IEEE

Electromagnetic Compatibility Society Newsletter

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OUR SOCIETY IN THE 1980s

As we enter into the 1980s, our Society is faced with many challenges.

As you look around, you see increasingly complex electronics and microprocessors used in almost every consumer, as well as industrial and military, electronic product both on the job, at home, and even in the hospital. At the same time, the electromagnetic interference eivironment is increasing both in magnitude and in presence. Our Society is there to present the latest technology through its symposia, to provide current EMC standards written by those of you who have practical experience, and, hopefully, to provide each of you an opportunity to contribute your talents to meet the professional as well as technical needs of our members. We especially want to concentrate on doubling our standards efforts to present the latest technology and to improve the application of existing and prior technologies. We also need your participation in contributing to our many technical committees on such subjects as interference control, measurements, environment, electromagnetic pulse, and Walsh Functions. We also are seeking members to help administer our Society by serving on the Board of Directors. Petitions for election to this body are now available from Vern Chartier, Nominations Chairman, and from your local Chapter Chairmen whose addresses are listed elsewhere in this Newsletter.

Finally, I want to personally thank my predecessor - Jackie Janoski - for her outstanding contribution to our Society. The smooth transition I experienced in January must be attributed to her dedication in the past two years as President and the years before. I hope that I can do nearly as well. But, I need your help so we can continue the excellence our Society represents. Again, let me welcome each of you to the challenge of the 1980s. I know that you will meet this challenge and exceed it.

Don Heirman

DEADLINE FOR JULY 1980 ISSUE OF THE NEWSLETTER IS JUNE 15, 1980

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FIRST CLASS MAIL

EDUCATION COMMITTEE NEWS

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

The Continuing Education Program at George Washington University is offering several courses of interest in Washington, D. C. "Electromagnetic Interference and Control" will be offered on May 5-9. "Hazardous Electromagnetic Radiation" will be offered May 19-20. "Grounding, Bonding, and Shielding" will be offered Sept. 4-5. All three of the above courses will be taught by Dr. Bernhard E. Keiser. On June 5-6 and Sept. 29-30, a course on "Lightning Protection" will be taught by A. K. Guthrie and Bernhard Keiser. For information on any of these courses, contact George Washington University, 202-676-6106.

The Center for Professional Advancement is sponsoring a course, "Electromagnetic Compatibility Engineering," which will be taught by Henry W. Ott. The course will be given in San Jose, CA on August 25-27, and in central New Jersey on Sept. 22-24. For information, contact The Center for Professional Advancement, 201-249-1400.

The Don White International Training Center is offering a large number of courses in the USA, Canada, England, Sweden and the Netherlands. "Grounding and Shielding" will be offered June 17-19 in San Francisco, CA and on Sept. 16-18 in San Diego, CA. "EMI Control in Electronic Data Processing Equipment" will be given July 14-18 in San Deigo, CA. "Interference Rejection in Telecommunications Systems" will be presented April 29 - May 2 in Los Angeles, CA. "MIL-STD-462 and System-Level EMI Testing and Procedures" will be offered on June 9-13 in Washington, D.C. "Digital Modulation, Coding and Signal-Processing Techniques" will be given July 8-10 in San Diego, CA. For information on these, as well as additional courses being offered, contact Don White International Training Center, 703-347-0030.

The IEEE also offers a continuing education course on "Electromagnetic Compossibility," taught by Dr. H. M. Schlicke. The course is available to companies for in-plant presentation, to universities, or to IEEE Societies, Groups, Section,s or Chapters. For information, contact the IEEE, 201-981-0060, Ext. 174.

If you have further information of an educational nature, please contact me.

Henry Ott

Chairman
EMCS Education Committee

Room 2C-322
Bell Laboratories
Whippany, NJ 07981
201-386-6660

CHAPTER OFFICERS ATTENTION!!!

You will get bonus points in the Chapter-of-the-Year competition if your reports on meetings and other activities are received before the EMC Newsletter deadline. Reports should be sent to Charlie Anderson, Chapter Chatter Editor, to reach him at least 10 days before Newsletter deadlines. The Newsletter comes out four times a year, with deadlines for each of the four issues as follows: March 15, June 15, September 15 and December 15. This will keep Charlie happy and make his job easier in doing his scoring for the Chapter-of-the-Year award.

NEWSLETTER STAFF

EDITOR: Robert D. Goldblum
R & B Enterprises
P. O. Box 328
Plymouth Meeting, PA 19462

ASSOCIATE EDITOR: (Chapter Chatter)
Charles F. W. Anderson
Martin Marietta
1716 Reppard Road
Orlando, FL 32803

ASSOCIATE EDITOR: (Book Reviews)
James S. Hill
The EMXX Corp.
6706 Deland Drive
Springfield, VA 22152

ASSOCIATE EDITOR: (EMC Personality Profiles)
William G. Duff
Atlantic Research Corp.
10507 Clipper Drive
Fairfax Station, VA 22039

ASSOCIATE EDITOR: (Sequency Union)
Dr. G. Robert Redinbo
Electrical & Systems Engrg. Dept.
Rensselaer Polytechnic Institute
Troy, NY 12181

ASSOCIATE EDITOR: (Abstracts)
Edwin L. Bronaugh
Southwest Research Institute
P. O. Drawer 28510
San Antonio, TX 78284

ASSOCIATE EDITOR: (Photographer)
Fred J. Nichols
LectroMagnetics, Inc.
6056 W. Jefferson Blvd.
Los Angeles, CA 90016

ASSOCIATE EDITOR: (EMC Standards Activities)
Richard B. Schulz
IIT Research Institute
ECAC - P. O. Box 1711
Annapolis, MD 21404

ASSOCIATE EDITOR: (EMCS Education Committee)
Henry Ott
Room 2C-322
Bell Laboratories
Whippany, NJ 07981

MIL-STD-461B ISSUED

The long awaited B Version of MIL-STD-461 has been completed. It has been dated 1 April 1980 and will be effective as of May 1, 1980 on new contracts. Notice 4 of MIL-STD-462 also is being issued concurrently. This notice covers the testing procedures for CS09, which is the structure test. Copies of the Standard will be available through the Naval Publications and Forms Center, 5801 Tabor Ave., Phila., PA 19120. The total revision of MIL-STD-462 is now underway; but, it may be some time before it is completed.

FDA EMC STANDARD CONSIDERED BY ANSI

The FDA EMC Standard, MDS-201-0004, dated October 1, 1979 was submitted to the American National Standards Institute (ANSI) for consideration for conversion or adoption as an ANSI Standard. This took place on March 5, 1980 during the ANSI Standards Management Board meeting. As a result of the meeting, the task was assigned to the ANSI Medical Electronics Committee, MD-105, under the chairmanship of Robert Flink of Medtronic, Inc.

The ANSI MD-105 Committee will meet on April 15, 1980 at 1:00 P.M. in the Pacific F Room of the Hyatt Regency Embarcadero, San Francisco to plan their activities relative to the FDA EMC Standard. This effort is to be coordinated with the SAE AE-4 EMC Committee and the EMC and EMB Societies of the IEEE. However, the meeting will be open to all those interested in attending.

NOMINATIONS BEING SOLICITED

The Nominations Committee is soliciting nominations for candidates for members as Directors-at-Large on the Board of Directors (BOD). Members of the EMCS who would like to run for members of the BOD should obtain petitions from:

V. L. Chartier
Bonneville Power Administration
P. O. Box 491-ER
Vancouver, WA 98666

In order to be nominated, the nomination petitions must be signed by 15 or more members of EMCS with short biographical sketches of not more than 125 words, and sent to Vern Chartier at the above address by May 30, 1980.

Elections will be by written ballot to all Society members. Persons nominated and elected to the BOD should possess significant technical and professional stature in EMC and should have adequate resources and/or backing to be able to attend meetings and actively contribute to the BOD undertakings.

NINE EMC SOCIETY MEMBERS ARE NEWLY ELECTED FELLOWS

Nine of our members have been honored by election to the grade of Fellow. They are Fred Bauer of Dearborn, Michigan; Vernon L. Chartier of Portland, Oregon; Rexford Daniels of Concord, Massachusetts; Dr. Seiichi Kagaya of Tokyo, Japan; Dr. Bernhard E. Keiser of Vienna, Virginia; John J. Kelleher of Annandale, Virginia; Raymond E. Lafferty of Parsippany, New Jersey; Dr. Shota Miyairi of Tokyo, Japan; and Edward N. Skomal of Redlands, California.

In the last issue of the Newsletter, five of the new Fellows whose citations were in the realm of EMC were identified. Added to that list are the following four:

Vernon L. Chartier - "For contributions to the understanding of corona phenomena associated with high-voltage power trnasmissions lines."

Dr. Seiichi Kagaya - "For contributions to power cables."

Raymond E. Lafferty - "For contributions to loss measurements of reactive components."

Dr. Shota Miyairi - "For contributions to electrical machinery, power electronics, and leadership in electrical engineering education."

DUES INCREASE LIKELY FOR 1981

An increase in the basic $35 annual dues of between four and eight dollars is being considered for 1981 by The IEEE. The Board of Directors is acting on the recommendations of a task force which prepared a dues management plan that included a broad range of fiscal policies of the organization. A specific recommendation on 1981 dues will be made at the August meeting of the Board.

The most recent dues increase was in 1976 when a five dollar increase was implemented both in the basic dues and in United States member assessment. In addition to the basic dues increase, the concept of an assessment for Region 8 - Europe and Africa - of between five and seven dollars also was approved by the Board.

While the 1980 operating budget was approved with a projected $1.2 million deficit, further assessment now targets that deficit at $750,000. This deficit is to be funded from general reserves. Without a dues adjustment, the deficit could be substantially higher in 1981. In addition to the dues recommendation, the task force also recommended that costs for goods and services offered for sale by the Institute include both direct and indirect costs for determining income performance, that prices to members avoid losses and that nonmember prices be established which reflect the value of member contributions.

PERSONNEL PROFILE OF ATTENDEES AT 1979 EMC CONFERENCE (SAN DIEGO)

by Ernest R. Freeman
Chairman, Employment Analysis Committee

The data contained below is a result of a survey conducted during the 1979 EMC Conference in San Diego. There were approximately 500 attendees, of whom 154 contributed data. The data is tabulated below in a format similar to that of the questionnaire. One difference is that the years of experience data have been classified to conform with the IEEE categories so as to allow correlation with the IEEE data. Work location in terms of ZIP CODES was gathered and is available; but, has not been reduced. One attendee considered the origin question to be insulting. This category is included as "insulted."

The data indicates that a "typical" attendee at the conference would be about 45 years old, and a male Caucasian. He has about 20 years experience and is employed in the aerospace industry. He has a bachelor's degree, with some graduate study and is earning about $32,000 per year. He is employed full time in EMC and works with 1 to 4 other EMC engineers. He is not a registered professional engineer nor is he represented by a professional bargaining unit. He is a member of the IEEE (member grade) and is active in his local EMC chapter. He pays his own dues. He believes that there will be an increase in EMC engineers at his company within the next 6 months and no decrease in the foreseeable future.

A comparison of these data with the 1979 IEEE data is contained in Table 1 below. Based on this comparison, the two groups appear very similar in age, salary, education and experience.

This salary vs experience data was correlated and plotted along with the IEEE data in Figure 1. Note that the EMC group shows a close correlation with MSEE engineers overall. The statistical significance of the data has not been assessed.

TABLE 1: COMPARISON OF 1979 IEEE SURVEY and EMC CONFERENCE SURVEY RESULTS

	1979 SURVEY IEEE	1979 EMC SURVEY	
Income (of all respondents)	$31,680	$32,270	
Years of Experience	17.7	19.9	
Unemployed Involuntarily	0.4%	0%	
Age (in years)	43.1	44.8	
Percent with Bachelor's Degree (as highest degree)	50.5%	41.1%	
Percent Male	98.9%	99.4%	
Percent Caucasian	93.7%	96.0%	
Respective Survey Respondents were as follows:			
Associates	365 (4.5%)	4 (3.4%)	
Members	6,255 (76.9%)	76 (64.4%)	
Senior Members	1,229 (15.1%)	23 (19.5%)	
Fellows	259 (3.2%)	5 (4.2%)	
No response or inapplicable	23 (0.3%)	10 (8.5%)	- (Not IEEE)
TOTALS	8,131	13.9%	

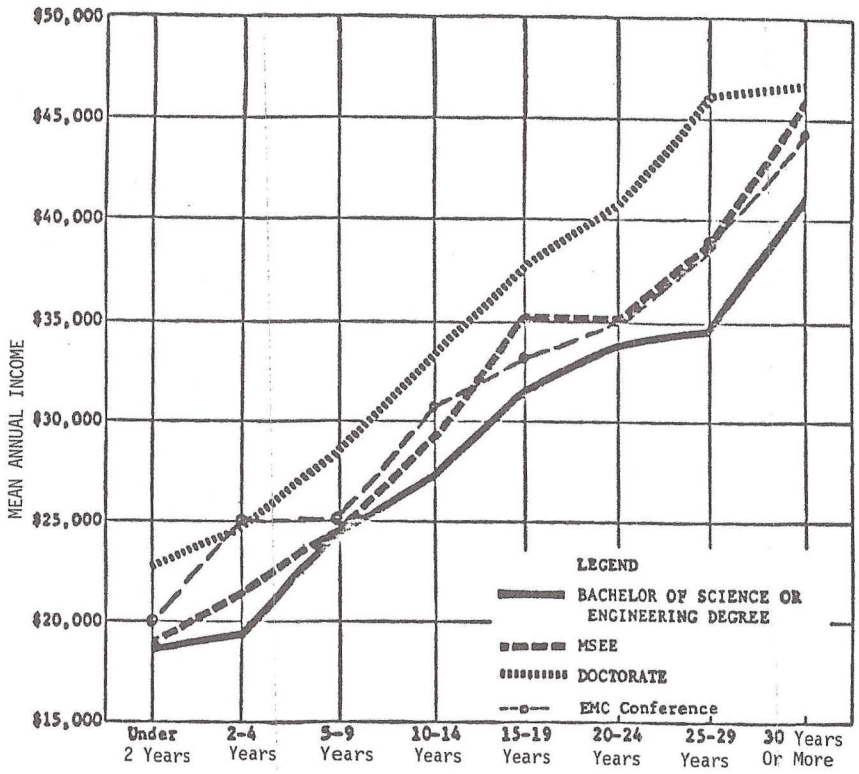

FIGURE 1

1979 IEEE Survey Data
vs
1979 EMC Conference Data
for
Average Income

Less Than Bachelor's Degree	4.7%	9.9%	
Bachelor	48.3%	41.1%	
Master	33.1%	35.1%	- Including Professional Degree
Doctorate	13.9%	13.9%	

EMC PERSONALITY PROFILES

by William G. Duff

THOMAS W. DOEPPNER

Tom Doeppner was born in Germany, attended high school in Berlin, and came to the United States in November, 1939. He attended McPherson College, Kansas, for two years, then transferred to Kansas State University, where he received the BS Degree in Electrical Engineering. Several years later, he earned the Master's Degree, also in Electrical Engineering, from the University of California, Berkeley.

