IEEE NEWSLETTER

ELECTROMAGNETIC COMPATIBILITY GROUP

ISSUE NO. 43 MAY 1966

Rexford Daniels, Editor
Monument Street
Concord, Mass.

Highlights of the March 24, 1966 AdCom Meeting

Dues increased from $2.00 to $4.00 per year.

Membership increased from 1639 - Dec. 31, 1965 - to 1679 on March 1, 1966.

San Francisco Seminar, July 11-12-13, 1966. Details will be sent later. 82 papers submitted, 43 already accepted.

National Electrical Convention, Chicago, Oct. 3-4-5, 1966 at which next AdCom meeting will be held, after San Francisco meeting.

Present officers asked to remain in office until returns from nominations are received and voted on.

1967 Washington, D. C. Symposium under discussion. To be held July 18-19-20, 1967.

J. J. O'Neil is forming the New Jersey Coast Chapter at Ft. Monmouth which was approved. Approved by IEEE Executive Committee March 19, 1966.

Milton Kant was asked to try out his data retrieval plan in conjunction with the Newsletter so as to have current bibliography available.

Balance in Treasury, as of December 31, 1965 - $7,270.90. Estimated Budget expenses for 1966 - $8,900.00. Estimated income - $11,260.00. New publishing requirements by Headquarters, IEEE, may increase expenses considerably.

CHAPTER ACTIVITIES

Boston:

The Circuit Theory/Electromagnetic Compatibility/Information Theory Groups held a joint meeting on November 16, 1965. Mr. M. J. DiToro, Cardion Electronics, Westbury, L. I., New York, spoke on "Adaptive Communication."

A joint meeting was held by Circuit Theory/Electromagnetic-Compatibility/Aerospace & Electronic Systems Group on December 9, 1965, and a paper was given by Mr. Saul Fast, National Company, Malden, Mass., on "Recent Advances in Systems Spectrum Utilization and E M Compatibilities."

The Communication Technology/Electromagnetic Compatibility/Information Theory Groups held a joint meeting on January 11, 1966 and Mr. W. E. Morrow, Jr., M I T Lincoln Lab., spoke on "The Lincoln Lab. Space Communication Program."

Another joint meeting was held on March 10, 1966 by Communication Technology/Electromagnetic Compatibility/Aerospace & Electronic Systems and Mr. E. H. Cooper, Defense Communications Agency, Washington, D. C., gave a talk on "Digital Simulation of Large Communication Systems."

Chicago:

A meeting was held on September 21, 1965 and a talk was given by Mr. Jim Klouda, Elite Electronics, on "Discussion of MIL-STD-826."

There was a meeting held on October 19, 1965 and Mr. David S. Levinson, Airborne Instrument Lab., spoke on "Spurious Power Measurement in Waveguide."

A third meeting was held on November 10, 1965 wherein Mr. J. Krstansky, I T T Research Institute, Chicago, Illinois, gave a talk on "Environment Generated Intermodulation in Communication Complexes."

Los Angeles:

This Chapter held a meeting on January 20, 1966 and Mr. Walter D. McKerchar, McDonell Aircraft, St. Louis, Mo., spoke on "The EMC Program for the RF 4C Phantom II."

Philadelphia:

A meeting was held by this Chapter on December 7, 1965 and Dr. Roy C. Spencer, Radio Corporation of America, Moorestown, N. J., spoke on "Antenna Patterns and Scattering Cross Sections as Factors in Electromagnetic Interference."

San Francisco:

There was a meeting held on October 27, 1965 and a talk was given on "Proposed Techniques for Evaluating System EMC" by Mr. Tom Webb, Lockheed Missiles and Space Co., Sunnyvale, California.

Seattle:

There was a meeting held on September 15, 1965 and Mr. Walter D. McKerchar, McDonnell Aircraft Corp., St. Louis, Mo., spoke on "The EMC Program for the RF 4C Phantom II."

On November 10, 1965 a panel discussion was held on the "EMC Problems of a Hypothetical Space System." The panel members were: Mr. Jerry M. Carter, Aerospace Division, The Boeing Company; Mr. Lars Jorgensen, Airplane Division, The Boeing Company; Mr. C. David Lunden, Airplane Division, The Boeing Company; Mr. Ray Strassle, The Sprague Electric Co., Los Angeles, Calif., and Mr. Len Carlson, Aerospace Division, The Boeing Company, was the Moderator.

Washington, D. C.:

A meeting was held on January 20, 1966 and Mr. Jerrald C. Shifman, Genistron, Inc., gave a talk on "Rapid Methods for EMI Filter Design."

Another meeting was held on February 21, 1966 and a talk was given on "Fundamentals of Ultra Sensitive EMI Measurements" by James J. Crenca and Willard F. Workman, Jr., Jansky and Bailey, Div. of ARC, Alexandria, Va.

A third meeting was held on March 10, 1966 and Mr. Stephen Caine, Engineer, BuShips, spoke on "Tri-Service Working Group for the Coordination of EMI Interference Standards and Specifications."

OFFICERS Of NEW YORK CHAPTER For 1966:

Chairman	-	David Fidelman Electro-Magnetic Measurements Co. 50 Baiting Place Rd. Farmingdale, L. I., N. Y.
Vice-Chairman	-	Mervin First R F Interonics 15 Neil Court Oceanside, N. Y.
Secretary	-	Andrew Varanelli, Jr. R C A Frequency Bureau 60 Broad Street New York City, N. Y.

IEEE Convention

PAPERS DELIVERED On EMC At IEEE 1966 CONVENTION:

An Operational Oriented Performance Control Model
by
Frank Pethel, Stanley Cohn, IIT Research Institute, Annapolis, Maryland

"A need exists within the military services for electromagnetic compatibility modeling techniques specifically tailored to special applications. Contingency planning, war-gaming, and operational exercises are areas which could be augmented with such techniques. The end result of on-the-spot consideration of radio frequency interference would be more effective planning and a more rapid operational reaction capability. It is the purpose of this paper to present one such analysis technique that can be effectively and efficiently applied to large environmental problems."

