IEEE

# Electromagnetic Compatibility Society

Newsletter

ISSUE NO. 128 WINTER 1986 (ISSN 0164-7644) EDITOR: ROBERT D. GOLDBLUM

## RESULTS OF THE BOARD OF DIRECTORS ELECTION BALLOT

A ballot for the election of six members to the IEEE Electromagnetic Compatibility Society Board of Directors was issued on September 12, 1985. The ballots returned have been counted, and the following candidates have been elected for a three-year term beginning January 1, 1986:

Richard T. Ford
L. Gilda Haskins
James S. Hill
H. R. Hofmann
Mel Johnson
Risaburo Sato

We wish the newly elected members of the Board of Directors success and thank all nominees for their willingness to serve and for permitting their names to be included on the ballot.

## 1986 IEEE CONFERENCE & EXHIBITION ON EMC

The 1986 IEEE Conference and Exhibition on EMC will be held February 6, 1986, at the Grand Hotel, One Hotel Way, Anaheim, CA. The theme of the conference is "Electromagnetics Today-EMC, FCC, EMP, ESD, Tempest and Fiber Optics" and will have both commercial and military electronics orientation.

The products and services represented provide an excellent opportunity for single-point review of the latest state-of-the-art RFI, EMC, EMP, ESD and Immunity Equipment, Facilities and Suppression Devices. There will be more than 40 exhibitors covering the following products and services:

Absorbers; Microwave
Adhesives; Conductive
Coatings; Anti-Static/Conductive
Contact Strips/Fingers
Fiber Optics
Field Intensity Meters
Filters
Fingerstock
Gaskets; RF
Generators, ESD, impulse Transient
LISN's
Probes; Current, RADHAZ Voltage
Receivers; EMI & TEMPEST

To obtain more information,contact Larry Caney, Chairman, Eaton Corporation, (213) 822-3061.

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# EDUCATION COMMITTEE NEWS

The EMC Society Education Committee held a meeting during the EMC Symposium in Boston. Fifteen people were in attendance, which is the largest group we have ever had for an Education Committee meeting. It was encouraging to see such a good turnout. Following are the major items discussed at the meeting.

Gene Corey discussed IEEE Home Study Courses sponsored by the Individual Learning Committee, and requested suggestions of subjects for future courses. Pat Coles gave a summary of the results of the EMC questionnaire, which was sent to colleges and Universities. The results were published in this column in the last issue of the newsletter (Fall 1985).

The subject of how do we better communicate with people outside the Society on the importance of EMC was discussed. One suggestion was to have a short article on EMC published in the IEEE student magazine *Potentials*. We are presently looking for someone who would like to write such an article. Along these lines, the December 1985 issue of IEEE *Spectrum* had an article by Don White, et al. on *Taming EMI In Microprocessor Systems.*

The *Experiments and Demonstrations in EMC* booklet still needs comments and criticisms from some of the over 300 people who have copies, before the project can proceed. To date, no comments at all have been received.

Plans were also made for holding a session on EMC Education as part of the 1986 Symposium in San Diego. Anyone interested in writing a paper for this session should contact me.

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

The Center for Professional Advancement is offering a course on *Electromagnetic Compatibility Engineering.* For more information contact the Center at 201-238-1600.

Interference Control Technologies is offering courses on: *Grounding and Shielding; EMC Design and Measurement; Tempest-Design Control and Testing; Practical EMI Fixes; Noise and EMI Control in Computers and PCBs; Introduction to EMI/RFI/EMC; EMP/SGEMP Design and Testing; ESD Control — Design and Retrofit;* and *EMI Control in Power Supplies.* For information call 703-347-0030.

R & B Enterprises has courses on: *Tempest — A Detailed Design Course; Tempest — An Overview For Managers and Tempest Officers; Fiber Optics Design For EMI/EMP Control; Electromagnetic Pulse (EMP) Design And Test; Grounding, Bonding & Shielding; EMI For Non-EMI Personnel;* and *The EMI Testing Workshops.* For more information call 215-825-1966.

Henry Ott
Chairman, EMCS
Education Committee
AT&T Bell Laboratories
Room 1E-212A
Whippany, NJ 07981
201-386-6660

# NEWSLETTER STAFF

# EMC STANDARDS ACTIVITIES

### The International LISNs

Instead of the broad overview of standards activities, this article is concerned with the narrow topic of the U.S. and international Line Impedance Stabilization Networks (LISN), which are known internationally as Artificial Mains Networks. These networks are used to simulate the impedance of a typical power convenience outlet and the wiring network.

This article was prompted by several phone calls which indicated that in the 10 kHz to 150 kHz frequency range the data taken in the U.S. does not match the data taken in Europe for the same RFI source. There are three possible reasons for this:

1) The U.S. LISN characteristics do not match those of the LISN's used in Europe.
2) The power in Europe is 220 V Phase-to-Neutral and Phase-to-Ground and in the U.S. it is generally 208 V Phase-to-Phase and 115 V Phase-to-Ground.
3) Each line must be connected to a LISN simultaneously and each RFI meter terminal must be terminated with a 50-Ohm load. This will ensure that the differentially generated RFI is converted to a common mode signal as measured by the RFI meter. This is often automatically done in available two-wire LISNs.

### The CISPR LISN Characteristics

The LISN characteristics are presently defined in CISPR Publication 16, Clause 8. Since these specifications are of insufficient detail, CISPR Subcommittee A worked out an amendment, CISPR/A (Central Office) 27. This document will eventually find its way into Publication 16. In the meantime, it is published here. This revision contains the characteristics for all LISNs in use as shown in Table 1, with reference to Figure 1.

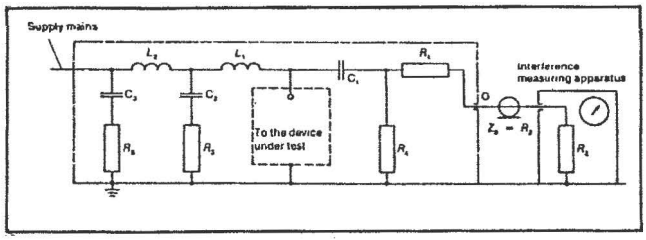


**Figure 1.** General Schematic of Artificial Mains Network for one phase of the Power Supply. One network must be used in each line.

### Frequency Range of 150 kHz to 30 MHz

The LISN characteristic for 150 kHz to 30 MHz frequencies as specified in ANSI C63.4, CISPR Publication 16 and FCC Part 15 (MP-4) is shown in Figure 2. The important network values are:

| | |
|---|---|
| Series Inductance, $L_1$ | = 50 $\mu$H |
| Coupling Capacitor, $C_1$ | = 0.1 $\mu$F |

by Herbert K. Mertel

| | |
|---|---|
| Terminating Capacitor, $C_2$ | = 1 $\mu$F |
| Terminating Resistor, $R_3$ | = 0 Ohm |

The $L_2$, $C_3$ and $R_5$ components to isolate the 50 $\mu$H LISN are not required.

### Frequency Range of 10 kHz to 150 kHz (and to 30 MHz)

The LISN characteristics for the 10 kHz to 150 kHz frequency range (and also usable to 30 MHz) as specified in ANSI C63.4 and CISPR Publication 16 is shown in Figure 3. The important network values are:

| | |
|---|---|
| Series Inductance, $L_1$ | = 50 $\mu$H |
| Coupling Capacitor, $C_1$ | = 0.25 $\mu$F |
| Terminating Capacitor, $C_2$ | = 8 $\mu$F |
| Terminating Resistor, $R_3$ | = 5 Ohms |
| Filter Inductance, $L_2$ | = 250 $\mu$H |
| Filter Capacitance, $C_3$ | = 4 $\mu$F |
| Filter Resistor, $R_4$ | = 10 Ohms |

