a routine manner, members of I. Division who may not be initially familiar with optical fibers will be involved with their use in the field. This report contains information that is intended to help those people in their experimental design and to provide a reference for those who are familiar with the uses of optical fibers.

**INDEX TERMS:** fiber optics data transmission, nuclear field

**EMCABS: 3-6-83**

Electromagnetic Pulse (EMP): Phenomena, Simulation, and Hardening.  
1976-June 1982 (Citations from the Energy Data Base).  
National Technical Information Service, Springfield, VA.  
PB82-869173, PC N01 MF N01, Rept. for 1976-Jun 82, Supersedes PB81-868143  
June 82, 132p, Prepared in cooperation with the Department of Energy, Washington, DC.

**ABSTRACT:** This bibliography contains citations concerning various aspects of electromagnetic pulse (EMP) from the environment through systems design and testing. The interactions and coupling of electronic components and systems, communication and power transmission systems, and sea, air, and spacecraft with EMP are considered as is their protection from it by shielding, isolation, and hardening methods and devices. Some attention is given to physical and computerized simulations of EMP and to health and safety hazards associated with its generation. (This updated bibliography contains 135 citations, 43 of which are new entries to the previous edition.)

**INDEX TERMS:** EMP bibliography, phenomena simulation hardening

**EMCABS: 6-6-83**

<p>Mine Grounding Systems: Development of Tests and Criteria to Evaluate Grounding Systems. Wils L. Cooley and Robert L. McConnell West Virginia Univ., Morgantown, Engineering Experiment Station PB82-209719, PC A07/MF A01, Open file report, 1 Jul 78-15 Sep 79 Sep 79, 150p, BUMINES-OFR-52-82, Contract G0188087</p> <p><b>ABSTRACT:</b> This report covers tests and criteria for the establishment of safe grounding systems for coal mines. The work deals primarily with underground mines, but much is applicable to surface mines as well. Included is an extensive guide to grounding and bonding procedures for mine surface substations. Xit-Rods (chemically charged, hollow-rod electrodes that generate their own moisture and metallic salts and use the resulting electrolyte as the interface medium between the conducting surface of the rods and outwardly in the soil and lowers resistance) are evaluated and shown to deviate from manufacturers' claims. An analysis shows that very long cables are difficult to monitor using audiofrequency ground-check techniques. A method is developed to detect failing cable splices without removing the cable from service. Simulation and measurement are compared for a technique to detect bad rail bonds, and an assessment is made of grounding techniques for dc face equipment.</p> <p><b>INDEX TERMS:</b> grounding systems, coal mines</p>	<p><b>EMCABS: 7-6-83</b></p>	<p>Development of a Low Cost EMP Protection Concept for Emergency Operations Centers. D. B. Clark Naval Civil Engineering Lab., Port Hueneme, CA AD-A114 320/5, PC A04/MF A01, Final Report, Oct 70-Sep 81 Jun 82, 64p, Rept. No. NCEL-TN-1617</p> <p><b>ABSTRACT:</b> Electromagnetic Pulse (EMP) shielding, isolation, and protection for emergency operations center type communications equipments have been reduced to a minimum size and cost through development testing, utilizing a concept of shielding, single entry, and in-line transient voltage protection. Shielding for direct induced EMP is balanced against protectors for direct connected EMP to result in EMP voltages at equipment input connections on the order of 5 to 10 volts peak with simulated EMP fields on the order of 10 kV/m and direct connected EMP of thousands of volts peak.</p> <p><b>INDEX TERMS:</b> EMP protection emergency centers</p>	<p><b>EMCABS: 10-6-83</b></p>
<p>Electromagnetic Pulse (EMP): Phenomena Simulation, and Hardening. 1972-June, 1982 (Citations from the International Aerospace Abstracts Data Base). National Technical Information Service, Springfield, VA. PB 82-869-165, PC N01/MF N01, Rept. for 1972-Jun 82. Supersedes PB81-868-168. Jun 82, 101p. Prepared in cooperation with the National Aeronautics and Space Administration, Washington, DC.</p> <p><b>ABSTRACT:</b> This bibliography contains citations concerning electromagnetic pulse (EMP) generation and propagation mechanisms and interactions and coupling with various structures, aircraft, spacecraft, and missiles, as well as electronic components, electrical circuits, and antennas. Physical and computerized simulations of EMP and EMP environments and interactions are considered. EMP protection methods and devices, including hardening, shielding, and isolation, are also covered. (This updated bibliography contains 96 citations, 40 of which are new entries to the previous edition.)</p> <p><b>INDEX TERMS:</b> EMP bibliography, phenomena simulation hardening</p>	<p><b>EMCABS: 8-6-83</b></p>	<p>Standing Waves and Notches in a Parallel-Plate Type of EMP Simulator and Their Reduction. T. T. Wu, R. W. P. King, D. J. Blejer, and M. Owens Mission Research Corp., Albuquerque, NM AD-A115 986/2, PC A03/MF A01, Final report Mar 81, 43p, AFWL-TR-80-162, Contract F29601-78-C-0082</p> <p><b>ABSTRACT:</b> The high standing-wave ratio (SWR) in a model simulator in the mid-frequency range defined by <math>kh = 2\pi h/\delta</math> approx. <math>= 2\pi</math> (where <math>h</math> is the height of the parallel-plate region) is investigated experimentally. It is shown that the isolated deep minimum or notch is due to the mutual cancellation of the imaginary parts of the TM01 and TEM modes. The effects on the SWR and the deep minimum of changes in the magnitude and location of the termination resistance are investigated. Also studied are the introduction of a bifurcating plate, resistive modal filters, and series aprons. It is shown that with the proper adjustment of the last named, the notch can be eliminated and the SWR reduced to near two at discrete frequencies that span the entire mid-frequency range. Since the low-frequency ranges already have low SWR's, the simulator has been made effective over the entire frequency band in the sense that the SWR is low.</p> <p><b>INDEX TERMS:</b> SWR EMP simulator reduction</p>	<p><b>EMCABS: 11-6-83</b></p>
<p>Use of Time Domain Reflectometry for EMP Hardness Surveillance. J. R. van Zandt MITRE Corp., Bedford, MA AD-A115 032/5, PC A03/MF A01, Technical rept. Apr 82, 26p, MTR-8535, ESD-TR-82-121, Contract F19628-82-C-0001</p> <p><b>ABSTRACT:</b> A laboratory demonstration of the feasibility of using a time domain reflectometer (TDR) to detect failures of electromagnetic pulse (EMP) hardening capacitors is described. The TDR enables a technician to easily detect an open circuit failure in a capacitor if measurements can be made near the capacitor. Measurements can also be made at a distance, if previous measurements of a known good installation are available for comparison. The Tektronix 1502 TDR cable tester was found to be particularly well suited to making these measurements.</p> <p><b>INDEX TERMS:</b> TDR EMP capacitors failure</p>	<p><b>EMCABS: 9-6-83</b></p>	<p>Near Field Antenna Measurement System. Alan E. Holley Hughes Aircraft Co., Fullerton, CA AD-A114 125/8, PC A06/MF A01, Final report 29 Aug 77-29 Oct 81 Mar 82, 111p, Contract DAAB07-77-C-0587</p> <p><b>ABSTRACT:</b> This report describes the development and evaluation of a fully automated self-contained near field antenna measurement facility. A description of the system and its normal operation is included. The development of each major subsystem is described and the evaluation procedures and results are detailed. Finally, recommendations for further development are given. In summary, the system has shown the feasibility of performing complex antenna measurements in a highly time-effective production mode while retaining accuracies comparable to typical far field ranges.</p> <p><b>INDEX TERMS:</b> near field antenna measurement system</p>	<p><b>EMCABS: 12-6-83</b></p>