Copies may be obtained through the authors.

Single Shot Transient Analyzer
by
D. W. Moffat, Paul Slysh, General Dynamics/Convair, San Diego, Calif.

"When frequency analysis can be performed quickly for complex, single-occurrence transients, the data supplied to the designer will, among other benefits, help prevent incompatible situations from occurring. The unit to be described plots a continuous spectrum in fifteen seconds by synthesizing the waveform and using two special formulas. In a typical application the waveform is retained on a photograph, selected points are entered in the unit, and then the output is plotted through a predetermined band of frequencies, usually up to gigacycles. Applications, limitations, and plans for improved versions are included."

Copies may be obtained by writing to the authors.

The Grounding Concepts for Instrumentation Groundings as They Differ from Lightning and Power Fault Safety Groundings
by
H. M. Hoffart, General Electric Co., Daytona Beach, Fla.

"All too often, electronic equipment is referenced to a building earth ground system which has been designed to provide lightning and power fault safety grounding. When operated referenced to building ground, the electronic equipment is found not to perform as specified. The answers for the electronic equipment malfunction are found in the noise potentials appearing in the building ground system which can include transients of quite high amplitudes. The high series inductance and the distributed capacitance of standard building safety grounding systems allow the ground system to electrically oscillate when initiated by a nearby lightning stroke [illegible] condition.

"Since it is almost impossible to design a satisfactory all-purpose grounding system it is well to understand the advantage and drawbacks of each.

"Both safety grounding and instrumentation grounding systems have certain characteristics in common, which have been adequately described in the available literature on grounding, b have not always been clearly defined as to how they differ with respect to each other. This paper will attempt to clarify these differences."

Copies may be obtained by writing to the author.

Oscillator Stability and Electromagnetic Compatibility
by
F. L. Marek, M. D. Aasen, IIT Research Institute, Annapolis, Md.

"Some of the areas where oscillator stability may affect electromagnetic compatibility are pulse repetition frequency (PRF) generation (range-gate capture), coherency effect on receivers employing phase lock, increase in susceptibility in equipment employing Doppler reception, and digital system re tion. As a representative example of the type of analysis per able in these areas a detailed examination of one of them (PR generation) is presented in this paper. The probability of gat steal as a function of the stability of the PRF-generating osci. is derived and presented as a family of curves. It is shown t this is one of the cases where an increase in system compatil is obtained by lowering design tolerances."

This paper will be available through DDC. The numbe be in the next Newsletter.

Analysis of the Frequency Dependence of Man-Made Radio Noise
by
E. N. Skomal, Aerospace Corp., San Bernardino, Calif.

"Two theoretical noise generation processes have bee posed and analyzed as models for the experimentally observ frequency dependence of man-made radio noise in the freque intervals 10 kc/s to 20 Mc/s and 100 Mc/s to 500 Mc/s. Th computed results for the normalized variation of the noise s power density as a function of frequency have been shown to within the statistical variation of the experimental data for l frequency intervals. The proposed mechanism of noise gen in the higher frequency interval presumes the man-made no arises from randomly occurring narrow impulses. In the l frequency interval the noise emissions are modeled assumi pulses form a train of independent events with an average f cy of occurrence, v. The noise arising from both emissio cesses is presumed to be attenuated in a manner controlled propagation statistics applicable to radio transmission ove ular terrain from low antenna heights."

Copies may be obtained by writing to the author.

Editor's note:

The Newsletter came in for quite a bit of discussion at the G-EMC Ad Com meeting on March 24th as it should get out oftener and quicker in order to carry more dated news items. A newsletter editor's luncheon was held at the IEEE Convention and ways to improve the handling of the copy and distribution were discussed. It looks as if the Newsletter situation may now clear up and be much improved.

The members of the AdCom wanted to thank all those who had been contributing to the Newsletter but also wanted to stimulate those, who had not sent items in or who had just joined, to remember that the EMC field is expanding so fast that new avenues are being discovered continually. If you see an article, hear of a new product or have delivered a paper with an EMC interest, please send it in promptly to the editor.

Rexford Daniels, Editor

COMPUTER ANALYSIS Of SIGNAL TRANSFER In COMPLEX COMMON IMPEDANCE NETWORKS

The above paper by J. E. Maynard, H. L. Rehkopf, D. R. Awerkamp, The Boeing Company, Aerospace Group, Seattle, Washington, was presented at the Aerospace Conference in Seattle July 1966. The Abstract is as follows:

"A computer program has been developed for determining the interference occurring at various points in a complex network resulting from common impedance coupling of signals introduced at other points in the network.

"For a network of almost any complexity, the program can calculate the transfer function between any two points and thus determine the magnitude of the resulting signal. A simple network of ten parameters was first analyzed and the results were compared with laboratory measurements on a simulated network. Refinements were made to obtain good agreement. Skin effect was included to get agreement at frequencies as high as 10 Mc. A system of one hundred parameters was then analyzed. Curves of the computed and measured transfer functions are presented to show the agreement obtained. The results of this analysis are as accurate as the determination of the network parameters and the terminating impedances."

• • • • •

NOISE SIMULATORS HELP FIND PERIL IN POWER-LINE DEFECTS:

Manohar L. Tandon, International Business Machines Corp., San Jose, Calif., has authored a 5-page article, under the above title, in Electronics, March 7, 1966. The sub-title and first two paragraphs are as follows:

"Designers can use testers to build in safeguards against disturbances in power sources before sensitive equipment goes to customer.

"Power-line disturbances such as voltage dips and high-frequency transients - a cause of unpredicatble effects on high-speed circuits - can now be created artificially in the laboratory through devices known as noise simulators. With these units, designers can anticipate and tame effects of unwanted electrical signals that often plague equipment such as data processors after installation.

"Although established techniques exist to shield low-level signals in systems against internal and radiated noise, the hazard of power-line noise has not been properly understood. Its control is important as the use of sensitive equipment continues and grows."

