# Electromagnetic Compatibility Society Newsletter



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# EDITOR: ROBERT D. GOLDBLUM

# A MESSAGE TO THE IEEE EMC SOCIETY FROM WILLIAM G. DUFF President Elect

I am writing this article as incoming president for the IEEE EMC Society to express some of my ideas concerning my role and the role of the EMC Society and its various committees. First, I would like to say I am honored to be elected President of the Society and I will serve the Society to the best of my ability. We are very fortunate to have very capable and dedicated members serving the Society as officers, members of the board of directors and committees; and the entire EMC community is indebted to these individuals. I will be counting heavily on these individuals to help me accomplish my goals during my term of office.

I feel that as President of the EMC Society, I have a responsibility to the entire EMC community and to the IEEE. As far as the EMC community is concerned, some of the more visible services of the IEEE EMC Society are provided by the Newsletter, Transactions, and Symposia. I think that our publications and Symposia are already of a high quality and I will try to maintain this. Also, I will look for ways of further improving our service in this area. At the last meeting of the Board of Directors a proposal to improve the quality of the Newsletter was approved. Hopefully, we will all notice the improvements in this issue. If any of you have suggestions as to how we may further improve our service in this area, please forward them to me.

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Another way that the EMC Society serves the community is through our Standards Activity. This is potentially a very valuable function and I hope that we will be able to increase our activity in this area in the next year.

Last but not least, the EMC Society serves its members through the various Chapters around the world. I hope to be able to improve communications between the Chapters and the EMC Society Board of Directors, to be more responsive to the needs of the Chapters, to provide more of a service to the Chapters, and to receive more guidance and support from the Chapters. I will need help from all of you to accomplish this.

As far as the IEEE is concerned, I plan to personally attend or to appoint a representative to attend the IEEE Technical Activities Board Meetings and any other IEEE meetings that are pertinent to the EMC Society.

In the final analysis the success of any organization is determined by its members. The EMC Society is fortunate to have a number of very dedicated, hard working volunteers. But we would be able to increase our accomplishments if more of our members would become active and be willing to serve the community. Also, we would increase the strength of our Society by increasing our membership. Therefore, I would like to issue a plea to all of you to contact me or one of the appropriate members of the Board of Directors if you are willing to serve the Society. Also, I would like to ask each of you to try to get a coworker or friend to join our Society. We as a Society would be able to accomplish so much more if all of you contribute.

Thank you for providing me the opportunity to serve the Society in this manner and please let me know how this Society can better serve you.

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# **EDUCATION COMMITTEE NEWS**

I have received very little information on EMC related courses scheduled for the spring of 1982. The following are the only ones that I have information on.

McGraw-Hill Seminar Center is presenting a course on *Controlling Electromagnetic Interference* on January 19-20 in San Francisco. The seminar leader is Ernest R. Freeman. For more information contact McGraw-Hill at 212-687-0243.

The Center for Professional Advancement is sponsoring a course *Electromagnetic Compatibility Engineering* to be presented on January 25-28 in Chicago. The instructors will be Henry Ott and Don Heirman. For more information contact the Center at 201-249-1400.

A course on *Fundamentals of Numerical Solution Methods in Electromagnetics* will be presented March 15-19 by The University of Mississippi. For more information contact Mark Tew at the university on 601-232-7231.

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

> Henry Ott Chairman, EMCS Education Committee 201-386-6660

### FCC RECEIVES dB AWARD

The dB Society has voted unanimously to award its Traveling Trophy for the year 1982 to the Federal Communications Commission for its "Outstanding International Contribution to the Field of Electromagnetic Compatibility." The Traveling Trophy is awarded yearly to an outstanding individual, company or professional organization for technical contributions to EMC endeavors. The IEEE was the 1977 recipient of the award. For the year 1978, the Air Force Systems Command was the recipient. In 1979, the Naval Air Systems Command was the recipient. The North Atlantic Treaty Organization (NATO) was awarded the trophy for 1980 and it was on display at NATO Headquarters in Brussels for that year. The award presently resides with the SAE in Warrendale, PA for 1981.

The dB Society is a fraternity of eminently qualified engineers devoted to excellence in the field of Electromagnetic Compatibility (EMC). Its charter fosters the conservation of the electromagnetic spectrum, promotes the introduction of young engineers into the EMC field, and provides financial assistance to engineering students in pursuit of studies related to our field.

# 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 ITT Research Institute ECAC—P.O. Box 1711 Annapolis, MD 21404
ASSOCIATE EDITOR:	(EMCS Education Committee) Henry Ott Bell Laboratories Room 2C-248A Whippany, NJ 07981

# HEIRMAN'S FAREWELL MESSAGE



DONALD N. HEIRMAN

It seems that it was only a few months ago that I was elected your Society's President. But it has been over two years ago and the Bylaws state that I must turn over the reigns. I do this with mixed emotions. I first feel that I could have accomplished more and time ran out. But then again there have been accomplishments that I am especially proud.

First, the Society membership has steadily grown in the past two years to close to 2000 members. The complexion of the Board of Directors has also changed to keep pace and reflect the new interests. In particular, 13 of the present 23 Board members are new faces who were not on the Board before I took office. Of these 13, 5 have progressed to the Board's Executive Committee. Similarly, 10 standing committee chairmen are in their positions for less than two years. These changes were not made just to make changes, but to reflect your current needs in order to keep our Society responsive to new ideas and approaches. The 50 percent increase in the past annual Society vote for new Board members over previous ballots further suggests your approval of these changes.

The attendance at our past two symposia which each exceeded predicted attendance by close to 50 percent also indicates that we are meeting your needs and expectations during the past two years. That fact also appears in the increased activity in our standards area where in the past two years we have taken positive action on updating and publishing several key standards. Two recent standards on electromagnetic ambient site surveying and measurement procedure for a field disturbance sensor have highlighted this work. There is still much to do and we need continued effort in this area and more active participation from you our Society membership.

In the area of grass root chapter activity we have truly become an international organization with the introduction in 1980 of the Japanese Chapter—the first outside the United States. In 1981, we added the new Littleton (Denver) chapter and the final paperwork for the central Texas chapter is now at IEEE Headquarters. Our technical and standing committees have continued to provide significant contributions to the Society, especially in organizing and offering workshops and panel sessions at our past two symposia. An important committee reactivated in the past two years was that concerned with EMC education. One highly visible output is a video tape on an "Introduction to EMC" which will be available by mid-1982. The response to the first showing at our 1981 symposium was overwhelmingly positive.

This type of response was also enjoyed by our special issues of the EMC Transactions. Added to the excellent regular quarterly issues which contained more application topics as well as a first time introduced editorial review and summary, the Transactions made another outstanding contribution. The Board in November also approved even further improvements in the Newsletter to allow more current information to be published. Along the lines of disseminating more information, we have published our first committee directory which contains key contacts to assist you in becoming more active in the Society. Each Society member received a copy in the mail.

Hence as you can see, we have made progress in the past two years. I would like to thank my Board members, standing, and technical committee chairpersons, symposium organizers, Transactions and Newsletter editors and all those members that made my two years an interesting and rewarding experience. I feel that they did an outstanding job in helping me to make our Society as strong as ever. I welcome the new President—Bill Duff—and offer him and the Society my services in whatever way I can in the future. Please help Bill keep our Society where it is today—a strong and highly respected technical contributor to its members and to the Institute.

> Donald N. Heirman President, EMC Society 1980-81

# **EMC PERSONALITY PROFILES**



**GEORGE H. HAGN** 

The EMC Personality Profile for this issue is for George H. Hagn. George received a Bachelor of Science in Electrical Engineering in 1959 and a Master of Science in Electrical Engineering in 1961 from Stanford University.

Upon graduation in 1959 George joined Stanford Research Institute (SRI) where he is currently the program director of the Telecommunication Sciences Center, Computer Science Technology Division, heading a group with a technical staff in Arlington, Virginia and Manlow Park, California. While at SRI, George has been involved in the variety of projects related to radio communications, spectrum management and EMC. Some of the more interesting and significant projects that George has been involved in include:

- Measurement of scattering of VHF waves from earth's surface
- Microwave diffraction and pit-shielding measurements and analysis
- Airborn antenna pattern measurements at HF, VHF, UHF, and SHF
- Analysis of ionospheric propagation, including nuclear effects
- Measurement and modeling of electrical parameters for forests and ground
- Design of communications/electronics R&D laboratory for Thailand (1962)
- Planning of technical research program for Thailand laboratory (1963-68)
- Study of satellite communications
- Study of strategic and tactical communications systems
- Test and evaluation of communication systems
- Measurement and analysis of atmospheric and manmade radio noise
- Study of U.S. radio-frequency monitoring and coordination

by William G. Duff



- Planning of U.S. government spectrum measurement capabilities
- Nap-of-the-earth (NOE) helicopter communications
- Simulation of communications effectiveness (including EW) using SCORES
- Study of strategic and tactical C<sup>3</sup>-1 requirements and Systems

During his career, George has authored or coauthored more than fifty technical reports, twenty papers in technical journals and has presented more than forty papers at technical meetings. Some of his more notable publications include, Chapter Seven, "Man-made Noise" of the *Handbook of Atmospherics*, H. Voland, CRC Press, 1981, and "A Survey of Frequency Coordination and Monitoring in the United States," which appears in *Spectrum Engineering the Key to Progress* (JTAC-IEEE 1968). George has also served as editor of *Review of Radio Science* and he was a guest editor for the *IEEE EMC Transactions*, special issue on Spectrum Management.

George has been very active in the IEEE EMC Society. He served as chairman of the Washington, D.C. EMC Chapter and while he was chairman the Chapter won two successive Chapter of the Year awards. He also served on committees for the 1976 EMC Symposium in Washington D.C. and the 1980 EMC Symposium in Baltimore, Maryland. He served as chairman for the EMC Society Government Liaison Committee.

George has also been very active in the International Union of Radio Science (URSI). He founded and chaired the US URSI Committee Eight on Radio Noise of Terrestrial Origin which became URSI Committee-E on Electromagnetic Noise and Interference. He is currently Chairman of the International URSI Committee-E and Vice Chairman of the US National Committee (USNC) of URSI. He has worked hard to establish a positive relationship between URSI and the IEEE EMC Society serving as the URSI liaison to the EMC Society Board of Directors and arranging for EMC Society membership on USNC-URSI. As a result of George's activities in this area, there has been considerable cooperation to date by the URSI Committee-E at the IEEE 1976 and 1980 Symposia and there has been participation by the IEEE EMC Society at USNC-URSI meetings in 1977, 1979 and 1980.