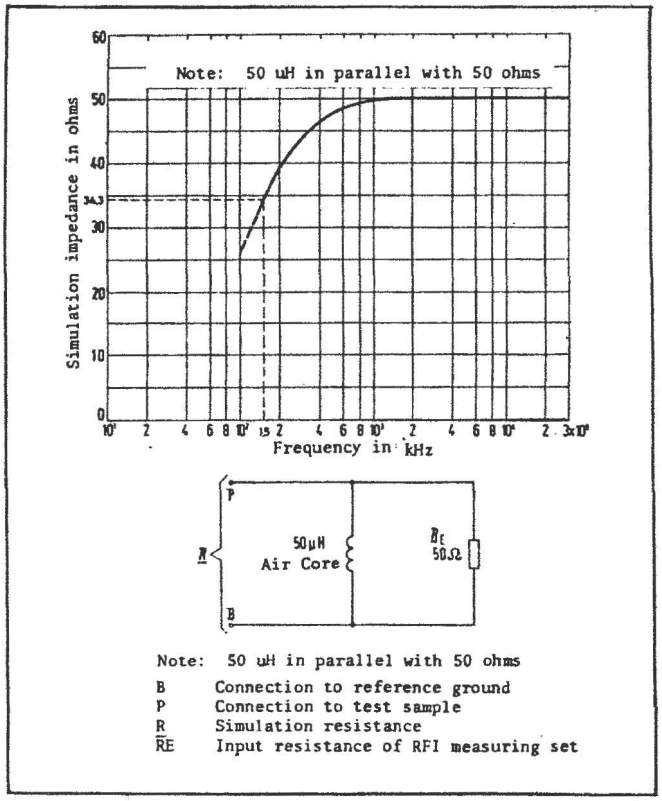


**Figure 2.** Impedance Characteristics of 50 Ohm/50 $\mu$H LISN, 150 kHz to 30 MHz.



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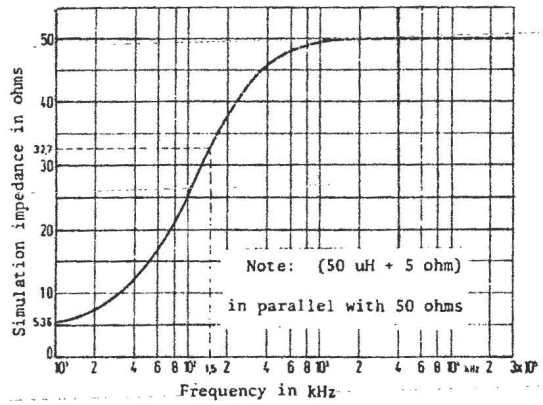
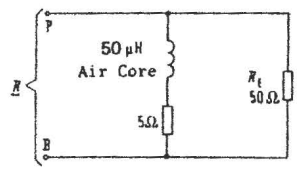
The $L_2$, $C_3$ and $R_4$ components are used to isolate the impedance-controlling components of the network from the AC power network. In a shielded room the AC power line may have a low impedance at 10 kHz because of the large RFI filters that are used at power entry. The inductive reactance of the 250 $\mu$H inductor at 10 kHz is 16 Ohms. This impedance in combination with the $C_3$ and $R_4$ will give an absolute network impedance value of 5.4 Ohms when measured from the EUT power terminal to ground as shown in Figure 3.




| f MHz | R |
|---|---|
| .01 | 5.4 |
| .02 | 7.3 |
| .08 | 21 |
| .15 | 33 |
| .3 | 43 |
| .8 | 49 |
| ↓ | |
| 30 | 49 |

Note: (50 uH + 5 ohm) in parallel with 50 ohm

B Connection to reference ground
P Connection to test sample
R Simulation resistance
RE Input resistance of RFI measuring set

**Figure 3.** Impedance Characteristics of 50 Ohm/50 $\mu$H/5 Ohm LISN, 10 kHz to 30 MHz.

To verify the suitability of an LISN for 10 kHz to 150 kHz measurements, a 50-Ohm signal source is connected between the EUT power terminal and ground (via a 10 or 20dB pad). The voltage measured at the RFI meter terminal should be reduced by the following values.

| | |
|---|---|
| 10 kHz | -21dB |
| 12 kHz | -13dB |
| 20 kHz | -18dB |
| 40 kHz | -7.5dB |
| 80 kHz | -3dB |
| 150 kHz | -1.3dB |

If these values cannot be achieved, the network is not suitable or a correction value for the network must be added to the readings.

### Correction for the 0.25 $\mu$F Coupling Capacitor

Note 2 of Table 1 points out that a correction value must be added to the readings at low frequencies. This correction value is shown in Figure 4.

### AC Supply Voltages

In Europe, the AC supply voltages are typically 220/380 V AC, 3-phase. This means that 220 V exists with respect to ground. In the U.S., the conventional AC supply is 115/208 V AC, 3-phase. This means that when RFI testing is done with 208 V, the phase-to-ground voltage is only 115 V and the RFI voltages may be lower. To obtain the European type AC voltage a motor generator can be used. As an option, a 115 V to 230 V isolation transformer can be used to make a 230 V neutral by grounding one side of the secondary winding before going into the dual LISN. Consequently, 230 V will exist from ground-to-phase and neutral-to-phase.

### Summary

To ensure a simulation of the European RFI voltage measurements from 10 kHz to 150 kHz, the following key points must be observed:

1) Use 220 VAC with respect to ground and neutral.
2) The LISN must be 50 $\mu$H/50 Ohm + 250 $\mu$H 5 Ohm to ensure 5.4 Ohm at 10 kHz.
3) The coupling capacitor to RFI measuring set must be 0.25 $\mu$F.
4) The 10 to 40 kHz meter readings must be corrected for the 0.25 $\mu$F capacitor voltage drop.
5) Each LISN must be terminated into 50 Ohms to convert differential mode RFI to the measured common mode RFI.

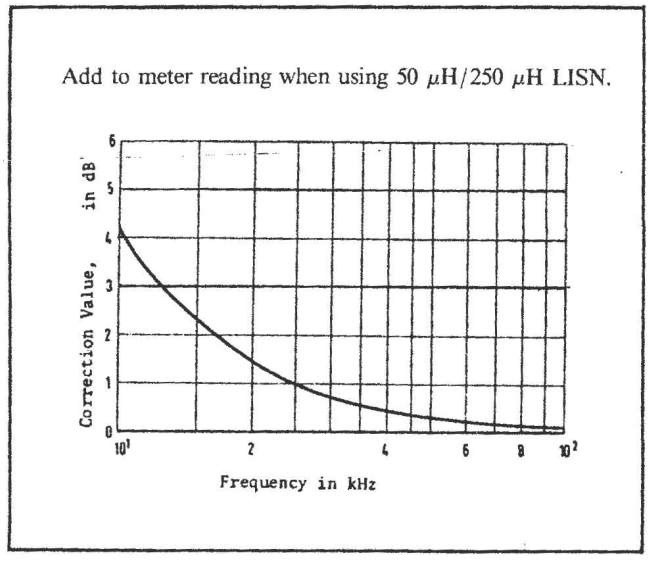



**Figure 4.** Correction Value in dB for 0.25 $\mu$F Capacitor in LISN.



(Continued . . . )

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| Band | A | B Note 6 | B | B Note 4 |
|---|---|---|---|---|
| **Frequency range** | **10-150kHz** | **150kHz-30MHz** | **150kHz-30MHz** | **150kHz-30MHz** |
| Current range | < 100 A | < 100 A | < 25 A | < 400 A |
| $R = R_1 + R_2$ | 50 Ω | 50 Ω | 150 Ω | 50 Ω |
| $R_3$ (Note 5) | 5 Ω | 0 | 0 | 1 Ω |
| $R_4$ | 1000 Ω | 1000 Ω | 1000 Ω | 1000 Ω |
| $R_5$ | 10 Ω | Note 8 | Note 8 | Note 8 |
| $C_1$ | 0.25 μF (Note 2) | 0.1 μF | 0.1 μF | 0.1 μF |
| $C_2$ | 8μF (Note 3) | 1.0 μF | Note 1 | 2 μF (min) |
| $C_3$ | 4 μF | — | — | — |
| $L_1$ | 50 μH | 50 μH | Note 1 | 5 μH |
| $L_2$ | 250 μH (Note 7) | — | — | — |

**Table 1.** Parameter Values for Artificial Mains Network.

NOTES:

1. The artificial mains networks shall have an impedance between each conductor and earth whose magnitude Z at any one frequency as shown in the Figures.
2. At the lowest frequencies of the range 10-150kHz, the 0.25 μF capacitor does not have a negligible impedance. Unless otherwise specified, it will be necessary to make a correction for this impedance.
3. Since the high capacitance value is used in this unit, the unit shall either be solidly bonded to earth or a mains isolating transformer shall be used.
4. The network may also be usable for interference voltage measurement to 100 MHz.
5. See Figure 1 for R, C and L location in networks.
6. The network used for Band A may also satisfy the requirements for Band B.
7. Q>10 for 10-150kHz frequency range. In practical networks it is advantageous to use inductors ($L_2$) coupled in series opposition in the Live and Neutral lines (Common Core Choke).
8. The $R_5$, $C_3$, and $L_2$ components are used only for the Band A network.

# PRACTICAL PAPERS, ARTICLES, AND APPLICATION NOTES

You will note the title of this department is no longer "Short...," but is now "Practical..." we are thus in a position to handle longer articles so long as they are practical.

Our publication deadlines are February 28, May 31, August 31, and November 23, so that I have time to do anything that must be done to an article before sending it on to the Newsletter Staff for publication.