ARTICLES Of INTEREST In MICROWAVES, MARCH 1966:

Low-Noise Receiving Antennas

Lamont V. Blake, Consultant, Search Radar Branch, Radar Division, U. S. Naval Research Laboratory, Washington, D. C., has written a 10-page article, with references, under the above title. The sub-head is as follows:

"Analysis of antenna noise and a review of low-noise antenna designs are combined into a valuable basic reference for the system engineer's file."

Choosing and Using BWOs

Albert T. Isaacs, Manager, Engineering, Stewart Div., Watkins-Johnson Co., Palo Alto, Calif., and Bobby F. Helms, presently Regional Sales Manager, Hewlett-Packard, Palo Alto, Calif., have authored a 6-page article under the above title. The sub-title and paragraphs of interest are as follows:

"Low-level BWOs provide vital electronic tunability in a growing number of ground and airborne systems and instruments. Whether you're looking for a BWO now or want more from those you already have, it may pay to read this first.

Magnetic Shielding

"The strong leakage fields of permanent-magnet-focused BWOs normally make it difficult to place the tube near another magnetic device without degrading the performance of either or both devices, especially in applications requiring high-density packaging. The problem can be minimized by careful consideration of chassis layout (e.g., using passive materials and components in the vicinity of the BWO). However, a more convenient solution, especially from the user's standpoint, is to magnetically shield the BWO in some integral fashion. This integral shielding also eases storage and handling problems in the case of tubes awaiting installation.

"Shielding can be accomplished by housing the PM-focused tube in an unsaturated steel housing. Such encasement effectively shunts the leakage flux of the magnet and lessens the tube's vulnerability to external fields. (External fields from shielded and non-shielded X-band BWOs are compared in Fig. 10).

RFI Shielding

"In any microwave tube, energy can leak from the output couplers, along the output cables and connectors, along the dc power-input leads, and even through the tube's mounting holes. Conversely, the leads and connectors can act as antennas, picking up stray RF signals that modulate the BWO output.

"Demands for RFI control by systems and instrument engineers have led to special packaging techniques: RF output connectors are mounted on a package that is precision machined and sealed; dc flying leads are eliminate and dc input is applied through RF attenuators mounted securely in the package."

SUPPRESSING UNWANTED MODES In 5-100 Mc/s THICKNESS-SHEAR QUARTZ PLATES

In the March/April 1966 issue of FREQUENCY, R. Bechmann, U. S. Army Electronics Command Laboratories, Fort Monmouth, N. J. and D. R. Curran, Clevite Corporation, Bedford, Ohio, have authored a 3-page article, with a list of 18 references, under the above title. The sub-head and first two paragraphs are as follows:

"As far back as the late 1920s, when spurious modes in quartz crystals were first observed, we've been trying to find ways to minimize their effect at high and very-high frequencies. Although this constant battle against unwanted responses still goes on, there have been significant gains - as you'll see in this article.

"One of the phenomena which interferes with the performance of quartz crystals in oscillator and filter networks is the multiciplicity of modes rather than a single mode. In filter networks, this effect degrades both the bandpass and stop band characteristics.

"Meissner was one of the first to observe the presence of disturbing unwanted modes in X-plates when he painstakingly took resonance curves point by point. In the first mechanical equipment for recording the resonance curve of AT- and BT-cut crystals, described by Bechmann, the crystal was placed in a π-network between two vacuum tubes. At the input of this set-up there was a signal generator, and the output consisted of an amplifier, demodulator, and a recorder. Fig. 1 shows the instrumentation used today in measurements of resonance curves for frequencies up to 150 Mc/s, as reported by Priebe. Such equipment is indispensable in the laboratory and for crystal manufacture."

oooooooooooooo

HOW To KILL INTERFERENCE:

Radio-Electronics, March 1966, has a 2 1/2-page article on how to correct TV interference. A previous article titled "How to Track Interference" appeared in the December 1965 issue of Radio-Electronics.

oooooooooooooo

MECHANICAL AIDS For The PREVENTION Of RFI:

E D N, March 1966, carries a 10-column article by David G. Gray, GPL Div., Aerospace Group, General Precision, Inc., Pleasantville, N. Y., under the above heading. The sub-title and first two paragraphs are as follows:

"RF can become RFI when it is permitted to stray beyond certain limits. Here is a survey of the mechanical devices and ideas that presently are being used to prevent RFI.

"The systems engineer must recognize the need for adequate mechanical radio-frequency interference (RFI) engineering of his system in addition to the usual emphasis placed on 'RFI engineering' the electrical circuits contained within the system. Electrical components such as feedthrough capacitors, suppression diodes, LC filters and isolation transformers used for RFI suppression are only half the story. The other half lies in the hands of the box engineer who must provide a virtual 'leak-free' enclosure from d-c to 10 Gc and on up. Total RFI protection is obtained only when both halves are integrated into the overall system.

"The proper use of these mechanical devices, coupled with the appropriately suppressed electronic circuitry, will insure RF compatibility of the final system with its external environment."

STRUCTURAL ASPECTS OF ATMOSPHERIC RADIO NOISE In The TROPICS:

The March 1966 issue of the Proceedings of the IEEE contained an article under the above title by Olu Ibukun, UNESCO Regional Centre for Science and Technology for Africa, P. O. Box 30592, Nairobi, Kenya. The Abstract is as follows:

"The amplitude probability and pulse rate distributions of noise envelope have been made the basis of a study of some structural aspects of atmospheric radio noise in a tropical area. The lognormal character of radio noise in the tropics has also been investigated. Direct comparisons are made with results obtained in termperature latitudes. The differences in the structural characteristics of noise have been related to intense local thunderstorm activity on tropical land masses."

oooooooooooooo

CAPACITOR CUTS NUISANCE RFI In A POWER SUPPLY:

The following is correspondence from the February 15, 1966 issue of Electronic Design concerning the article with the above title which was mentioned in Newsletter No. 42:

Is A Rectifier Diode an RFI Source? Author Says It's a Switch

"Sir:

"Re: 'Capacitor Cuts Nuisance RFI In A Power Supply,' (E/D, Dec. 20, p. 42) the author has touched on an important source of RFI. His solution is correct - a capacitor across the transformer secondary. However, I feel that the analysis is either incomplete or incorrect.