<p>Performance Evaluation of RF Electric and Magnetic Field Measuring Instruments. Billy C. W. Nesmith, and Paul S. Ruggera Bureau of Radiological Health, Rockville, MD PB82-195009, PC A03/MF A01, Final Report Mar 82, 36p. FDA/BRH-82/59, DHEW/PUB/FDA-82-8158</p> <p><b>ABSTRACT:</b> The need to quantify the electromagnetic fields emitted by industrial, scientific, or medical (ISM) products operating in the 10 to 300 MHz region requires the testing of instrumentation suitable for use in RF radiation hazard surveys. To meet this requirement, several procedures were devised to test the accuracy of the RF survey instrumentation. Measurement systems and protocols were developed and evaluated. The electric (E) and magnetic (H) field measuring instruments were tested for linearity, calibration accuracy, amplitude modulation response, directivity, antenna patterns, temperature response, drift and noise, Radiofrequency Interference (RFI), and polarization response. Tests were performed on three commercially available RF survey instruments and a one-of-a-kind device over the 10 to 100 MHz region. Complete tests were only performed at the ISM frequency of 27.12 MHz. Errors for each of the tests are presented in tabular form.</p> <p><b>INDEX TERMS:</b> RF measurement instruments evaluation</p>	<p><b>EMCABS: 13-6-83</b></p>	<p>Performance of Telecommunications Systems in the Spectral-Use Environment; VIII. Interference Scenarios and the Canonical and Quasi-Canonical (First-Order) Probability Models of Class A Interference David Middleton PB82-226861, PC A07/MF A01, See also Part 6, PB81-249344 Mar 82, 148p. NTIA/CR-82/18, Contract HO-A01-78-00-1158</p> <p><b>ABSTRACT:</b> The earlier work of the author on Class A electromagnetic interference (EMI) models is further developed and extended to include approximately-canonical and quasi-canonical cases, in addition to the earlier, strictly-canonical forms. The necessity for an extension was shown by Berry's computer simulation of Class A interference.</p> <p><b>INDEX TERMS:</b> EMI models, Class A interference</p>	<p><b>EMCABS: 16-6-83</b></p>
<p>Millimeter Wave Electromagnetic Measurement Techniques E. E. Donaldson, J. C. Mantovani, G. B. Melson, and D. W. Acree Georgia Inst. of Tech., Atlanta, GA, Engineering Experiment Station AD-A116 390/0, PC A07/MF A01, Final rept., 1 Sep 80-30 Apr 82. GIT-A-2746-F May 82, 148p. CECOM-80-0569F-80-0569-F, Contract DAAK80-80-C-0569</p> <p><b>ABSTRACT:</b> This report presents the results of studies to develop the rationale for EM measurement techniques for use in the EMC evaluation of millimeter wave (MMW) communication-electric equipment and systems. In the development of this rationale, seven basic tasks were performed. Under the first task, the EMC/EMI data requirements for MMW equipments and systems were established to provide a clear definition of the type of data needed. The second task was the definition of appropriate measurement philosophy and techniques for obtaining the required data. Third task, the state-of-the-art in WEMC/EMI measurement instrumentation and components for the 10-300 GHz frequency band was reviewed to identify the available instrumentation for the measurement techniques defined in the previous tasks. Fourth task was an evaluation of the advantages and disadvantages of manual, semi-automated, and the fully automated measurement techniques to determine both the feasibility and cost-effectiveness of these three approaches to data collection and analysis. Fifth task, the likely errors associated with EMC/EMI measurements at MMW frequencies were identified.</p> <p><b>INDEX TERMS:</b> EM measurement millimeter wave</p>	<p><b>EMCABS: 14-6-83</b></p>	<p>S-Band Radar Pulse Densities in the Los Angeles Area R. J. Matheson, J. D. Smiley, and V. S. Lawrence National Telecommunications and Information Administration, Boulder, CO., Inst. for Telecommunication Sciences. AD-A114 116/7, PC A05/MF A01, Final Report Aug 81, 85p. DOT/FAA/RD-82/17, Contract DTFA01-81-Y-10535</p> <p><b>ABSTRACT:</b> This report contains results of spectrum occupancy measurements made of the 2700-3100 MHz radar bands in the Los Angeles, CA area. Approximately 500 sets of measurements were made, which included peak pulse amplitude, as well as the number of pulse counts at three threshold levels measured in 1 MHz frequency increments. These measurements have been combined and are displayed in this report in graphs showing the maximum average, and minimum amplitude and pulse counts in 1 MHz frequency increments (400 samples). These measurements were made for the Federal Aviation Administration (FAA) by the Institute for Telecommunication Sciences (ITS) using the Radio Spectrum Measurement System, a computer-controlled spectrum analyzer system. The measurements will be used to quantify the S-band electromagnetic environment expected to be encountered with NEXRAD, a doppler weather radar currently under development.</p> <p><b>INDEX TERMS:</b> spectrum measurements, 2700-3100 MHz, Los Angeles</p>	<p><b>EMCABS: 17-6-83</b></p>
<p>Threshold Signal Reception in Electromagnetic Interference Environments: Part II. Receiver Structures and Performance for Class A EMI Environments and Scenarios. David Middleton PB82-226846, PC A07/MF A01, See also Part I, PB80-218753 Mar 82, 137p. NTIA/CR-82/17</p> <p><b>ABSTRACT:</b> In this second part of a continuing study, the specific problems of determining minimum detectable signals and maximum detection ranges for telecommunications receivers operating in highly nongaussian electromagnetic interference (EMI) environments, are examined in detail. Various characteristic models of Class A interference are developed, along with their EMI scenarios (namely, source distribution, propagation law, waveform structures and statistics). These are needed, in turn, to establish the analytical and quantitative forms of the optimum signal processing algorithms, particularly in the limiting threshold (weak-signal) cases considered here. Various modes of detection are employed: optimum (threshold) coherent and incoherent reception, and the important suboptimum coherent case of cross-correlation detection (well-known to be optimum for gaussian noise).</p> <p><b>INDEX TERMS:</b> threshold reception EMI MDS</p>	<p><b>EMCABS: 15-6-83</b></p>	<p>Adaptive Array Behavior with Sinusoidal Envelope Modulated Interference Abdulaziz S. Al-Ruwais and R. T. Compton, Jr. Ohio State Univ., Columbus. ElectroScience Lab. AD-A116 586/9, PC A03/MF A01, Technical Report Mar 82, 46p. Rept. no. ESL-713603-5, Contract N00019-81-C-0093</p> <p><b>ABSTRACT:</b> The behavior of an LMS adaptive array with modulated interference is described. An interference signal with sinusoidal, double-sideband, suppressed-carrier modulation is assumed. It is shown that such interference causes the array to modulate the desired signal envelope but not its phase. The amount of the desired signal modulation is determined as a function of signal arrival angles and powers and the modulation frequency of the interference. Such interference also causes the array output signal-to-interference-plus-noise ratio (SINR) to vary with time. However, it is shown that when the desired signal is a digital communication signal, the averaged bit error probability is essentially the same as for CW interference.</p> <p><b>INDEX TERMS:</b> LMS, adaptive array, modulated interference</p>	<p><b>EMCABS: 18-6-83</b></p>