Upon graduation from Kansas State, Tom worked on seismographic surveys for the National Geophysical Company of Dallas, Texas, then joined the Army for what he thought at the time would be a short, wartime military obligation. Much to his surprise, he enjoyed military life, and particularly the technical challenges of the Signal Corps, so he spent nearly thirty years as a Signal Corps officer. Tom's early interest was in antennas and propagation. While stationed in Japan after the war, he designed the antenna farm for the Army's Transmitter Site at Kashiwa near Tokyo, a complex of some forty doublet, Vee, and rhombic antennas spanning the parts of the world which were then considered friendly.

Tom spent a lot of his career teaching, first in the US Army Signal School's Radio Repair Course, later in the Military Science Department of the University of California, Berkeley; more recently, he taught mathematics courses in the University of Maryland's off-campus program.

He spent four years with the Advanced Research Projects Agency, where, as Program Manager for Communications and Surveillance, he guided a series of contractual efforts in electromagnetic propagation in tropical forests. These efforts provided evidence of the significance of the "lateral wave" component as the major carrier of VHF and certain UHF energy in tropical forests, and established the feasibility of using AM single-sideband transmission in lightweight, manpacked radio sets. It was at this time that Tom became interested in EMC problems, and he gives major credit to such EMC stalwarts as Carl Frederick, George Hagn, and Leonard Thomas for introducing him to the technical challenges of EMC.

In 1969, he became Director of Frequency Management, and later, Director of the Electronics Directorate, on the Army General Staff. In these positions, he had the responsibility for the Army's frequency allocations and assignments, as well as for its Electromagnetic Compatibility Program. Under his direction, the Army's EMC Program was revitalized with the development and implementation of EMC design criteria in the telecommunication system/equipment acquisition process, and the establishment of "critical EMC decision points" for each acquisition phase, along with technical selection factors to guide these decisions.

Upon retirement from the Army in 1973, Tom joined the technical staff of the General Research Corporation (GRC), where he is now a Principal Engineer and Director of Communications Research in the Corporation's Operations Analysis Group. While working for GRC, Tom developed a methodology for integrating the often conflicting technical and military requirements of EMC, frequency supportability, electronic counter-countermeasures, and signal security. He also has continued his work in the spectrum management field, and has recently, in cooperation with Dr. Bernie Keiser, developed a concept for a spectrum "Figure of Merit" for use by regulatory agencies in the allocation and assignment of frequencies. The concept works on the principle of giving "Brownie points" for the degree to which a potential spectrum user exceeds minimum regulatory requirements in some ten specific spectrum-conservation related areas. Tom has written numerous technical reports and professional papers, and has published extensively in journals and proceedings, mostly in the areas of spectrum management and electromagnetic propagation.

Tom is a Fellow in the IEEE, and an active participant in IEEE activities. He was Secretary, Vice Chairman and Chairman of the EMC Society's Washington Chapter, Publications Chairman for the 1976 EMC Symposium in Washington, is on the Steering Committee for the 1980 EMC Symposium in Baltimore, and Vice Chairman for the 1983 EMC Symposium to be held in Washington. He currently is serving on his second tour as Executive Committeeman for the Washington Section of the IEEE.

Tom is married and very proud of his two sons who are emulating his career: one in the military (Air Force Officer) and the other in electrical engineering (a Professor of Computer Science, and member of the IEEE).

NOMINATIONS FOR AdCOM MEMBERSHIP

Your support of the annual nominations for membership on the S-EMC Administrative Committee (AdCom) is requested at this time. In addition to nominations from individuals, officials of each EMC Chapter should nominate a candidate whom they would like to represent them at the national level. Active participation at the national level is essential for an effective EMC society and profession.

The names of persons nominated will appear on the ballot which will be submitted to the S-EMC membership for voting on approximately August 1, 1980.

In order to be nominated, a nominations petition (sample below) signed by 15 or more members of S-EMC and a short biograhical sketch of not more than 125 words must be submitted to the undersigned by June 20, 1980.

It is essential that nominess for AdCom membership have adequate resources and/or employer support to be able to attend meetings and contribute actively to AdCom undertakings. Also, nominees should have sound technical qualifications and have a degree of recognition within the EMC community. Six members are elected annually to AdCom and serve a three-year term of office. A minimum of 12 nominees are necessary for the ballot submitted to the membership for voting.

Please reply to:

Vernon L. Chartier, Chairman
Nominations Committee, AdCom
Bonneville Power Admin.
P. O. Box 491-ER
Vancouver, WA 98660

VALIDATION PROGRAM ESTABLISHED

The IEEE is pleased to announce the establishment of an experimental Validation of Educational Achievement Program. The objective of the program is to motivate practicing electrical/electronics engineers to pursue quality continuing education. Quality is ensured through course evaluations by peers and participants. Motivation is provided by IEEE's recognition of the participant's learning accomplishments with the awarding of Continuing Education Achievement Units (CEAUs). In addition, the participant's achievements in IEEE-evaluated courses will be maintained in a computer-based registry. Transcripts will be available to program participants. During 1980, program participation will be limited to IEEE members in Regions 4 and 6. This new service is available to IEEE members at no charge and has been funded for two years by the National Science Foundation (NSF).

ELECTRONICS COMPANIES MAY EXCEED WAGE GUIDELINES

Because of the critically short supply of electrical engineers, high-technology electronics companies have been granted an exemption from the wage and price guidelines. Under new guidelines from the Council on Wage and Price Stability, companies must notify COWPS in writing of any job category that they want exempted from the guidelines in the quarter before the pay-rate increase is to be implemented.

NOMINATION PETITION
ELECTROMAGNETIC COMPATIBILITY SOCIETY AdCOM

Date: _____

I. NAME:

II. BIOGRAPHICAL SKETCH:

III. SIGNATURES: We, the undersigned, all of whom are current S-EMC members, nominate _____ to serve on the S-EMC AdCom for a three year term beginning January 1, 1981.

MEMBER NAME MEMBERSHIP NO.

THE EMI ENGINEER AND THE PERSONAL COMPUTER

Nowadays, we hear a lot about having a personal computer (PET, APPLE, KIM, TRS-80, etc.) in the home or at the office to perform all kinds of interesting tasks. Sometimes, I wish we had one. However, most of the work we do in EMI involves mathematical solutions which lend themselves to sophisticated scientific calculators, such as the HP-67 and the TI-59. (And, besides, we don't have to learn a new language, of which there seem to be literally hundreds!)

In our various design efforts here at Solar, we have compiled many programs for the TI-59 which aid us in our everyday work.

Some of these programs are original, others were obtained from the TI Exchange Program. Some are arranged to be used with the PC-100A Printer. All of them are FREE. Just call or drop us a note mentioning the particular program(s) by number, and we will send a printout from one of our PC-100A's.

Although we use many more programs than would be of interest in EMI, we have selected a few that may be of interest to you if you have access to a TI-59 or other such calculator. They are briefly described below.

If you use a programmable calculator in your work and have some pet programs that you feel would assist other EMI engineers, why not share them? Send them to us and we will make them available to EMI engineers through our catalog.

As the fella says, "Keep those cards and letters coming!" We are here to help.

Cordially,

Al Parker

Program No.	Title
ATP-1	Reactance in terms of kHz, uF, mH a. Calculate Cuf or Xc. b. Calculate LmH. c. Calculate XL. d. Calculate LmH in tuned circuit. e. Calculate CuF in tuned circuit. f. Calculate frequency of tuned circuit. g. Calculate impedance of tuned circuit. h. Calculate frequency at which CuF and Xc are known. i. Calculate impedance of series X and R. j. Calculate impedance of parallel X and R.
ATP-2	a. Determine circuit values for a d.c. EMI 'L' filter in terms of desired dB loss at a stipulated frequency. b. Calculate R and C values for arc suppressor across switch.
ATP-3	Broadband EMI prediction when waveform, amplitude, rise time and duration are known.
ATP-11	a. Design EMI 'L' filter for a.c. circuits considering power frequency voltage drop. b. Also, enter dB and calculate voltage or current ratio. Enter ratio and calculate dB.
ATP-26	Design Pi and T network resistive attenuators.
ATP-27	Calculate number of poles required for low pass wave filter to obtain desired insertion loss at stipulated frequency.
ATP-29	Calculate cutoff frequency for series R and C.
ATP-32	Calculate voltage and current induced into EED by known 'E' field.

MODEL PATENTS AGREEMENT PROPOSED

The U.S. Activities Board is circulating the "Proposed Model Agreement Concerning Inventions and Discoveries and Proprietary Information" for comment. The agreement will be distributed to the Regional Activities Board and the Technical Activities Board for consideration. USAB is also requesting comments from members. Comments should be sent to W. Thomas Suttle at the Washington Office, 1111 19th St., N.W., Washington, DC 20036.

IEEE MEMBERSHIP TOPS 200,000

IEEE's total membership at the end of 1979 was 201,673, an increase of 5.4% from 1978. Membership in Technical Societies and Groups was 213,308, an increase of 6.9%. The 10,299 increase in total members for 1979 represents more than 1/5 of the total membership increase since IRE merged with AIEE to form IEEE in 1963.

WORLD ADMINISTRATIVE RADIO CONFERENCE REPORT SUBMITTED

The FCC Office of Science and Technology formally reported to the Commission that the 1979 World Administrative Radio Conference (WARC), held in Geneva, Switzerland, from September 24th to December 6, 1979, was a substantial success from the U. S. point of view.

Among the major achievements of the conference, according to FCC Chief Scientist Stephen J. Lukasik's report, were:

- A 100 kHz expansion of the AM broadcasting band, which in the present U. S. spacing pattern would create 10 additional AM radio channels.
- Additional radio frequency spectrum for satellite broadcasting uses, which will provide separate bands for broadcasting to the public and for fixed international and domestic communications uses.
- More high frequency spectrum for amateur and maritime mobile uses and for international high frequency broadcasting.

Those and other actions of the conference will have no immediate effect on the U. S. telecommunications system, the report said. The conference is a function of the International Telecommunication Union (ITU), an international organization predating the League of Nations. Conference actions have treaty status and as such must be ratified by the U. S. Senate to take effect.

Final actions of the conference take effect in 1982, and most incorporate a timetable for phasing them into operation over a period of years. Further, most will require FCC rulemakings before they can take effect, since they involve reallocation of segments of the radio frequency spectrum. The actions listed as major achievements, for example, will require FCC reassignment of the uses now occupying the affected parts of the spectrum before the proposed expansions can take place.

Since expansion of the AM band is a priority matter for the Commission, the U. S. delegation proposed broadening it by 255 kHz, some of which was to be shared with other services. The conference reduced that to 100 kHz to accommodate other uses. The change as approved would provide spectrum for many additional AM radio stations in the United States, as well as in other countries.

Conference action met all U. S. objectives for satellite transmission in the 12 GHz band, the foremost of which was to alleviate the congestion resulting from shared use by both fixed and broadcasting satellites. The conference separated most of the available spectrum between the two uses, leaving the remainder to be divided at a Western Hemisphere regional conference to be held in 1983. A primary characteristic of high frequency bands is the long range of transmission. Amateurs were given additional bands which, the Chief Scientist's report said, should accommodate future amateur radio growth. Amateur satellite operations were authorized in higher amateur bands.

Several bands were obtained for ships at sea and related uses. Additional spectrum in five bands was allocated for high frequency international broadcasting, such as the Voice of America conducts. The conference adopted an extensive multistep procedure to eliminate frequency provisions no longer needed and provide for displaced uses. This will continue into the 1990s.

The conference adopted a number of resolutions and recommendations calling on the developed countries to increase their technical assistance to the developing countries, to raise their levels of expertise and enable them to cooperate in worldwide frequency management. While the United Nations Development Program was expected to be the primary source of funding, the United States will be expected to participate directly or indirectly in implementing those plans.

Conference actions increased the Commission's responsibilities in international monitoring and in reporting information to the ITU for regulatory purposes. The information requirements will pose problems and necessitate revision of applications forms and files.

While not all U. S. objective were achieved, nearly all of the 900 U. S. proposals were adopted either entirely or substantially. On a few decisions, the U. S. delegation submitted reservations, which are formal statements that a country will not necessarily be bound by a decision.

The 150 national delegations attending submitted nearly 15,000 proposals. In preparation for WARC, the Commission adopted a Report and Order in December 1978 containing proposals subsequently submitted to the ITU by the State Department. Former FCC Commissioner Glen Robinson led the U. S. delegation.

CHAPTER CHATTER

by Charles F. W. Anderson

Things definitely are looking up! I've been receiving lots more material from the Chapters - but, there are many from which I don't hear a thing. Please let me have your news so that we can publish it in the next issue.

Albuquerque

The Joint AP/EMC/MTT Chapter has a new Chairman - Karl S. Kunz. He holds M. S. and PhD Degrees from New Mexico State and a B. S. from MIT. Dr. Kunz is the manager of the Albuquerque of LuTech, Inc. He primarily is interested in EMP phenomenology and has published over 50 papers and reports in that area and related ones. Besides his membership in IEEE, Dr. Kunz is affiliated with APS, Sigma Xi, Phi Kappa Phi and Sigma Pi Sigma. (Thanks to Jim Prewitt, Chapter Secretary, for the above information.)

Atlanta

The Chapter's 26 February meeting featured a talk by Michael J. Hopkins of KeyTek Instrument Corp. on "Diagnostic Surge Testing." In addition to the technical presentation, a demonstration of state-of-the-art surge testing was given. There were 17 attendees. Interest in the area is so high that a follow-up meeting is planned for 29 April, when Dr. Keith Huddleston of the Georgia Tech Electrical Engineering Department will report on a major lightning study involving complex solid-state electronic systems.

Planning for next year is already in progress. A Chapter survey soon will be circulated to assist in shaping the directions which will be taken.

Bob Hammack has been designated as Chairman of the Nominating Committee for the new slate of officers. (Bob rates a "well-done" for his interesting little Newsletter.)