George lives with his wife and two children in Annandale, Virginia. He is a Cubmaster for Pack 50 in Annandale and when George is not busy with his work or other activities, he enjoys fishing, hunting, hiking, tennis, golf, swimming and camping with the family.

# CHAPTER CHATTER



#### by Charles F.W. Anderson

#### **Baltimore/Annapolis**

The Chapter opened its 1981/82 meeting year with a talk by William Cook on the subject of EMC and the Geostationary Satellite Orbit. Mr. Cook is on the staff of the Deputy Under Secretary of Defense, C<sup>3</sup>I. He headed the US delegation during recent satellite coordination meetings with the USSR, France and UK. His presentation featured discussion of current and future crowding of the orbit and its meaning for the US. The meeting was held on November 24th at the IIT Annapolis facility, preceded by a dinner at Fred's Restaurant in Parole, MD. Thanks to Bill Tate for the above report.

#### **Central New England**

At the Chapter's November 4th meeting, J. Shekelton of Sanders Associates gave a talk titled, "A New Methodology for EMC and Microelectronics." The speaker introduced a new probabilistic approach to EMC in systems using digital microcircuits. The meeting was attended by about ten people and many questions were asked of the speaker. Plans are being firmed up for future meetings, including one on radio noise problems to be held in May. John Clarke rates the "thank you" for this contribution.

### Los Angeles

Chris Kendall (Chris Kendall Consultants) addressed the Chapter meeting on October 15th. His topic was "FCC and VDE Open-Field Testing." Chris' organization recently received FCC recognition of its open-field radiated emissions test site. He discussed FCC and VDE site requirements and implications. The November meeting featured Hank Smith (President of H & S Industries), speaking on "Electrostatic Discharge Awareness & Control."

### Mohawk Valley

The Chapter sponsored the "First Mohawk Valley Symposium on EMC" on November 12th. Featured were invited papers on electronically-tunable filters, VCO technology, interference cancellation, EMC in microelectronics, EMC and computers, PC board EMC, non-linear circuit analysis and the ARC-164. Your Column Editor has heard that this event was quite successful—congratulations to Carmen Paludi, John Dobmeier and their committee on a fine job!

## New Jersey Coast

On November 24th, the Chapter (joint with VT) held a luncheon meeting at which the speaker was Samuel Segner, Chief of the C3 Survivability and Spectrum Management Division of CENSEI at Fort Monmouth. His presentation was based on the paper, "The Army Tactical Frequency Engineering System (ATFES) Pilot System: A User/ Developer Interactive Program," which he gave at the September meeting of the local AFSCEA chapter. (The November issue of the Chapter's Newsletter was the first of Volume 12 of that publication-it just doesn't seem that long ago that your Column Editor was struggling to get No. 1 of the first volume published!). The Chapter celebrated the holiday season with a cocktail party scheduled on December 15th. The December issue of the Newsletter contained a saddening item, in that it was announced that John Boyadjian had died. He was one of the real old-timers in EMC/EMI, and was well-known to many of us in EMCS.

### San Diego

The Chapter held a meeting on November 11th with William H. (Hal) Grigsby of the FCC's San Diego Field Office as the featured speaker. The topic was "The Role of the FCC in RF Electromagnetic Compatibility." His presentation covered such areas as radio laws and regulations, frequency allocations and assignments, spectrum management, FCC Field Operations Bureau and some special cases of interference (receiver-originated, transmitter-originated and of other origins).

## Tokyo

Professor Sato and his colleagues continue to hold their research meetings. Topics covered include such items as cable sheath shielding against lightning, effects of 60-Hz HV on plants, hyperthermia techniques, computer system protective shielding and high-speed sliding contact noise investigations. Professor Sato keeps me posted on the activities, and Ed Bronaugh is, I believe, beginning to receive abstracts of the papers (see the Abstracts section of the Fall Newsletter).

# Book Reviews



by Jim Hill, EMXX Corporation.

This month, we review a little book that we were introduced to at a workshop conducted by Don White at the 4th Symposium and Technical Exhibition on EMC at the Swiss Federal Technical Institute at Zurich. The subject was covered in an afternoon; but, I understand that there is a more extensive coverage of the subject in one of the current Don White courses. It is a subject of vital interest now that the FCC has established emission limits for various types of equipment incorporating printed circuit boards. This little book serves as an introduction to an important printed circuit board design consideration.

"EMI Control in the Design of Printed Circuit Boards and Backplanes" BY Donald R.J. White Publisher, Don White Consultants, Inc. P.O. Box D, Gainsville, VA 22065 141 Pages, \$10.00

This little book was prepared as the textbook for a course on EMI control in the design of the subject printed circuit boards and backplanes. There is a dearth of information on this subject in the literature so the author has brought together that information which is available from the trade journals and from manufacturers' literature. It does not treat the subject of printed circuit board design on a broad scale; but, rather narrows in on those aspects of design which must be considered in the control of EMI. It is claimed to be the first handbook of its kind which is focused on the effects of EMC and EMI in the design and layout of printed circuit boards. It covers both analog and digital design, with emphasis on the high-speed logic family, such as Schottky and emitter-coupled logic.

The book is limited in scope to the consideration of commonimpedance coupling resulting in voltage drop from power supply, return rails, and interconnecting leads. The problems of radiated field to common-mode coupling or differentialmode coupling and crosstalk are referred by the author to his handbook, "EMI Control Methodology and Procedures." The subject is organized into four chapters. Chapter One is an overview of printed circuit boards and backplanes. Chapter Two deals with signal traces and power bussing. Chapter Three discusses wirewrap and printed circuit board layout. Chapter Four addresses EMC considerations in interconnecting boards with backplanes and motherboards. An appendix is included to aid the designer in translating from the time to the frequency domain. Logic designers who have been concerned only with the time domain now must consider the frequency domain because the legal requirements of the FCC (and the VDE, if the product is to be marketed in West Germany) require that emission levels be below certain specified limits. These specifications define the allowable powermains conducted and overall radiated emission limits as a function of frequency.

The text deals with the advantages and disadvantages of various types of boards including the wirewrap, multi-wire, multipac, and multilayer boards. Illustrations are well done and pertinent to each topic discussed and the tables are helpful in dealing with the design problems which are discussed. A very fine feature of the book is the use of illustrative examples for each type of problem. These include, in each case, a detailed method of solution. References are included with three of the chapters so that the reader may do further exploration of this subject. In addition, there is a rather comprehensive index.

One must consider that this book is a primer on a rather limited subject. It considers only common-impedance coupling in printed circuit board design. EMI control involves more than this limited scope, so it is well to bear this in mind when considering purchase of this book.

# NOVEMBER 1981 BOARD OF DIRECTORS MEETING HIGHLIGHTS

Another well attended meeting of our Board of Directors was held in Chicago on 10 November. Only 7 of the 23 Board members did not attend. Items of particular interest discussed and acted upon at the meeting include the following:

1. The treasury remains healthy with an uncommitted balance of \$110,000.00 which is well within the Institute guidelines. It was decided that future budget reports will contain where practical an indication of funds expended to date and those unspent. This will aid the Board in determining in near real time areas where the expenditures are not tracking the budget and hence where corrective action should be taken.

2. A significant upgrade in the appearance of our EMC-S Newsletter was approved. As soon as it can be implemented, the Newsletter will use coated stock, color in the masthead and typesetting. The additional news density and lighter paper will help offset these costs and improve the Newsletter use to the Society membership.

3. Plans for our 1982 Symposium continue. The Symposium will be held on September 8-10 which is a Wednesday through Friday at the Marriott Hotel in Santa Clara, CA. For further information, call Andy Nalbandian on (408) 742-5336. We expect over 400 attendees for the Labor Day week. Requests have been received for symposia beyond 1986. The Board felt that it is premature to select sites more than 5 years in advance.

4. A proposed symposium guideline revisions were discussed by the Board who strongly indicated that a continuing control of symposia was necessary to ensure uniformity among symposia. Such areas as paper review, session sponsorship, conflicting non-EMCS meetings were major concerns. Copies of the proposed guidelines can be secured from the Society Secretary, Leonard Thomas on (202) 526-2545.

5. We have received word from IEEE Headquarters that our new plan for involvement with international symposia is acceptable with only minor questions on the way by which conference records are to be handled. The new "cooperating" involvement has been exercised with the 1982 Polish Wroclaw Symposium, subject to their agreement. Similar negotiations are under review with the Swiss symposium in Zurich. For further details, contact Bill Duff on (703) 642-4049. 6. Standards activity continues with balloting due on the revised IEEE Standards 213 and 214 which deals with the measurement of conducted emissions from FM/TV in the band 0.3-25 MHz. Bud Taggart also reports that volunteers are needed to revise standards on minimizing interference from RF heating equipment, high performance shielded enclosures, signal grounding practices, and home appliance EMI control. Contact Bud on (303) 497-3462.

7. Technical committee participation at the 1982 EMC Symposium were outlined by Herb Mertel (714) 578-1444. Several workshops are planned with an especially interesting one on open site measurements the entire afternoon of the first day. In addition, the technical committees will be meeting at night to avoid session conflicts. For more details contact Herb.

8. The video tape on "Introduction to EMC" is scheduled for availability by mid-1982. Response to date indicates widespread interest according to Hank Ott (201) 386-6660. A fellowship for instructors for EMC graduate university courses is also under study.

9. The Central Texas (Austin-San Antonio) chapter formation is moving ahead with Headquarters reviewing the petitions. Those EMC-S members in the area should contact Ed Bronaugh on (512) 684-5111, Ext. 2792. The Chapter of the Year for 1980 and 1981 will be evaluated when the response to the information requested from each Chapter chairman indicated in the Committee Directory is returned. Those not returning the ballot will be eliminated from consideration. Gene Knowles is tasked to determine the winners for 1980 and 1981. Contact him on (206) 575-5280.

10. Membership development is moving ahead especially in seeking Senior member upgrades. Contact Jim Toler on (404) 894-3964.

11. Jim Hill announced his resignation from chairing the Awards/Fellows Committee. We want to thank Jim for all his efforts over the past two decades in this area. We now need a volunteer. Contact Bill Duff.