<p>Study of EMI/RFI Seals on Shielded Enclosure Personnel Access Doors Roy A. Axford Construction Engineering Research Lab. (Army), Champaign, IL AD-A116 760/0, PC A03/MF A01, Final Report Apr 82, 45p. Rept. no. CERL-TR-M-313 <b>ABSTRACT:</b> This study investigated the relative shielding capabilities of three EMI/RFI door seal designs: the double-mesh gasket, the wiping compression contact fingerstock gasket, and the recessed fingerstock contact (knife edge). The effects of aging and wear on the doors when no maintenance was applied and the effectiveness of the manufacturers' recommended maintenance procedures were investigated. The effects of electroplating tin on door seal contacts were also determined. <b>INDEX TERMS:</b> EMI/RFI Seals, enclosure doors</p>	<p><b>EMCABS: 19-6-83</b></p>	<p>Options to Open-Field and Shielded Enclosure Electromagnetic Compatibility Measurements M. L. Crawford National Bureau of Standards, Washington, DC PB82-233552, Not available NTIS, Final rept. 1981, 6p. Pub. in Proceedings of Symposium and Technical Exhibition on Electromagnetic Compatibility (4th), Zurich, Switz., Mar 10-12, 1981, p383-388 <b>ABSTRACT:</b> This paper discusses optional measurement techniques that are being investigated as potential alternatives to using open-field sites and conventional shielded enclosures for performing EMC measurements. Techniques discussed include: (1) low-Q underground or buried test chambers, (2) transverse electromagnetic (TEM) transmission line cells, and (3) reverberating or mode tuned/stirred enclosures. <b>INDEX TERMS:</b> EMC measurements, buried chambers, TEM Cells, reverberating enclosures</p>	<p><b>EMCABS: 22-6-83</b></p>
<p>Evaluation of Applicability of Standard CW EMI/RFI Shielding Effectiveness Test Techniques to Assessment of EMP Hardness of Tactical Shelters Roy Axford, Ray McCormack, and Raj Mittra Construction Engineering Research Lab. (Army), Champaign, IL AD-A113 042/6, PC A04/MF A01, Final Report Mar 82, 61p. Rept. No. CERL-TR-M-307, Contract MIPR-FY76-208100019 <b>ABSTRACT:</b> This report investigates the validity of analytical techniques for converting continuous wave (CW) test data to values for electromagnetic pulse (EMP) to measure the EMP hardness of tactical shelters. MIL-STD-285 and specifications for CW testing IEEE 299 specify measurements in the near field using dipole and loop antennas. Consequently, the test wavefronts are spherical, rather than planar, as in the case of an EMP. Thus, correction factors for EMP needed to be developed. <b>INDEX TERMS:</b> EMI/RFI Shielding, EMP Applicability</p>	<p><b>EMCABS: 20-6-83</b></p>	<p>Optimal Application of Multilayer Shielding for Maximal EM Field Attenuation F. C. Yang, and K. S. H. Lee Mission Research Corp., Albuquerque, NM AD-A115 187/7, PC A06/MF A01, Final rept., Prepared in cooperation with Dikewood Corp. Apr 82, 114p AFWL-TR-81-127, Contract F29601-78-C-0082 <b>ABSTRACT:</b> A two-surface cable shield with periodic bondings and with either discrete or distributed excitation is analyzed. It is found that the bondings improve the overall shielding effectiveness of the cable shield at certain frequencies, but degrade the shielding at others. Certain criteria are established for better shielding. In the case of distributed excitation, the overall effective transfer functions of a two-surface cable shield can be calculated from simple circuits. These circuits can be extended for multisurface cable shields. Part II extends the previous work on a single-surface shielded enclosure of arbitrary shape to a multisurface enclosure with or without electrical bonding between the shields. It is found that the inductive mutual interactions among the shields and the bonding straps reduce the effectiveness of a multisurface shielded enclosure against the penetration of external magnetic fields. <b>INDEX TERMS:</b> multilayer shielding, EM field attenuation</p>	<p><b>EMCABS: 23-6-83</b></p>
<p>Electromagnetic Transmission through an Aperture or Arbitrary Shape in a Conducting Screen Chih-Lin I, and Roger F. Harrington Syracuse Univ., NY. Dept. of Electrical and Computer Engineering Technical rept., AD-A115 593/6, PC A05/MF A01 Apr 82, 98pm Rept. Nos. TR-82-5, TR-16, Contract N00014-76-C-0225 <b>ABSTRACT:</b> In this work, the problem of electromagnetic transmission through an arbitrarily-shaped aperture (undercovered) or window (covered with a thin glossy dielectric sheet) in a perfectly conducting plane is treated. The method of moments is used to solve numerically the integral equation for the equivalent magnetic current. Triangular patching is used to conform to the arbitrary shape. Local position vectors are chosen as both the expansion functions and the testing functions. The centroid-pair matching is utilized to complete the approximation. A set of computer codes is presented and briefly described. To illustrate the solutions, computations are given for various apertures (different shapes), windows (different dielectric materials), and half spaces (different media). Numerical results are also compared with other data, if available. For windows with proper thickness or half spaces with proper media, the phenomena of aperture resonance is demonstrated. <b>INDEX TERMS:</b> EM Transmission Aperture</p>	<p><b>EMCABS: 21-6-83</b></p>	<p>Electromagnetic Coupling to an Infinite Wire through a Slot in a Conducting Plane. Yang Naiheng, and Roger F. Harrington Syracuse Univ., NY. Department of Electrical and Computer Engineering Technical rept., AD-A114 824/6, PC A05/MF A01 Mar 82, 85p. Rept. no. TR-82-3, Contract N00014-76-C-0225 <b>ABSTRACT:</b> The problem of electromagnetic coupling through a slot-perforated conducting plane to an infinitely long wire is considered. It is treated as a boundary value problem and is formulated by use of the equivalence principle and image theory as a pair of coupled operator equations. The operator equations are solved simultaneously by means of the method of moments. The equivalent magnetic current on the slot and the electric current on the wire are obtained. The equivalent circuit seen by the transmission line mode on the wire is derived for the aperture-to-wire coupling system. Computer programs for solving this problem are presented and described. Some numerical examples are given and plotted. <b>INDEX TERMS:</b> EM coupling, infinite wire slot plane</p>	<p><b>EMCABS: 24-6-83</b></p>