Central New England

Chapter Chairman Chet Smith reported on the status of planning for the 1985 symposium, which will be held 20-22 August 1985, probably at the Colonial Hilton in Wakefield. A steering committee has been established. Nominations for the 1980/81 Chapter officers are: Chairman, Arthur W. Murphy; Vice Chairman, Chester L. Smith; Vice Chairman, John M. Clarke; Secretary/Treasurer, Robert J. Berkovits. The election will be held at the next meeting in April. This will be a co-sponsored meeting, with the PES. The subject will be "Electromagnetic Compatibility of Advanced Propulsion Systems for Urban Rail Vehicles." Speakers will be L. A. Frasco and R. Gagnon of U.S. DOT/TSC and Dr. F. R. Holmstrom, University of Lowell. The May meeting will feature a tour of the Emerson and Cuming facilities.

(Keep up the good reporting, John Clarke!)

Dayton

On 13 February, the Chapter had a short luncheon/business meeting at the WPAFB Officers Club. This was followed by a tour of the Atmospheric Electricity Hazards Research Facility, complete with simulated lightning demonstration.

The April meeting will be a "double-header," according to Eldon Wicks, who provided the following information by telecon: Speakers will be Dr. Phillip Little of Culham Labs, Abingdon UK, who will describe the lightning-related research being performed at that facility; and Dr. Pete Rustan, of the Air Force Institute of Technology, who will present a popularized version of his PhD dissertation titled "The Lightning Flash - From Soup to Nuts." The meeting will be held at the AFIT Conference Room at 12:30, preceded by lunch at 11:30 (Hilltop Area).

If your business takes you to Wright-Pat, contact Jack Corbin at 255-5078 or Larry Walko at 257-7469 to find out about meetings of the Chapter.

New Jersey Coast

The January meeting of the Joint EMC/VT Chapter featured Dave White of Hewlett-Packard, whose topic was "Application of HP Instrumentation to EMI Testing." He demonstrated uses of storage scopes and spectrum analyzers as troubleshooting aids. At the March meeting, Joe Chislow of Bell Labs presented "An Interpretation of FCC Docket 20780." Joe's talk focused on the consumer/manufacturer effects of the "First Report and Order" on that docket which establishes radiation limits for "computing devices" (including your pocket calculators). After the effective date of 80/07/01, all such items must comply with the restricted radiation rules.

The February meeting's speaker was Jan Jubon, a telecommunications consultant, who spoke on "A Small Cellular Compatible Mobile Telephone System for Bakersfield, California."

The April meeting will have as its feature a talk by Paul J. Phillips, US Army Spectrum Management Engineer. His topic: "WARC '79 Decisions Affecting DOD." The Chapter is losing its Newsletter Editor - Roger Peterson is relocating to The Phoenix, AZ area. Congrats on a fine job as N/L Editor and let us hear from you from time to time!

Washington

Art Wall, of the FCC, reports that the Chapter's January meeting had Richard D. Parlow of the NTIA staff presenting a talk on the spectrum management activities within that organization. Dick, who was a delegate to WARC, also gave his views on the overall conduct of the world conference plus some of the general results thereof.

Dr. Stephen Lukasik, Chief Scientist of the FCC, was the speaker at the March 20th meeting. His talk was about the FCC's responsibilities in implementing the results of the 1979 WARC.

Japan

Our colleagues across the Pacific continue their fine technical meetings. Professor Risaburo Sato, of Tohoku University, sends us lists of the papers presented at their frequent meetings. (Let Bob or me know if you would like to have the lists published in the Newsletter.)

EMCS CHAPTER CHAIRMAN

The following is the list of Chapter Chairmen as our records presently indicate. Chapter officers are requested to send all changes or corrections to:

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

Albuquerque
Juinn Yu
1511 Columbia Dr., N.E.
Albuquerque, NM 87106

Atlanta
Donald E. Clark
4086 Shady Circle
Lilburn, GA 30247

Baltimore
William E. Tate
12901 Broadmore Rd.
Silver Spring, MD 20904

Boston
C. L. Smith
2 Jonathan La.
Bedford, MA 01730

Boulder
Ezra Larsen
3450 Emerson Ave.
Boulder, CO 80303

Central New England
Arthur W. Murphy

Dayton
J. C. Corbin, Jr.
48 Esquire Ave.
Dayton, OH 45459

Denver
Herb F. Ostenberg
230 N. Cedar Brook Rd.
Boulder, CO 80302

Eastern Shore
Hugh H. Maddocks
170 Mariners Way
Stevensville, MD 21666

Long Island
S. S. Bernstein
2797 School St.
Bellmore, NY 11710

Los Angeles
Michael Malinick
18822 Via San Marco
Irvine, CA 92715

Mohawk Valley
Carmen A. Paludi, Jr.
5626 Main St.
Verona, NY 13478

New Jersey Coast
Margaretta V. H. Stone
130 Summit Ave.
Neptune City, NJ 07753

San Diego
Open at this moment, owing to
Abul Rashid's recent move to Denver

San Francisco
Evangelos Tonas
726 - 26th Ave.
San Mateo, CA 94403

Santa Clara Valley
Sam B. Shankle
1502 Wright Ave.
Sunnyvale, CA 94087

Seattle
G. M. Gillet
2507 W. Viewmont Way, W.
Seattle, WA 98199

Tucson
Thomas F. Hassett
Bell Aerospace Co.
1050 E. Valencia Rd.
Tucson, AZ 85706

Washington, DC
Bernhard E. Keiser
2046 Carrhill Rd.
Vienna, VA 22180

EMC STANDARD ACTIVITIES

by Richard B. Schulz

The last issue of the EMCS Newsletter saw the first of a series of columns on activities in the area of EMC Standards. This issue had the same type of difficulty as many new efforts: better information was received after the publication deadline. The present chairman of ANSI C68 should be changed to J. H. Moran. Also, a scheduled meeting of ANSI C63 was incorrectly designated for members only. Committee meetings listed are usually open to the public for discussion, although voting privileges generally reside with committee members only.

In this issue, ANSI committees other than C63 will be covered. Since their scopes of EMC interest were given previously, more detailed information will be provided here.

C16: Communication and Electronic Equipment

Chairman: Irving Kolodny
General Cable Corp.
1 Woodbridge Center
Woodbridge, NJ 07095
201-636-5500, Ext. 250

Secretary: J. Fragola
IEEE
345 E. 47th St.
New York, NY 10017
212-644-7960

ANSI 16 does not normally hold meetings; but, conducts its business by correspondence. Basically, it performs a coordination function for standards developed by other organizations. Such standards are submitted to it for ANSI approval; committee members perform an evaluation and balloting function, and attempt to resolve problems associated with negative ballots.

C68: High-Voltage Testing Techniques

Chairman: J. H. Moran
Interpace Corp.
Leroy, NY 14482
716-768-6221

Secretary: J. J. Burns
Philadelphia Electric Co.
2301 Market St.
Phila., PA 19103
215-841-4400

ANSI C68 is a subcommittee of the IEEE Power Systems Instrumentation and Measurement Committee. It recently has published for trial use the hardcover IEEE Standard No. 4, "Standard Techniques for High-Voltage Testing."

C95: Radio-Frequency Radiation Hazards

Chairman: Prof. S. Rosenthal
Polytechnic Institute of NY
Long Island Graduate Center
Route 110
Farmingdale, NY 11735
516-694-5500, Ext. 6
212-642-2250

Secretary: S. Caine
ELEX-51024
Naval Electronic Syst. Cmd.
Washington, DC 20360
202-692-3155

Congressional and Federal Agency activities in the area of radiation safety have resulted in increased use and importance of Voluntary Standards such as those developed by C95. Agencies such as the Occupational Safety and Health Administration and the Environmental Protection Agency will be issuing standards in the near future covering electromagnetic radiation safety, thereby emphasizing the need for ANSI to keep its standards up-to-date for ultimate adoption as Federal Standards.

The C95 Committee met in November 1979 at ANSI Headquarters, New York. As a result of the efforts by representatives of the C95 Committee, a series on the biological effects of electromagnetic radiation was established as part of the annual meeting of the U. S. National Committee for the International Union of Radio Science. The series has been held since 1975, with another one planned for 1980. The various C95 Subcommittees held periodic meetings during the year. Activities of the subcommittees are summarized in subsequent paragraphs.

1. Subcommittee I - Techniques, Procedures and Instrumentation

   The subcommittee has completed action on a proposed new standard, "Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave." The new standard will cover near-field, as well as far-field, situations. The document has been submitted to C95 for approval; comments currently are being resolved. C95.3-1973 was submitted to ANSI for reaffirmation. The document was reaffirmed on 29 August 1979.

2. Subcommittee II/III - Terminology and Units of Measurement

A proposed revision of C95.2-1974 was circulated in mid-September 1977 for approval. The "negative" votes have been resolved. The document will be submitted to ANSI in the spring of 1980.

3. Subcommittee IV - Safety and/or Tolerances With Respect to Personnel

Efforts have been underway to revise C95.1-1974. Specific areas to be addressed in the revision include possible non-thermal effects; effects from peak power; frequency dependency; whole - and partial - body exposure; and application of the Standard to the general population or as an occupational standard. It is expected that a draft revision will be submitted to C95 for review/approval by June 1980.

4. Subcommittee V - Safety Levels and/or Tolerances With Respect to Ordnance

Efforts are underway to develop an ANSI Standard on Radio Frequency Hazards to Electric Blasting Caps. It is expected that a draft will be available for C95 approval by the end of CY1980. A change to the C95.4 Guide has been approved in October 1979.

5. Subcommittee VI - Safety Levels and/or Tolerances With Respect to Flammable Materials

The subcommittee is investigating various aspects of the flammable-material hazard, including a proposed British standard. Recommendations are expected by mid-1980 concerning future subcommittee activities.

6. Subcommittee VII - Medical Surveillance

A standard or guide is being developed which would define the data and controls required for a medical surveillance program. A draft will be circulated during CY1980 for C95 approval.

Standards

C95.1-1974 ELECTROMAGNETIC RADIATION WITH RESPECT TO PERSONNEL, SAFETY LEVEL OF

Under Revision; draft to be circulated by June 1980.

C95.2-1966(R1974) RADIO FREQUENCY RADIATION HAZARD WARNING SYMBOL

Under revision; circulated for C95 approval; comments being resolved.

C95.4 RADIO FREQUENCY HAZARDS TO ELECTRIC BLASTING CAPS (Guide)

Revised October 1979.

C95.3-1973 TECHNIQUES AND INSTRUMENTATION FOR THE MEASUREMENT OF POTENTIALLY HAZARDOUS EM RADIATION AT MICROWAVE FREQUENCY

Ballot circulated for reaffirmation 2/3 approved; ANSI reaffirmed August 1979.

C95. MEDICAL SURVEILLANCE PROGRAM

In preparation: draft due during CY1980.

C95. GLOSSARY OF TERMS FOR RADIO FREQUENCY RADIATION HAZARDS

Cancel.

C95. SAFETY LEVEL OF EM RADIATION WITH RESPECT TO FLAMMABLE MATERIALS

Under consideration by Subcommittee.

C95. MEASUREMENT OF POTENTIALLY HAZARDOUS ELECTROMAGNETIC FIELD-RF and MICROWAVES (near and far field)

Circulated for C95 approval; comments being resolved, will submit to ANSI in Spring 1980.

C95. RADIO FREQUENCY HAZARDS TO ELECTRIC BLASTING CAPS

In preparation; draft due for C95 approval by December 1980.

MD105: Medical Electronics

Chairman: R. Flink
Medtronics, Inc.
3055 Old Highway Eight
Minneapolis, MN 55418
612-574-3025

Secretary: G. Willingmyre
Health Ind. Mfrs. Assoc.
1030 15th St., N.W.
Washington, DC 20005
202-452-8240, Ext. 814

ANSI MD105 is basically a census body to which ANSI looks to judge whether or not non-accredited medical-device standards should be adopted by ANSI. (Not included are standards from accredited organizations, such as the American Assoc. for Medical Instrumentation (AAMI), American Standards for Testing Materials (ASTM), etc.) Committee MD105 also serves to support the technical advisor to International Electrotechnical Commission (IEC) Subcommittee 62D on Electromedical Equipment. Furthermore, it gets the IEC information known to the electromedical community. An immediate concern of MD105 is the Food and Drug Administration (FDA) Document MDS-201-0004 on "Electromagnetic Compatibility of Medical Devices." This document was not issued as a regulation, nor is it properly a standard, since it has not been subjected to the concensus process. Although the future of this document is unclear, it will have been (by publication time) considered at a 5 March 1980 meeting of the Medical Device Standards Management Board.

SCHEDULED COMMITTEE MEETINGS OF MAJOR EMC INTEREST

COMMITTEE	NAME	NEXT MEETING
ANSI C63 (Also Subcom. 1)	Radio Electrical Coordination Techniques and Developments)	3/26/80, FCC Washington, DC
ANSI C68	High-Voltage Testing Techniques	5/28-29/80, Sheraton Hotel, Ft. Lauderdale, FL
ANSI C95	Radio Frequency Radiation Hazards	Fall
ANSI MD105	Medical Electronics	4/18/80; 1-4:00 P.M. Hyatt Embarcodero Pacific F Room San Francisco, CA
CBEMA ESC5	Environment and Safety Committee Subcommittee 5	5/13-14/80, CBEMA Washington, DC 10/8-9/80, Baltimore Hilton Baltimore, MD
EIA G-46	Electromagnetic Compatibility	4/21-23/80, La Mansion del Rio San Antonio, TX
EIA R-2	Consumer Electromagnetic Compatibility	Around 6/18-19/80 Consumer Electronics Conf., Chicago, IL
EIA TR8.10	Vehicular Electrical Interference and Electromagnetic Compatibility	Unscheduled
IEEE S27	EMC Standards Committee	Unscheduled
SAE AE-4	Electromagnetic Compatibility	4/24-25/80, Holiday Inn Cornwells Heights, PA (Host to NATO EMC) 10/6/80, Baltimore Hilton, Baltimore, MD
SAE ESC/SC	Electronic Systems Committee/EMI Standards and Test Methods Subcommittee	5/13/80 - 9:00 A.M. General Motors Detroit, MI 6/18-20/80 (with ISO TC22, SC3, WG3 on EMI) Frankfort, Germany 10/6/80 - 9:00 A.M. Baltimore Hilton Baltimore, MD
SAMA PMC33	Process Measurement and Control	6/3-4/80, SAMA Washington, DC

Book Reviews

by Jim Hill, EMXX Corporation

This issue brings you two reviews. One of these on a new textbook, "Electromagnetics: Classical and Modern Theory and Applications," is by a new reviewer, Andy Farrar, who uses some rather unusual analogies in his evaluation. Andy also is serving as General Chairman of the 1980 EMC Symposium to be held in Baltimore, October 7th through 9th. "Electromagnetics" is intended as a two-semester textbook for undergraduate and beginning courses in electrical and mechanical engineering and it is also useful as a reference work on electromagnetics, drawing ideas and examples from thermal, acoustic, mechanical and fluid fields. The second review is on a book about EMC control applied to aerospace systems. The author. Dr. Bernhard (Bernie) Keiser, is a very active member of IEEE, presently serving as the Washington, DC EMC Chapter Chairman and concurrently holding the position of Vice Chairman of the Northern Virginia Section. He is also a member of the 1980 class of newly elected Fellows. He has also recently authored a basic EMI/EMC textbook which he uses in a short course he teaches in the George Washington University Continuing Engineering Education Program. Look for a review of this book in the next issue.