12. The Constitution and Bylaws are being revised and updated. Areas of interest include Chapter chairman formal participation on Board matters as well as a proposal to turn over all committee chairpersons and elected Board members every three years unless otherwise indicated in the Bylaws. Comments should be addressed to Hugh Denny on (404) 894-3535.

13. We still need a volunteer to serve as our intersociety relations chairperson. The duties include serving on technical program committees for other Society conferences so that an EMC-S session can be included. Call Gene Knowles for information. The Board reviewed and endorsed the proposed IEEE position paper on Biological EM Hazards. Joe Chislow provided inputs to the document (201) 949-6600. Volunteers are needed for positions for our Energy Committee representative to the IEEE technical activities Board (TAB). Sully Sullivan has requested that he step down after serving many years and contributing excellent inputs and feedback to the Board. Call Gene Knowles if you are interested. By the way, CSIT is now the Society for Social Implications of Technology. Bob Brook explained the details (516) 938-6991.

14. Broadband measurement activity needs volunteers. A recent FCC Docket on Spread Spectrum again raised the interest of the Board to fulfill an outstanding obligation to provide EMC-S inputs to the Chief Scientist of the Commission.

15. Ed Bronaugh was confirmed by the Board to fill the unexpired term of Carl Allen who retired in August. Ed's term extends through 1983.

16. The EMC-S Committee Directory is out. It has already been viewed as the best source of names and activities within the Society. To get free spare copies while they last, call Art Wall on (202) 653-8247. Why not use the copies as a membership development tool? Jim Toler also has spare copies.

17. New Society officer elections were held. The results are contained in a separate news article. There were at least 2 candidates for each of the 8 elected officers. The Board deliberated well over an hour using secret balloting procedures. We feel that the new officers and technical directors are the best we could have. Please support them.

I hope that you all had a happy holiday season and that you find the time in the new year to help support your Society and its officers and chairpersons in 1982. Good luck.

Donald N. Heirman Outgoing President 1981

# SOCIAL IMPLICATIONS OF TECHNOLOGY a new Society in IEEE

The Executive Committee of the IEEE has approved the formation of a Society on Social Implications of Technology (SSIT). The Society will supersede the Committee on Social Implications of Technology and is now enrolling members for 1982. It will work with the other Societies of the IEEE with the objective of providing:

- An open forum for the interchange of ideas related to the technology/society interface.
- A mechanism for focusing relevant ideas developed by members of IEEE.
- Means to encourage and support social responsibility and a professional approach to the practice of engineering.

The Society will:

- Develop programs to explain technology to society through its publication, and through its Chapter and national level meetings.
- Foster communication among engineers and between engineers and society on needs and concerns of society and responsibility of technology.
- Encourage and publish articles related to the social implications of technology.
- Recognize service in the public interest in the profession by the establishment of appropriate awards.

SSIT intends to publish scholarly articles on the subject of engineering ethics. It is not, however, the sole IEEE body given responsibility for the development of ethical standards for electrical and electronics engineers or for IEEE members. Positions taken by SSIT will be submitted to the IEEE Technical Activities Board (TAB) and other major Boards under existing policies and procedures for approval as IEEE position papers.

# SSIT Membership:

Joining SSIT provides you with the opportunity of participating in, as well as keeping abreast of, the ever expanding society/technology relationship.

You can join this important new Society by enrolling with your 1982 dues payment; the SSIT fee is six dollars. If you can become active by serving on one of the committees either on a Chapter or national level, or would like more information, please write and send your name, address, and telephone number to:

> IEEE Technical Activities Attention: SSIT Interim AdCom 345 East 47th Street New York, NY 10017

# EMC SOCIETY MEMBERSHIP NOW INCLUDES 94 FELLOWS

Two society members recently elected Fellows of the IEEE bring the number of Fellows on the membership list of the Society to a total of ninety-four. Ferdy Pierre Maximilien Mayer, President and Director General of Laboratoire d'Electronique et d'Automatique, Grenoble, France was elected to the grade of Fellow for his contributions to the theory, teaching, and practical realization of interference and hazard prevention. Ralph Edward Taylor, Electronics Engineer, Aerospace Technology, Measurement and Instrumentation Systems, Goddard Space Flight Center, National Aeronautic and Space Administration, Greenbelt, Maryland received the Fellow grade for his contributions to electromagnetic interference prediction. Fellow grade is the highest grade of membership in the IEEE and is achieved only be election by the IEEE Board of Directors.

Nominations for the next class of Fellows (1983) should be considered and action taken so that all of the paper work can be completed and received by the IEEE Fellow Committee on or before April 30, 1982.

Any IEEE member, regardless of grade of membership, can act as nominator. In particular, chapter chairmen and present Fellows, because of their knowledge of technical accomplishments of other IEEE members, have a special responsibility to see that "outstanding accomplishments" are recognized. Information on the nomination process and IEEE Fellow nominating kits can be obtained from: Staff Secretary, IEEE Fellow Committee, 345 East 47th Street, New York, NY 10017; Telephone: 212-644-2750. Call A.H. (Sully) Sullivan, Jr. at 301-881-4036, or Jim Hill at 703-451-4619, for questions or help in preparing the nomination.

# EMC ZURICH 1983 CALL FOR PAPERS

The Fifth Electromagnetic Compatibility Symposium and Technical Exhibition will be held from March 8 to 10, 1983. It is sponsored by the Swiss Electrotechnical Association and organized by the Institute for Communication Technology of the Zurich Federal Institute of Technology.

As usual, the program provides for technical sessions and exhibition, workshops, round table discussions, technical excursions and social events. Best papers will receive citations and monetary prizes totalling Swiss Frances 5'000.

English abstracts of approximately 500 words shall be received on or before March 15, 1982 by: EMC 1983 Program Committee, ETH Zentrum—IKT, 8092 Zuerich, Switzerland; Tel: (Dr. T. Dvorak) 411/256-2790, Tlx: 53-178 ethbi ch.

# **MILCOM '82—CALL FOR PAPERS**

MILCOM '82, the 1982 IEEE Military Communications Conference, will be held in Boston, October 17-20, 1982. Theme of the conference is "Progress in Spread Spectrum Communications," and sponsors are IEEE Communications Society, U.S. Department of Defense, AFCEA, and the IEEE Boston Section. Papers oriented toward spread-spectrum communications are being solicited; however, papers concerning other aspects of military communications also will be considered. Both unclassified and classified technical papers will be accepted and published in the Conference Record.

Possible subjects for MILCOM '82 papers include, but are not limited to, the following spread-spectrum topics:

- Spread Spectrum Theory
- Antijam Systems
- Multiple Access
- Synchronization
- Electromagnetic Compatibility
- Satellite-Borne Equipment
- Low Probability of Intercept (LPI)
- Network Control
- Network Modeling
- Data Compression
- Adaptive Antenna Systems
- Software
- Switching
- Operational Exercises
- Broadbanding
- Cellular Radio
- Civil Applications

If you intend to submit a paper, please so inform Dr. Fred W. Ellersick, Communications Div., MITRE Corp., Bedford, MA 01730, by January 1, 1982. Include the topic of the paper and whether it will be unclassified or classified.

Five typed, double-spaced copies of the manuscript and a one-page abstract must be submitted by March 1, 1982, also to Dr. Ellersick. The author's name, address and telephone must be included on the first page. Camera-ready copy will be due by July 5, 1982. For additional details concerning the submission of classified papers, contact Dr. Ellersick, at the above address, or by phoning him at 617-271-3343.

# CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS

A final call for papers is being issued for the Conference on Precision Electromagnetic Measurements (CPEM), to be held at the National Bureau of Standards' Boulder, CO Laboratories from June 28 to July 1, 1982. CPEM is sponsored by the Institute of Electrical and Electronics Engineers, the U.S. Committee of the International Scientific Radio Union, the Union Radio Scientifique International, and NBS.

All papers concerned with electromagnetic measurements will be considered. Papers in the following areas will be particularly appropriate: direct current and low frequency; time domain measurements; time and frequency; antennas and fields,microwaves and millimeter waves; automated measurements; application of microprocessors; component and system metrology; infrared, visible, and ultraviolet radiation; fiber optics; lasers; cryoelectronics; and technical calibration services.

Authors are requested to submit, in English, both a 35-40 word abstract and a 500-1000 word summary ready for printing in the CPEM '82 Digest. The submission should be received at NBS no later than February 15, 1982. Potential authors will need to request an "author's kit" in advance of the February 15, 1982 due date.

Correspondence regarding abstracts and summaries or requests for authors' kits should be sent to: David W. Allan, Technical Program Chairman, CPEM '82, National Bureau of Standards, 325 Broadway, Boulder, CO 80303; Tel.: 303-497-3755.

# EMCS BOD ELECTION RESULTS

At a regularly scheduled Board of Directors meeting of the IEEE EMC Society on November 10th, 1981 in Chicago, the following officers were elected, in accordance with the provisions of the IEEE EMC Society Bylaws, to serve for a one-year term, beginning January 1, 1982:

President -	William G. Duff Atlantic Research Corp. 5390 Cherokee Avenue Alexandria, VA 22314 (703) 642-4049	Vice Pres.	-William H. Parker 18435 Susana Road Rancho Dominguez, CA 90221 (213) 537-4750
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Ralph M. Showers, Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia, PA 19104, (215) 243-8123

# **EMCABS**



EDWIN (ED) BRONAUGH

In this issue we are publishing 36 abstracts. These are abstracts on various EMC topics. We plan to continue publishing abstracts of papers from previous EMC Symposia and from other conferences. The EMCABS committee is composed of the members listed below. By way of introduction to the community, they are listed with their company affiliations.