"If the diode is considered to be an RF generator, it sees a circuit that includes some rather high inductive reactance, and some lower valued radiation resistance, before the capacitor is added. The diode will radiate'.

"The added capacitor bypasses the inductance (and the radiation resistance), and allows the RF energy to be dissipated in the load along with the lower frequencies."

R. Cameron Barritt

Washington, D. C.

The Author's Reply

"Sir:

"In answer to Mr. Barritt, the rectifier diode is not considered a source of RFI, per se. It is viewed as a switch which interrupts a sinusoidal current pulse. The rate of the current-change, when interrupted, depends mainly on the size of the filter capacitor.

"The transformer's leakage inductance, combined with the rapid rate of the current-change as the rectifier diode opens, produces an excitation of the circuit, as shown in Fig. 2b of the article. The result is a damped, oscillatory current. In the time domain, the impulse interference occurs after the rectifier diode has opened. There is no interference generated from the oscillatory current transient, discussed in the article, prior to the end of rectifier conduction.

"The discussion presented in the article assumes that there is no coupling between any circuitry which follows the rectifier and the power supply transformer. Only conducted interference is being considered. Consequently, radiation and its effects on circuits following the rectifier did not exist. In practical situations, particularly with active regulators following the rectifier and filter, the discussed oscillatory transient can cause unwanted spurious response in the regulator. This is another reason why the oscillatory transient should be shifted down in frequency."

William J. Mattox

Supervisory Engineer
Electro International, Inc.
Annapolis, Md.

INTERNATIONAL COMPARISON Of MEASUREMENTS At HIGH FREQUENCIES:

M. C. Selby, National Bureau of Standards, has written a 9-page article, under the above title, in the IEEE Spectrum, January 1966. The sub-title and a paragraph of interest are as follows:

"Measurements of dc and some low-frequency electrical quantities have long been coordinated internationally. Cogent arguments are set forth for intensifying emerging efforts to achieve this same status for high-frequency (30 kHz to 40 GHz) quantities.

"The objective here is not to try to improve on previous voluminous dissertations but to implement these when necessary, as applicable to the international aspect of measuring high-frequency electrical quantities. An attempt is made to point out by examples the role of international agreement and to acquaint the reader with the status of past and present efforts toward international inter-comparison in this area."

STATIC ELECTRICITY And HYDROCARBON LIQUIDS In PIPES:

Under the title "Electric Currents and Potentials Resulting From the Flow of Charged Liquid Hydrocarbons Through Short Pipes," by M. R. Shafer, D. W. Baker, and K. R. Benson, is a 10-page article published in the Journal of Research of the National Bureau of Standards - C, October-December 1965. The sub-title is as follows:

"The electrical currents and potentials produced in pipes of intermediate and very high resistivities, by the flow of a charged liquid hydrocarbon, have been investigated. The maximum pipe currents to the ground were in the range 1 to 6 microamperes. Depending upon the electrical resistance of the pipes, these currents produced potentials ranging from essentially zero to values in excess of 30,000 volts which were sufficiently severe to cause electrical breakdown and arcs within some of the pipes under investigation. It is concluded that hazardous pipe potentials, resulting from static electricity, can be eliminated in practical applications if the electrical resistance from each and any protion of the interior surface of the pipe to the ground does not exceed about 10^7 ohms."

RFI/EMC ARTICLES In ELECTRONIC PACKAGING And PRODUCTION:

The following articles for 1965 are listed in the January 1966 issue of the above publication:

"A Practical See-Through Panel for RF-Tight Enclosures" by O. P. Schreiber, Jan., p. 54-57 - Mentioned in Newsletter No. 37

"RFI Shielding Techniques for Electronic Enclosures!" Jan. p. 44-48 - Mentioned in Newsletter No. 37

"Shielding at Microwave Frequencies" - by Martin R. Reynolds, Jan., p. 50-53 - Mentioned in Newsletter No. 37

"Shielding Cable/Connector Terminations from RFI" by Larry Schwartz and Donn L. Ingram, Feb., p. 10-13 Not Mentioned in Newsletter

DETECTOR PICKS SIGNAL OUT OF NOISE

E D N, January 1966, has a page article by R. Tonndorf, correspondent in Germany, under the above title. There is a block diagram and a schematic with the following text:

"When the signal is only one tenth of the noise level, how do you measure it? Only a signal of the same frequency and phase as a reference voltage will be detected by using this bridge detector.

"A new VTVM can detect any sinusoidal signal having a level down to 20 db below the noise level. Using a patented phase-sensitive homodyne rectifier, this voltmeter will rectify and indicate only a signal having the same frequency as a reference voltage, thus precluding the rectification of noise with statistically distributed frequencies.

"In-phase odd harmonics of the input signal can affect the reading to a known degree if they are not filtered out. An RC circuit filters the resulting ripple. The voltmeter can be switched to measure and indicate the noise-affected input signal, the test signal that has been passed through the object to be evaluated or the object-attenuated test signal freed from noise in the homodyne rectifier. The rectifier is commutated by the reference frequency so that detection takes place only when the reference is in phase with the signal. The reference signal may have any shape (sine, square wave, trapezoidal or triangular), provided this shape is symmetrical.

"The voltmeter handles signal frequencies in a range from 1.5 Hz to 50 kHz; it has six full-scale ranges between 1v and 300 v (or -10db through +40 db). The phase-coincidence control circuit covers a phase range from 0 to 180 deg, both continuous or in steps, the continuous mode being switchable to a range of 180 to 360 deg. Owing to the principle employed, the bandwidth in which the expected signal appears - or the selectivity - can be switched in five steps from 100 Hz down to 0.01 Hz. The VTVM was developed and built in Poland and won a gold medal at the Leipzig Fair."

SHIELDING AND GROUNDING FOR INSTRUMENTATION SYSTEMS:

The 8-page booklet described on the bottom of page 5 of the February 1966 issue of the G-EMC Newsletter has been condensed into a 5-page article in the February 1966 issue of Electromechanical Design.