"Electromagnetics: Classical and Modern Theory and Applications"

BY

Samuel Seely and Alender D. Poularikas
Published by Marcel Deker, Inc.
New York and Basel, 1979
808 pages, $19.50

Review by Andrew Farrar
U.S. Department of Commerce, NTIA
Annapolis, MD 21401

I wondered how a new book on the subject of electromagnetics can find a market of any magnitude in a mature discipline so highly saturated with numerous volumes which have survived the test of time. The "Electromagnetics" is a useful contribution, since it uses the subject of electromagnetic theory as a canopy to introduce the reader to other disciplines such as: acoustics, thermal, plasma, elasticity, physical and geometrical optics. The new overview approach adopted by the authors, however, has not attenuated the extensive mathematical sophistication that an undertaking of this magnitude requires. The approach spares the reader a rather regrettable experience that usually accompanies any learning endeavor. Ordinarily, the majority of students should absorb a large chunk of inferior material to learn the equivalent amount of material as presented in the "Electromagnetics." When a mess sergeant said to the private who kept demanding more coffee, "You really like coffee, don't you?", the private replied, "Yes. That's why I am willing to go through so much hot water to get some." Drs. Seely and Poularikas have spared the reader the necessity of going through hot water. In my judgment, everything in the "Electromagnetics" is worth consuming.

The "Electromagnetics" is prepared in the form and style of a textbook. It is basically for students. Like the majority of textbooks, it lacks a seductive introduction to motivate a reader beyond the objective of studying for a better grade. The practical application of the material has not been emphasized. The authors' purpose has been to present enough information in order to convey to the student the concepts in electromagnetic theory. The "Electromagnetics" is not intended for a do-it-yourself reader. An uninitiated reader is more likely to repeat the mistake of a young English lady who asked the clerk in a bookstore whether he had any recent translation of Shakespeare. An advanced student may find Chapter 15 of the "Electromagnetics," Special Methods in Field Analysis, to be a well organized, yet insufficiently referenced, introduction to the solutions of some problem of practical interest in the field theory. An extension of this chapter will be a worthwhile effort to fill a long overdue gap.

Every chapter in the "Electromagnetics" ends with review questions and problems. The questions are related to the material presented earlier and obviously help the student obtain a better understanding of the material.

Just like a weekend stew made of all that is left in the refrigerator, the authors have prepared a final product by a careful arrangement of massive material between the two covers of the "Electromagnetics," a product which should be attributed to many years of research and classroom experience. One can enjoy eating the stew without having the need to like every single ingredient in it. So, if you have a specialty or would like to develop a general knowledge, you can be benefitted by studying the "Electromagnetics."

"EMI Control in Aerospace Systems"

BY

Dr. Bernhard E. Keiser
Published by Don White Consultants, Inc.
State Route 625, P. O. Box D
Gainesville, VA 22065, 1979
283 pages, $29.50

This is Volume 5 of the 40 Volume Encyclopedia Series of Don White Consultants, Inc.

The author, Dr. Keiser, is well qualified to write about EMC and aerospace systems, having headed up the EMC program on a number of important aerospace projects. According to him, the book is intended to emphasize those aspects of EMC that are peculiar to aerospace systems because of such physical limitations as space, weight, and power, as well as the rigors of temperature and pressure characteristic of outer space and reentry environments. In addition to treating the special situations found in spacecraft, aircraft, and reentry vehicles, the book covers the problems of aerospace ground equipment and ground support equipment. Such equipment must often operate at sites having a high level of electromagnetic interference from surrounding electronic equipment and automotive vehicles.

The book is organized into eight chapters. Chapter 1 is an introduction, giving an overview of aerospace EMC problems. It briefly discusses the various vehicle systems, as well as the ground support systems, and includes prediction and analysis as well as test programs. In each case, there are specific references to pertinent sections of the following chapters.

Chapter 2 deals with the EMI control of space systems, including the control plan, specifications, system and subsystem design, testing in a simulated ambient environment, and the problems of static charging after launch. Chapter 3 looks at the EMI control of aerospace ground equipment. It covers the problems of interface with a computer, the various types of telemetry systems, design integration, special component design techniques, and range environments.

Chapter 4 has to do with EMI control of aircraft systems. It discusses the frequency plan, antenna placement, power distribution, radar and warning systems, communication systems, navigation systems, weapon systems, control devices and triboelectric charging and lightning protection. The EMI control of ground support equipment is covered in Chapter 5. This contains discussions of the GSE radiated and conducted environment, the various types of GSE systems, and guidelines for GSE EMC.

In Chapter 6, reentry systems are dealt with. The subjects discussed are thermal protection, component sensitivities, and subsystems EMI control techniques. Chapter 7 has a look at EMI prediction and analysis. This is divided into intersystem and intrasystem compatibility, modeling for analysis, computer programs, and the development of specifications for systems and components. Chapter 8 is on EMI test programs. This includes test plans and test procedures, components and subsystems, and, finally, test facilities and test sequences for the various types of systems.

Each chapter contains a comprehensive list of references. In addition, there is a helpful list of abbreviations and symbols at the front of the book and a subject index in the final pages.

The author has included some mathematical derivations; but, the longer ones have been omitted. Where the mathematical models are included, the practical limits are given. In many cases, the application of principles is illustrated with performance data from the author's experience with well known systems and subsystems. An interesting example is the author's cost analysis of the spacecraft system electromagnetic ambient tests. This involves the cost impact and margin calculation for conducted interference, E-field and H-field radiated interference for the spacecraft system.

In conclusion, your reviewer would recommend this book as a good basic reference and design guide for practicing engineers and it also will be helpful to management personnel by giving an insight into the EMI/EMC techniques that should be applied to the development of an aerospace system program.

NOTES FROM SEQUENCY UNION

NEW TEXT IN WALSH ANALYSIS SCHEDULED

BY

G. ROBERT REDINBO

Professor Mohammad Maqusi, Electrical Engineering Department, University of Jordan has a new text, Applied Walsh Analysis and Its Applications, to be published by Heyden and Son late this year or early next. The primary intent of this book is to provide a clear concise treatment of generalized continuous Walsh functions and some of their applications. It proceeds from basic topics to intermediale and advanced levels. A list of the chapter titles is given below.

I	INTRODUCTION
II	WALSH FUNCTIONS
III	WALSH TRANSFORM
IV	CERTAIN CONCEPTS IN STOCHASTIC STUDIES
V	LINEAR DYADIC INVARIANT SYSTEMS
VI	WALSH ANALYSIS OF NONLINEAR SYSTEMS
VII	APPLICATIONS OF WALSH FUNCTIONS TO STATISTICAL PROBLEMS
VIII	HAAR FUNCTIONS
IX	RELATIONS BETWEEN WALSH AND FOURIER SPECTRA
X	SOME APPLICATIONS IN COMMUNICATIONS

Dr. Maqusi is an active researcher concerned with the analysis of nonlinear systems including the use of Walsh techniques. He has kindly consented to detail several aspects of the current research work in this area. The list of references that he has included at the end of his remarks below are a good starting point for further reading in this rapidly unfolding research area.

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Some Aspects of Walsh Analysis of Nonlinear Systems

Mohammad Maqusi

Visiting Associate Professor
University of Texas at El Paso
El Paso, Texas 79968

I. Introduction

Application of Walsh functions to linear dyadic invariant (LDI) systems has produced a theory which is strikingly similar in many respects to Fourier analysis of linear time invariant systems. However, the analysis of nonlinear systems by Walsh functions techniques has drawn relatively less interest [1].

This article is primarily designed to draw attention and give brief appraisals of certain Walsh techniques that have been found useful in the representation and analysis of nonlinear systems and transformations. Certain studies of instantaneous nonlinear problems were made by Corrington [2] in 1962, Weiser [3] in 1964, and Maqusi [4] in 1973. Essentially, Walsh analysis of nonlinear systems draws on the efficiency with which certain computations involved in these systems may be performed. In certain systems (e.g., power-law), the closure property of Walsh functions is primarily responsible for the alleviation of intermodulation sequencies at the output. Such sequencies could be the cause of intermodulation distortion.

II. Discussion

General instantaneous nonlinear systems are described by an input - output relation which specifies the output in terms of the input at same instant; e.g., $y(t) = g[x(t)]$. In case the input $x(t)$ represents a random process, it becomes of interest to consider the class of weakly dyadic stationary (WDS) processes. Such a process induces a stayadic (statistical dyadic) correlation function $C_x(\tau) = E[x(t)\, x(t \oplus \tau)]$, where the operator $\oplus$ denotes modulo - two addition, without - carry.

Walsh Characteristic Function (WCF) Method

The WCF aims at deriving an expression for the output stayadic correlation function [5]. For a random variable x, a WCF is simply defined as the expectation of a Walsh transform kernel, $\psi(\sigma,x)$. If the nonlinear transfer characteristic function $g(x)$ is Walsh-transformable, with a Walsh transform (WT) $G(\sigma)$, then output stayadic correlation is given by

$$C_y(\tau) = \int_0^\infty \int_0^\infty S_x(\sigma,\alpha;\tau)\, G(\alpha)\, d\sigma\, d\alpha \qquad (1)$$

where the second - order WCF

$$S_x(\sigma,\alpha;\tau) = E[\psi(\sigma,x(t)\psi(\alpha, x(t\oplus\tau))]. \qquad (2)$$

Clearly, when an output sequency power spectral density exists, it may be computed from (1) via a WT.

Quasi-Linear Approximation

According to this scheme, the output is approximated by a weighted linear combination of the input components. Assuming Walsh signal inputs, the weighting filters may be suitably chosen as LDI systems. Under a minimum mean-squared error criterion, the optimal filters may be specified by Walsh function impulse responses [1]. Hence, Walsh functions serve essentially as describing functions [6], [7].

Walsh Series Expansion Approximations

The approximation of signals and systems by appropriate Walsh series expansions could provide an efficient means of nonlinear analysis.

i) Input Approximation: If an input $x(t)$ could be sufficiently represented by a truncated Walsh series expansion, say the first N terms. Then in matrix form we may write $x(t) = [A]^T [wal(t)]$, where $[A]$ and $[wal(t)]$ denote N x 1 column matrices of the Walsh coefficients and Walsh functions, respectively. Under this approximation, the output may be evaluated to yield.

$$y(t) = [C]^T [wal(t)] \qquad (3)$$

where the output Walsh coefficients are $[C]^T = [g([A]^T)]^T W^T$, and T designates matrix transposition and W denotes the Walsh matrix.

The usefulness of this matrix method lies in the exploitation of fast Walsh transforms to compute the output coefficients [5]. For certain nonlinear systems (e.g., power - law), computations can be executed by some rather simple procedures [8].

ii) Probability Distribution Expansions: If we assume a bounded input process $x(t)$, then for a fixed time t_1, $x(t_1)$ yields a bounded random variable with a corresponding probability distribution function $f(x_1)$. Now if $f(x_1)$ could be sufficiently described by a Walsh series expansion, then it becomes possible to determine the output general moments for certain classes of nonlinear systems according to some computationally - efficient procedures [9].

Wiener Analysis

The use of Wiener and Voltera functional series expansions offers a useful means for the description of memory-type nonlinear systems. Applications of Walsh functions could serve to ease the burdens of computing associated Wiener or Voltera kernels [10]. Indeed, this computational advantage offers an alternative technique for the identification of such kernels [11], which ultimately describe the system.

Sampled Signals and Time Series Analysis

In practice, time series are frequently analyzed via corresponding sampled values. Sequency - bandlimited signals have their sampling theorems which dictate appropriate sampling rates [12], [13]. A recent work [14] investigates the computations of correlation functions and associated frequency spectral densities of nonlinear transformations by exploiting a sequency sampling expansion representation for the input processes. Results indicate striking advantages over the use of Cardinal (frequency sampling) series expansions for same processes. The results are primarily attributed to the natures of the sequency and Cardinal sampling pulses. In the former it is a simple rectangular pulse, while in the latter it is a sampling function pulse.

Further Work

Applications of Walsh functions to nonlinear problems have been made in still other areas, including nonlinear filtering [15], solution of nonlinear differential equations [16], problems of nonlinear distortion and their effects on Walsh function detection [17], and computation of dyadic correlations of nonlinear systems [18]. Undoubtedly, other contributions have been made, and this area will continue to offer other challenging problems. In some of these problems Walsh functions will be found useful. In others, they may not be as suitable.

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ETHICAL ISSUES UNITE IEEE GIVE ADDED MEANING TO PAC "PROTECT ALL COLLEAGUES"

by V. Edgerton
PAC Chair, New York Section

For many years now, engineering personnel have been quietly doing their best to protect the public from predictable equipment malfunction that can cause death or serious injury - and getting fired, demoted, or forced to resign because of it. Many people have been killed in accidents that were predicted by engineers and, thus, could have been avoided. And, perhaps, even worse, the entire technology community was blamed for the very death an engineer predicted and tried his best to prevent. I wrote a paper on this, which was published at ELECTRO 79.* Anyone can read some examples that prove what I just said. But, that is just the tip of the iceberg.

When people are fired for doing their jobs, they don't want to talk about it, they don't want to hear about it, and they are not really interested in reporting it to anyone. They try to pick up the pieces, and they seek work in an environment that does not call for this kind of heroism.

As a matter of fact, some of us, like myself, spend their entire careers running away from this very type of confrontation, turning down job offers that have the remotest possibility of having anything whatsoever to do with medical applications, high reliability components, or dangerous fuels and chemicals. So, it can happen to you.