L.F. Babcock, Bell Aerospace Textron E.L. Bronaugh, Southwest Research Institute R.N. Hokkanen, Naval Training Equipment Center R. Jacobson, Sperry Flight System D.R. Kerns, Southwest Research Institute S. Kuniyoshi, Naval Sea Systems Command R.B. Schulz, IITRI/ECAC

R.M. Showers, University of Pennsylvania

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Spectrum Sharing Between FDM/FM and Radar Systems Using	ACCESSION NO. EMCABS 12-81-1	EMC Considerations in Telecommunications Equipment R. Diaz de la Iglesia CTNE (Dpt Inga Planes y Normas—Transmisión)	ACCESSION NO. EMCABS 12-81-4			
<ul> <li>Pulse Blanking</li> <li>E. Byron</li> <li>The Applied Physics Lab. Johns Hopkins University, Laurel, MD</li> <li>NTC '79 Conference Record 79CH1514-9</li> <li>November 27-29, 1979, Vol. 2 of 3</li> <li>ABSTRACT: The world's use of the electromagnetic frequency spectrum has increased dramatically. As a result, frequency sharing has become an important aspect of satisfying this increase through more efficient spectrum utilization. This paper addresses some of the theoretical aspects for the specific case of sharing between pulse radar systems and FDM/FM communication systems by using receiver blanking techniques</li> <li>INDEX TERMS: Electromagnetic Frequency Spectrum, Pulse Radar, FDM/FM Communication, Compatibility</li> </ul>		Madrid, Espana CH1539-6/80/0000-0050 1980 IEEE <b>ABSTRACT:</b> The nature and consequences of the four kinds of electromagnetic interfer ence on cable telecommunication systems are reviewed: capacitive interference can b avoided through simple shielding of the telecommunication circuit; inductive and ohmi				
		interference are more dangerous, and if the data of the disturbing and disturbed line are accurately known, the logitudinal induced voltage can be accurately known. Overvol- tages from thunderstorms can only be assessed on a statistical basis. The classical coaxial line protection philosophy is presented and we offer some arguments for reliability increasing in 60 MHz coaxial systems, by introducing a change on repeater protection A mathematic model is presented and some quantitative considerations are offered.				
		INDEX TERMS: EMC, Telecommunications Equipment, Cable Telecommunication, Interference, Inductive, Interference, Induced Voltage, Overvol- tages, Repeater Protection, Mathematic Model.				
Fundamental and Harmonic Spectrum Characteristics of Communications Transmitters Richard B. Schulz, IIT Research Inst.	ACCESSION NO. EMCABS 12-81-2	Broad-Spectrum and Intermodulation Characteristics of Communications Transmitters H. Ervin Lobaugh, Richard B. Schulz	ACCESSION NO. EMCABS 12-81-5			
H. Ervin Lobaugh, EMETF (Bell Tech. Operations) <b>ABSTRACT:</b> Techniques are described in this and a companion pa types of measured transmitter data used specifically for EMC anal	per to obtain those yses. Such data for	EMETF (Bell Tech. Oper., Tucson, AZ—ITT Research Inst.) CH1539-6/80/0000-0051, 1980 IEEE ABSTRACT: Techniques are described in this and a companion paper to obtain those				
AM, FM, SSB, multichannel FDM/FM, multichannel PCM-TDM/FM, and multi- channel QPSK and QPR transmitters encompass emitted spectrum characteristics over a broad frequency range, such as 14 kHz to 12 GHz (extendable). This paper presents procedures for determining transmitter output spectra in the immediate vicinity of the fundamental and second through fifth harmonics. Other procedures are presented in the companion paper, "Broad Spectrum and Intermodulation Characteristics of Communi- cations Transmitters." For each procedure, the following subjects are treated: 1. Purpose		types of measured transmitter data used specifically for EMC analyses. Such data for AM, FM, SSB, multichannel FDM/FM, multichannel PCM-TDM/FM, and multi- channel QPSK and QPR transmitters encompass emitted spectrum characteristics over a broad frequency range, such as 14 kHz to 12 GHz (extendable) This paper presents the following procedures: 1. Conducted-Emission Spectrum Characteristics: Wide Band- width 2. Intermodulation. For each procedure, the following subjects are treated: 1. Purpose 2. Major features of the technical approach. 3. Nature of the resulting data				
2. Major features of the technical approach 3. Nature of the result INDEX TERMS: Fundamental, Harmonic, Spectrum, Transmitte EMC, Analyses, Broad Frequency, Digital Cor	ing data. rs, Measured Data, mmunications.	INDEX TERMS: EMC, Conducted-Emission, Spectrum, Wide Bandwidth, Inter- modulation, Measurement Procedures.				
Frequency Spectrum Planning and Management A.P. Gomes, G.P. Morais, J.S. Madrid Morales, E. Perri & M.S. Assis	ACCESSION NO. EMCABS 12-81-3	Microwave Anxieties: The U.S. Embassy in Moscow, A Case In Point Herbert Pollack, M.D. Professor Emeritus, George Washington University	ACCESSION NO. EMCABS 12-81-6			
Promon Engenharia S.A., Rio de Janeiro, Brasil CH1539-6/80/0000-0049 1980 IEEE		ICC 79 Conference Record, Volume 2 of 4, 79CH1435-7 CSCB June 10-14, 1979, p. 31.6.1	ince 1953 the U.S.			
<ul> <li>ABSTRACT: This paper presents a computerized method, called FR for preparing frequency plans involving UHF radio relay links. The oped for the 225 to 470b MHz band and it is composed of three main with data bank manipulation, frequency spectrum analysis and inter and two auxiliary programs for propagation losses estimation and system can be used with great efficiency in the preparation of frequer band spectrum management.</li> <li>INDEX TERMS: Frequency, Spectrum Planning, Spectrum Manter, Frequency Plans, UHF, Interference.</li> </ul>	EQPLAN System, e system was devel- n programs, dealing ference calculation, relief storage. This ney plans and UHF magement, Compu-	Embassy in Moscow has been exposed to microwaves. Information been described in various official statements as well as in open Senate time had there been any reports of impaired health attributable to the the past three years there have been a number of stories in the n magazines, daily newspapers, and radio and TV programs alleging se ranging from an epidemic of leukemia to cancer and birth defects. contracted with Johns Hopkins University to carry out an in-depth b miological study of U.S. employees in Moscow from 1953 to 1 <b>INDEX TERMS:</b> U.S. Embassy, Microwaves, Irradiation, Health,	on the signals has e Testimony. At no microwaves. Over hajor weekly news rious health effects The Dept. of State biostatistical epide- 976.			

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Levels of Electromagnetic Energy in the Immediate Vicinity	ACCESSION NO.	Radio-Frequency Radiation: The Buildup of Knowledge Against	ACCESSION NO.
of Representative Microwave Radio Relay Towers R.C. Petersen	EMCABS 12-81-7	The Background of Concern Samuel Koslov, Ph.D.	EMCABS 12-81-10
Bell Laboratories, Murray Hill, N.J. 07974	L	The Johns Hopkins University, Applied Physics Laboratory	
ICC '79 Conference Record, Volume 2 of 4, 79CH1435-7 CSCB		ICC 79 Conference Record, Volume 2of 4, 79CH1435-7CSCB June	10-14,1979 p.31.2.1
June 10-14, 1979, p. 31.5.1		ABSTRACT: The history leading to the present-day program is t	raced through the
<b>ABSTRACT:</b> This paper describes the results of a series of measure	ements of the power	Tri-Service Program, Pandora, and other events of the last few decac	les. The differences
density levels in the immediate vicinity of several representative mic	crowave radio relay	between ionizing and nonionizing radiation in physical properties and	I biological interac-
towers. The results of these mesurements, for systems operating in the	he 4, 6, and 11 GHz	tion and the problems of assessing the environment and the biolog	ical impact will be
common carrier bands, are compared with the corresponding the	oretical approxima-	discussed. Substantially more complex factors apply in defining radi	io-frequency radia-
tions and with existing international general population exposure sta	indards. The results	tion exposure than in the case of ionizing radiation. The Eastern Euro	opean and Western
of these comparisons indicate that theoretical techniques, currently	used for estimating	Philosophies of neurophysiology and environmental protection that	t lead at present to
power densities at off-axis points in the near field, are extremely consi	ervative, yielding an	widely differing maximum permissible exposure limits are compared.	. A broad overview
upper bound up to several orders of magnitude greater than the meas	ured corresponding	is presented of the range of effects reported versus those confirmed, w	ith emphasis on the
values. The measured power density levels are significantly lower tha	n the most stringent	differences between an "effect" and a "hazard."	
exposure standards used by any nation.	Ũ	INDEX TERMS: Nonionizing Radiation, Radio-Frequency Ra	diation Exposure,
INDEX TERMS: Power Density, Microwave Radio Relay Tower	rs, Near Field	Electromagnetic Phenomena	
Padiofraquency Environments in the United States	T	Effecting Compliance with EMC Logislation	
David E. Janes. Jr.	ACCESSION NO.	Richard R. Schulz	ACCESSION NO.
U.S. Environmental Protection Accord	EMCABS 12-81-8	IIT Research Institute/ECAC Annanolis MD 21402	EMCABS 12-81-11
ICC 70 Conference Record Volume 2 of 4 70CH1425 7 CSCP	L	1978 International Conference on Communications Conf. Red	
lung 10.14, 1070, p. 31.4.1		Volume 1 78CH1350-8 CSCB June 4-7 1078 n 1.5.1	
Julie 10-14, 1979, p. 51.4.1		ABSTRACT: Legislation and regulations pertaining to FMC can	never he effective
ABSTRACT: As part of a program to determine the need for g	uidelines to control	without mechanisms to beln ensure compliance. Some of the more	never be encente
environmental levels of radiofrequency radiation (3 kHz - 300 GHz	z). the Environmen-	nisms are presented here for discussion. These may be grouped gene	rally under various
tal Protection Agency began measuring levels in urban areas in Oct	ober 1975. Data on	concentual approaches to the problem of ensuring compliance. Mai	or approaches may
environmental levels in the frequency range 0.5-900 MHz have be	een obtained for 15	be categorized as (a) legalistic enforcement. (b) motivational enh	ancement or (c) a
urban areas. This paper summarizes the results of these measurem	nents in the general	combination of both Legalistic enforcement creates on adversary	of laws and regula
environment and gives comparative data from other studies on	levels near specific	tions. Not so motivational enhancement, which creates a cooperativ	a relationship. The
sources such as broadcast antennas, radars, walkie-talkies, medical d	liathermy units, and	combination of the two is exactly that; it creates adversary relationsh	ins in some matters
radiofrequency heat sealers.		combination of the two is exactly that, it creates adversary relationsh	ips in some matters
INDEX TERMS: Environmental Levels Radiofrequency Radiati	on General Radio	INDEX TEDMS: Degulations EMC Logalistic Enforcement	nt Motivational
frequency Environment	on, Ocherai Raulo-	INDEA IERIVIS: Regulations, EMC, Leganstic Enforceme	int, wouvational
nequency Environment		Ennancement	
A Review of Effects of Microwave Radiation on Biological	ACCESSION NO.	Government Regulation of Electromagnetic Interference and	ACCESSION NO.
Systems S.F. Cleary Dept. of Biophysics, Med. College of VA	EMCABS 12-81-9	Suscentibility Views of a "Regulatee"	EMCABS 12-81-12
VA Commonwealth University, Richmond, VA 23298 ICC 79		Stuart I Bailey Consultant Atlantic Research Corporation	
Conference Record, Volume 2 of 4, 79CH1435-7 CSCB June 10-1	4, 1979, p. 31.3.1	Alexandria Virginia	
ABSTRACT: Studies conducted during the past ten years both in this	is country and in the	1978 International Conference on Communications Conf. Red	
USSR, Poland, and Czechoslovakia, have resulted in reports of pro-	eviously undetected	Volume 1 78CH1350-8 CSCB June 4-7 1978 P 141	
sensitivities of experimental animals of microwave exposures at inten	isities in the range of		
1-10 mW/cm <sup>2</sup> . Reported effects on behavior, nervous tissue, and the	immunological and	ABSTRACT: There is a long history of interference control through	regulation either by
reticuloendothelial systems suggest specific sensitivities of mammal	ian systems to such	government or by industry. The results are varied and some are disc	ussed in this paper.
exposure. Available data is not adequate to draw general conclusion	ons but these results	In the field of control of susceptibility, a new series of problems i	s encountered. The
are not inconsistent with effects reported to result from occupational	exposure of human	Goldwater-Vanik bill, if enacted, must be implemented. Some of the	difficulties inherent
beings. The bases for microwave-specific biological alterations in	this intensity range	to such implementation are discussed.	
have not been established, although recent data relative to physical	interaction mecha-	INDEX TERMS: EMC, EMI, Interference Control, Control of S	usceptibility
nism suggests the possible involvement of the modes of international states of the modes of international states and the states of the modes of the	al radiation energy		
absorption.			
INDEX TERMS: Microwave Radiation, Radio Frequency Radia	tion, Safety Guide-1	3	