Procedure to Evaluate Changes to the FM Broadcasting Table of Assignments to Determine if Interference to Aeronautical Radio Facilities Could Result

Charles W. Cram

Federal Aviation Administration, Washington, DC. Systems Research & Development Service

AD-A114 102/7, PC A03/MF A01, Final Rept.

Feb 82, 29p, Rept. no. DOT/FAA/RD-82/4

**ABSTRACT:** For several years, the FAA has been receiving complaints of interference to ILS Localizer facilities in the 108-112 MHz band, VOR facilities in the 108-118 MHz band, and ATC communication facilities in the 118-136 MHz band from FM broadcasting stations in the 88-108 MHz bands. In 1978, the FAA published a report documenting a test program performed by the National Aviation Facilities Experimental Center (NAFEC) that investigated the problem of FM interference to avionic receivers. At the request of the FAA, the Radio Technical Commission for Aeronautics established Special Committee, SC-141, to study the problem and recommend methods to reduce the potential for interference to avionic receivers. One of RTCA's recommendations was that changes to the Table of FLM Assignments administered by the FCC should be evaluated during the rulemaking process necessary to make such changes to determine whether interference to aeronautical radio facilities could result.

**INDEX TERMS:** FM assignments, interference, FAA complaints

EMCABS: 25-6-83

EMCABS: 28-6-83

A Comparative Study of Electromagnetic Compatibility (EMC) Analytical Predictions and Measurements

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British Aerospace Dynamics (Space), Stevenage (England)

N82-25438/4, PC A06/MF A01, Final Report, Contract

ESTEC-3691/78/NL-HP

Mar 81, 107p, BAE-TP-7855, ESA-CR(P)-1538

**ABSTRACT:** Predictions by the specifications and EMC analysis program (SEMCAP) used in the design of communication satellites to analyze and control EMC of electronic subsystems and wiring are compared with OTS, MAROTS, and Meteosat data. The SEMCAP values are also checked against measurements on an experimental model of cable-coupled interference. A simple system handbook is provided. For a configuration of generators, receptors, and wires, SEMCAP agrees reasonably well with measurements. The bundle shielding effect (of wires in the bundle other than those constituting the hard wire connections studies) introduces discrepancies. If this effect is allowed for in modeling, agreement with measurements is good.

**INDEX TERMS:** EMC analysis predictions

Intrasystem Analysis Program (IAP) Model Improvement

Thomas E. Baldwin, William G. Duff, James J. Foster, Richard G. Robinson, and Harvey K. Schumann

Atlantic Research Corp., Alexandria, VA.

AD-A114 752/9, PC A16/MF A01, Final technical rept. Jun 79-Dec 81

Feb 82, 358p, RADC-TR-82-20, contract F30602-79-C-0169

**ABSTRACT:** The Intrasystem Electromagnetic Compatibility Analysis Program (IEMCAP) is a system level, computerized analysis program which may be used in analyzing electromagnetic compatibility (EMC) for aircraft, spacecraft or ground stations on both present and future systems. The objective of this effort was to increase the prediction capability of the IEMCAP. The defined tasks to obtain the new capability are the following: (1) development of a frequency dependent power gain antenna model for IEMCAP; (2) modify IEMCAP to predict the electromagnetic (EM) interference for those devices whose compatibility is not related to average power; (3) implement within IEMCAP a mathematical model(s) to predict the degradation to receptors of EM energy, caused by spurious signal products generated at an emitter, a structural nonlinearity (i.e., in the transmission path), or in a victim receptor (i.e., signal harmonics, intermodulation, cross modulation, desensitization, gain compression/expansion and spurious responses); and (4) modification of the modeling procedure for a port's emission and/or susceptibility.

**INDEX TERMS:** IEMCAP final report

EMCABS: 26-6-83

EMCABS: 29-6-83

Field Manual: Calculation of Electric Fields in Conducting Media

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DE82002959, PC A03/MF A01, Microfiche only after original copies are exhausted.