Please keep your practical papers coming.

by Edwin L. Bronaugh

# 1986 INTERNATIONAL IEEE AP-S SYMPOSIUM NATIONAL RADIO SCIENCE MEETING

The 1986 International Symposium, sponsored by the IEEE Antennas and Propagation Society and the National Radio Science Meeting, sponsored by the USNC/URSI Commissions A, B, E, and F, will be held jointly at the Wyndham Franklin Plaza Hotel, Philadelphia, Pennsylvania, June 9-13, 1986. The technical sessions for IEEE AP-S and the National Radio Science Meeting will be coordinated to provide a comprehensive and well-balanced program. Inquiries regarding the technical program may be directed to Ali Afrashteh, Technical Program Committee Chairman. Further information regarding the symposium may be obtained from Charles C. Allen, General Chairman, General Electric Company, Valley Forge Space Center, Room U4018, P.O. Box 8555, Philadelphia, Pa. 19101.

# BOOK REVIEWS

by Jim Hill, The EMXX Corp.

Our book review subject for this issue of the Newsletter is Product Safety, a subject that cuts across all engineering disciplines. Product safety means different things to different people. To the design engineer it means the design of a product which will be useful, but will not present a hazard which may threaten his employer with a public liability suit. To the test engineer it means subjecting the product to meaningful tests that will insure a useful product life without jeopardy of liability litigation. To the manager it means an organization within the company that can evaluate the potential product from a safety standpoint and assure that the product in the hands of the ultimate user will perform in a safe manner. Beyond these interests are the lawyers looking at the legal aspects, and the engineers who will act as expert witnesses when a product liability case goes to court. Our book deals for the most part with this last aspect, product liability and the law. It is written by engineers for engineers, and succeeds very well within its 100 pages of text.

The authors are professors in the College of Engineering at the University of Cincinnati, Dr. Thorpe in the Mechanical Engineering Department, and Dr. Middendorf in the Electrical Engineering Department, who has been a member and fellow of the IEEE and its predecessor societies since 1947.

**WHAT EVERY ENGINEER SHOULD KNOW ABOUT PRODUCT LIABILITY**
(What Every Engineer Should Know:
A Series, Volume 2)
by James F. Thorpe and William Middendorf. 1979.
Marcel Dekker, Inc., 270 Madison Avenue,
New York, NY 10016
120 pages, bound, illustrated. $9.75.

Today the designer must not only be able to apply the technical elements of design but must also meet society's expectations of a design. The need for greater product safety has created new and confusing legal pressures for engineers involved in product design, manufacturing, management and sales. In responding to these challenges, the engineer needs to develop a broadened perspective of the total design responsibility. "What Every Engineer Should Know About Product Liability" shows how the process of designing safer products is a natural extension of traditional engineering aptitudes and procedures.

The authors, a mechanical engineer and an electrical engineer, have had extensive experience as educators, product designers, and witnesses and advisors in product liability cases. Their wealth of experience is drawn upon in a core of topics chosen to illuminate the engineer's multifaceted responsibility. The discussions cover: the theories upon which product liability cases are built; steps to reduce product liability risks; the use of warning labels; advice for the neophyte engineering expert witness; the technical and ethical conflicts that pit loyalty to the employer against responsibility to protect the public; the role of product liability insurance and the challenge to legislative reform; and, the needed changes in engineering curricula to stimulate awareness in the area of product safety.

One of the interesting points brought out in the book is that traditionally the concept of *caveat emptor* (let the buyer beware) has been a governing consideration in product liability. The prevailing concepts of liability were based on manufacturer negligence, contributory negligence of the plaintiff, and reasonable conduct of the manufacturer. The relationship between manufacturer and consumer in the design atmosphere have changed to the spirit of *caveat venditor* (let the seller beware) with a consequent impact on the design engineer.

The idea of product liability can be traced back as far as 1800 BC when the king of Babylon, Hammurabi, compiled his great code of laws. The code provided for stringent measures against a craftsman guilty of making a faulty product. The penalties were so severe that the offense was considered more of a criminal than a civil nature. The injured party received no compensation other than the satisfaction derived from knowing the severe punishment of the offender.

The product must be designed and manufactured with its total life and total use environment in mind, that is from the moment it leaves the factory until it no longer exists. Perhaps the potential liability easiest to overlook is the one that takes place before the product is put to use. For example, a door manufacturer was shipping doors overseas. The doors had a large opening in the top half for glass to be installed later. A number of doors were packed together forming a stack 42 inches high. A cardboard cover was wrapped around them as protection and the bundle was secured by two steel bands. The opening in the doors were in line covered only by the cardboard with only the marking "fine doors." A longshoreman carrying a 100-pound sack of flour walked across the doors and sustained injury when he fell through the void area. In the ensuing trial, the manufacturer stated that this was a clear case of abuse. However, the court affirmed the judgment that the injury was caused solely by the manufacturer in packaging the product. The manufacturer should have known that it is customary for stevedores to walk on material already loaded. Damages were paid because of failure to foresee that a product can cause injury even in transit. Product safety specifications are principally set for the consumption or use of the product, but the product must be safe both before and after this stage in its life. In the discard stage, the product must not poison streams, must not explode, nor in any way be a potential liability.

This book is easy to read and provides the legal aspects of product liability of interest to a product design engineer.

# Division 4
# Electromagnetics and Radiation
# Key Developments of the Last Hundred Years

*by*

*Emerson W. Pugh, 1984 Director*

In commemoration of the IEEE Centennial, I met with presidents of the IEEE societies in the Division of Electromagnetics and Radiation to discuss the technological advances of the past hundred years that have most influenced the work of our members. Our meeting was held by phone, air mail, and electronic mail, none of which existed one hundred years earlier.

Clark E. Johnson, Jr., 1984 president of the Magnetics Society, noted that his society probably represents the oldest of our technologies with the use of magnetic compasses for navigation dating back before 1100 AD. By the time the American Institution of Electrical Engineers was organized in 1884, two major applications of magnetism and magnetic materials had already been created: the dynamo and the electromagnet. During the last century, significant advances in soft magnetic materials have made power distribution and generation more economical, and permitted development of higher-efficiency, low-cost motors. The development and commercialization of nonmetallic magnetic materials, such as ferrites, have sparked the way for exceptional improvements in telephoning, communications, and radar, not to mention ferrite cores that provided the first reliable, high-speed memories for electronic computers beginning in the mid-1950s. Yet magnetics have often been considered to be an arcane and somewhat uninteresting endeavor. Nothing could be further from the truth.

The atomic origins of magnetism itself are still only poorly understood, and in so far as a dynamic growth industry is concerned, magnetic recording media manufacturing has been growing at 30 percent per year over the last three decades. Recent magnetic developments, such as amorphous films, will undoubtedly touch our daily lives in as important ways as the magnetics of old.

Allan W. Love, 1984 president of the Antennas and Propagation Society, notes that in the 36 years of its existence, the Antennas and Propagation Society and its members have contributed to many astonishing developments. Prominent among these are the sophisticated ground and satellite antennas with their multiple and contoured beam capabilities for communications, the antennas of NASA's deep space tracking network that facilitate the exploration of our solar system by space probes, and the exquisitely sensitive antennas used in radio astronomy to probe the vast reaches of the universe at distances well beyond the capabilities of their optical counterparts. In the area of remote sensing, there are many examples of satellites carrying both active and passive remote sensing systems using antennas to gather the unimaginably weak signals emitted or reflected by the land and sea surfaces. A prodigious amount of theoretical and experimental effort has gone into studies of electromagnetic wave propagation in all kinds of media, homogeneous and nonhomogeneous, isotropic and nonisotropic. Electromagnetic waves are now used extensively to delineate otherwise inaccessible subsurface features in the earth's crust and to locate discontinuities which can point to oil, gas and mineral deposits, and they are increasingly being used in medical imaging techniques and for noninvasive diagnosis and treatment.

H. George Oltman, 1984 president of the Microwave Theory and Techniques Society, observed that microwave devices and components are generally not end-products; they are used as components by other industries to make useful systems for the benefit of mankind. An obvious example is radar in all of its forms: weather avoidance, commercial and military, airborne, satellite geophysical, automotive and on and on. Microwave heating has come closest to being a microwave end-product. Two major thrusts have made possible the recent expansion in communication services: point-to-point microwave repeaters and satellite stations. Now we are beginning to see the effects of another technology, fiber optics, that promises even lower communication costs. Members of the Microwave Theory and Techniques Society have, over the last five decades, developed sophisticated and versatile design tools. Not only have these tools extended the variety, the speed, and the quality of microwave components, but they have been modified and used by workers in other fields.