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	Practical EMI Control for Telecommunications Equipment —Workshop Session— Chairperson: H. Knoller, Lockheed-California Co., Burbank, Calif. 91520 1978 National Telecommunications Conference Record	ACCESSION NO. EMCABS 12-81-13	EMI Control for Communication Equipment Robert B. Cowdell Rockwell International, 'Collins Government Telecommunications Grp. NTC 77 Conference Record Vol. 1, 77CH1292-2 CSCB, p. 08:5-1	ACCESSION NO. EMCABS 12-81-16
	Volume 3, 78 CH1354-0 CSCB, Dec. 3-6, p. 37.1.1 <b>ABSTRACT:</b> Presentation by the panel members will attempt to; (1) a practical Electromagnetic Interference (EMI) control program tha tic design requirements, test limits and procedures; (2) provide the a design direction and quality assurance provisions to ensure Electroma ity (EMC); and (3) describe the basic tools necessary to investigate, i EMI problems. The workshop will include a review and demonstr effective methods to reduce EMI and assess EMC. This will be fo panel discussion with active participation by members of the audience leaders. The panel members will provide their expertise to resolve J experienced by those in attendance. INDEX TERMS: EMI Control, Test Limits, Analysis, Quality As	justify the need for t established realis- nalysis techniques, ignetic Compatibil- dentify and resolve ation of some cost llowed by an open e and the discussion presented problems ssurance, EMC	ABSTRACT: Illustrated cases of automobile and alarm susceptive electromagnetic radiation emphasize that malfunction and failure proving more commonplace in our commercial environment. Many proble mobile transmitters. FCC established maximum and minimum avail using omnidirectional and high gain antennas are compared with measures to determine reasonable susceptibility test levels against which to determine the test methods of the RS03 and RS04 tests in MI then be used from 1 MHz through 1 GHz as a standard to test the safe equipment. For a source to receptor distance of one meter, the restrict recommend a limit of 57 volts per meter between 1 MHz and 512 MH INDEX TERMS: Automobile and Alarm System Susceptibilities, S Levels.	bilities caused by blems are becom- ms are due to land lable power levels sured field intensi- design equipment. IL-STD-461A can ety of commercial sults of this study z. Susceptibility Test
Statistics and the state of the	EMI Measurements for Commercial Equipments Steve Jensen Genisco Technology Corp. 18435 Susana Rd., Compton, Calif 90221 NTC 77 Conference Record Vol 1., 77 CH1292-2 CSCB, p. 08:4-1	ACCESSION NO. EMCABS 12-81-14	Stocastic Modeling of the Electromagnetic Interference Environment A.D. Spaulding Office of Telecommunications, Institute for Telecommunication Sciences, U.S. Dept. of Commerce, Boulder, Colorado 80302	ACCESSION NO. EMCABS 12-81-17
	ABSTRACT: Todays manufacturer of electronic equipments is faced and important consideration with respect to EMI requirements f Todays environment prepresents a proliferation of devices that en- energy by various techniques, and the increasing use of digital ele more opportunities for equipment malfunction because of suscep- electrical phenomenon. The purpose of this paper then is to explo- limits apply to commercial equipments today and what additional r be considered by manufacturers as a matter of good practice. Fina- inexpensive measurement techniques is offered. <b>INDEX TERMS:</b> EMI Measurements, FCC Requirements, VDI ments. Conducted and Radiated Emissions	with an interesting for his equipment, nit radio frequency ectronics represents ptibility to outside ore what applicable requirements might ally a discussion of E/CISPR Require-	ICC 77, Volume 3 of 3, 77 CH1209-6 CSCB, June 12-15, p. 42.2-14 ABSTRACT: Most natural and man-made electromagnetic interfer non-Gaussian random processes, whose degrading effects on comme tronic system performance can be severe, especially for conventional designed for optimum performance against Gaussian noise. In order effects of the real world interference environment on the performance order to be able to design effective signal detection algorithms, more is the interference process is required than can generally be obtained alone. It is the purpose of this paper to present a short summary interference process that have been proposed in the past and to summ statistical models recently developed at the Office of Telecommuni INDEX TEPMS: EMI Models, Noise, Pandom Process	4 erences are highly munications/elec- systems which are r to determine the of systems and in nformation about by measurement of models of the narize the physical- ications.
	National and International RFI Regulations for Commercial Products Herbert K. Mertel EMACO Consultants, San Diego, California NTC 77 Conference Record Vol. 1, 77CH1292-2 CSCB, p. 08:1-1	ACCESSION NO. EMCABS 12-81-15	Use of a Parallel Plate Transmission Line to Calibrate Fiber-Optic Coupled Magnetic Field Sensor Andrew A. Cuneo, Jr., & James L. Loftus Harry Diamond Labs, Adelphi, MD Technical memo, Jan. 80, 17p, AD-A)85 201/2 PC A02/MF A01, Rept No. HDL-TM-80-11, AD A085 201/2 PC A02/MF A01	ACCESSION NO. EMCABS 12-81-18
	<b>ABSTRACT:</b> The legal and technical status of Radio-Frequency Intions for consumer products are reviewed for countries that have support analyzes the formulation of interference limits on the basis of ITU/CCIR treaties; reviews the status of certification systems; taburegional, and international regulations; and looks at the regulation European Economic Community. Specific data for the legal status of the pertinent reference, and their source are presented.	iterference Regula- ch regulations. The f natural noise and ulates the national, ns planned for the of EMI regulations,	<b>ABSTRACT:</b> It is vitally important to accurately measure the field simulated electromagnetic pulse (EMP), to determine both the wa amplitude of the electromagnetic test environment. A parallel plate the used to calibrate a magnetic field sensor as well as to determine the fi factor when the sensor is mounted on the compact transmitter of an data-link system. The transmitter is coupled to the recording instrum- of a fiber-optic cable rather than an rf cable, thus eliminating a spur source.	components of a aveshape and the ransmission line is field enhancement optical electronic entation by means ious signal pickup
-	quency Interference, Radio Spectrum Pollution	itions, Kadio Fre-	5 Data Link, Fiber-Optic	nu sensor, Optical