14TH ANNUAL NATIONAL RELAY CONFERENCE, APRIL 26-27 OKLAHOMA STATE UNIVERSITY

The above conference will have as its general theme the design of small electrically controlled switches called electromagnetic relays. Other subjects will include design of contactors, miniature crossbar switches, dc magnet structures, and rotary solenoids. Electrical contacts, relay testing and other subjects will also be covered. Additional information may be obtained from Daniel D. Lingelbach, conference chairman and associate professor of electrical engineering at OSU, Stillwater, Oklahoma 74075.

RADAR WORK LINKED To AGING EYE LENSES

The following article appeard in the New York Times, January 24, 1966, under the above heading:

"Chicago, Jan. 23 (AP) - Some persons who work with high-powered radar equipment show evidence of accelerated aging in their eye lenses, two New York medical investigators reported today.

"It was noted, however, that there was no evidence yet that such a condition leads to impairment of vision or development of cataracts.

"The two investigators from New York University Medical Center examined 736 persons who worked with microwave equipment in 16 areas. They also examined 559 persons from the same areas who were not exposed to microwave radiation.

"Their report, in the Archives of Environmental Health, published by the American Medical Association, said a significantly greater number of minor lens defects were found among radar workers. The defects were the same types associated with aging of eye lenses, it was observed.

"The study showed that those who worked in radar research and development had greater numbers of minor eye defects than radar installers, operators or maintenance men.

"Further statistical studies indicated it was microwave radiation and not X-ray exposure from radar-set tubes that contributed to the lens aging. It developed that workers with the greatest exposure to X-rays showed the lowest incidence of eye disease."

IEEE Transactions on Aerospace and Electronic Systems

OPTIMUM FILTERS For SIGNAL DETECTION In CLUTTER:

IEEE Transactions on Aerospace and Electronic Systems, December 1965, page 297, has a letter under the above title by A. W. Rihaczek, Aerospace Corp., El Segundo, California. This is a condensed version of Aerospace Corporation Report TDR-469 (5230-43)-1 of the same title. The first paragraph of the Introduction is as follows:

"Signal detection in white Gaussian noise and the optimality, in a practical sense, of the matched-filter receiver are well understood. This is not so for signal detection in clutter. Of the two approaches to the problem, the first involves optimization of the filter in the presence of colored Gaussian noise, assuming uniform clutter distribution and negligible differential velocity between target and clutter-causing scatterers. The second considers optimization of the waveform by adapting it to the target environment when the scatterer distribution is non-uniform or the differential velocity is appreciable, assuming a matched-filter receiver. If the latter approach succeeds in eliminating the clutter, the matched filter is evidently optimum; however, since residual clutter usually remains, the optimality of the matched filter and of the entire approach to clutter filtering is frequently questioned. It is the purpose of this correspondence to show that special filter design for clutter suppression is largely academic, and that under most circumstances the proper approach to clutter suppression is via waveform design and matched-filter receiver."

COMPLIMENTARY TICKETS TO NEP/CON '66 AVAILABLE ON REQUEST

The National Electronic Packaging and Production Conferenc (NEP/CON '66) will be held in the New York Coliseum on June 21, 22, 23, 1966. Papers of interest to those engaged in electromagnetic compatibility packaging will be given as well as other papers under the following subjects: Underwater Equipment Packaging; Intercomponent Connections and Intercircuit Connections; New Techniques in Printed Circuit and Multilayer Design and Manufacture; Airborne and Spaceborne Equipment Packaging; Shock and Vibration Resistance; as well as a number of Workshops on Thin-Film Manufacturing Techniques. A copy of the advance program and complimentary tickets may be obtained by writing to Admissic Committee, NEP/CON, 222 West Adams Street, Chicago, Illinois 60606.

"ELECTROMAGNETIC RADIATION IN AGRICULTURE" - PROCEEDINGS NOW AVAILABLE

Proceedings of the 1965 conference on "Electromagnetic Radiation in Agriculture" now are available from: American Society of Agricultural Engineers, St. Joseph, Michigan 49085.

The 70-page (8 1/2 x 11) Proceedings covering papers prese ted at the conference held in September, 1965, in Roanoke, Virgi sells for $4.00 per copy. The conference was co-sponsored by Illuminating Engineering Society and American Society of Agricult al Engineers.

A symposium of papers presented dealing with the effects of light and its associated spectrum (ultraviolet, infrared, and gamma) on plants, livestock, insects and man.

EXCERPTS FROM FCC GENERAL INFORMATION BULLETIN 11/8/65:

Samples of International Interference

The FCC monitoring and direction-finding net continually assists its licensees and Federal agencies in solving interference cases with international complications. The following are typical:

A station in Red China was found to be causing interference to reception by a telephone station in California from the transmitting point in Hong Kong.

Transmissions from Moscow to Havana were identified as the cause of adjacent channel interference to radio communication between a U. S. Air Force base in Maryland and Newfoundland.

Interference to a Coast Guard station in Virginia was found to come from a Dutch vessel docked in the vicinity. The latter's handset had been left in such a position that the transmitter remained on.

Interference to another shore-based U. S. Coast Guard station was identified as a spurious emission from a Canadian nav vessel.

EXCERPTS FROM FCC GENERAL INFORMATION BULLETIN 1/27/66

Notes From FCC Field Engineering Reports

Grounded:

Complaint of interference to space communication was made to the FCC's monitoring station at Powder Springs, Ga., by the NASA test facility at Bay St. Louis, Miss. FCC observers identified the interfering signal as unstable radiation from an industrial electronic heater. Their long range direction finding bearings indicated a source north of Memphis, Tenn., and the case was referred to the FCC's Atlanta district office for further investigation. The cause was found in a factory at Ripley, Tenn., where excessive radiation was eliminated when a loose ground strap on one of the four heaters was replaced.