Oct 81, 29p, LA-9012-M, Contract W-7405-ENG-36

**ABSTRACT:** A computer program (FIELD) written in BASIC that may be used to calculate electric potential, gradient, and power-density distribution in conducting media is discussed. Either cylindrical or rectangular coordinate systems may be used. Information is supplied to assist users in providing necessary data for the program and in interpreting output. A program listing is appended. (ERA citation 07:016896)

**INDEX TERMS:** electric fields, conducting media, calculations

EMCABS: 27-6-83

EMCABS: 30-6-83

Susceptibility Determination under Uncertainty

L. C. Martin, E. J. Bogdan, and H. S. Cabayan

Lawrence Livermore National Lab., CA

DE82001667, PC A02/MF A01, International conference on electromagnetic compatibility, Southampton, UK, 16 Sep 1980

1980, 9p UCRL-85809, CONF-8009220-1, Contract W-7405-ENG-48

**ABSTRACT:** The determination of the susceptibility of systems, equipment, or components to external electromagnetic stimuli is compounded by uncertainties. A probabilistic approach to such determination is outlined and discussed. This approach recognizes variation in the uncertainties, makes use of the probability distribution in describing this variation, and relies heavily on computer-oriented models for the interaction phenomena. In practical application, fairly extensive computer program tools are necessary for the Monte-Carlo systems and circuit analyses required.

**INDEX TERMS:** EM susceptibility, probabilistic approach

Electronically Tunable Phase Locked Loop Oscillator

Mathew Balasis, Michael R. Davis, and Charles R. Jackson

E-Systems, Inc., St. Petersburg, FL. ECI Div.

AD-A113 253/9, PC A07/MF A01, Final technical rept. 10 Mar 80-12 Jun 81

Feb 82, 149p, GO-62244, RADC-TR-81-400, Contract F30602-80-C-0133

**ABSTRACT:** This report describes the design and development of a low noise, high power, variable oscillator incorporating a high "Q" electronically tunable resonator as the frequency determining element. The VCO provides improved EMC performance in phase locked synthesizers which are a part of communications equipments. The oscillator combines a low noise VMOS transistor with the selectivity and out-of-band attenuation of a coaxial resonator to provide superior EMC performance. Several oscillator designs were examined and the basis for the final configuration is presented. Oscillator noise is discussed and models for analysis are explained. A brass board model was constructed and tested and the technical results are presented.