Bounds of (Microwave) Power In an FCC Type Approval Process Hector Davis	ACCESSION NO. EMCABS 12-81-19		ACCESSION NO. EMCABS 12-81-22	
rederal Communications Commission, Lab. Div. Laurei,	12.15 42.4.120	The Social and Political Impacts of CB IV Interference		
ABSTRACT: Microwaya overs are regulated in the United States	12-15, p. 42.4-128	Ronald S. Stone		
called "Type Approval" In treating this regulatory process from a	s unough a process	Federal Communications Commission, Washington, D.C. 20554		
effectiveness for the public over manufacturers and the Covernme	perspective of cost-	NTC 77 Conference Record, 77CH1292-2, CSCB, p. 25:4-1 Volun	ne 2	
that many technical standards arise as the result of interference	e problema due te	<b>ABSTRACT:</b> CB related TV interference is increasing at an alarming	rate An identifica-	
characteristics not controlled under existing regulations. Type Ar	e problems due to	tion of the narties that are affected, and their possible responses to	o this problem will	
characteristics not controlled under existing regulations. Type Approval is the most rigorous of the procedures of equipment authorization, defined in the Rules and Regula- tions of the Federal Communications Commission Under Type Approval the Labora-		determine the social-political impacts of the problem. Possible impacts of this interfer- ence problem include higher cost CB and TV equipment, reduced usage of the CB and		
noncompliance with the Commission's Rules. Thus a device subject	to Type Approval is	activity and increased interpersonal and community strife.		
thoroughly tested twice: once by the manufacturer and once by	the Commission's	INDEX TEDMS: TV Interference, CB, TV Communication		
Laboratory Division.	the commissions	INDEX TERMS. IV Interference, CB, IV Communication.		
INDEX TERMS: EMC, "Type Approval," Cost-Effectiveness, In	terference, Regula-			
tion.	, 8		T	
Control of Electrostatic Damage to Electronic Circuits	ACCESSION NO.	Interference Between UHF Television Systems and 850 MHz	ACCESSION NO.	
W.J. KIIK, Jr. RDX-613-2428 PC A02/ME A01 Mar 80 21 p CONE-800440-1	EMCABS 12-81-20	Cellular Mobile Telephone Systems	EMCABS 12-81-23	
Contract EV_76_C_04_0613 Annual Reliability Testing		Reed E. Fisher		
Institute Tucson AZ USA 14 Apr 1980		Bell Laboratories, Whippany, N.J.		
<b>ABSTRACT:</b> Static is caused by the flow of materials and people	within an environ-	NTC 77 Conference Record, 77CH1292-2, CSCB, p. 25:3-1 Volum	ne 2	
ment The static voltages generated by these movements can degra	de or destroy many	ABSTRACT: At this moment, considerable planning and development are underway		
solid state devices currently being used in sophisticated electronic eq	uinment Discharge	for High Capacity Mobile Telephone Systems; dense cellular systems which will permit a dramatic increase in both the quantity and quality of available mobile telephone service		
of static voltages through these sensitive devices during assembly one	rations can lead to a			
nonfunctional assembly fabricated from parts which previously we	ere acceptable or to	in the United States These systems were made possible when in N	lav 1974 the FCC	
later failure of an assembly which was functional after fabrication. Sources of electro-		reallocated the upper portion of the UHF TV band (806-881 MHz) to various types of		
static charges, equipment and methods for minimizing the genera	tion of electrostatic	land mobile services including cellular. This paper will address one	class of interference	
voltages during the production, assembly and packaging of solid stat	te devices to electro-	which may exist between UHF television systems and land mobile set	rvices in the 806-881	
static damage are discussed.		MHz band, using cellular systems as an example of land mobile s	ervices.	
INDEX TERMS: Electrostatic Discharge, ESD, Reliability, Pro-	otection, Electronic	INDEX TEDMS: EMC. Callular Mabile Padia	×	
Circuits		INDEA TERMS: ENIC, Centular Mobile Radio		
Microwave Frequency Radiation Power Densities From 4 GHz	ACCESSION NO		ACCESSION NO	
and 6 GHz Radio Relay S.D. Hathaway	ACCESSION INU.	The Marine and Amateur Services Meeting Changing Needs	EMCARS 12-91-24	
Bell, Telephone Laboratories Holmdel, New Jersey	ENICADS 12-01-21	David C. Thompson	ENICADS 12-01-2-4	
ICC 79 Conference Record, Volume 2 of 4, 79CH1435-7CSCB Ju	ne 10-14,1979p.31.1.1	SBE, Inc., Watsonville, California		
ABSTRACT: The communications engineer designs a radio relay	system to meet an	NTC '77 Conference Record, 77CH1292-2, CSCB, p. 25:2-1 Volum	ne 2	
acceptable overall transmission performance. In order to do this h	he concerns himself	ABSTRACT. The increased value of time to an individual for either l	ousiness or personal	
with such parameters as transmitter power, waveguide losses, antenn	na gains, clearances,-	reasons the need to reduce the consumption of natural resources in	creasing awareness	
path loss, fading, protection, etc. While he may think in terms of rec	ceived levels in dBm	of the value of radio communication to gain assistance in time of	emergency and the	
or dBW, the electromagnetic fields that produce these levels repre-	esent spatial power	increase in the amount of leisure time available to individuals are	all socio-economic	
densities. Other speakers will discuss the biological effects but my provide the biological effects but my p	urpose is to put into	changes taking place which have caused an incredibly increased	awareness by all	
perspective what levels of power density exist in the vicinity of a m	icrowave path. The	segments of the population of the advantages which accrue with the u	se of one or more of	
power densities caused by a relay station transmitting 12 channel	els at 4 GHz and 8	the radio services authorized by the Federal Communications Con	mmission. The two	
channels at 6 GHz will be examined. Antenna patterns and clearand	ces will be discussed	radio services discussed in the context of these changes are Amate	ur and Marine.	
with power density profiles given for distances beyond the Rayleigh	limit. Estimates will	INDEX TERMS: Radio Communication Amateur Marine		
be given for densities in the near fields which are upper bounds on le	evels to be expected.	TIDEA TERMS, Naulo Communication, Amateur, Marine.		
INDEX TERMS: Power Density. Antenna Patterns. Near Fields.	. 1	7	1	

Maritime Secondary Radar: Interference Considerations Between Competing Systems R.D. Groombridge, B. Sc. Eng. Proceedings of the Conference on Electromagnetic Compatibility IERE Conference Proceedings No. 39, pp. 119-129 <b>ABSTRACT:</b> In the maritime radionavigation (MRN) service opera ity must be maintained between shipborne primary radar, certain type and certain classes of static and shipborne secondary radar. These swept frequency beacon, and in the future possibly fixed freque transponders—the latter giving precedence/priority to the others e.g. ity. The premise is made that interference has its origins in three do Space iii) Frequency. Methods exist in each domain which can pr reduction. Most are independent but can be applied together to redu of potential interference. <b>INDEX TERMS:</b> Interference, Maritime, Radionavigation, EMC, craft Beacons Transponders Time Domain Fr	ACCESSION NO. EMCABS 12-81-25 ational compatibil- es of aircraft radar include at present ency beacons and ., in cost/complex- omains: i) Time ii) rovide interference ice the overall level Radar, Ships, Air-	<ul> <li>Investigation of Alternatives to Exothermic Welding of Copper Conductors to Ground Rods</li> <li>Stuart A. Wagner, Jan 15, 1981</li> <li>Electronics Engineering Grp. (1842nd), Scott AFB, IL.</li> <li>Final Report May-Dec. 1980, 20p Report no. 1842-EEG/EEIC, Tr- Ad-A097 728/0 PC A02/MF A01</li> <li>ABSTRACT: Four types of conductor to ground rod attachments accelerated corrosion exposure and subsequent low current, high current lightning strike tests. All samples passed all tests. This testing indication imposed restrictions on use of other than exothermic bonds or bell unnecessary.</li> <li>INDEX TERMS: Ground Rods, Corrosion, Simulated Lightning,</li> </ul>	ACCESSION NO. EMCABS 12-81-28 -81-/7 were subjected to ent, and simulated ates that presently low grade use are Tests.
Present Interrelationships and Future Trends in Personal Radio Services Carlos V. Roberts Federal Communications Commission, Washington, D.C. 20554 NTC 77 Conference Record, 77CH1292-2, CSCB, p. 25:1-1 Volun ABSTRACT: This paper examines common aspects present in toda services, and develops the theme that the various personal radio ser general mobile, mobile telephone) have a number of key elements presence of these same elements in what have been previously con- services may indicate that the present services distinctions are artifi- have occurred due primarily to the historical development of these trends in the development of personal radio services may be leading to of the various services, and there are some indications that futu communications of all types may well be provided under one serviced <b>INDEX TERMS:</b> Personal Radio Services, EMC Trends, Amat Mobile Radio, Mobile Telephone, Certain Mari	ACCESSION NO. EMCABS 12-81-26 ne 2 ay's personal radio vices (marine, CB, in common. The nsidered disparate icial divisions that e services. Current owards integration are personal radio e. teur, CB, General time Services	Measurement of Interference-to Navigation/Communication Avionics from Cable Television (CATV) Systems. Edward M. Sawtelle, and James G. Dong AD-A081 430/1, PC A04/MF A01, Final rept. Jan-Sept 78, Dec. 79, 69p FAA-NA-79-7, FAA-RD-79/104 <b>ABSTRACT:</b> Airborne measurements of cable television (CATV) lea selected cities to compile a representative sampling of interference altitudes were used in the flight-grid-type pattern. Ground measu accomplished by the Federal Communications Commission (FCC) a determine any correlation between the ground and air measurem analysis was performed on the data upon finding that direct airborn tion to strong ground leak points was not possible. The analysis is pro each of a grid and a comparison to determine if significant difference runs. <b>INDEX TERMS:</b> CATV, Cable Leakage, EMC, Interference, RF quency Allocation, Statistical Noise Analysis, M	ACCESSION NO. EMCABS 12-81-29 the age were made at e effects. Different rements were also at the sites tested to nents. A statistical ne position correla- ovided the mean for eas existed between I, Navigation, Fre- feasurements.
<ul> <li>Detection Instrumentation for Cable Shield Defects</li> <li>James R. Cosby, Gerald B. Gilbert, &amp; Jay H. Stoudenmire</li> <li>Bendix Corp., Baltimore, MD, Environmental and Process</li> <li>Instruments Division Open File Report (Final) Oct. 10, 1978</li> <li>June 1980, PB81-194540 PC A03/MF A01 Aug. 29, 1980, 50p BUN</li> <li>Contract J0188081</li> <li>ABSTRACT: This report describes work performed for the Bureau o</li> <li>available portable instruments for their effectiveness in detecting and</li> <li>metallic shields in types SHD and SHC cables. A second phase of t</li> <li>several instruments of a type that could prove effective and were purch</li> <li>tion and testing to verify their performance.</li> <li>INDEX TERMS: Cable Shield, Portable, Metallic Shields, Ca</li> <li>Testing.</li> </ul>	ACCESSION NO. EMCABS 12-81-27 AINES-OFP 33-81 of Mines to evaluate l locating damaged he program covers hased for modifica- tbles, Instruments,	The Impact of EMC and EMI Considerations During Development Of A Microwave Radio System Al Rutulis Bell-Northern Research, Ottawa, Canada ICC 77, Volume 3 of 3, 77 CH1209-6 CSCB, June 12-15, p. 42.3- ABSTRACT: This paper discusses the impact of EMI consideratio ment of the 90 Mb/s RD-3 digital radio operating in the 7.725 to 8.7 development was carried out at the Bell-Northern Research Labo transmitters and receivers of a radio system may be located in a singl the equipment must ensure that intrasystem interference is kept with One of the basic features of the RD-3 radio is the "overbuild" concept be installed in existing radio sites using the same antennas and feed as equipment. This requires that the new system does not interfere susceptible to interference from, the existing 4 GHz system. INDEX TERMS: EMI, Digital Radio, Intrasystem Interference, Fr Layout, Critical Frequencies, Unit Leakage, Sus	ACCESSION NO. EMCABS 12-81-30 124 ns on the develop- 25 GHz band. The ratories. As many e site, the design of hin tolerable levels. which permits it to s the 4 GHz analog e with, and is not requency Plan, Site- sceptibility.