Search for Oil Hampers Search for People:

The Coast Guard station at Pt. Vincente, Calif., received interference to a frequency reserved for ground-to-helicopter rescue operations. An engineer from the FCC's Los Angeles office drove to the station but the signal was too weak to be heard in the investigative car. FCC monitoring stations at Livermore and Douglas, however, were able to get long range bearings which placed the source 50 or 60 miles away, near Santa Cruz Island. Direction finder bearings brought the engineer to a truck camper body, supported on a wooden platform, on a hill some 50 feet from the highway. A 35-foot antenna and buried ground radials and power cable indicated a permanent installation. A name and telephone number posted on the premises provided contact. The station was found to be one of several licensed to a petroleum company searching for oil deposits. Violation notices were served and the licensee was instructed to take remedial measures before resuming radio prospecting.

Police "Bug" Crashes TV:

An unexpected turn of events sometimes adds spice to what initially appears to be a routine interference investigation. Such was the case when engineers from the FCC San Francisco office and its western TV-FM enforcement unit collaborated in tracking down the source of interference on TV Channel 5. Approaching the suspected area, a steady carrier was heard between the sound and video signals. It was punctuated with background noises -- the ticking of a clock, loud crashes, male voices discussing the use of drugs and other chatter. The search led to a vacant dwelling. No antenna was visible, but entry was made. Two youths were found inside, one of which made a speedy exit. An adult male observed loitering outside of the building also vanished. The remaining youth told the engineers that he was cooperating with the local police in an effort to obtain information on the supply and use of drugs by students in the area. Authorities confirmed that the house was a decoy for persons engaged in illegal drug traffic. A microphone hidden in a downstairs lamp relayed conversation to a transmitter (licensed to the police) in the attic which was received by a recording point about half a mile away. The operator was directed to remedy the situation as far as TV service was concerned.

FM Background Music Blacks Out TV Picture:

In response to four identical complaints about interference to Channel 7 in Los Angeles, the local FCC office investigated. Direction finding equipment set up in front of one complainant's home registered the interfering signal, but the area had to be cruised to define the extent of radiation. A building housing a large supermarket proved to be the place of strongest emission. When an FM musicast system serving the shoppers was discontinued the interference did likewise. The store was warned to take remedial measures before resuming its background music operations.

Garage-Door Openers Still Interference Headache:

The garage-door interference epidemic, which is a hazard to aviation communication, broke out in San Diego, Calif. An engineer from the local FCC office, assisted by one from the Los Angeles office, systematically detected and removed from the air 130 excessively radiating electronic garage-door opening devices. Enforcement continues to deal with this particular problem.

Incidental Radiation Renders Aviation Aid Useless:

The FCC'S Savannah, Ga., office resolved an interference problem that had closed down a local airport instrument landing system to prevent incoming planes from being diverted to a housing area. The first effort was a flight over the scene to determine where a ground search could begin. This was unsuccessful since the whole city appeared to be radiating. The signal could be heard in the air three miles from the landing strip. Signal intensity observations while ground cruising around the airfield finally centered on about three city blocks served by an electrical distribution system running parallel to the runway. The power company was advised and promptly sent a crew to locate and correct the cause. Seven men worked to disconnect arrestors, tighten circuit connections and remove tree limbs. Finally, wiggling a tie line on an insulator gave results, and repair of seven tie lines enabled the airport instrument landing system to be restored to service.

New Products

Hewlett-Packard Brings Out New RFI Measurement Instrument

In the March 1966 Hewlett-Packard Journal, a new Spectrum-Analyzer Up-Converter is described on the two back pages. It is described as Model K15-8551B Spectrum-Analyzer Up-Converter mounted on top of -hp-Model 851B/8551B Spectrum Analyzer. Analyzer range without converter is 10 MHz to 40 GHz; converter extends this down to 10 kHz. The last two paragraphs are as follows:

"The analyzer/converter is, of course, a general-purpose spectrum analyzer that can be used for many types of frequency spectrum measurements. In laboratories it can be used to examine very low-level signals from transistor oscillators. However, the analyzer's minimum IF bandwidth of 1 kHz limits its resolution at audio frequencies, so that for applications requiring greater resolution, other instruments would have to be used. Fig. 5 shows the resolution of the 1-kHz IF bandwidth of the analyzer, both with and without a crystal-filter accessory which improves its selectivity.

"The converter meets MIL-I-618D RFI-susceptibility specifications when the individual components are installed in the combining case with a filter in the amplifier power line."

Conductive Coating on Apparatus Bushings Eliminates RFI Noise

Insulation, March 1966, carries the following article under the above title:

"An electrically conductive coating applied to large porcelain insulators for power transformers, oil switches, and oil reclosers by Illinois Edison Porcelain Div., McGraw-Edison Co., is said to be highly effective in suppressing the corona and arcing that causes radio frequency noise on power lines. The coating is a dispersion of colloidal graphite in an epoxy resin solution. The dispersion is applied by brush onto a portion of the unglazed area of the insulator. Spraying and dipping techniques also can

be used, depending on the type and size of the component to be coated. After the dispersion is applied, it is baked for 4 hours at 350°F (177°C) to produce a durable, corrosion, resistant electrically-conductive coating with low resistance.

"The colloidal graphite, measuring only a few microns in size, provides the conductive medium. The fine particle size combined with epoxy resin forms a smooth and void free surface, particularly important in reducing resistance levels and minimizing radio noise. In addition, the cured coating is inert to both transformer oil and degreasing agents used in cleaning the apparatus components prior to final assembly.

"The cured coating is claimed to have extremely good wear characteristics and, in fact, can be used as a dry film lubricant that resists the effects of oils and solvents. Resistance to oil is important in the transformer application, since a portion of the insulator is constantly submersed in oil during normal operation.

"The dispersion, 'dag' 213, is supplied by Acheson Colloids Co., Port Huron, Mich."

Low-Power Regulator Cleans Up Noise

Electronics, March 7, 1966, has a description of a low-power regulator which cleans up noise and which is made by the Wanlass Electric Company, Santa Ana, Calif. The new line, designated R-3200, is designed primarily to hold peak voltage constant, and the manufacturer says it is relatively insensitive to power fluctuation. It will go out of regulation to accommodate voltage surges, and will blow a fuse if subjected to a sustained overload.