Eugene D. Knowles, 1984 president of the Electromagnetic Compatibility Society, considers Marconi to be the first EMC engineer. Four years after Marconi successfully demonstrated radio communication, he filed patent No. 7777, which permitted more than one station to operate without interference. Since then, technology and systems have grown and become more sophisticated. Armstrong's superheterodyne permitted more devices in a finite spectrum, and the advent of radar and pulse equipment in the 1940's and 1950's expanded the use of the spectrum and greatly increased the need for electromagnetic compatibility. The field was technically active but professionally unorganized until 1957 when the IRE granted a charter to the new Professional Group on Radio Interference; the group later became the IEEE Society. In the IEEE Centennial year, the membership passed 2500, and the first International Symposium was held in Tokyo, Japan. Now, 85 years after patent 7777, electromagnetic compatibility has become an internationally recognized discipline.

John A. Martin, 1985 president of the Nuclear and Plasma Sciences Society, recalls that this society was formed as the



*(Continued . . . )*

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professional group on Nuclear Science in 1949, two years after the study committee was commissioned to determine the proper role of the IRE in this field. At the beginning of this century of progress, the scientific discoveries that underpin the nuclear plasma sciences had not been made: the electron was discovered in 1896; the neutron was identified in 1932; nuclear fission was not understood until 1939. The development of the nuclear energy sources and applications, and basic research in nuclear and particle physics have driven the growth of the nuclear sciences. The plasma sciences have been stimulated by a broad spectrum of important applications of plasma devices and the possibility of limitless power through controlled thermo-nuclear fusion. The challenges seem limitless. Perhaps in no field of IEEE are there greater uncertainties and opportunities as we enter the second century of the IEEE.

# U.S., AUSTRALIAN LABORATORIES AGREE ON EQUIVALENCY OF MEASUREMENT STANDARDS

Officials of U.S. and Australian national standards laboratories signed a binational agreement recognizing the equivalency of their national standards for six basic units of measurement as defined by the International System of Units (SI).

The agreement, signed at Gaithersburg, Md., by Dr. Ernest Ambler, director of the Commerce Department's National Bureau of Standards (NBS), and Dr. William R. Blevin, chief standards scientist at the National Measurement Laboratory for the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), is based on a long history of interlaboratory comparisons of SI Units for length, voltage, electrical resistance, electrical capacitance, time, and temperature.

Both the United States and Australia are signatories of the Convention of the Meter, and determine their basic units of measurement in accordance with the definitions for SI Units which have been adopted by the General Conference of Weights and Measures, an intergovernmental body that is the world authority on physical quantities and the ways they are measured.

George Uriano, director of NBS Measurement Services, says, "The agreement with Australia benefits industrial sectors in both countries and will facilitate international trade. For example, a manufacturer of an electrical component will be able to verify the performance of the product by tracing the equivalency of a basic measurement to either NBS or CSIRO, and thereby eliminate unnecessary product testing."

NBS, a nonregulatory agency of the U.S. Department of Commerce, has similar international agreements with the United Kingdom, Canada, and Italy.

Since 1901, the bureau has provided the basis for uniform and accurate measurements throughout the U.S. economy by providing standards, measurement techniques, reference data, test methods, and calibration services to ensure national and international measurement capability and compatibility.

CSIRO is the major research organization of the Australian government. The National Measurement Laboratory in Sydney has the responsibility for maintaining the national standards of measurement for the Australian government.

# A LETTER OF APPRECIATION TO THE IEEE

Constance Sullivan, wife of the late A. H. "Sully" Sullivan, a longtime member and Life Fellow of the IEEE, asked that we print the following letter.

**"Regarding the Late IEEE Fellow Aaron H. Sullivan Jr.**

The support and friendship I have received from IEEE Members these past 12 months is beyond measure. At the suggestion of my husband's close associates and friends, a Memorial Fund was set up in his name when I requested no flowers. I want you to know that I greatly appreciate the kind generosity of contributing Members to the Fund, which has shown me the deep regard held for Sully and makes me very proud. My heartfelt thanks and best wishes to everyone of you. Thank you."

Sincerely,
Constance Sullivan

# EMC PERSONALITY PROFILE

by William G. Duff

## JULIUS P. KNAPP

Julius Knapp, whom most people know as Julie, has been employed as an electronics engineer with the Federal Communications Commission since June 1974. He spent his first year with the Commission at its Washington, D.C. headquarters office, where he was involved with the processing of applications for equipment authorization under Parts 15 and 18 of the Commission's Rules. These rules contain the general EMI standards for radiofrequency devices and industrial, scientific, and medical (ISM) equipment. They also contain the provisions for nonlicensed operation of a wide variety of low-power transmitters, such as cordless telephones, intrusion detectors, and radio control and security devices.

In May 1974, the equipment authorization activity was shifted to the Commission's new laboratory facility in Columbia, Maryland, and Julie moved along with it. One reason for moving the activity to the lab was to allow the engineers, who were, up to that time only reviewing paperwork, to gain some hands-on experience in performing EMI measurements. In addition to his work reviewing EMI data filed with applications for equipment authorization under Parts 15 and 18, Julie was also extensively involved in performing radiated and power-line conducted emissions measurements on such devices at the laboratory. One of the exciting aspects of the job was that the lab was constantly confronted with new devices and gadgets, ready to be introduced to the marketplace, often requiring development of novel measurement techniques. Among the more exotic devices were a vehicle identification system that beamed a radio signal towards the ground from above a toll booth, and a device designed to trigger the bursting of a cannister containing red dye that would be tossed in with the "loot" during a bank hold-up. Julie was also responsible for activities in a number of other areas, such as review of open-field test site descriptions, administration of the FCC Form 740 importation program, and enforcement of the Commission's marketing rules.

From January 1981 to the present, Julie has served as a senior electronics engineer in the Radio Frequency Devices Branch, which has recently merged into the Technical Standards Branch. This group is responsible for preparation of Commission rulemaking items related to Parts 15 and 18. It is also responsible for interpretations and policies related to these rules. Among some of the Commission items for which Julie was principal author are: authorization of new frequencies for cordless telephones; FCC Measurement Procedure MP-4: FCC Methods of Measurement of Radio Noise Emissions From Computing Devices; FCC Bulletin OST 55: Characteristics of Open-Field Test Sites; and, establishment of exemptions from the FCC computing device rules for medical equipment. Anyone who has attended the past few EMC Symposia is aware of the keen interest in MP-4 and OST 55. Julie has also overseen a number of other major projects, including a recent comprehensive rewrite of the administrative provisions in Part 18 for (ISM) equipment, and a complete review of the Part 15 technical standards and measurement procedures for radio control and security devices.

Mr. Knapp has been an active participant in a number of EMC standards activities. He is presently an FCC representative on the American National Standards Institute Committee C63. He is the U.S. Technical Advisor to ANSI on matters pertaining to Subcommittee B of the International Special Committee on Radio Interference (CISPR), the subcommittee that establishes international voluntary standards to control radio interference caused by ISM equipment, including, until recently, computer equipment. Subcommittee B developed the long-awaited and soon to be released CISPR Publication 22: Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment. Julie is also the U.S. Representative to the International Radio Consultative Committee (CCIR) Interim Working 1/4 which is considering international standards to limit emissions from ISM equipment. In contrast to the CISPR standards, which are voluntary, the recommendations of CCIR IWP 1/4 could ultimately become binding upon the U.S. through treaty.

Recently, Julie co-authored a paper with Mr. Frank Rose, Chief of the Technical Standards Branch, outlining a possible framework for a complete revision of the Part 15 Rules. The revision of Part 15, which many people feel has been needed for some time, will surely be a massive undertaking, since it affects, in one way or another, virtually all users of the radio spectrum.



*(Continued . . . )*

(Continued . . . )

Born in New York City on October 21, 1951, and raised on Long Island, Julie received his Bachelor of Engineering in Electrical Engineering in 1974 from the City College of the City University of New York. He joined the FCC upon graduation. During his tenure with the Commission, he has taken numerous technical courses and is currently pursuing a Masters Degree in Engineering Administration at the George Washington University in Washington, D.C.

Julie has been active in the Washington/North Virginia Chapter of the EMC Society. He served as Secretary/Treasurer of the Chapter in 1984-85 and is presently serving as Vice Chairman. In December 1984, he helped to organize the chapter's 25th Anniversary Celebration. Julie was Secretary of the Board of Directors for the 1983 International Symposium on EMC in Washington, D.C., and is currently serving as Secretary of the Preliminary Planning Committee for the 1990 EMC Symposium. He has presented a number of papers on the Part 15 and 18 Rules at various IEEE-sponsored EMC Symposia in the U.S. and abroad.

Julie currently lives in Columbia, Maryland. He is married and has two young boys, ages 1 and 3, who make sure he keeps busy. He enjoys a variety of sports, including golf and tennis, and is the captain of a co-recreational softball team. He plays guitar, keyboards, and sings in a church music group that has played in a variety of locations around the Baltimore-Washington area, including the Baltimore Civic Center.