	and the second secon		Construction of the other state
	ACCESSION NO.	Recent Developments in Short Wave Communication Receiver Circuits Ulrich L. Rohde	ACCESSION NO. EMCABS 12-81-34
Band Sharing—A Case Study	ENICADS 12-81-51	Dept. of Electrical Engineering University of Florida.	ENICADO 12-01-54
A. L. Covitt, D.D. Neuman		Gainesville, FL NTC 79 Conference Record 79CH1514-9	
The MITRE Corporation		November 27-29 1979 Vol 2 of 3	
NTC '79 Conference Record 79CH1514-9		<b>ABSTRACT:</b> The recent increase in traffic of short wave comm	unication and the
November 27-29, 1979, Vol. 2 of 3		present height of the sun spot cycle has further crowded the HP bat	nds. Because of the
ABSTRACT: The United States Table of Frequency Allocations	has recently been.	vulnerability of satellite communications because of jamming and	attack by missiles.
amended to allow the Department of Defense Joint Tactical Inform	nation Distribution	short wave communication is still heavily used and will continue to g	row. New receivers
System (JTIDS) to operate in the 960-1215 MHz band simultane	ously with existing	must have a substantially improved large signal handling capability a	nd better frequency
TACAN/DME radio navigation services and Air Traffic Control Ra	dar Beacon System	resolution. The digital circuitries involved made a number of mecha	nical solutions, like
(ATCRBS) air traffic control services. This paper describes the techni	cal and administra-	tracking filters, impossible. A number of new approaches to improv	e and even simplify
tive issues associated with obtaining the allocation.		short wave receiver design will be presented. A number of schematic	cs of interest will be
INDEX TERMS: EMC Frequency Allocations ITIDS Interfere	nce Rejection	shown.	
THE PLANES, Programsy Amountains, 5 (1005, Interfere	nee Rejection.	INDEX TERMS: Receivers, Large Signal Handling Capability,	Input Selectivity,
		Untralinear, High Level Mixers.	
Radiodetermination Spectrum Utilization/Conservation	ACCESSION NO.	Carrier Phase Recovery Performance for PN-Spread TDRSS'Link	ACCESSION NO.
Robert L. Hinkle, Robert M. Pratt, Jay S. Levy	EMCABS 12-81-32	With Radio-Frequency Interference	EMCABS 12-81-35
U.S. Dept. of Commerce, National Telecommunications &		Teresa M. McKenzie, Walter R. Braun	
Information Administration, Annapolis, MD		LinCom Corp. P.O. Box 2793D, Pasadena, CA 91105	
NIC 79 Conference Record 79CH1514-9 November 27-29, 1979,	Vol. 2 of 3	NTC 79 Conference Record 79CH1514-9 November 27-29, 1979,	Vol. 2 of 3
ABSTRACT: This paper summarizes an investigation conducted by	NTIA in coopera-	ABSTRACT: Two problems are analyzed in this paper: carrier-pha	ise recovery perior-
tion with the Dept. of Transportation, Federal Aviation Administrati	on (FAA) to assure	mance of a Costas loop for a nonlinear satellite channel with uplink a	nrecent The signal
that future spectrum requirements for Aeronautical Radionavigati	on Services in the	format is hippry phase shift keyed (BPSK) or unbalanced quarternal	v nhase-shift-keved
2700-2900 MHz band can be satisfied. An extensive measurement,	, model validation,	(LOPSK) with either non-return-to-zero (NRZ) or hiphase (Man	hester) symbols In
receiver simulation and analytical investigation was undertaken to a	assess the degree of	the LIOPSK case at least one data stream must be PN-spread. The	e channel consist of
band congestion in the 2700-2900 MHz band. The investigation	showed that new	additive white Gaussian noise (WGN) a wideband filter, a bandpa	iss nonlinearity and
transmitter output tubes and waveguide filter devices, along with ra	adar receiver signal	more additive WGN. The RFI considered is pulsed continuous-wave	e. pulsed WGN, or a
processing techniques will result in more efficient use of the spec	trum.	combination of the two.	, p
INDEX TERMS: Aeronautical Radionavigation, Model Validation	n, Receiver Simula-	INDEX TERMS: Nonlinear Satellite Channel, Uplink RFI, P	ulsed Continuous-
tion, Radar.		Wave, Pulsed WGN, TDRSS.	
A Low-Noise, Interference-Tolerant TV Receiver	ACCESSION NO.	Low Inductance Methods for Grounding Cable Shields to Ship	ACCESSION NO.
Darrell L. Ash RF Monolithics, Inc.	EMCABS 12-81-33	Structures for EMP Protection	EMCABS 12-81-36
NTC 79 Conference Record 79CH1514-9		B. Zendle and M.C. Petree Final Report (Aug. 1976-Aug. 78)	
November 27-29, 1979, Vol. 2 of 3		Naval Surface Weapons Center, White Oak, Silver Spring, MD	
<b>ABSTRACT:</b> Under a contract with the FCC, a previously conceiv	ved TV receiver was	ABSTRACT: The EMP coupling measurements at EMPRESS	on DD and DLG
designed and tabricated to demonstrate the feasibility of a	cost-effective high-	classes of ships have shown that an efficient low-inductance method	of grounding cable
performance system that would allow more efficient utilization of	the spectrum space	shields is needed. High frequency currents up to 150 ampers can be	expected on cable
presently anocated for TV purposes. The technologies developed for	toma For example	shields in interior ship compartments where sensitive and sophistic	ated electronic sys-
military commercial and consumer transceivers all have near/f	ar problems i.e. a	tems are located. The test program encouraged by NAVSEC has	demonstrated that
receiver trying to receive a weak signal from a distant source is over	rloaded by a nearby	attenuation of cable shield currents by 60 dB and higher over a frequ	ency range from 0.5
transmitter even though the transmitter may be on a different chan	nel. The technology	MHZ to 100 MHZ can be achieved by grounding cable shields to stu	Ting tubes through
utilized in the improved TV receiver can be used to greatly inc	crease the overload	sou degree low-inductance grounding devices. Grounding collars ext	ernal to the stuffing
capability of such transceivers.		inspect and were less exposed to the sea environment	asier to install and
INDEX TERMS: TV Receiver, Spectrum Space, Overload Can	ability. Image Fre-	inspect and were ress exposed to the sea environment.	Shiphoord Cables
quency, IF Beat, Intermodulation Distortion (	ross-Modulation	INDEX TERMS: Electromagnetic Pulse, Nuclear weapon Effects	, sinpooard Cables.

20.2 million - 1 million - 1 million - 2

# **EMC STANDARDS ACTIVITIES**



Richard B. Schulz IIT Research Institute Annapolis, Maryland 21401

This particular column not only lists scheduled meetings of EMC standards committees, but also highlights RF radiation-hazard (RADHAZ) standards outside the military area.

## CIVILIAN RADHAZ STANDARDS/GUIDES

Scientific data to serve as a firm basis for RADHAZ standards and regulations is quite limited due to the difficulty in obtaining it. Furthermore, the allowable risk depends upon the specific application. Such factors, and possibly others, give rise to differing requirements among RADHAZ standards.

Standards and guides are considered here in three different categories: (1) those developed by voluntary (professional or industry) groups, (2) those intended for use by federal and state governments, and (3) those used by foreign governments. These are listed respectively in TABLES 1, 2, and 3. Most voluntary documents developed in the United States originated under the auspices of the American National Standards Institute. Indeed, the foremost standard, C95.1-1974 is under revision. Proposed limits (not yet adopted) are listed in TABLE 1. The new limits differ from the original values in several respects: (1) they are a function of frequency, (2) values are presented as the squares of the E and H fields for near-field applications, and (3) values may be exceeded under certain conditions of frequency and average whole-body specific absorption rate. This revision of ANSI C95.1 is particularly important since it might be widely adopted by military and civilian government agencies, as well as by international standards organizations.

COMMITTEE	NAME	NEXT MEETING
ANSI C63	Radio Elec. Coord. Tech. & Develop.	9/11/82 EMC '82 Santa Clara
ANSI C68	High-Voltage Testing Techniques	June 1982 Ft. Lauderdale
ANSI C95	Radio Frequency Radiation Hazards	Unscheduled
ANSI MD 105	Medical Electronics	Spring 1982 (AAMI) San Francisco
CBEMA ESC5	Environment & Safety CommSubcommittee 5	3/9-11/82 Phoenix, AZ
EIA G-46	Electromagnetic Compatibility	Unavailable
EIA R-2	Consumer Electromagnetic Compatibility	Unscheduled
EIA TR8.10	Vehicular Electrical Inter- ference & Electromagnetic Compatibility	Unscheduled
IEEE S27	EMC Standards Committee	Unscheduled
SAE AE-4	Electromagnetic Compatibility	May 1982 (Tentative) Washington, DC
SAE ESC/SC	Electromagnetic Systems Comm/EMI Standards & Test Methods Subcommittee	Unavailable
SAMA PMC 33	Process Measurement & Control	10/15-15/82 (SAMA) Washington, DC

## SCHEDULED MEETINGS OF EMC STANDARDS COMMITTEES

#### TABLE 1 VOLUNTARY RADHAZ PUBLICATIONS

Number-Date Title	RADHAZ Considered	Scope/ Purpose	RADH	AZ Limits		Coordinated Documents	
C95.1-1974 Electromagnetic Radiation with Respect to Personnel, Safety Level of	Personnel	AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) Recommendations are made to prevent harmful effects on mankind, resulting from exposure to EM_radiation from 10 MHz to 100 GHz. They are not intended to apply to the deliberate exposure of patients by, or under the direction of, practitioners of the healing arts.	Continuous: Proposed rev f (MHz) 0.3-3 3-30 30-300 300-1500 1500-100,000	10 mW/cm <sup>2</sup> vision (8/7/81): A E <sup>2</sup> (V <sup>2</sup> /m <sup>2</sup> ) 4000 (900/f <sup>2</sup> ) 4,000 4,000 (f/300) 20,000	All values averag H <sup>2</sup> (A <sup>2</sup> /m <sup>2</sup> ) 2.5 0.25 (900/f <sup>2</sup> ) 0.025 0.025 (f/300) 0.125	ed over 0. 1-hr Pd (mW/cm <sup>2</sup> ) 100 900/f <sup>2</sup> 1.0 f/300 5.0	period. Notes: 1. In near-field regions, only $E^2$ and $H^2$ apply 2. For 300 kHz $< f < 100$ GHz, values may be exceeded pro- vided average whole-body specific absorption rate (SAR) $< 0.4$ W/kg, and peak spatial SAR $< 8$ W/kg averaged
C95/2-1974 Radio-Frequency Radiation Hazard Warning Symbol		Applies to design of a symbol for use as a sign intended to warn workers or the public of the presence of biologically hazardous levels of electromagnetic radiation and, insofar as considered desirable, to define specific hazards and provide cautionary information				Adopted by 6/28/67	DoD
C95.3-1979 Potentially Hazardous Electromagnetic Radiation at Microwave Frequencies, Techniques and Instrumentation for the Measurement of		Establishes specifications for techniques and instrumentation to be used in evaluating radio-frequency hazards to personnel. Emphasis is on techniques for measuring power density at microwave frequencies and are generally applicable only in the far field. (Standard will be extended to measure quantities associated with hazards to fuel and ordnance.)				Adopted by 11/20/72	DoD 2
Z136.1-1980 American National Standard for the Safe Use of Lasers		Provides reasonable and accurate guidance for the safe use of læsers and laser systems with output wavelengths between 0.2 um and 1mm.	See TABLE	5-2			
C95.4-1979 Radio Frequency Hazards to Electric Blasting Caps (Guide	Explosives						
C95.5-1981 Recommended Practice for the Measurement of Hazardous Electromagnetic Fields— RF and Microwave	Personnel, E	xplosives, Fuel NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)					
NFPA 407-1965 (USASI Z119.1-1966)	Fuel	Provides precautions for fueling aircraft on the ground	None			Adopted by	ANSI