Solar Electronics Offers Useful RFI/EMC Graphs

Solar Electronics Company, 901 North Highland Avenue, Hollywood, California 90038, has prepared a series of graphs and reactance charts which should be useful to RFI/EMC engineers.

RFI Prediction Graph for Rectangular and Trapezoidal Puls Interference has been prepared from 10 ns to 100 ms with frequencies from 1 cps to 10G. The three Reactance Charts include inductance, reactance, capacitance and frequency from 1 cps to Gs. Copies of these graphs and charts may be obtained by writing to A. T. Parker, President.

Metamorphic Ceramic Capacitor Guide

Electro Materials Corporation, 11620 Sorrento Valley Road, San Diego, California 92121, has prepared a movable circular chart which permits information to be obtained on its above products, such information classified under the headings of Power Factor, Insulation Resistance, Test Voltage, MIL SPEC (meets or exceeds), LEADS (tinned copper) WVDC, and Capacitance Tolerance. This guide can be used to supplement the various catalogs available.

A New Concept in Shielded Enclosures

Amerind, Inc., Royersford, Pennsylvania, has recently begun to market its CLAMPANEL shielding panel system which has been designed for pre-fabrication and installation. Only panel modules and flat spring clamps are required to produce high shielding effectiveness. The CLAMPANEL system can then be upgraded to weldpanel, a maximum attenuation shielding system, simply by removing the flat spring clamps with a carpenter's claw hammer then welding the edges. Panel modules utilized in either system are fabricated of standard commercial zinc-coated steel sheets. Edges are bent for structural stability. Peripheral interfaces of panel modules are bent for structural stability. Peripheral interfaces of panel modules are held in conductive continuity by clamps or continuous weld. Built-in structural flexibility allows for expansion or contraction without loss of shielding reliability. Maintenance is not required to prevent degradation. Problems inherent in older designs, where an enclosure can lose its shielding effectiveness in a short period of time, have been claimed to be eliminated. Both systems are designed for permanent building or demountable applications. Technical data is available upon request from Amerind.

Two New Circuitry Components

RAFEC Electronics, P. O. Box 566, Temple City, California 91781, has developed two new circuitry components called a Dycon Attenuator and Radio Frequency Energy Converter.

The Dycon Attenuator has applications as follows:

"RAFEC Electronics' Model 220 "Dycon' circuit attenuator, utilizing non-resonating elements, is designed from a radically new concept in design circuitry. For particular applications, it can be so designed to initiate explosives if the DC firing voltage has exceeded a predetermined level. Thermal batteries, circuit squib switches and other system reliability components can be protected from low DC and RF voltages. Primary applications are in Ordnance, mining, bridge and road construction and oil well drilling."

The Radio Frequency Energy Converter has applications as follows:

"RAFEC Electronics' Model 307-A Radio Frequency Energ Converter is designed, primarily, for use as an RF Voltmeter to measure unmodulated RF Voltage by developing a D. C. Voltage proportional to the 'E' component of the unit under measurement, and as an RF Detector. When used as an RF Detector, the DC Voltage varies with the modulation of the carrier, producing a varying D. C. Voltage that carries the intelligence of the signal. The Model 307-A is used, also, to indicate tuning of the RF stage in radios, transmitters, signal generators and similar devices. By calibration, it can be used to measure the 'E' component in the near field of an antenna."

Solderable Conductive Paint

Dynaloy, Inc., 408 Adams Street, Newark, N. H. 07114, has brought out a solderable conductive paint known as Dynaloy 350. Dyanloy 350 is a pure silver filled electrically conductive polymer alloy which exhibits high conductivity, good environmental protection and can be easily soldered to with conventional solders. It readily adheres to conventional solders, metals, plastic, glass, rubber and ceramic surfaces. Further technical details may be obtained by writing to Sam Ringel at the above addr address.

Explosion-Proof Connectors for Hazardous Locations

The Pyle-National Company, 1334 North Dostner Avenue, Chicago, Illinois 60651, has brought out Bulletin No. 1252-J describing its Pyle-Star Line of explosion-proof connectors for hazardous locations.

Thermal Noise Filtering and Bandwidth Restriction

Electro Optics Associates, 981 Commercial St., Palo Alto, Calif., is offering a Coolable Photomultiplier Assembly EOA PM-101 to improve the detection of thermal noise from background noise. Its usefulness is claimed when noise filtering and bandwidt restriction fail, or for the detection of fast-rise-time signals involving large bandwidths. Signal to noise improvement can be 10^2 with proper application.

CONSTITUTION

CONSTITUTION

IEEE ELECTROMAGNETIC COMPATIBILITY GROUP

This Constitution was approved by the IEEE Executive Committee on August 25, 1965:

Table of Contents

IEEE ELECTROMAGNETIC COMPATIBILITY GROUP
(G-EMC)
CONSTITUTION

Article I

Name and Objective

Section 1. This organization shall be known as the IEEE Group on Electromagmagnetic Compatibility of the Institute of Electrical and Electronics Engineers, Inc.

Section 2. Its objects shall be scientific, literary and educational in character. The Group shall strive for the advancement of the theory and practice of electrical and electronic engineering and of the allied arts and Sciences, and the maintenance of a high professional standing among its members and affiliates, all in consonance with the Constitution and Bylaws of the IEEE and with special attention to such aims within the field of interest of the Group as are hereinafter defined.

Section 3. The Group shall aid in promoting close cooperation and exchange of technical information among its members, and to this end shall hold meetings for the presentation of papers and their discussion, and through its committees shall study and provide for the needs of its members.