**INDEX TERMS:** oscillator tunable resonator, PLL

<p>Development of Techniques to Assess Interference to the MF Broadcasting Services James S. Washburn, Charles M. Rush, and F. G. Stewart National Telecommunications and Information Administration, Boulder, CO. Inst. for Telecommunications Sciences PB82-194598, PC A04/MF A01 Jan 82, 60p, NTIS/REPORT-82-90</p> <p><b>ABSTRACT:</b> The Institute for Telecommunication Sciences has embarked upon a program to improve the techniques that are used to determine medium frequency broadcasting parameters. This work is motivated by the fact that increased transmitter power which is planned by a number of administrations in the Western Hemisphere could seriously impact MF broadcast service in the United States by giving rise to unacceptable interference levels. In order to provide a technically accurate tool for use in assessing the performance of MF broadcast operations, efforts have been undertaken to develop a capability to determine the broadcast service area, taking into account both groundwave and skywave modes of propagation. In addition, a program of monitoring long-distance signals will be used to form the basis for changes in existing MF skywave prediction programs.</p> <p><b>INDEX TERMS:</b> MF broadcasting interference</p>	<p><b>EMCABS: 31-6-83</b></p>	<p>USAFSAM Review and Analysis of Radiofrequency Radiation Bioeffects Literature: Second Report Louis N. Heynick SRI International, Menlo Park, CA AD-A116 139/7 PC A07/MF A01, Contract F33615-80-C-0608 Final Rept. 1 Sep 80-30 Jun 81, May 82, 150p, SAM-TR-82-16</p> <p><b>ABSTRACT:</b> The objectives of this project were to acquire, review, and analyze on an ongoing basis, information on research pertaining to the biological effects of radiofrequency radiation (RFR), for the USAF School of Aerospace Medicine (USAFSAM). The method used was to: (1) select documents that are judged to be representative of prior and current research on various RFR-bioeffects topics, (2) analyze in detail the contents of each such document and (3) assess the validity and the significance of the results presented. In this report, the major RFR-bioeffects topics are listed, and the format used for analyzing each selected document is described. The text of each analysis completed was prepared and submitted to USAFSAM in optical character recognition (OCR-B) font, to permit direct storage of the information in a computer at USAF-SAM. During the contract period, 80 analyses were completed.</p> <p><b>INDEX TERMS:</b> RFR, biological effects</p>	<p><b>EMCABS: 34-6-83</b></p>
<p>USAF Radiofrequency Radiation Bioeffects Research Program — A Review John C. Mitchell School of Aerospace Medicine, Brooks AFB, TX Interim Rept. AD-A114 344/5, PC A19/MF A01 Dec 81, 439p, Rept. nos. SAM-REVIEW-4-81, SAM-TR-81-30</p> <p><b>ABSTRACT:</b> These papers were presented during a comprehensive Air Force radio-frequency-radiation-bioeffects research program review. This first-of-a-kind meeting brought together all investigators, contractor as well as in-house, currently supported by Air Force funding, to present technical summaries of their work and to interact and exchange information with their peers. During the 2½-day conference, research in a number of key areas was described. This demonstrates the breadth and overall integration of objectives of the Air Force program in this vital area.</p> <p><b>INDEX TERMS:</b> RFR, biological effects</p>	<p><b>EMCABS: 32-6-83</b></p>	<p>Skin Effect in Electrical Conductors. 1975-June, 1982 (Citations from the International Information Service for the Physics and Engineering Communities Data Base) National Technical Information Service, Springfield, VA PB82-869231, PC N01/MF N01, Rept. for 1975-June 82 June 82, 144p, Supersedes PB81-873978</p> <p><b>ABSTRACT:</b> This bibliography contains citations concerning the theory, effects, and calculations of skin effect in various types of electrical conductors. The skin effect phenomenon in conductors of several cross-sectional shapes, transmission lines, coaxial cables, and semiconductors are discussed. Some reference is made to the effect of frequency level and magnetic field strength on skin effect. (This updated bibliography contains 130 citations, 24 of which are new entries to the previous edition.)</p> <p><b>INDEX TERMS:</b> conductors, skin effect</p>	<p><b>EMCABS: 35-6-83</b></p>