EPA-520/7-73-( 8/73 Non-Ionizing R Measurement C State and Feder MDS-201-0004	Personn 001 Radiation Capabilities— ral Agencies	ENVIRONMENTAL PROTECTION AGEI el, Ordnance, Fuel Capabilities of various state organizations and Federal Agencies to measure nonionizing EM radiation have been determined. This document is intended to aid agencies of the Federal Government in locating possible sources of measurement assistance. HEALTH & HUMAN SERVICES (I Food and Drug Administration (FE	NCY (EPA) HHS)		
EPA-520/7-73-0 8/73 Non-Ionizing R Measurement C State and Feder MDS-201-0004	Personn 001 tadiation Capabilities— ral Agencies	el, Ordnance, Fuel Capabilities of various state organizations and Federal Agencies to measure nonionizing EM radiation have been determined. This document is intended to aid agencies of the Federal Government in locating possible sources of measurement assistance. HEALTH & HUMAN SERVICES (I Food and Drug Administration (FE	HHS)		
MDS-201-0004	D	HEALTH & HUMAN SERVICES (I Food and Drug Administration (FF	HHS)		
MDS-201-0004	P	reed and Drug Hammonder (12	DA)		
MDS-201-0004	Personn	3			
		Places requirements on emissions and	f		Limit
10/1/79		susceptibility of medical devices. Test		Conducted S	Susceptibility
Electromagnetic	c	methods provided. Rationales given	0.1-2	kHz	4.5 Vrms
Compatibility		(APPENDIX A). Does not address signal-line	0.002-10	MHz	1.5 Vrms
Standard for		of patient-lead conducted emissions and	10-30	) MHz	3.5 Vrms
Medical Device	-5	susceptionity		Padiated S	uscentibility
			10-550	) kHz	114 dBuV/m
			0 55-30	MHz	126  dBuV/m
			30-450	) MHz	133dBuV/m
			0.45-1	GHz	137dBuV/m
		CALIFORNIA			
		Department of Public Health			
	Personn	el			
California State	e	Compliance required by users and manufacturers	(Supplie	d by Bell Teleph	one Labs.)
Guide		of microwave equipment. Guidance and biological effects provided.	>10 mW	//cm <sup>2</sup> : potentiall	y hazardous
			1-10 mV	W/cm <sup>2</sup> : safe for i	ncidental or occasional exposure
			<1 mW7	cm <sup>2</sup> : safe, prolo	nged exposure.

# TABLE 2 FEDERAL AND STATE RADHAZ TECHNICAL PUBLICATIONS

		FOREIGN RADHAZ PU	BLICATIONS	
Number-Date RADHAZ				
Title	Considered	Contents/Purpose	RADHAZ Limits	
		CANADA		
	C.	ANADIAN STANDARDS ASSOCIATION		
	Personnel, Explosives			
CSA Z65-1966	Compliance re-	quired by manufacturers and	Personnel: $P_{avg} = 10 \text{ mW/cm}^2 \text{ in } 0.1 \text{ -hr period}; 10 \text{ MHz}$ -	
Radiation Hazards	users of electro	nic equipment.	100  GHz	
Fouinment			Fixed	
Edulphiene		CZECHOSI OVAKIA	Exposites, but distances and currents provided by fable.	
	Personnel	CZECHOSLOVAKIA		
Marlia, K., "Maximum	Contains limits	and specifications of RF	Entire workday and nonoccupational exposure to	
Permissible Values of	radiation hazar	ds to personnel.	(a) pulsed radiation: 10 uW/cm <sup>2</sup>	
HF and UHF FM Radiation			(b) CW radiation: 25 uW/cm <sup>2</sup>	
at Work Places in				
Czechoslovakia",				
Symposium Proceedings:				
Biological and Health				
Radiation BHR/DBF				
70-2, HEW, 1970				
an a		FEDERAL REPUBLIC OF GERMANY		
		(WEST GERMANY)		
	GE	RMAN ASSOCIATION FOR RADAR AND		
		NAVIGATION		
	Personnel			
Health Damages by	Guidance; sets	critical limit for	Microwave radiation: 10 mW/cm <sup>2</sup> . No allowance	
Radar and Similar	microwave exp	osure of personnel.	for exposure duration.	
Prevention				
revention		EDANCE		
	Personnel	FRANCE		
Swanson, J.R., V.E. Rose,	Contains expo	sure guides for	Military: >1-hr exposure, 10 mW/cm <sup>2</sup>	
and C.H. Powell, "A Review	various countr	ies	$\leq 1  \text{hr},  \text{T}_{\text{p}} = 6000 /  \text{W}^2$	
of International Microwave			for $10 < T_P < 100 \text{ mW/cm}^2$ (but	
Exposure Guides," American			55 mW/cm <sup>2</sup> recognized in practice)	
Industrial Hygiene Journal			Rest and public areas: 1 mW/cm <sup>2</sup>	
31:023, 1970				
		NETHERLANDS		
	-	N.v. rumps Company		
Cas assume ob sur	Personnel	d other avidence for	For 0.02 200 GHz >10 mW/cml considered descent to W/(cml considered descent)	
See source above.	Gives levels an	a other guidance for	For $0.03 - 300$ GHz, $>10$ m w/cm <sup>3</sup> considered dangerous; 1 m W/cm <sup>2</sup> permissible: >6 min: 1 m W/cm <sup>2</sup>	
	protection of t	anproyees of iv.v. r maps CO.	$\leq 6 \text{ min: } 10 \text{ mW/cm}^2$	
		POLAND		
	Personnel			
Journal of Statutes,	Contains limit	s and specifications for	Non-occupational exposure: 10 uW/cm <sup>2</sup>	
No. 21, 1972	KF radiation	nazards to personnel,	Entire workday exposure: 200 uW/cm <sup>2</sup>	

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#### SWEDEN

#### Personnel

Clemedson, C.J., Biological Effects of Microwave Radiation and Possible Risks from Radar, 1961 Contains information on Government of Sweden RF exposure recommendations.

Occasional exposure: 10 mW/cm<sup>2</sup>, all frequencies

# USSR

#### MINISTRY OF HYGIENE

#### Personnel

Pub. No. 273 1966 Biological Effect of Microwaves in Occupational Hygiene 1968 Occupational Health Aspects of Radio-Frequency Electromagnetic Radiation For users of microwave generators and public. Gives limits and general guidance, 0.3-300 GHz

Provides limits for medium-UHF frequencies (0.1-300 MHz)

Exposure (0.3 - 300 GHz): Entire working day: 0.01 mW/cm<sup>2</sup> <2 hrs/day: 0/1 mW/cm<sup>2</sup> <15-20 min/day: 1.0 mW/cm<sup>2</sup>

0.1-3 MHz: 20 V/m 3-30 MHz: 5 V/m

#### UNITED KINGDOM BRITISH POST OFFICE (BPO)

#### Personnel

BPO Recommendation: Safety Precautions Relating to Intense Radio Frequency Radiation Compliance by users and manufacturers of RF equipment. Precuations given.

For 30 MHz-30 GHz, continuous daily exposure Exposure:  $10 \text{ mW/cm}^2$ . Also for pulse systems, average taken over complete trains of pulses.

# INSTITUTIONAL LISTINGS

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

SERVICE DIVISION, AMERICAN ELECTRONICS LABS., INC., Richardson Rd., Montgomeryville, PA 18936 EMI/EMC, shield, enc. consult. test. & anal.; Scrn. rm. (incl. for large veh.); Comp. instr. for Mil. EMI test.

ELECTRO-METRICS, Division of Penril Corp., 100 Church St., Amsterdam, NY 12010 EMI meters and automated systems incl., calculator/computer-based;20 Hz-40 GHz\*MIL-STD/CISPR/VDE/SAE/FCC.

EMERSON & CUMING, INC., Canton, MA-Gardena, CA-Northbrook, IL.

Eccoshield RF shielded chambers-Eccoshield EMI/RFI gaskets and materials-Eccosorb anechoic chambers.

METEX ELECTRONIC SHIELDING GROUP, A Unit of Metex Corporation, 970 New Durham Road, Edison, NJ 08817

EMI/RFI, EMP & EMC Shielding Materials, Custom-Engineered Conductive Components, and Coatings.

TECKNIT, INC., 320 N. Nopal St., Santa Barbara, CA 93103

EMI/RFI Shielding Products, Conductive Components, Textiles, Coatings, Adhesives, and EMC Windows.

HONEYWELL, ANNAPOLIS OPERATION, P. O. BOX 391, Annapolis, MD 21404 Telephone (301) 224-4500

EMI/EMC/TEMPEST, R & D, Test and Analysis, Communication and Digital Design.

KEENE CORPORATION, RAY PROOF DIVISION, 50 Keeler Ave., Norwalk, CT 06856 Telephone (203) 838-4555 Telex 96-5812

RF Shielded Enclosures and Anechoic Chamber Systems to 100 GHz, Turnkey Installation of EMC, EMI, RFI, and Tempest Facilities.

SPECTRUM CONTROL, INC., 8061 Avonia Rd., Fairview, PA 16415 Telephone (814) 474-1571 Telex 510/699-6848

EMC test and consulting VDE, CISPR, MIL-461, FCC. Mfr. RF filters, RFI capacitors, chips, variable caps- in stock at HALLMARK.

LECTROMAGNETICS, INC., 6056 W. Jefferson Blvd., Los Angeles, CA 90016 Telephone (213) 870-9383

RF shielded enclosures, modular, prefabricated & all welded. RFI/EMI power line filters; signal line filters.

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