It's a tough problem, because we are mostly employees, vulnerable to the whims of employers, dependent on their favors, and sometimes having real reason to fear. The way things are, we will not find an easy solution. But things can be changed. That is our heritage, as human beings: We change, we adapt.

I like to think that PAC also stands for "Protect All Colleagues." This Institute, with its extraordinary subdivisions, overlapping subspecialties, and very large size, still does appear united by a straightforward Code of Ethics, which states simply that we must protect the public from equipment malfunction. A common respect for logical alternatives also unites us, as well as the knowledge that the way things are, even by getting fired we still may not be able to protect anyone from anything. So, we must change the way things are.

IEEE is on to this problem. This is the second consecutive year that an award was given to one of us for protecting the public, despite the retaliation that was sure to - and did indeed - follow. I'm referring to the CSIT award, first presented to the three BART engineers at WESCON 78, and subsequently to me at ELECTRO 79. This award constitutes a pledge to our fellow human beings, to protect them from predictable equipment malfunction and from technological harm. I got an award for doing this, and maybe, we don't know for sure, but maybe some people are walking around the streets of New York today who might have died, and they are walking around because - directly because - of IEEE. If so, that's something all 190,000 of us can be very proud of.

*"ELECTRO 79" is available from Western Periodicals of North Hollywood, CA

IEMCAP COURSE

The Electromagnetic Compatibility/Intrasystem Analysis Program (EMC/IAP) Support Center is presenting its third course on the Intrasystem Electromagnetic Compatibility Analysis Program (IEMCAP).

The training course will run five full days, June 23 through June 27, 1980. The course will be given at the Pacific Missile Test Center, Pt. Mugu, California. The cost of the course is $500.00. Class size is limited to 30 students on a first-come-first-serve basis. Registration for the course closes May 23, 1980. This course will only be held if sufficient interest is evidenced by the EMC community. A minimum of 20 reservations must be made or the course will be postponed until a further date. Both the theory and practical operations of IEMCAP Version 05 will be examined.

Topics to be covered include:

- The EMC/IAP and its role in the Air Force
- Continuous Systems Equations
- Discrete Systems Equations
- Port Spectrum Quantization
- Emitter, Receptor and Transfer Models
- IEMCAP Implementation and Data Preparation
- Data and Program Execution Workshop

The student is responsible for supplying his pen and a calculator only. The Support Center will supply the books needed for the course. Hotel reservations are being arranged at a local hotel. Particulars will be included in a future announcement. Contact Ms. Donna Crossland at the Support Center for reservations not later than May 23, 1980. Phone: 315-339-3830, or AV 587-7168.

TELECOMMUNICATIONS BILLS GET BACK ON TRACK

The Commerce Committees on both sides of the Capitol have risen from the drawing boards and produced new working drafts of Telecommunications legislation. The most significant effort has come on the House side. On December 13, 1979, the entire membership of the Communications subcommittee joined in sponsoring a bill to amend the common carrier title of the 1934 Communications Act. The new bill, H.R. 6121, carries the sponsorship also of the Chairman of the full committee, Rep. Harley Staggers, and the ranking minority member, Rep. Samuel L. Devine.

The House bill confines itself to the Telecommunications area and omits consideration of issues that sent the earlier legislation down the tube (cable television, broadcasting, and frequency management). Rep. Lionel Van Deerlin, sub-committee chairman, said his panel is indebted to NTIA for bringing the group together on the present bill draft.

A summary of the major provisions of the measure, issued by the subcommittee, includes the following:

> "Finds that competition shall be relied upon to the maximum extent possible to determine the availability, variety, quality, and cost of telecommunications services and facilities; opens all intercity markets and services to competition"
>
> "Deregulates all intercity (interexchange) services and carriers, except for 'dominant carriers' (defined to apply only to AT&T at present), except for the provision of basic telephone service which will continue to be regulated as it is today; provides for an access charge for use of a local telephone company's facilities by any intercity carrier; creates the national telecommunications pool and other safeguards to offset any significant increases in costs of rural telephone service brought about by increased competition"
>
> "Modifies conditions imposed on AT&T and Western Electric by the 1956 consent decree which prohibited them from participating in unregulated activities; requires AT&T to establish fully separated subsidiaries for offering any unregulated service or product; and deregulates all terminal equipment and establishes in statute a customer's right to connect his own terminals."

AT&T rates H.R. 6121 a big improvement over the earlier Van Deerlin bill.

Meantime, Van Deerlin's California colleague, Rep. George Brown, has noted his own subcommittee's effort to educate itself on communications and information technologies. "The rapid maturation of these technologies presents policymakers with an unprecedented set of challenges," Brown said (in a floor statement December 4). Brown's Science Research & Technology subcommittee has held hearings on information technology in education and is mounting a wider effort in this and other aspects of information policy. Among other efforts in progress are the OTA study of telecommunications and national information systems and a Congressional Research Service background paper and bibliography on telecommunications and information systems.

On the Senate side, the Commerce Committee chairman, Senator Howard Cannon, has called for a concerted effort at a committee bill early in the next session. At the December 6th meeting of the Communications Subcommittee, he joined with Senators Hollings and Stevens in sponsoring a new "Staff Working Draft" to amend the 1934 Act and to provide for improved domestic, rural, and international telecommunications. Previously, Senator Barry Goldwater circulated his own Discussion Draft for comment.

VIEWS ON ALIEN ENGINEERS SOUGHT

The U.S. Activities Board is looking for views to help formulate a position on U.S. procedures governing the entry of foreign engineers into this country. Current Department of Labor (DOL) regulations govern engineer entry based upon proven domestic shortages. Recent initiatives have been taken to apply the open entry guidelines for skilled aliens used by the Immigration and Naturalization Service (INS) to engineers.

Which approach is most appropriate? This question is particularly relevant for engineers when viewed in the supply vs. demand equation. The few comments received by USAB to date show a strong preference for retaining the DOL procedures over the INS approach. Other suggestions called for open entry with qualifications and State Department certification of unusually high technical grades.

If you would like your voice heard, write to Dick Backe, USAB Vice Chairman, c/o the Washington Office, 1111 19th St., N.W., Washington, DC 20036.

EMCABS

EDWIN (ED) BRONAUGH

EMCABS

In this issue we are publishing 54 abstracts. These are abstracts of some of the papers presented at the last International EMC Symposium that was held in San Diego, California, last October, and the 1979 IEEE Transactions on EMC - Volume 21. We plan to continue publishing abstracts of papers from previous EMC Symposia and from International Conference on Communications (ICC) and National Telecommunications Conference (NTC) Records. The EMCABS committee is composed of the following members:

L. F. Babcock	E. L. Bronaugh
J. S. Hill	R. N. Hokkanen
J. R. Janoski	M. Kant
D. R. Kerns	G. R. Redinbo
R. B. Schulz	R. M. Showers

Ignition Noise of Foreign and Domestic Vehicles in Use in the United States

ACCESSION NO. EMCABS 2-80-01

R. A. Shepherd, James C. Gaddie, SRI International, Menlo Park, Calif. 94025

1979 IEEE International Symposium on EMC 79CH1383-9 EMC October, 1979, pp. 232-238

ABSTRACT: Electromagnetic noise from the ignition systems of more than 11,000 individual vehicles in service in the United States in mid-1977 was measured at 50 and 153 MHz. We found very little difference between the noise of U.S. domestic and foreign vehicles. Older vehicle groups are noisier than newer vehicles groups--a fact which may be accounted for by either of two causes: a) some vehicles in a group become noisier with age, b) newer vehicles may have improved noise supression systems. Measurements made in a single year will not show which effect predominates. We found the greatest noise differences between vehicle types (cars, trucks, and so on).

INDEX TERMS: EMI, Automotive Ignition Noise, Noisy Vehicle Survey.

Radio Spectrum Surveillance Station

ACCESSION NO. EMCABS 2-80-02

Donald R. Hersey Jet Propulsion Laboratory California Institute of Technology

1979 IEEE International Symposium on EMC '79 CH 13839 EMC, Oct. 1979, pp 239-244

ABSTRACT: Radio frequency interference at NASA's deep space stations has become a serious problem. A radio spectrum surveillance capability at these stations is needed to determine the sources of interference so that preventative measures can be taken. The first phase of a program to develop this capability was the development of a low cost surveillance station now in operation at the Goldstone Deep Space Communication Complex near Barstow, California. This interim surveillance station is described and findings from the use of this equipment are presented.

INDEX TERMS: RFI, Spectrum Surveillance, Space Communications

Airborne Surveys of USA Urban Areas at 121.5/243 MHz

ACCESSION NO. EMCABS 2-80-03

Ralph E. Taylor, NASA/Goodard Space Flight Ctr.
James S. Hill, EMXX Corporation, Springfield, Virginia 22151

1979 IEEE International Symposium on EMC '79 CH 13839 EMC, Oct. 1979, pp 245- 251

ABSTRACT: In situ, aircraft flight measurements were made in 1976 and 1977 by the National Aeronautics and Space Administration (NASA) of the radio-frequency environment over USA urban areas within the emergency distress search and rescue frequency bands at 121.5 and 243.0 MHz. This paper analyzes test results reported previously for USA East Coast and Midwest flight surveys; presented also are test results obtained in May 1977 for the USA West Coast during the NASA, ASSESS-II, Space Shuttle/Spacelab simulation aircraft flights.

The USA West Coast flights include data at 121.5/243 MHz during an extensive series of aircraft-flyover passes for the Los Angeles, CA urban area. The USA East Coast/Midwest measurements show correlation with population count.

INDEX TERMS: Airborne EMI, Emergency Frequency, EMI, Radio Frequency Environment

Recent Results on Determining Population Exposure to VHF and UHF Broadcast Radiation in the United States

ACCESSION NO. EMCABS 2-80-04

Richard A. Tell & Edwin D. Mantiply, U.S. Environmental Protection Agency

1979 IEEE International Symposium on EMC '79 CH 13839 EMC, Oct. 1979, pp 252-256

ABSTRACT: The U.S. Environmental Protection Agency has been collecting broadcast signal field intensity data for over three years to estimate population exposure to this form of nonionizing radiation. Data have been obtained at 486 locations distributed throughout 15 large cities and 14,000 measurements of VHF and UHF field intensities. A computer algorithm has been developed which uses these measurement data to estimate the exposure at some 47,000 census districts within these 15 cities. The results of the computations indicate what part of the population may be exposed to various levels of radiofrequency radiation. Details are provided on techniques to determine the uncertainty inherent in the exposure estimation procedure. Half of the population of the cities studied is exposed to more than 0.005 $\mu W/cm^2$ time averaged power density. The data also suggest that about 1 percent of the population studied (about 441,000) may be exposed to levels greater than 1 $\mu W/cm^2$.

INDEX TERMS: VHF/UHF, Broadcast Field Strength, EPA, Computer Algorithms, Exposure levels

Field Excitation Of General Multiconductor Transmission Lines for EMC Applications*

ACCESSION NO. EMCABS 2-80-05

Fredrick M. Tesche LuTech, Inc, Berkeley, CA 94701

1979 IEEE International Symposium on EMC '79 CH 13839 EMC, Oct. 1979, pp 257 - 259

ABSTRACT: This paper discusses the excitation of a general multiconductor transmission line by an incident electromagnetic field. Specific relations for the terminal (or load) response of a multiconductor line are derived in terms of a field-induced voltage and current sources which are distributed along the transmission line. It is shown how these sources are derived for a general multiconductor line and how they may be related to the incident (or free space) fields by using a field coupling parameter which has been used in the past for two-wire transmission-line analysis.

INDEX TERMS: EM Coupling, Multiwire transmission lines, EM Fields

Design of Wire Routing for EMC

ACCESSION NO. EMCABS 2-80-06

Gerard T. Capraro, Rome Air Development Ctr.
Clayton R. Paul, Dept. of Electrical Engineering

1979 IEEE International Symposium on EMC '79 CH 13839 EMC, Oct. 1979, pp 260-267

ABSTRACT: A study of the feasibility of developing a wire routing algorithm to minimize wire-coupled interference is discussed. An optimal wire routing algorithm is presented which generates a wire bundle (harness) configuration that minimizes the wire-coupled interference and satisfies certain physical contraints such as allowable bundle segment paths. The wire coupling model and the compatibility criteria are also discussed. It is shown that the optimal wire routing problem can be reduced to an iterative tree building algorithm. Implementation of the algorithm for a digital computer is briefly discussed and an example is presented.

INDEX TERMS: EMC Design, Computer Aided Design, Coupling

Effect of Pigtails on Coupling to Shielded Wires

ACCESSION NO. EMCABS 2-80-07

Clayton R. Paul Dept. of Electrical Engineering U. of Kentucky
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 268-273

ABSTRACT: An investigation of the effect of pigtails (exposed sections of shielded wires) on the coupling to braided-shield cables is presented. It is found that even though the lengths of these exposed sections of a shielded wire may constitute only a very small portion of the total line length, they may, depending on the terminal impedances of the shielded line, constitute the dominant coupling mechanism for the braided-shield cable. For situations in which pigtail coupling is dominant, the shield simply serves to reduce the exposed section of the interior wire from what it would be if no shield were present. Thus, the shield provides some reduction in coupling, but the effectiveness of the shield is shown to be as much as 30 dB less than it would be if the pigtail lengths were minimized. Experimental results are given to support these conclusions.

INDEX TERMS: Coupling, Shielding, pig-tail coupling, EMI, EMC

Antenna-to Antenna Coupling In Aircraft Radio Systems

ACCESSION NO. EMCABS 2-80-08

David A. Bull and Brian W. Smithers Electrical Research Assn.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 274-281

ABSTRACT: Interactions between co-sited antennas on airframes can seriously limit the performance of control, guidance and communications systems. Much ground and in-flight data has been gathered and laboratory investigations have indicated where improvements can be made. Empirical formulae have been developed which are applicable for both in-band and out-of-band frequencies.

INDEX TERMS: Intra-System RFI, Cosite Antenna Coupling, Avionics, EMC

Analysis of Electromagnetic Coupling in Branched Cables

ACCESSION NO. EMCABS 2-80-09

Clayton R. Paul Dept. of Electrical Engr. U. of Kentucky
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 282-290

ABSTRACT: A model for the prediction of electromagnetic coupling in branched cable bundles is described. The model is based on the admittance matrix representation of the coupled wires in each bundle segment, and a formal algorithm, suitable for implementation on a digital computer, is developed. The model allows for a variety of representations of the coupling within the bundle segments - multiconductor transmission line theory, lumped parameter models, experimental characterization. A connection matrix is developed which describes the wire interconnections at the bundle branch points and the bundle terminals. An important property of this connection matrix allows a simple construction of the resulting equations which are to be solved for the wire junction and terminal voltages. The total number of simultaneous equations to be solved is equal to the total number of wire junction and terminal nodes.