We look forward to the further efforts of Julie and others in the Commission towards improving the Part 15 Rules. Julie would like to pass along a special thanks to all those in the EMC community who have contributed their efforts and ideas towards solving the EMI problems faced by the Commission.

# IEEE INTERNATIONAL SYMPOSIUM ON EMC

## CALL FOR PAPERS & TO EXHIBIT

The 1986 IEEE International Symposium on EMC will be held at the Town & Country Hotel in San Diego, California, September 16-18, 1986.

The IEEE EMC Society is seeking original, unpublished papers on all aspects of EMC. Suggested topics include, but are not limited to, the following categories.

The IEEE EMC-86 is now accepting Exhibits reservations. The first booth space (8' x 10') for each exhibiting firm will be $750; all additional spaces listed under the same company name will be $500/space.

To reserve a hospitality suite during the IEEE EMC-86, submit your request in writing, stating the purpose of the suite room, to Bill Johnson, EMT, Inc., 4410 Glacier Avenue, San Diego, California 92120.

### TECHNICAL AREAS

- Analysis
- Control
- Design
- EM Environment
- EMP
- ESD
- Filters
- Instrumentation & Theory
- Lightning
- Magnetics
- Materials
- Microwave Theory & Techniques
- Noise Phenomena
- Non-Sinusoidal Signals
- Radiation Hazards
- Regulations
- Signal Processing
- Spectrum Management
- Standards
- Susceptibility
- Vulnerability

### APPLICATION AREAS

- Aerospace & Electronic Systems
- Antennas & Propagation
- Automatic Control
- Biomedical Engineering
- Broadcasting
- Circuits & Systems
- Communications
- Components, Hybrids & Manufacturing
- Computer-Aided Design of Integrated Circuits & Systems
- Computers
- Consumer Electronics
- Control Systems
- Education
- Electrical Insulation
- Electron Devices
- Geoscience & Remote Sensing
- Isolation & Shielding
- Industrial Electronics
- Industry Applications
- Medicine
- Military Applications
- Plasma Science
- Power Apparatus & Systems
- Quantum Electronics
- Solid State Circuits
- Vehicular Technology

Abstracts and summaries should be sent directly to: Technical Paper Chairman, Mr. Edward N. Skomal, MS:M4/937, Aerospace Corporation, P.O. Box 92957, Los Angeles, CA 90009, (213) 648-7024. For other information, contact: Vice Chairman & Publicity Chairman, Mr. George Ufen, GRU Associates, 1105 E. Commonwealth Ave., Fullerton, CA 92631, (714) 738-0903.

Your Exhibits Committee for IEEE EMC-86 will be happy to answer any questions which may arise. To obtain more information call Jerry Rothhammer or Pat Ullrich at 213/822-3061.

# A MESSAGE FROM SAN DIEGO—EMC/1986

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

The emphasis of the planning committee will be on service:

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

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

The three key items of an EMC Symposium are:

1. Technical Program
2. EMC Exhibits
3. Arrangements

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

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

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

.. The American Radio Relay League will hold its National Convention prior to EMC-86 from 5 to 7 September 1986 and also at the Town & Country Convention Center. Walt Hicks (W6UZL), Tel.: (619) 292-7918, is the General Chairman. Many of the EMC Society members belong to the A.R.R.L. and vice versa and may therefore be interested in attending both meetings.

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

Cordially,

Herb Mertel
Chairman - EMC-86

George Ufen
Vice Chairman & Publicity

# 7TH INTERNATIONAL ZURICH SYMPOSIUM & TECHNICAL EXHIBITION ON EMC

The 7th International Zurich Symposium and Technical Exhibition is planned for March 3 to 5, 1987 at the Federal Institute of Technology, Zurich, Switzerland.

The "EMC 1987" is organized under the auspices of the Director General of the Swiss PTT by the Institute for Communications Technology of the Swiss Federal Institute of Technology in Zurich. It is sponsored by the Swiss Electrotechnical Association and cosponsored by the URSI.

Prospective authors are invited to submit an abstract and summary of up to 5 pages in 11 copies to Technical Program Committee EMC 87, ETH Zentrum-IKT, 8092 Zurich, Switzerland. Materials must be received no later than March 14, 1986.

For anonymity of reviewing quote addresses, affiliations, telephone and telex numbers of all authors should be on a separate sheet. Submissions should clearly describe work done, including results and conclusions and should preferably be accompanied by graphs and figures. Only papers not published or submitted elsewhere will be considered.

Authors will be notified by June 23, 1986, author's kits will be included. Photo-ready manuscripts will be due by October 31, 1986. All accepted papers will be published in a Symposium Record. Best papers will receive special citations, the first three will be awarded monetary prizes of Swiss Francs 2'500, 1'500 and 1'000 respectively.

For further information contact Symposium Chairman, Prof. Dr. T. Dvorak in Zurich at (..411) 256-2790 or, in the USA, Prof. Dr. R. M. Showers (Program Chairman) at (215) 898-8123.

# POWER MODULATOR SYMPOSIUM

The 17th Power Modulator Symposium will be held June 23-25, 1986, at the Hyatt Seattle, 17001 Pacific Highway South, Seattle, Washington. Sponsored by: **The Institute of Electrical and Electronics Engineers, Inc.** in cooperation with **The Advisory Group on Electron Devices** and under the management of **Palisades Institute for Research Services, Inc.**, the Symposium will focus on the latest technology, devices and systems applications associated with rep-rated power. The scope of the meeting includes: **Systems (Design, Fabrication, and Testing)** RF Systems, Accelerators, Lasers, EMI, Computer Analysis; **Technology (Design and Theory)** Switches, Auxiliary Devices, High Energy Density Packaging, Power Conditioning.

The deadline for abstracts is March 7, 1986. Prospective speakers are asked to submit a comprehensive abstract — approximately 200 words; about one double-spaced page. The abstract should be headed by: title, author(s), professional affiliation, complete return address and phone number.

An original and 25 copies of the abstract should be sent to the Program Secretary, Leslie Gallo, Palisades Institute for Research Services, Inc., 2011 Crystal Drive, One Crystal Park, Suite 307, Arlington, VA 22202. Questions regarding abstracts should be referred to the Chairman, Bobby Gray, at (315) 330-4846, or the Program Chairman, Larry Luessen at (703) 663-8057 or Stephen Levy at (201) 544-5404.

# ANSI SUBCOMMITTEE 1 GROUP ON CABLES

A new working group has recently been formed within ANSI Subcommittee 1. The task of the group which is chaired by Glen Dash, is to develop standards for cables and peripheral placement when testing computing equipment. Emissions readings from computing equipment vary dramatically as cables are moved or peripherals repositioned. The working group intends to devise an industry consensus on just how the variations in emissions with cable and peripheral placement should be evaluated.

The working group is currently seeking members; interested parties should contact Glen Dash, Dash, Straus & Goodhue, Inc., 593 Massachusetts Ave., Boxborough, MA, 01719. Phone: (617) 263-2662.

# CORRECTION NOTICE

In the Fall 1985 issue of the IEEE EMC-S Newsletter, the article entitled "dB Society Donation" erroneously referenced the IEEE's dB Society. It should be noted that the dB Society is not affiliated with the IEEE or the Electromagnetic Compatibility Society. The editor apologizes for this mistake.

# MEASURING FIELD STRENGTHS IN COMPLEX ENVIRONMENTS

A complex matrix of electronic equipment results in a complex electromagnetic environment. As a result, the estimation of the maximum EM field strength in a given area is very important in addressing many interference problems, such as the penetration of EM waves into buildings which house sensitive electronic and ordnance equipment. NBS Technical Note 1081, *Possible Estimation Methodologies for Electromagnetic Field Distributions in Complex Environments* outlines three approaches to estimating EM field distributions in complex environments: 1) statistical treatment of the spatial distribution of EM field intensities; 2) a numerical computation using a finite-element form of the EM action functional; and 3) use of a directional probe to scan a volume. According to the authors, M. Kanda, J. Randa and N. S. Nahman, all three methods are still in the development stage, but each appears promising. The publication is available for $2 from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Specify stock number 003-003-02638-7.

# PROFESSIONAL ENGINEERING EMPLOYMENT REGISTRY

"PEER" the new registry established by IEEE is a free member service that helps individuals seeking a change of employment. A brochure is available describing how PEER operates and the safeguards employed to ensure complete confidentiality. If PEER could be useful to you, now or in the future, send for information which will enable you to submit a resume. If your organization has positions to fill, you can invite your firm to contact Job Net Inc., the company that operates PEER for IEEE. They can be contacted in California at (408) 986-0525 or in Massachusetts at (617) 275-3010.