<p>Biological Effects of Nonionizing Electromagnetic Radiation: A Digest of Current Literature from October 1980 thru June 1981. Volume V, Numbers 2-4 Science Information Services, Inc., Philadelphia, PA PB82-203233, PC A11/MF A01, See also Volume 5, Number 1, AD-A093402 Feb 82, 228p, Contract NT-81-SAC-00064</p> <p><b>ABSTRACT:</b> This digest is issued quarterly to provide current awareness information on biological effects and health implications of microwave and other radio frequency radiation. The effects of electric and magnetic fields (static and alternating) and research on medical application of these nonionizing electromagnetic radiations are also included. Each issue contains abstracts of current English and foreign-language research literature, research summaries, new items, and announcements and information on relevant meetings and conferences. Subject and author indices are provided for all literature abstracts to facilitate specific search and reference use. Journals, books, and conference proceeding from all over the world, together with materials from correspondents, are used as sources for this publication.</p> <p><b>INDEX TERMS:</b> nonionizing EMR, biological effects</p>	<p><b>EMCABS: 33-6-83</b></p>	<p>Electronic Properties of ZnO Varistors: A New Model G. E. Pike Sandia National Labs., Albuquerque, NM Contract AC04-76DP00789, Symposium on grain boundaries in semiconductors, Boston, MA, USA, 15 Nov 1981, Available in microfiche only. DE82005799, MF A01, 1981, 18p SAND-81-1908C, CONF-811178-1</p> <p><b>ABSTRACT:</b> Much of the research on ZnO varistors has concentrated on the explanation of their dc current-voltage characteristics. However, varistors also have unusual ac properties which can be technologically important, and must be described by any comprehensive model. In an ideal varistor with identical grain boundaries throughout, there should be no dispersive capacitance at zero bias. In real varistors, this capacitance varies considerably with frequency. This dispersion has two causes, charge trapping in the depletion regions and differing grain boundary barriers. Calculations for each process are given. As the voltage across the varistor is increased, the low frequency capacitance is observed to increase well below the breakdown voltage. At even higher voltages, the capacitance turns over and becomes negative. All of these effects can be described with a double depletion layer/thermionic emission model.</p> <p><b>INDEX TERMS:</b> ZnO, varistors, ac properties</p>	<p><b>EMCABS: 36-6-83</b></p>



EMCABS: 37-6-83

Harmonic Characteristics of Rectifier Substations and Their Impact on Audio Frequency Track Circuits  
Vilas D. Nene

OAO Corp., Greenbelt, MD

Final rept. 15 Jan 81-15 Jul 81, Contract DTRS57-81-C-00033, PB82-229659

PC A04/MF A01, May 82, 57p. UMTA-MA-06-0025-81-6,

DOT-TSC-UTMA-81-75

**ABSTRACT:** This report describes the basic operation of substation rectifier equipment and the modes of possible interference with audio frequency track circuits used for train detection, cab signalling, and vehicle speed control. It also includes methods of estimating EM noise received by track circuits from substation operation.

**INDEX TERMS:** substation rectifier, interference

Direct Lightning Strikes to Aircraft

Jeffrey S. Schowalter

Air Force Inst. of Tech., Wright-Patterson AFB, OH, School of Engineering

Master's thesis, AD-A118 075/1, PC A06/MF A01

Jun 82, 122p. Rept. no. AFIT/GE/EE/82J-12

**ABSTRACT:** Two direct lightning strikes to a NOAA WC-130 aircraft equipped with eleven electromagnetic field sensors were recorded in South Florida during the summer of 1981. In both cases, the aircraft was flying in precipitation at an altitude of about 4 km and a few kilometers away from active thunderstorm regions. An analysis of the data shows that both strikes exhibit a train of discrete pulses which can be correlated in most of the eleven sensors. The flashes lasted 295 and 460 ms and were characterized by an initial active period of about 40 ms with a pulse repetition rate of ten pulses per millisecond. In both flashes, most of the current flow was along the fuselage with peak currents estimated at 3 ka in one flash and 600 A in the other flash. A continuing current of an estimated 50 A was evident in only one strike. The electric field sensors recorded a maximum change of 200,000 V/M. In one flash, the leader appears to propagate from the cloud to the aircraft with a duration of 350 microsecond which implies a distance of about 175 m to the cloud charge center.