INDEX TERMS: EM Coupling, modelling, cable coupling, Computer Aided Design

Everyday Analyses Using IEMCAP Models and Programmable Calculators

ACCESSION NO. EMCABS 2-80-10

Hector Smith
Douglas Aircraft Co., McDonnell Douglas Corp., Long Beach, Calif.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 291 - 296

ABSTRACT: A large number of EMI problems involve coupling from one emitter to one receptor, e.g., one antenna to another. Large computer programs, such as the Intrasystem Electromagnetic Compatibility Analysis Program (IEMCAP) are cumbersome to use for smallscope analyses. Programmable calculator programs are ideal for this task. This paper describes programs for the Hewlett-Packard 9820A calculator, based on IEMCAP models. The programs calculate wire-to-wire, antenna-to-antenna, and antenna-to-wire coupling. Simplifications and special algorithms used to stay within the capabilities of the calculator are described.

INDEX TERMS: IEMCAP, CAP, EMI Models, Coupling

A Second Generation Intrasystem Analysis Program

ACCESSION NO. EMCABS 2-80-11

William G, Duff, Harvey K. Schuman, Larry D. Thompson, and Donald R. Pflug, Atlantic Research Corp.Alexandria, VA
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 297 - 305

ABSTRACT: The second generation intrasystem analysis program (IAP-II) should provide the EMC system designer with a very general analysis tool that may be used on a variety of different types of EMC analysis problems. IAP-II will provide capabilities ranging from a microscopic analysis of one of the elements of the system analysis problem (e.g., a nonlinear circuit analysis or a method of moments coupling analysis) to a macroscopic analysis of the total system.

INDEX TERMS: IEMCAP, EMC, Analysis, Circuit Analysis

A System Data File and Handler for the Electromagnetic Compatibility/Intrasystem Analysis Program

ACCESSION NO. EMCABS 2-80-12

Thomas E. Baldwin, Jr., William G. Duff, Richard G. Robertson, Barbara E. Miller, Atlantic Research Corp. Alexandria, VA
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 306 - 309

ABSTRACT: This paper discusses the System Data File (SDF) and System File Handler (SFH) developed for implementation with the RADC Electromagentic Compatibility/Intrasystem Analysis Program (EMC/IAP). The SDF provides a source of input data for any of the various EMC/IAP computer programs (e.g., IEMCAP, GEMACS, etc.) as required for a particular EMC analysis problem. The SFH has the capability of building and editing hierarchical structured sequential files. The SFH aids the user to interface the SDF with the EMC/IAP program. These developments will provide the users of the EMC/IAP with a significant increase in data handling capability and an interface for an intrasystem EMC analysis.

INDEX TERMS: IEMCAP, Analysis, Data Manipulation

An Improved Prony Algorithm for Exponential Analysis

Harold J. Price Mission Research Corp. Albuquerque, NM
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 310 - 313

ACCESSION NO.
EMCABS 2-80-13

ABSTRACT: -An improved Prony algorithm is described which produces a lower sum of squares of residuals than the usual Prony Algorithm. Indeed, the new algorithm produces the lowest sum of squares of residuals possible. A simple numerical example is used to compare the new and old algorithms. Within the context of the new algorithm, a technique to constrain poles is also described.

INDEX TERMS: Prony's Method, Analysis, Computer Algorithms,

Significant Receiver Intermodulation (RIM) Products

M. N. Lustgarten IIT Research Institute Annapolis, MD
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 314- 318

ACCESSION NO.
EMCABS 2-80-14

ABSTRACT: Results of measurements of receiver intermodulation products are reviewed. A large number of products were identified, many of which could result in degradation of performance of communications receivers collocated with transmitters using the same or adjacent tuning ranges. Probable mechanisms are described and suggestions provided for ranking the relative significance of the various interactions.

INDEX TERMS: Intermodulation, Co-site, EMI, Receivers

A Note On An Idealized Antenna Pattern

Wolf Kuebler Engineering Division of Hydrotronics, Inc.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 319 - 324

ACCESSION NO.
EMCABS 2-80-15

ABSTRACT: In EMC analysis, it is often required to assess the mutual interference between stations without knowledge of the antenna patterns involved. Typically only the mainbeam gain is available from large scale spectrum data management systems. This paper concerns itself with a simple methodolgy to synthesize, in a somewhat deterministic manner, an antenna pattern from this insufficient information. Results based on synthesized patterns are compared with measured antenna patterns.

INDEX TERMS: EMC Analysis, Co-site EMC, Antenna patterns

Special EMC Problems in Public Wire Telecommunications Installations
G. Gratta, Italy Chairman of CCITT Stdy. Grp. V, H. Lorke, German Democratic Republic, Vice Chairman CCITT Stdy. Grp.V
P. O. Persson, Sweden, Vice Chairman CCITT Study Grp. V
1979 IEEE International Symposium on EMC '79 CH 13839
EMC Oct. 1979, pp 325 - 331

ACCESSION NO.
EMCABS 2-80-16

ABSTRACT: This report is based on the results of activities carried out in CCITT* Study Group V. This Study Group is responsible for questions relating to the protection of wire telecommunication installations against the effects of external electromagnetic fields. The activities of Study Group V were described in detail on the EMC Symposium of 1978 in Wroclaw (People's Republic of Poland).

*) CCITT: Comité Consultatif International Télegraphique et Téléphonique

INDEX TERMS: EMC, Wire Communication, CCITT, Coupling

Sharing Between Fixed and International Broadcasting - A Time Sharing Example
David P. Anderson, Fed. Communications Commission, Washington
Arthur R. Thompson, Family Stations, Inc. West Orange, NJ
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 332-335

ACCESSION NO.
EMCABS 2-80-17

ABSTRACT: The United States position for the 1979 World Administration Radio Conference (WARC-79) proposes sharing of frequency bands by the fixed and international broadcasting services in the High Frequency (HF) bands. In the past, frequency allocations for international broadcasting have been made exclusive due to the high powers employed. A time sharing example is described which assigns geographical areas of operation to each service based upon limiting the hours of operation of each radio service. The impact upon selected domestic fixed circuits by transmissions from several different international broadcast stations is examined.

INDEX TERMS: Spectrum Allocation, WARC-79, Frequencies, Shared Frequencies

Influence of the Correlation Coefficients in Determining Circuit Compatibility at HF
David B. Sailors EM Propagation Division
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 336- 339

ACCESSION NO.
EMCABS 2-80-18

ABSTRACT: The sensitivity of the circuit compatibility calculation at hf to input correlation coefficients is examined. The results show that the values of the correlation coefficients used have significant effect. But the change in circuit compatibility during the daytime was primarily due to the change in the correlation coefficient between the signal-to-noise ratio (S-N) and the interference-to-noise ratio (I-N) rather than the correlation between the interfering and desired path MUFs.

INDEX TERMS: EMC, Communications, S/N, Interference, I/N, HF, Compatibility

Spectrum Management Through Optimum Channel Assignments

Wolf Kuebler Engr. Div. of Hydrotronics, Inc. McLean, VA
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 343-346

ACCESSION NO.
EMCABS 2-80-19

ABSTRACT: The problem addressed is the interference-free operation of n identical transmitters and n identical receivers arranged at fixed intervals. The deterministic solution of this problem is applied to the practical problem of naval vessels arranged in a ringlike screen. Every ship is postulated to carry the same transmitter/receiver equipment. It is required that the channels are assigned to each ship to ensure interference-free operation and in such a manner that, given the radius of the ring, the optimum number of ships may be placed in the ring.

INDEX TERMS: Spectrum Management, EMC, Frequency Allocations, Ship EMC

Master File Search System (MFS)

Joseph V. Cesaitis and Phillip G. Tremper, Federal Communications Commission, Washington, D.C.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 347 - 349

ACCESSION NO.
EMCABS 2-80-20

ABSTRACT: This paper describes a computerized system, designated Master File Search (MFS), which is a FORTRAN-based information retrieval program for all non-Government frequency assignments except for citizens and amateur licenses. The MFS was developed by the Spectrum Survey and Analysis Branch of the Spectrum Allocation Division which is part of the FCC s Office of Science and Technology (OST), discusses various query capabilities and output reports of the MFS system and its application as an aid in solving spectrum allocation problems.

INDEX TERMS: Computer Analysis, Spectrum Survey, Data Storage, EMC Data

Integration of Electromagnetic Environmental Considerations into Navy Programs

Morton Roney, Naval Material Command, Stepehn Caine, Naval Electronic Systems Command, William Masi, Jr. Tom DeRieux, Naval Surface Weapons Ctr./Dahlgren
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 355-364

ACCESSION NO.
EMCABS 2-80-21

ABSTRACT: This paper describes the Navy program to integrate the application of electromagnetic compatibility (EMC) considerations with those of related electromagnetic effects of radiation hazards, electronic counter-countermeasures, electromagnetic pulse and natural effects of design, development, test and evaluation, and operation of equipment, systems and platforms. The program includes standardization, documentation, test and evaluation, data base, technology transfer and design integration.

INDEX TERMS: EMC, Rad Haz, ECCM, EMP, Integrated System

Ground Plane Effects On Far-Field EMI Measurements

W. Scott Bennett Desktop Computer Division Hewlett-Packard Co.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 365 - 368

ACCESSION NO.
EMCABS 2-80-22

ABSTRACT: Open-field radiated EMI measurements made over bare earth often yield results which are significantly different from results of the same measurements made over a metal ground screen. Using well-known analytical methods, it is seen that measured results depend, among other things, upon the permittivity, permeability and conductivity of the reflecting medium. Thus, knowledge of these parameters for each test site is essential in order to make open-field radiated EMI measurements which are repeatable from one test site to another.

INDEX TERMS: EM Measurement, Open Site EMC Tests, Far Field, Ground Characteristics

ELF E-Field Meter for In-Vitro Field Strength Measurements for Bio-Effects Research

Edwin L. Bronaugh and Donald R. Kerns, Southwest Research Institute, S.A., Texas
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 375-378

ACCESSION NO.
EMCABS 2-80-23

ABSTRACT: A field strength meter which may be used to measure the levels of high-strength electric fields invitro in cell cultures is described. The meter measures field strengths from 1 kV/m to 100 kV/m in the 30 Hz to 300 Hz frequency range. The natural extension of the measurement frequency range into the UHF region is discussed. Applications and needed future experimental work are discussed.

INDEX TERMS: ELF, E-Field, Instruments, EM Bioeffects

Emission of Electrically Small Radiating Sources From Tests Inside a TEM Cell*

I. Screenivasiah and D. C. Chang, Mark T. Ma
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp.379 - 384

ACCESSION NO.
EMCABS 2-80-24

ABSTRACT: Currently there is considerable interest in the use of rectangular coaxial TEM cells, developed at NBS, to measure EM Emissions for electronic equipment. A measurement scheme using a TEM cell, that enables one to determine the individual dipole moments, as well as the cross-components is presented. The method involves two sets of power measurements from the output ports of the cell. Each set consists of six measurements corresponding to six different orientations of the EUT chosen such that the twelve needed quantities are obtained in a simple manner. The method includes the effects of either matched or mismatched transitions at the ends of the cell, and a method of obtaining the scattering matrix of the entire cell, is described for the case when the transistions are identical. Experimental results, using an electric dipole of unknown strength and orientation, are presented to support the theory.

INDEX TERMS: TEM Cells, EM Emissions, Measurements, Instruments

The Effect of Electric and Magnetic Fields Near HVDC Converter Terminal on Implanted Cardiac Pacemakers
M. J. Frazier ITT Research Institute, Chicago, Illinois
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 385- 393

ACCESSION NO. EMCABS 2-80-25

ABSTRACT: The electromagnetic fields associated with HVDC converters and transmission lines constitute a unique environment for persons with implanted cardiac pacemakers. A measurement program has been conducted to assess the potential interfering effects of these harmonically rich fields on implanted pacemakers. The experimental procedures that were employed take into account the combined effects of the electric and magnetic fields. The effect of the resulting body current on the response of six pacemakers was assessed in the laboratory, using a previously developed model to relate body current to pacemaker pickup voltage. The results show that R-wave pacemaker reversion can be expected at some locations within the converter facility, but that a large safety margin for unperturbed pacemaker operation exists beneath the transmission lines.

INDEX TERMS: HVDC Field Effects, Cardiac Pacemaker Interference, HVDC Transmission Lines, E & M Fields

Towards A Safety Standard for Radiofrequency Hazards To Flammable Mixtures - Progress and Problems
P. S. Excell, G. H. Butcher and Prof. D. P. Howson
Postgraduate School of Electrical & Electronic Engineering
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 394 - 398

ACCESSION NO. EMCABS 2-80-26

ABSTRACT: Intense RF fields present a hazard to flammable mixtures as sparks may be drawn from metallic structures acting as unintended receiving antennas. The recent history of attempts to quantify this problem is reviewed. Very recent British work has raised many new problems which suggest that the safety standard will have to be very complex if it is not to reach unreasonably pessimistic conclusions (i.e. it must not predict hazards at great distances from transmitters where direct measurements of power available from structures suggest that there is no hazard). Some possible approaches for future attempts to draft such a standard are discussed.

INDEX TERMS: EM Hazards, Safety Standards, Flammables, Explosions

Tailoring EMI Specifications for Spacecraft Electrical Power System Compatibility
Richard W. Boettcher and Alan K. Johnson Lockheed Missiles and Space Co., Inc. Sunnyvale, California 94088
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 399- 404

ACCESSION NO. EMCABS 2-80-27

ABSTRACT: An analysis procedure is described for use in determining the steady-state EMC margin in a spacecraft primary power distribution system. The analysis begins with estimates of broadband and narrowband emissions from each equipment unit. These are combined at the power source impedance to produce a bus ripple voltage spectrum which is then compared to the equipment susceptibility specification. Thus, the three variables of emission, susceptibility and source impedance are related in such a manner that specification tailoring can be performed and design tradeoffs can be evaluated.

INDEX TERMS: EMC Specifications, Analysis, Spacecraft Power, Susceptibility

Rod Antennas for High-Strength Radiated Susceptibility Tests From VLF To HF
Edwin L. Bronaugh and Donald R. Kerns, Southwest Research Institute, San Antonio, Texas 78284
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 413 - 416

ACCESSION NO. EMCABS 2-80-28

ABSTRACT: The Low Frequency RS03 Rod Antenna, used in conjunction with a suitable signal source, will produce electric fields greater than 50 volts per metre at a distance of one metre from the radiating element over the frequency range 10 kHz to 2MHz. Less than 100 watts is required to produce the 50 V/m E-Fields. Later developments covering the range of frequencies from 2 MHz to 30 MHz are also reported. The antennas consist of four components--the base, counterpoise, radiating element, and top hat.