Inquiries may be directed to:
Job Net, Inc.
PEER Service Center
10 DeAngelo Drive
Bedford, MA 01730

IEEE

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

**Announces the 14th Annual Competition for**

# 1986-1987

# Congressional Fellowships

## A CONGRESSIONAL INTERNSHIP FOR MEMBERS OF IEEE

**PROGRAM:** Electrical and Electronics Engineers and Allied Scientists are competitively selected to serve a one-year term on the personal staff of individual Senators or Representatives or on the professional staff of Congressional Committees. The program includes an orientation session with other Science-Engineering Fellows sponsored by the American Association for the Advancement of Science (AAAS).

**PURPOSE:** To make practical contributions to more effective use of scientific and technical knowledge in government, to educate the scientific communities regarding the public policy process, and to broaden the perspective of both the scientific and governmental communities regarding the value of such science-government interaction.

**CRITERIA:** Fellows shall be selected based on technical competence, on ability to serve in a public environment and on evidence of service to the Institute and the profession. Specifically *excluded* as selection criteria shall be age, sex, creed, race, ethnic background, and partisan political affiliations. However, the Fellow must be a U.S. citizen at the time of selection and must have been in the IEEE at Member grade or higher for at least four years. Additional criteria may be established by the selection committee.

**AWARDS:** IEEE plans to award two Congressional Fellowships for the 1986-1987 term. Additional funding sources may permit expansion of awards.

**APPLICATION:** Further information and application forms can be obtained by calling W. Thomas Suttle (202) 785-0017 at the IEEE Washington, D.C. Office or by writing:

**Secretary, Congressional Fellows Program**
**The Institute of Electrical and Electronics Engineers, Inc.**
**1111 Nineteenth St., N.W.**
**Suite 608**
**Washington, D.C. 20036**

Applications must be postmarked no later than March 31, 1986 to be eligible for consideration.

## ELECTROMAGNETIC SUSCEPTIBILITY TESTING

Electromagnetic interference testing involves methods for making measurements at low and high frequencies. Until now, a gap existed between about 50 MHz and 1 GHz, and most tests were traditionally performed in a far-field, uniform plane-wave environment. Generating an environment can be costly because of the typical requirement for a very large distance between antennas. NBS researchers have examined the use of a near-field array of Yagi-Uda antennas at a frequency of 500 MHz, which produce the required plane wave in the near zone of the source antennas. These antennas offer advantages from both the frequency and distance points of view. The array includes an anechoic chamber at a frequency of 500 MHz to verify the theory and to gain experience in controlling the amplitude and phase of the array elements. The results are excellent for both the amplitude and phase of the electric field. However, additional research is necessary to make the phased array useful for electromagnetic susceptibility testing. "A Near-Field Array of Yagi-Uda Antennas for Electromagnetic Susceptibility Testing," (TN 1082) describes the work to date. It is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $3 prepaid. Order by stock no. 003-003-02669-7.

## IEEE POWER ENGINEERING SOCIETY

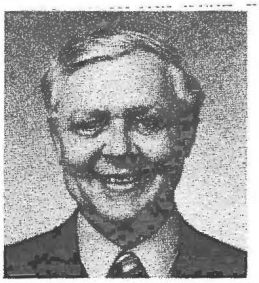
The Surge Protective Devices Committee of the IEEE Power Engineering Society has initiated work in the area of Electrostatic Discharge (ESD). The scope of this standard's activity in working Group 3.6.8 will include characterization of the ESD environment for typical electronic equipment, and description of tests to be performed to simulate this environment.

The second meeting of the 3.6.8 group was held in September 1985; the next one is scheduled for April 1986. Individuals interested in participating are encouraged to write to Mr. Peter Richman, Chairman, WG 3.6.8, KeyTek Instrument Corp., 12 Cambridge Street, Burlington, MA 01803.

# EMCABS

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

L.F. Babcock, Ford Aerospace Textron
E.L. Bronaugh, Electro-Metrics/Penril Corp.
R.N. Hokkanen, Harris Corporation
R. Jacobson, Sperry Flight System
S. Kuniyoshi, Naval Sea Systems Command
D.R. Kerns, Southwest Research Institute
R.B. Schulz, Xerox Corp./Off. Products Div.
R.M. Showers, University of Pennsylvania



MELVIN J. JOHNSON

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

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

**EMCABS: 1-12-85**

Light Barometric Measurement System Utilizing a Functional Device
Yasuaki Kido, Takanobu Aoyama, Hideki Okuda, Atubiko Isihara, Takashi Ihara, Takeo Abe
Toyama National College of Technology: Department of Engineering, Nigata Univ.
EMCJ85-66
**ABSTRACT:** In the past, delicate changes of atmospheric pressure in rainfall or snowfall are closely related with local amounts of rainfall or snowfall. It is necessary to develop a new barometer so that valid observations and measurements having close relation may clarify. This paper describes the measurement system of the atmospheric pressure using the functional device based on the investigation about the light barometer. Then the delicate changes of the atmospheric pressure are able to be measured by the new barometer.
**INDEX TERMS:** Rainfall, snowfall, barometer, measurement

**EMCABS: 2-12-85**

Light Temperature Measurement System Utilizing A Functional Device
Yasuaki Kido, Hideki Okuda, Takanobu Acoyama, Takeo Abe, Takashi Ihara, Atuhiko Isihara
Toyama National College of Technology: Department of Engineering, Nigata University
EMCJ85-67
**ABSTRACT:** In recent years, an optical measurement shield is being investigated very actively by development of this device. This paper describes the measurement system for continuous temperature about height and depth, that is structured by the optical therometer which is combined with the optical fiber of the typical functional device and the shape memory alloy.
**INDEX TERMS:** Functional device, shape memory alloy, measurement

**EMCABS: 3-12-85**

Estimation of Electromagnetic Waves From A Sine Wave Source In the Earth with Reference to the Electromagnetic Noise Related to Earthquakes
Takashi Yamaguchi
Kanazawa Institute of Technology
EMCJ85-68
**ABSTRACT:** To examine the possibility of the observation of the electromagnetic noise related to earthquakes, this paper presents some fundamental data on the electromagnetic waves propagated in the earth. On the basis of the observed noise level by other authors, strength of the wave source was estimated. As a result, there is little hope for observation under some assumptions of our simple model.
**INDEX TERMS:** Electromagnetic noise, earthquake prediction, wave propagation

**EMCABS: 4-12-85**

Electromagnetic Noise From Microcomputer Systems
Takeo Abe, Yoshio Yamaguchi, Masakazu Sengoku
Faculty of Engineering, Nigata University
EMCJ85-70
**ABSTRACT:** This report presents the experimental results of noise reduction from personal computer systems. The characteristics of shielding materials such as metallic mesh, conductive glass, conductive paint, etc. are measured in a frequency range 10 - 1000 MHz. It is required to use metallic mesh with size less than 2 x 2 cm or conductive materials with surface resistivity less than 100 ohm/cm$^2$, in order to shield the interference level by 20dB. By applying these shielding materials to a personal computer and its peripheral equipment, in addition to grounding and filtering techniques, it is possible to reduce the noise by more than 20dB.
**INDEX TERMS:** Reduction, personal computer system, shielding, grounding, filtering

**EMCABS: 5-12-85**

Radio Broadcast Wave Induction Voltage On A Telecommunication Line
Mutsuo Wakuda, Mitsuo Hattori, Tsuyoshi Ideguchi
NTT Ibaraki Electrical Communication Laboratories
EMCJ85-69
**ABSTRACT:** An estimation method of radio broadcast wave induction voltage is clarified for aerial telecommunication lines. Induced voltage calculation equation is derived by considering both vertical and horizontal electric field components of broadcast wave. The theoretically calculated value agrees well with the measured values in the region of 40 kHz to 10 MHz. It is clarified that the conventional estimation method which is derived by considering only horizontal component is not suitable for the estimation of high frequency band broadcast wave induction voltage.
**INDEX TERMS:** RF wave induction, induction voltage, broadcast wave

**EMCABS: 6-12-85**

Power-line Conditioning, Grounds for Danger
Dr. Phillip A. DeLangis
Harbor City, CA
Evaluation Engineering
Vol. 23, No. 9; October 1984; P88-95
**ABSTRACT:** Inherent in the design of many power line conditioners now on the market is a potential menace, not just to the connected equipment, but to the operator's life. Some products simply do not adequately protect the equipment. Another uses a constant voltage transformer to protect against brown-out. This type of device completely turns off the power when input voltage drops below 110 V. This design accentuates the problem rather than eliminates it. At a recent computer show, every product I inspected had the ability to generate lethal or severe shock potentials on the computer terminal.
**INDEX TERMS:** Shock hazard, power lines, spikes, surges, digital circuits, computers, protection, operator safety