**INDEX TERMS:** lightning aircraft measurements

EMCABS: 40-6-83

A Study of the Electromagnetic Fields Distribution Inside Buildings with Apertures Excited by an External Source

Mart T. Ma, M. G. Arthur

National Bureau of Standards, Washington, DC

Sponsored in part by Army Communications-Electronics, Engineering

Installation Agency, Fort Huachuca, AZ

Feb 82, 124p, NBSIR-82-1659, PB82-193418, PC A-6/MF A01

**ABSTRACT:** Two special cases of the penetration of electromagnetic fields into a cavity, building, or box are formulated and analyzed. One is to consider the case of a lossy cavity with small apertures in free space, based on an application of the equivalence principle and the use of a generalized network formulation. It is found that the field strength at the aperture center is approximately inversely proportional to the square-root of the conductivity of the cavity walls and that high field levels can exist inside the cavity under certain physical conditions. The second case is to treat the problem of large buildings with large apertures on a practical lossy ground by a combination of theoretical approach and measurement data. Field levels inside the building for this latter case depend on the transmitter power, the transmitter-to-building distance, the ground conductivity, and the measurement antenna height relative to that of the transmitter.

**INDEX TERMS:** EM field aperture, penetration

EMCABS: 38-6-83

Performance Tests Results of Automatic Direction Finder Receiver

Interference Susceptibility

T. Mullins and R. Luebbers

Ohio University, Athens, Department of Electrical Engineering

Contract DTFA01-80-C-10072, FAA/RD-81/83, AD-A118 438/1, PC

A06/MF A01

Dec 81, 101p, DOT, Final Report

**ABSTRACT:** The intent of this effort was to measure the interference susceptibility of present-day ADF equipment and to determine if RTCA and ICAO documents dealing with this subject are still representative. The results of these tests show that the equipment tested meet the specifications of DO-142 Category A. Recent works had indicated that the interference susceptibility characteristics of ADF receivers may be dependent primarily on the absolute level of the undesired signal and secondarily on the ratio of the desired to the undesired signal. The data presented in this report, however, demonstrated that the interference characteristics of the aircraft ADF system are a function of the ratio of the desired to the undesired signal levels present at the antenna, and are not correlated to the absolute undesired signal levels.

**INDEX TERMS:** ADF, susceptibility testing

EMCABS: 41-6-83

Interaction of Electromagnetic Pulse with Commercial Nuclear-plant Systems

D. M. Ericson, Jr.

Sandia National Labs., Albuquerque, NM

Contract AC04-76DP00789, CONF-820329-1, DE82008923, PC A03/MF A01

1982, 48p. SAND-82-0625C, Power Engineering Society conference, Charlotte

NC, USA, 15 Mar. 1982, portions of document are illegible.

**ABSTRACT:** Sandia National Laboratories has been engaged since October 1980 in a study of the potential interaction of the electromagnetic pulse (EMP) from a high altitude nuclear burst with commercial nuclear power plant systems. This study, which is being conducted for the Nuclear Regulatory Commission, addresses a concern about our ability to safely shut down nuclear power plants exposed to EMP. This report provides some background on EMP phenomena and the current national interest in EMP in general. The Sandia program is then described in terms of the objectives, study approach, some preliminary analytical results, and the analysis verification measurements effort.

**INDEX TERMS:** EMP nuclear power plants

EMCABS: 39-6-83

Test Bed Considerations for the Evaluation of EMP Protection Measures for Defense Electronics Installations

Ernest E. Donaldson, John K. Daher, Hugh W. Denny, and Jimmy A.

Woody

Georgia Tech. Research Inst., Atlanta

AD-A114 539/0 PC A03/MF A01, Final report. 1 May 80-31 May 81

31 May 81, 44p, DNA-5768F, SBI-AD-E300 982, Contract DNA001-80-C-

0292

**ABSTRACT:** This report presents the results of a study whose purpose was threefold: (1) to ascertain whether the Defense Nuclear Agency (DNA) needs a test bed facility to evaluate EMP protective measures, (2) to identify the functions which would be desirable and feasible for such a facility to perform, and (3) to determine the kind of facility which would best accommodate such functions. This study also addressed the concept of, and the need for, a programmatic approach to identifying and resolving those technical issues and voids which currently inhibit formulating well-defined EMP hardening principles and practices. Program results and conclusions were derived from a literature review, several visits to cognizant agencies, and an EMP Workshop.

**INDEX TERMS:** EMP evaluation, test bed facility

EMCABS: 42-6-83

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