INDEX TERMS: Susceptibility, Testing, Instruments, Antennas, E-Fields

A New Probe for the Measurement of the VHF Surface Currents on the Metal Body
H. Echigo, M. Murata, Y. Nagasawa and R. Sato Tohoku Univer.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 417 - 422

ACCESSION NO. EMCABS 2-80-29

ABSTRACT: To analyze the unwanted electromagnetic waves radiated by electric machines and electronic equipments, it is essential that surface current distributions on their metal conductors should be measured in detail, because the electromagnetic field is determined by the current distribution. For determining the current distribution, authors developed a new kind of probes which can measure the density and direction of the current on the metal bodies.

INDEX TERMS: Surface Currents, Probes, Instruments, VHF

A Broadband, Isotropic, Real-Time, Electric-Field Sensor (BIRES) Using Resistivity Loaded Dipoles for EMI Measurements
Motoshia Kanda EMC Fields Division, Boulder, Colorado 80303
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 423- 428

ACCESSION NO. EMCABS 2-80-30

ABSTRACT: A broadband, isotropic, real-time, electric-filed sensor (BIRES) developed by the National Bureau of Standards (NBS) consists of three resistively loaded dipoles mounted orthogonally to each other. It has the capability of measuring frequency, polarization, magnitude, and phase information of the incident electromagnetic (EM) field. The typical tangential sensitivity of the BIRES is 13 to 16 μV/m with a typical usable dynamic range of 125 to 144 dB for various bandwidths in the frequency range of 10 MHz to 1 GHz. The isotropic response of the BIRES is obtained by arithmetically calculating the Hermitian magnitude of the incident electric field, and its variation is found to be less than ±1 dB.

INDEX TERMS: Broadband, isotropic, real-time, electric-field sensor (BIRES); dynamic range; Hermitian magnetude; isotropicity; resistively loaded dipole; tangential sensitivity.

An Improved Optically Isolated ELF Electric Field Sensor
R. J. Spiegel, E. H. Cooper, E. L. Bronaugh, and
D. R. Kerns Southwest Research Institute, S.A., Texas 78284
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 429 - 434

ACCESSION NO.
EMCABS 2-80-31

ABSTRACT: The design, development, and construction details of a probe for measuring electric fields between 200 V/m and 200 kV/m with a nominal measurement error of one percent are described. The probe is comprised of two small hemispheres, less than four centimeters in radius, which are separated by a small insulated gap. The electronics are placed inside the sphere, and a fiber optic link carries the field strength information to the remote receiver/display unit.

INDEX TERMS: ELF, E-Fields, Instruments, Optic links, Ultra High Field Strength, E-Field Probe

ARC Initiating Processes in the Automotive Distributor
W. J. Johnson and R. W. Terhune, Ford Motor Company
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 188-193

ACCESSION NO.
EMCABS 2-80-32

ABSTRACT: A series of optical and electrical experiments on the transient electrical behavior of the automotive distributor have been carried out. These experiments were guided by the understanding of corona and other pre-electrical breakdown phenomena. Using these ideas and simplified models, it was possible to interpret many experimental observations. The objective of this work was to reduce the EMR (Electromagnetic Radiation) associated with the distributor. Since earlier work indicated that most of this EMR was associated with the initial breakdown, this investigation concentrated on arc initiating processes. Major conclusions from this study are 1. The initial current surge lasts for a few nanoseconds. 2. Breakdown cannot occur until a threshold voltage is exceed ed and a separate triggering event is needed. 3. The source of the EMR is the current surge associated with the discharging of the capacitance of the leads close to rotor. 4. When silicone coated or nonmetallic cathodes are used, break-
INDEX TERMS: down occurs close to threshold conditiond.
Spark Ignition Noise, EM emissions, EMC, EM Radiation

The Relationship of EMC and Instrumentation Engineering In The Environmental Laboratory
Glenn G. Sundberg Hughes Aircraft Co. Fullerton, Calif.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 440 - 445

ACCESSION NO.
EMCABS 2-80-33

ABSTRACT: This paper addresses the role of EMC and instrumentation engineering in a modern equipped aerospace environmental engineering laboratory. It includes the EMC/TEMPEST testing instrumentation and related EMC applications in other areas of environmental engineering and instrumentation. This paper described these various testing activities and instrumentation applications in the environmental engineering department of the Hughes Ground Systems Group at Fullerton, Calif. Sone of the areas covered in the test laboratories include vibration, airborne/structureborne noise, shock, temperature, humidity, electromagnetic emissions and susceptibility. In some cases, electrical tests are performed with test sample installed in the environmental chambers.

INDEX TERMS: EMC. Testing, Environmental Testing, Susceptibility, EMC Engineering, Environmental Engineering.

Reverberating Chambers for EMC Measurements
Ronald R. Lentz & Harold C. Anderson Litton Microwave Cooking, Minneapolis, Minnesota 55440
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 446 - 451

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EMCABS 2-80-34

ABSTRACT: A brief review of the theory of operation of reverberating chambers is given along with several tests of the theory. The probabilistic model of the power received from a radiating device under tests in the chamber is often taken to be an exponential probability density function. The received power in a non-ideal chamber is shown to be described by a probability density function which reduces to the exponential distribution as the chamber more effectively randomizes the interior fields. The probability density function of the received signal's phase is shown to be a sensitive test of chamber optimization. Experiments are reported which quantify the effect of reverberating chamber on a device under test.

INDEX TERMS: EMC, Measurements, Reverberating Chambers, Probability

A Technique For Evaluating An Electroexplosive Subsystem Performance When Placed In An Electromagnetic Field
John W. Hafer, Jr. General Dynamics Corp. San Diego, Calif.
1979 IEEE International Symposium On EMC '79 CH 13839
EMC, Oct. 1979, pp 435 - 439

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ABSTRACT: This paper established test methods and procedures used to characterize the response of an Electroexplosive Subsystem (EES) when placed in an RF field in the frequency range of 250 kHz to 40 GHz. The complete test program consists of various tests required to collect the incremental results. The data accumulated from the various tests are used to derive the EES performance in the presence of an electromagnetic environment. Comparison can then be made with MIL-STD-1385 or any similar requirement. The attractive features of this approach result from the ability to perform the required test with test equipment commonly found in EMC test facilities. High RF power levels are not required.

INDEX TERMS: HERO, EES, RF Tests, EMC

Analyst/IAP Interface and Interactive Graphics
S. J. Kubina, H. Widmer and M. Vuille, Dept. of Electrical Engineering, Concordia University/Loyola Campus, Montreal, Canada
1979 IEEE International Symposium on EMC '79 CH 13839
EMC, Oct. 1979, pp 194-196

ACCESSION NO.
EMCABS 2-80-36

ABSTRACT: EMC analysis of the numerous avionics subsystems on modern aircraft can now be performed by batch-oriented computer codes such as ATACAP and IEMCAP which provide the user with many pages of comprehensive yet formidable numerical output require careful and time consuming examination. Furthermore, the design or compatible systems involves several interactions of program execution, output examination and system redesign. Each such interaction recomputes the majority of parameters which remain unchanged from one run to the next. In this mode of man-computer interaction, visibility of the overall interaction between systems as well as the appreciation of the important elements is unclear. AAPG (Advanced ATACAP Plus Graphics) has been developed to make the man-computer interaction more natural, rapid and productive. The user plots, illustrations and tables of the particular information he wishes to see, and may redesign subsystem and recompute the narrow band EMI margins as often as he needs during a single session.
INDEX TERMS:
IAP, IEMCAP, ATACAP, Interactive Graphics, Computers, EMI margins.

Aperture Antenna Hemispheric Gain Statistics

ACCESSION NO. EMCABS 2-80-37

Lawrence Katz
IIT Research Institute, DoD ECAC, Annapolis, Maryland
1979 IEEE International Symposium on EMC '79 CH 13839
EMC Oct. 1979, pp. 215-220
ABSTRACT: The directional gain characteristics of aperture antennas are described by design specifications and patterns for the desired coverage direction. For mutual compatibility in the electromagnetic environment, the gain coupling of system antennas at off-axis angles with antennas of transmitting and receiving equipment, with which the exchange of signal energy was not intended, is of equal importance. The gain at angles outside of the mainbeam if the composite effect of the angle off-axis, the frequency, polarization and site effects, which are generally not precisely known when attempting to predict potential environmental interactions. For this level of analysis a statistical description of the gain in terms of the median and standard deviation to the gain for the volume under consideration, is usually adequate. The statistical summary of the measured hemispheric gain characteristics for the several antenna types for estimating signal coupling when precise information on equipment siting and operation is not available.
INDEX TERMS: Aperture antennas, off-axis antennas gain, site effects, statistical summary, hemispheric gain

New Developments in Navy Spectrum Management Systems

ACCESSION NO. EMCABS 2-80-38

J. Caldwell, J. Rockway, G. Stanley, Naval Ocean Systems Ctr.
M. Roney, Naval Material Command

1979 IEEE International Symposium on EMC '79 CH 13839
EMC Oct. 1979, pp. 340-342
ABSTRACT: The Navy has used the electromagnetic spectrum for many years for communications, detection, tracking and telemetry using radar equipments, and techniques have been developed to deny an enemy the usage of the spectrum and to prevent the enemy from denying use of the spectrum by friendly forces. Planned frequency usage of the three classes of equipments if constrained by: National and international agreements, no mutual interference, mission performance, and equipment capabilities. Two recent developments in Navy spectrum management systems will give both the afloat and ashore community a quantum increase in their management of their communication assets. The principal intent of both systems was the automation of those functions which either involved tedious and rote manual operations or involved complicated computational capability and are therefore often ignored. The creative thought of the system still rests with th communicator. The emphasis was on local, limited scale computational support as opposed to the centralized accessed large scale computer.
INDEX TERMS: Electromagnetic Spectrum, frequency usage, mutual interference, spectrum management.

A Frequency Assignment Algorithm based on a Minimum Residual Difficulty Heuristic

ACCESSION NO. EMCABS 2-80-39

S. Cameron and Y. Wu

1979 IEEE International Symposium on EMC '79 CH 13839
EMC Oct. 1979, pp. 350-354
ABSTRACT: The frequency assignment alogrithm treated in this paper is intended to solve frequency assignment problems that are stated in terms of a list of nets to which frequencies must be assigned, a list of resource frequencies which are available for assignment to the nets, and finally a set of constraint relations that must hold amoung the assigned frequencies. The constraints imposed on a problem are restrictions arising from, for example, EMC considerations, or allocation regulations. The concept of the new assignment alogrithm is as follows: select the requirement that is most difficult to assign amount the as yet unassigned requirements, and whenever a frequency is to be selected for assignment to a requirement select the frequency which will minimize the expected difficulty of the remaining assignment problem. The major innovation reported here is the use of the minimum residual difficulty heuristic for the selection of the frequency as well as the requirement to be next assigned.
INDEX TERMS: Frequency assignment, algorithm, EMC considerations, computer aided.

Influence of Ground Reflection in Open Site Measurements of Broadband Interference

ACCESSION NO. EMCABS 2-80-40

T. Dvorak, G. Meyer
Inst. of High Frequency Electronics, Fed. Inst. of Technology
1979 IEEE International Symposium on EMC '79 CH 13839
EMC Oct. 1979, pp. 369-374
ABSTRACT: Various factors influencing the propagation of metric waves in the presence of ground are discussed with special regard to the zone of field oscillations near to the source. Theoretical considerations are illustrated by computer-generated graphs showing how the received field depends on polarization, distance, frequency, soil parameters, antenna height and vertical directivity. In conclusion the impact on radiated measurements is considered and the reasons for discrepancies in vertical measurements commented.
INDEX TERMS: Propagation, metric waves, ground, antenna height, radiated measurements, vertical measurements.

A Rationale for Susceptibility Limits for Commercial Digital Control Equipments

ACCESSION NO. EMCABS 2-80-41

M. J. Frazier and J. J. Krstansky, IIT Reserach Inst.
R. Liebl and D. E. Pridmore, Johnson Control, Inc.
1979 IEEE International Symposium on EMC '79 CH 13839
EMC Oct. 1979, pp. 405-412
ABSTRACT: Digital control and computing equipment which must operate in the industrial and commercial segment may be subject to a wide variety of interference of electromagnetic origin. There are no widely accepted or formal test procedures and limits that are used by the community to insure the compatible operation of such equipment. However, there are two standards that exist and specify susceptibility testing procedures and limits, that are more or less applicable to the present problem, and which can be used as guidance. The first is the Military Stds. of the 461-462-463 series. This standard set is applicable for most military procurements, and is sometimes imposed on non-military government procurements or electronic equipment. This standard is not specifically tailored to digital control equipment. More recently, the FDA has published a voluntary standard applicable to medical equipments that are used in hospitals. The limits used in this standard were based on representative measurements made within hospital facilities, as well as engineering judgement.
INDEX TERMS: Digital control, electromagnetic interference, susceptibility testing.

Quasi-Peak-to-RMS Voltage Conversion

ACCESSION NO. EMCABS 2-80-42

James H. Cook
IIT Research Institute/ECAC
IEEE TRANS EMC, Vol. EMC-21, No. 1, pp. 9-12, Feb. 1979

ABSTRACT: A technique is presented by which the conversion between quasi-peak and rms voltage levels may be made for any noise process for which the relative amplitude probability distribution is known. The technique is not exact, since it requires that the time waveform of the quasi-peak voltage be constant. However, the resulting error seems to be small for many cases. Several results obtained using the techniques are given and compared with measurements. An analysis is also presented of the effect of the constant quasi-peak voltage requirement on the error.

INDEX TERMS: Quasi-peak, rms, APD.

Civilian EMC Standards and Regulations

ACCESSION NO. EMCABS 2-80-43

M. Nihat Yazar
Department of Communications of Canada
IEEE Trans EMC, Vol. EMC-21, No. 1, pp. 2-8, Feb. 1979

ABSTRACT: EMC activities in the civil sector are evaluated through the analysis of some of the existing EMC standards and regulations. The evaluation shows that these documents could be improved in the area of the immunity of electrical/electronic equipment. Anticipatory requirements in order to improve EMC activities in management, engineering, scientific, and policy areas are presented. The essential components of an effective and efficient enforcement system are indicated.