# CALENDAR
# 1986

January 13-16

National Radio Science Meeting
University of Colorado, Boulder, CO
Contact: S. W. Maley
Dept. of Electrical Engineering
Univ. of Boulder
Boulder, CO 80309

February 6

1986 IEEE Regional Conference & Exhibition on EMC
Grand Hotel, Anaheim, CA
Contact: Larry Caney, Chairman
Eaton Corp.
(213) 822-3061

March 25-27

IEEE Instrument/Measurement Technology Conference (IMTC)
University of Boulder, Boulder, CO
Contact: IMTC Office
1700 Westwood Blvd.
Los Angeles, CA 90024
(213) 475-4571

April 29-30

Santa Clara Valley EMC '86
San Jose Convention & Cultural Fac., San Jose, CA
Contact: Alan K. Johnson
Chairman — EMC '86
P.O. Box 70577
Sunnyvale, CA 94086
(403) 257-8614

May 19-24

1986 Nuclear EMP Meeting (NEM '86)
Univ. of New Mexico, Albuquerque, NM
Contact: C. W. Jones
Dikewood
1613 University Blvd., N.E.
Albuquerque, NM 87102

June 2-4

IEEE MTT-S International Microwave Symposium
Baltimore, MD
Contact: Edward C. Niehenke
Westinghouse Elec. Corp.
P.O. Box 746, MS 339
Baltimore, MD
(301) 765-4573

June 9-13

Int'l IEEE A/P-S Symposium
Wyndham Franklin Plaza Hotel, Phila., PA
Contact: Ali Afrashteh
IEEE A/P-S Symposium Chairman
c/o IEEE Office
Moore School of Electrical Engrg.
Univ. of Pennsylvania
Philadelphia, PA 19104

*(Continued . . . )*

**EMCABS: 7-12-85**

IS ANSI C95.1 - 1982 too Conservative? A Reader's Viewpoint
J. E. Ogden, G. M. Stone
Telesciences International, LTD.
Microwave Journal
Vol. 28, No. 1; January 1985; P 167-169
**ABSTRACT:** The purpose of this communication is to explore the bases of standards developed to assure the safety of persons working with non-ionizing EM energy and to suggest some alternatives to unreasonably tight safety standards.
**INDEX TERMS:** Field strength, standards, safety, biological effects, measurement, electromagnetic energy, radiation, hazard

**EMCABS: 8-12-85**

Overvoltage Protection for Analog Multiplexers
T. R. Fleming
Harris Corporation
Integrated Circuits Magazine
Vol. 3, No. 1; January 1985; P 22-26
**ABSTRACT:** Your fair-weather design could go up in smoke if you rely too heavily on data sheets for overvoltage information. Here's some tips on what it takes to keep your mux alive when "lightning" strikes.
**INDEX TERMS:** Transients, voltage spikes, multiplexers, ESD, CMOS IC's, analog, digital, suppression, protection

**EMCABS: 9-12-85**

Shield Measurement Techniques for Electronic Cable, Part I
by Belden Electronic Wire and Cable
Engineering Group
Electri-onics
Vol. 30, No. 9; August 1984; P 57-59
**ABSTRACT:** Many methods have been developed to test shielding effectiveness (since there are a large variety of shielding requirements and designs). It is important therefore to understand the background of the main test techniques, as well as their advantages and disadvantages.
**INDEX TERMS:** Cable shields, attenuation, radiation, test set-up, transfer function, triaxial tests, shielding effectiveness

**EMCABS: 10-12-85**

Shield Measurement Techniques for Electronic Cable, Part II
by Belden Electronic Wire and Cable
Engineering Group
Electri-onics
Vol. 30, No. 10; September 1984; P 53-55
**ABSTRACT:** Many test procedures are used to measure transfer impedance and capacitive coupling impedance without subjecting the cable to the impact of a real interference source. Two of these methods, the IEC (International Electrotechnical Commission) procedure and the terminated triaxial method are considered here.
**INDEX TERMS:** Cable shields, braid, triaxial tests, test method, transfer impedance, shielding effectiveness, radiation

**EMCABS: 11-12-85**

At long last, DBS Receiver Standards
M. Kachmar
Associate Editor
Microwaves and RF
Vol. 23, No. 9; September 1984; P 33-60
**ABSTRACT:** Instead of recommending specific antenna performance standards the working group on interference urges the DBS industry to develop guidelines that help consumers buy antennas with adequate interference and noise performance. It suggests that each antenna manufacturer label its products to indicate noise and interference performance, and that each DBS operator publish preferred antenna specifications on noise (C/N) and interference (C/I) for each major geographic region it serves.
**INDEX TERMS:** FCC, DBS, satellite, reception, antenna, standards, format cable, encryption

**EMCABS: 12-12-85**

ESD Design Maturity Test for a Desktop Digital System
S. William Wong
Apple Computer INC.
Evaluation Engineering
Vol. 23, No. 9; October 1984; P 104-112
**ABSTRACT:** ESD can create five major disruptive effects on a system. 1) Charge build-up corona generated EMI, 2) Predischarge electric field, 3) Discharge E-field breakdown, 4) Discharge magnetic field, 5) Discharge injected current standing wave
**INDEX TERMS:** ESD, office environment, computers, printers, human capacitance, ESD simulator, testing, suppression

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|---|---|
| June 23-25 | 17th Power Modulator Symp.<br>Hyatt Seattle, Seattle, WA<br>Contact: B. Gray, Chairman<br>Rome Air Development Ctr.<br>Griffiss AFB, NY 13441<br>(315) 330-4846 |
| June 23-27 | Conference on Precision Electromagnetic Measurements (CPEM '86)<br>National Bureau of Standards, Gaithersburg, MD<br>Contact: Norman Belecki<br>B146 Metrology Bldg.<br>National Bureau of Standards<br>Gaithersburg, MD 20899<br>(301) 921-2715 |
| June 24-26 | 8th International Wroclaw Symposium<br>Technical University, Wroclaw, Poland<br>Contact: Dr. W. Waszkis<br>Box 2141<br>51-645 Wroclaw, Poland<br>Telex: 0712118 ilw pl |
| July 20-23 | Nuclear & Space Radiation Effects Conf.<br>Providence Biltmore<br>Providence, RI<br>Contact: Sandra Grawet<br>Science Applications, Inc.<br>2615 Pacific Coast Hwy.<br>Hermosa Beach, CA 90254<br>(213) 318-2611 |
| September 16-18 | IEEE International Symposium on EMC<br>San Diego, CA<br>Contact: Herb Mertel<br>EMACO, Inc.<br>7562 Trade St.<br>San Diego, CA 92121<br>(619) 578-1480 |
| September 29-October 3 | 5th Int'l Conference on EMC<br>University of York, England<br>Contact: Mr. R. Larry<br>IERE<br>99 Gower St.<br>London, WC1E 6AZ England<br>01-388-3071 |

**EMCABS: 13-12-85**

Techniques Enable the Avoidance and Suppression of Terrestrial Interference
in Receive-only Earth Stations
William P. Johnson
Microwave Filter CO.
MSN Magazine
Vol. 14, No. 5; May 1984; P 110-112
**ABSTRACT:** A major problem affecting TVRO earth stations is terrestrial interference. Moving the site is not always practical, so other techniques for avoidance and suppression of TI must be used.
**INDEX TERMS:** Terrestrial interference, TVRO, sidelobes, LNA, feedhorn, dish, FCC, computer analysis, spectrum

**EMCABS: 14-12-85**

Filtered Connectors Fight the EMI Gremlins
Kamal Boutros
Amphenlo Products CO.
Electronic Products
Vol. 27, No. 3; 2 July 1984; P 79-82
**ABSTRACT:** Connectors with built-in networks help provide effective low-cost interference control.
**INDEX TERMS:** Connectors, filters, FCC, attenuation, hi-rel, test data, low pass, PI/C filters, cables

**EMCABS: 15-12-85**

Beat RFI and EMI with Differential Backplane Transceiver
Gary Connor
Advanced Micro Devices, INC.
Digital Design Magazine
Vol. 14, No. 7; July 1984; P 110-112
**ABSTRACT:** A new transceiver capable of providing users with a means to comply with FCC regulations IS.ADM'S AM26LS38 quad differential backplane transceiver, designed to integrate Schottky TTL performance, high noise immunity and wired logic capability into low-cost differential backplane structure.
**INDEX TERMS:** FCC, EMI/RFI, suppression, commercial, differential mode, TTL, common mode

**EMCABS: 16-12-85**

Part 2, Installing a Computer-Based Process Control System
William T. Shaw
EMC Systems, INC.
I & C S Magazine
Vol. 57, No. 3; March 1984; P 33-37
**ABSTRACT:** Part 1 explains how to set up a control room and provide a suitable environment for the computer. Part 2 tells how to provide a clean power source, ground the system properly, and connect the various wires and cables correctly so as to minimize electrical noise.
**INDEX TERMS:** Computer, primary power, transients, surges, spikes suppression, isolation transformer, grounding