INDEX TERMS: EMC standards, EMC regulations and civil sector.

Experimental Characterization of Multiconductor Transmission Lines in Inhomogeneous Media Using Time-Domain Techniques

ACCESSION NO. EMCABS 2-80-44

A. K. Agrawal, H. M. Fowles, and L. D. Scott

IEEE Trans EMC, Vol. EMC-21, No. 1, pp. 28-32, Feb. 1979

ABSTRACT: An effective method for the time-domain characterization of lossless multiconductor transmission lines with cross-sectionally inhomogeneous dielectrics is presented. Lines of this type are characterized by multiple propagation modes having different velocities. Time domain reflectometry is used to obtain the characteristics impedance and the modal velocities of the line. A pulse or step-function response of the line is used to obtain the modal amplitudes which, in turn, determine the velocity matrix. The appropriate multiconductor transmission-line equations are solved to obtain the per-unit-length inductance and capacitance matrices in terms of the measured characteristic-impedance and velocity matrices. The method is concise and complete and identifies the propagation modes in a way that permits direct physical interpretation of the results. The time-domain experimental results for a four-conductor transmission line are presented and are found to be in good agreement with independent frequency-domain measurements.

INDEX TERMS: Multiconductor transmission lines, inhomogeneous media, experimental, time-domain techniques.

The Analysis & Identification of Flux-Induced Voltage Transients on Low-Loss Transmission Lines with Application to the Lightning-Transient-Analysis (LTA) Problem

ACCESSION NO. EMCABS 2-80-45

William J. McCormick
Wright State University
IEEE TRANS EMC, Vol. EMC-21, No. 1, pp. 13-19, Feb. 1979

ABSTRACT: One of the acknowledged lightning threats to aircarft is the induction threat in which a lightning-induced fuselage skin current inductively or capacitively flux couples through small dielectric "holes" or apertures in the fuselage onto internal avionics cabling. In order to optimize the circuit protection, it is necessary to identify both the nature and location of the flux excitation. Using standard capacitorbank LTA testing, this paper advances a linear-system-identification technique, based on the impulse response, that will define both the nature and location of the dominant excitations. The technique is then successfully applies to the identification of the Yaw Damper Circuit of the USAF F-111.

INDEX TERMS: Low-loss transmission lines, voltage transients, lightning-induced, aircraft, analysis, identification.

Scattering Characteristics of VHF/UHF Television Broadcasting Waves by Overhead Power Transmission Conductors

ACCESSION NO. EMCABS 2-80-46

K. Takeshita, S. Takeshita, and H. Hashimoto
IEEE TRANS EMC, Vol. EMC-21, No. 1, pp. 33-40, Feb. 1979

ABSTRACT: The paper analyzes the scattering characteristics of VHF/UHF television broadcasting waves wnich are obliquely incident of finite length multi-bundle conductors of overhead power transmission lines.

Numerical calculations were made for four-bundle conductors currently employed in Japan; the attenuation, directivity, and frequency characteristics were clarified.

To verify the theoretical results, 1: 40 scale (for VHF) and 1: 10 scale for (UHF) model experiments have been carried out. Agreement between the theoretical results and the measurements was reasonably good.

INDEX TERMS: Power Transmission, overhead conductors, VHF/UHF TV waves, scattering.

Experimental Characterization of Multiconductor Transmission Lines in the Frequency Domain

ACCESSION NO. EMCABS 2-80-47

A. Agrawal, K. M. Lee, L. D. Scott, and H. M. Fowles
IEEE TRANS EMC, Vol., EMC-21, No. 1 pp. 20-27, Feb. 1979

ABSTRACT: Although a number of papers have been published on the experimental characterization of multiconductor transmission lines, they are limited to the time domain for lossless multiconductor lines in homogeneous media. This paper presents a method for the characterization of multiconductor transmission lines in inhomogeneous media. The experimental technique for the measurement of multiconductor line parameters is presented and the appropriate multiconductor line equations are solved to obtain these parameters. The experimental method involves only the short-and open-circuit impedance measurements for different configurations. The experimental results for a four-conductor line are found to be in good agreement with computed results and a low-frequency lumped model.

INDEX TERMS: Multiconductor transmission lines, inhomogeneous media, experimental, frequency domain.

Synthetic-Aperture Radar Based on Nonsinusoidal Functions: II-Pulse Compression, Contrast, Resolution, and Doppler Shift

ACCESSION NO. EMCABS 2-80-48

Henning F. Harmuth
IEEE TRANS EMC, Vol., EMC-21, pp. 40-49, Feb. 1979

ABSTRACT: The first of this series of papers derived geometric relations for a synthetic aperture radar that used either a moving antenna or stationary antenna arrays in one or two dimensions. This second paper deals with additional concepts that are required to make the geometric relations pratically useful. The sections on pulse compression and contrast carry these well-known concepts from sinusoidal to certain nonsinusoidal functions. The section of resolution shows that the resolution can be increased either by increasing the signal bandwidth Δf or the signal power P, and that this exchange is possible according to the very favorable relation $\Delta f P 1/2 = \text{constant}$. Very little mathematics is used to derive this result which is contrary to experience although fully in line with basic theory; a simple derivation helps one avoid hidden assumptions and other sources of mistakes. The section on Doppler shift shows that this effect can be used to separate moving targets from stationary ones; such a discrimination is not possible with the conventional synthetic-aperture radar since it used the Doppler shift to produce the synthetic aperture.

INDEX TERMS: Synthetic-aperture radar, pulse compression, contrast, resolution, nonsinusoidal electromagnetic waves, Walsh functions, sequency theory

A Comparison of Theoretical & Experimental Video Compression Designs
Harry W. Jones, Jr.
COM-CODE, Inc. and consultant to NASA-Ames Research Ctr.
IEEE TRANS EMC, Vol. EMC-21, No. 1, pp. 50 - 62, Feb. 1979

ACCESSION NO. EMCABS 2-80-49

ABSTRACT: This paper compares theoretical and experimental picture compression designs, for images processed in 8 x 8 blocks using the Walsh-hadamard transform (WHT). The optimum picture compression design is well known, if the mean-square error (mse) is used as the measure of distortion, and if it is assumed that the video process is a stationary first-order Markov process with a Guassian distribution. This theoretical design gives useful results when the transform processing is done on full pictures, but gives inferior results (relative to empirical design) when transform processing is done on small 8 x 8 blocks. The use of non-Gaussian distributions for the transform components fails to improve this poor performance, which is due to the nonstationary nature of the video process. An experimentally based design procedure, which considers nonstationarity, yields significantly improved MSE and subjective performance.

INDEX TERMS: Video compression designs, compression, theoretical, experimental.

Scattering Characteristics of VHF Television Broadcasting Waves by Steel Towers of Overhead Power Transmission Lines
Sakae Toyada and Hiroshi Hashimoto

IEEE TRANS EMC, Vol., EMC-21 No. 1, pp. 62-65, Feb. 1979

ACCESSION NO. EMCABS 2-80-50

ABSTRACT: To determine the scattering characteristics of VHF television waves by steel towers for power lines, waves having a frequency 40 times that of television waves were radiated on a 1/40 scale model tower. The reflection characteristics were measured by rotating the model tower and changing the receiving point.

A 50-cm by 50-cm metallic reflector was positioned at the model tower when measuring the reflection field and comparison was made of the receiving power from the model tower and that from the metallic reflector. The results showed that the maximum value of the reflection field attenuated in approximate proportion to the distance between the tower and the receiving point. This fact led to an experimental formula for determining the maximum value of the reflection field when the wave is incident upon the tower at a uniform strength in the vertical direction.

INDEX TERMS: VHF TV, wave scattering, overhead power lines.

Applicability of MIL-STD-449D & MIL-STD-469 to Modern Radar Systems
Samuel J. Caprio

IEEE TRANS EMC, Vol., EMC-21, No. 2, pp. 75-79, May 1979

ACCESSION NO. EMCABS 2-80-51

ABSTRACT: MIL-STD-449D and MIL-STD-469 are not completely applicable to modern radar systems, specifically those with an electronically scanned antenna. Some of the requirements most applicable to electronically scanned radar systems are identified and some suggestions for their revision are offered. The need for improved definitions along with suggested definitions is presented.

INDEX TERMS: EMC Standards, radar, electronically scanned, measurement requirements.

PREDICTION OF CROSSTALK INVOLVING TWISTED PAIRS OF WIRES-PART II: A SIMPLIFIED LOW-FREQUENCY PREDICTION MODEL
Clayton R. Paul and Jack W. McKnight
University of Kentucky; Bell Telephone Laboratories
IEEE TRANS EMC, Vol. EMC-21, No. 2, pp. 105-114, May 1979

ACCESSION NO. EMCABS 2-80-52

ABSTRACT: In a companion paper (1), a transmission-line simulation model for predicting crosstalk involving twisted-wire pairs was developed. In this paper, a simplified model valid for low fequencies is developed. The total coupling is separated into inductive and capacitive coupling contributions. The capacitive coupling contribution is shown to provide a "floor" which limits the effect of reducing the inductive coupling achieved by twisting a wire pair for the unbalanced case and is zero for the balanced case.

INDEX TERMS: Crosstalk, twisted-wire pairs, low-frequency model.

ELECTROMAGNETIC WAVE PROPAGATION ALONG A PAIR OF RECTANGULAR BONDED WIRE MESHES
David A. Hill
Inst. for Telecommunication Sciences, National Telecommunications and Information Admin.
IEEE Trans EMC, Vol, EMC-21, No. 2, pp.114-122, May 1979

ACCESSION NO. EMCABS 2-80-53

ABSTRACT: A mode equation is derived for propagation between a pair of rectangular wire meshes, and numerical results for the propagation constant of the quasi-TEM mode are presented. An approximate method based on averaged boundary conditions is found to agree, if the mesh dimensions are small and the mesh separation large. The field distribution of the quasi-TEM mode is also examined.

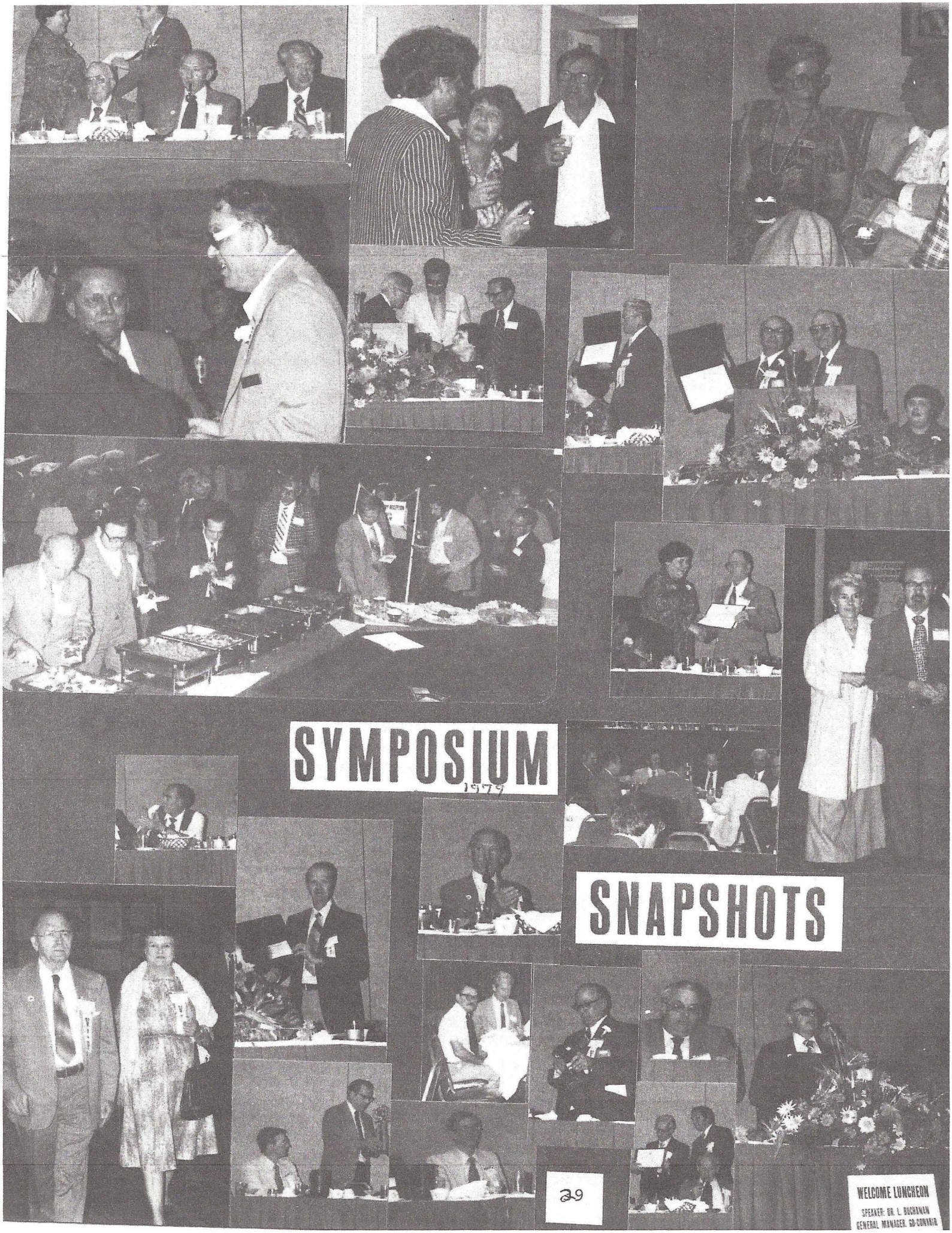
INDEX TERMS: EM propagation, rectangular bonded wire-mesh pair.

COMPATIBILITY OF SPREAD-SPECTRUM SIGNALS WITH NARROW-BAND FM RECEIVERS IN VHF MOBILE NETWORKS
T. J. Dvorak
Federal Institute of Technology Zurich
IEEE TRANS EMC, VOL, EMC-21, No. 2, pp. 131-136, May 1979

ACCESSION NO. EMCABS 2-80-54

ABSTRACT: The feasibility of a tentative introduction of the spread-spectrum (SS) scheme in VHF mobile bands on an area-and frequency-sharing basis with existing FDM service is investigated. It is shown that compatibility can be attained only for cellular SS networks with small cell area. The approach outlined may be useful in the treatment of general compatibility problems involving variable geometry of the transmitter/receiver configuration.

INDEX TERMS: Spread-spectrum techniques, VHF mobile communications, receiver technology, VHF propagation.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