**EMCABS: 17-12-85**

Join a Government Program to Unveil TEMPEST-spec Mysteries
A. J. Mauriello
Radiation Sciences INC.
EDN Magazine
Vol. 28, No. 13; 23 June 1983, P 191-195
**ABSTRACT:** How can you design information-processing equipment to the US government's TEMPEST specs if those specs are classified? Avoid this catch 22 by participating in the industrial TEMPEST program, through which you can access portions of the data.
**INDEX TERMS:** TEMPEST, NACSEM 5100, design, industrial emission, TEMPEST program, TEMPEST specs

**EMCABS: 18-12-85**

Defeating Ivan with TEMPEST
James B. Schultz
Defense Electronics
Vol. 15, No. 6; June 1983; P 64-75
**ABSTRACT:** TEMPEST guidelines and operating requirements are found in NSA standard NACSEM 5100A, which also compiles a TEMPEST preferred product list. Most machines requiring TEMPEST certification are cryptographic systems, computers, teleprinters, transmitters and receiver sets, and displays. Spurious signals or electronic leaks can be easily detected by Soviet Elint systems allowing determination of operating frequency and coding processes.
**INDEX TERMS:** TEMPEST, emission, testing, design, compliance, test agencies, evaluation factors, test equipment

**EMCABS: 19-12-85**

Connectors/Interconnections, FCC Regulation 15J Has Arrived
Evaluation Engineering
Vol. 23, No. 1; January 1984; P 84-92
**ABSTRACT:** FCC shielding requirements have forced manufacturers to shield both cabinets and discrete parts, such as connectors, with filtering connectors, metal hoods, and shielded cable assemblies. Shielding is accomplished by plated coatings, metal hoods, metal cladding of plastic shells is also possible.
**INDEX TERMS:** Connectors, filtered pins, FCC, standard, shielding, attenuation, commercial, digital equipment

**EMCABS: 20-12-85**

EMC — The Consciousness of Another Pollution Problem
Alain Bolliger
American High Voltage Test Systems, INC.
Evaluation Engineering
Vol. 23, No. 6; June 1984; P 35-37
**ABSTRACT:** High product quality can only be achieved if EMC is fully taken into account. Since electronic systems contain more and more sensitive circuits, they are more susceptible to the damaging effects of EMI found near their service location. Products utilizing integrated circuits must be subjected to intensive interference tests.
**INDEX TERMS:** EMI sources, EMI effects, NEMP, testing, standards recommendations, lightning, ESD, switching

**EMCABS: 21-12-85**

ESD Floor Protection Systems for Clean Room Environments
George Berbeco
Charleswater Products, INC.
Evaluation Engineering
Vol. 23, No. 6; June 1984; P 96-109
**ABSTRACT:** Because protection from degradation is as important as outright destruction of the IC, the level of floor protection should be sufficient for sensitivity of the devices being handled.
**INDEX TERMS:** ESD, clean rooms, floor conductivity, sources, microcircuit sensitivity, static charge

**EMCABS: 22-12-85**

Focus on Switching Power Supplies
Harold Winard
Electronic Design
Vol. 32, No. 13; 28 June 1984; P 301-312
**ABSTRACT:** By far the greatest concern among switching supply designers today is compliance with a range of electrical safety and noise specifications. This includes Underwriters Lab (UL), the Canadian Standards Assoc. (CSA), IEC 380 from the International Electrotechnical Commission, and VDE 0806 from the Verband Deutscher Elektrotechniker. EMI filters help but proper construction of magnetic components and shielding are also required.
**INDEX TERMS:** Power supplies, EMI, compliance, commercial, UL, CSA, TEC, VDE, design, switching, MFG Directory

**EMCABS: 23-12-85**

Follow PC Board Design Guidelines for Lowest CMOS EMI Radiation
Roger Kozlowski
National Semiconductor Corp.
EDN Magazine
Vol. 29, No. 10; 17 May 1984; P 149-154
**ABSTRACT:** The application of such high speed CMOS-logic circuits as the 54HC/74HC family (as compared with CD4000 metal-gate logic) requires special attention to PC Board design to minimize conducted and radiated noise.
**INDEX TERMS:** EMI, radiation, CMOS, integrated circuits, design measurement, matching, common impedance, decoupling

**EMCABS: 24-12-85**

Evaluate EMI Reduction Schemes with Shielded-Loop Antennas
Scott Roleson
Hewlett-Packard Co.
EDN Magazine
Vol. 29, No. 10; 17 May 1984; P 203-207
**ABSTRACT:** Because of their small size and ability to respond only to the magnetic component of radiated fields, small shielded-loop antennas yield high resolution and accuracy as EMI/RFI probes.
**INDEX TERMS:** Magnetic field, radiation, measurement, probe, isolate, leakage, shielding, balun

**EMCABS: 25-12-85**

An update on line conditioners for solving today's power problems, Part II
Edward Cooper
Power-Matic Inc.
Design News
Vol. 40, No. 22; 19 November 1984; P 127-134
**ABSTRACT:** There are two devices which are now broadly advertised as "power protectors," "surge protectors" or under similar names, some of them as "line conditioners." These are RFI filters (radio interference filters) and spike suppressors.
**INDEX TERMS:** MPS, Triac, RFI filter, spike suppressor, transzorbs, metal oxide varistor (MOV), variation, primary power, conducted INT, common mode, National Electric Code, isolation transformer

**EMCABS: 26-12-85**

NSA and Industry Experience TEMPEST Growing Pains
James B. Schultz
Defense Electronics
Vol. 16, No. 6; June 1984; P 190-200
**ABSTRACT:** Several TEMPEST equipment manufacturers have suffered financial losses due to certification test failures of TEMPEST equipment designed by improperly trained engineers. While no charges have been filed against any firms, the national security agency (NSA) which administers the TEMPEST program, discussed the certification issue at its May 1984 industrial TEMPEST program meeting. When questioned about TEMPEST certification for engineers, an NSA spokeswoman said the agency was not at liberty to discuss the subject.
**INDEX TERMS:** TEMPEST, certification, NSA, measurement, TEMPEST products, TEMPEST business, TEMPEST companies, shielding, filters

**EMCABS: 27-12-85**

Testing Shielding Effectiveness, Key to Protecting Against EMI/RFI
Ed Rowlands
TRW Electronics Group
Electri-onics
Vol. 30, No. 9; August 1984; P 35-39
**ABSTRACT:** The focus of this article is on one of the most critical points in a system: the connection. It examines how connectors especially D- Subminiature types are being protected against EMI, how they help to ensure that the cable shield is properly terminated, and how the effectiveness of shielding is measured.
**INDEX TERMS:** Connectors, FCC docket 20780, shielding, shield data, shield test methods, filtering, triaxial test configuration, quadaxial, quintaxial

**EMCABS: 28-12-85**

Protecting against EMI
Dale Benedick
Industrial Solid State Controls
I & C S Magazine
Vol. 57, No. 10; October 1984; P 57-62
**ABSTRACT:** As more electronic equipment appears on the production floor, EMC becomes more important. Vendors are building more protection against EMI into their products, but users should be familiar with the possible problems and know what precautions to take. This article describes sources of EMI and explains how to categorize them as a guide to specifying and installing equipment.
**INDEX TERMS:** Control Systems, EMI, Noise sources, natural sources, transients, chemical contamination, conducted noise, standards, routing

**EMCABS: 29-12-85**

Minimizing Noise in Digital PCB Layouts
T. Williamson
Machine Design
Vol. 56, No. 20; September 6, 1984; P 144-146
**ABSTRACT:** Impedance is the culprit in most PCB ground layout problems, and inductive pickup is one cause of cross-talk. Because the currents that flow in digital circuits tend to be spiked, the inductance of the path, not trace resistance, dominates impedance. Trace resistance is in milliohms and the width of the trace has little effect on impedance.
**INDEX TERMS:** Magnetic coupling, Printed Circuit Boards, ground loop, impedance, common ground, PCB layout

**EMCABS: 30-12-85**

Connectors — The Missing Link in EMI Suppression
F. Drzymkowski, D. Goodman
ITT Cannon
Computer Design
Vol. 23, No. 9; August 1984; P 77-84
**ABSTRACT:** Computer equipment must meet stringent FCC restrictions on RF emissions. Although the first line of defense for designers is proper packaging, electromagnetic interference can occur between units if attenuation is not paid to connector design.
**INDEX TERMS:** Digital systems, computers, FCC docket 20780, limits, standards, spectrum analysis, cables, connectors, shielding, transfer impedance

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