Article II

Field of Interest

Section 1. The Field of Interest of the Group shall be the enhancement of Electromagnetic Compatibility (Electromagnetic Compatibility is defined as the capability of electronic systems or equipments to be operated in the intended operational environment at designed levels of efficiency without degradation due to unintentional electromagnetic interference), including:

1) The generation of Engineering Standards
2) Measurement Techniques and Test Procedures,
3) Measuring Instruments and
4) Equipment and Systems Characteristics, such as:
   susceptibility
   vulnerability
   related propagation effects
   subjective effects, frequency allocation and assignment
5) Improved (interference reduction or control) techniques and com-
6) Education in Electromagnetic Compatibility ponents
7) Studies of the origins of interference, both man-made and natural, and their classification
8) Spectrum Conservation
9) Spectrum Utilization
10) Shielding Techniques
11) Harmful side effects of electromagnetic energy in other disciplines.
12) Scientific, technical, industrial or other activities that contribute to this field, or utilize the techniques or products of this field, subject as the art develops, to additions, subtractions, or other modifications directed or approved by the IEEE Technical Activities Committe

Section 2. The field of interest of the Group may be enlarged, reduced or shifted moderately as the needs of the occasion indicate with the provision that such revisions shall be processed as an amendment to this Constitution.

Article III

Membership

Section 1. Membership in the Group shall be available only to members of the IEEE in any grade, including students, having a professional interest in any phase of the field of interest of the Group.

Section 2. Affiliates may participate in the Group activities, as provided by the IEEE Bylaws and subject to the applicable IEEE rules and regulations and any additional limitations imposed by the Group Bylaws.

Article IV

Financial Support

Section 1. The Group shall collect from its members an annual assessment or fee, in accordance with the IEEE Bylaws and applicable rules and regulations. The amount of the fee shall be prescribed in the Bylaws.

Section 2. The Group may make registration charges at its Group meetings, symposia, conferences, and conventions. The registration fee for non-members of the IEEE may be higher than for IEEE members.

Section 3. The Group may raise revenues by other means, such as advertising, shows, requests for contributions, and charges for sending out notices to non-Group members, provided such means are consistent with applicable IEEE rules and regulations, and do not encroach on revenue fields of prior established Groups or Sections. Any new revenue means not explicitly covered by IEEE rules and regulations must be approved by the General Manager before being adopted by the Group.

Article V

Administration

Section 1. The Group shall be managed by an Administrative Committee of 15 elected members of the Group plus members "ex-officio with vote" as specified in the Bylaws. (There may also be members "ex-officio without vote.") No less than 70% of the voting members of an Administrative Committee shall be elected members.

Section 2. Subgroups may be formed as provided in the IEEE rules and regulations and the nature of subgroups, and the supervision of subgroup affairs other than by the Administrative Committee, shall be prescribed in the Bylaws.

Section 3. The terms of the 15 members-at-large of the Administrative Committee shall be for three years, five members to be elected year. Only two consecutive full terms are permitted, but eligibility is restored after a lapse of one year.

Section 4. The Administrative Committee shall annually elect one of its elected members as Chairman, and another as Vice Chairman whose terms shall be for one year. A Secretary and a Treasurer shall also be elected annually for a one-year term, which officer need not be a member of the Administrative Committee, and he may be re-elected.

Section 5. Newly elected Chairman, Vice Chairman and members of the Administrative Committee shall assume office on the first of July of each year, unless a different time is provided by the Bylaws.

Section 6. The duties and responsibility of the officers shall be as defined hereunder and in the Bylaws and as delineated by the Administrative Committee.

Section 7. The Chairman, under direction of the Administrative Committee, shall have general supervision of the affairs of the Group. He shall preside at meetings of the Administrative Committee, at general meetings of the Group, and at the Annual Meeting of the Group," and have such other powers and perform such other duties as may be provided in the Group Bylaws, or as may be delegated to him by vote of the Group Administrative Committee. In his absence or incapacity, his duties shall be performed by the Vice Chairman.

Section 8. The Chairman shall be an ex-officio member of all Committees of the Group. He is a member of the IEEE Technical Activities Board, and when notified of a meeting of said Board, he shall insure representation of the Group at such meeting by himself, or by an alternate. If an alternate can not be found, the Chairman shall present the views of the Group by a letter of proxy.

Section 9. The Administrative Committee may establish standing or ad hoc committees as prescribed in the Bylaws, including both functional committees (e. g. Awards, Chapters, Membership, Nominations) and technical committees. Technical Committees may be established as needed to develop specific areas of the field of interest. All appointments to committee and similar posts will be for a term of one year or until successors are appointed or the committees dissolved.

Section 10. The Administrative Committee may utilize the services of Headquarters as bursar, for all or part of the Group funds, as provided by the IEEE Bylaws and rules and regulations. If any part of the Group funds are received and deposited separately, the terms and conditions shall be in accordance with IEEE policies and subject to the provisions of the Group Bylaws and to any special limitations imposed by the Administrative Committee.

Section 11. Neither the Electromagnetic Compatibility Group, nor any officer or representative thereof, shall have any authority to contract debts for, pledge the credit of, or in any way bind the IEEE, except in accordance with previously approved budgets.

Article VI

Nomination & Election of Administrative Committee

Section 1. The nominating procedure shall include provision for petition by Group members to place a name on the ballot.

Section 2. Election of the 15 members-at-large of the Administrative Committee shall be as prescribed in the Bylaws.

Section 3. Within-term vacancies on the Administrative Committee shall be filled by appointments, for the unexpired terms, by the Chairman with the consent of the Committee.

Article VII

Meetings

Section 1. The Group may hold meetings, conferences, symposia, or conventions either alone or in cooperation with Sectional, Regional, or National Convention Committee of the IEEE, or other technical organizations, subject to IEEE rules and regulations. The Group shall sponsor at least one technical conference of national scope each year, which may be held during the International Convention, or during some other IEEE meeting, or as a separate conference.

Section 2. Meetings, Conferences or Conventions of the Group shall be open on an equal basis to all members of the IEEE. The Group may not sponsor or co-sponsor a meeting which is subject to security clearance.

Section 3. The Administrative Committee shall hold at least two meetings, one an Annual Meeting at a time specified in the Bylaws. Other meetings of the Administrative Committee shall be held at such times as are found necessary and/or convenient. Special meetings of the Committee may be called by the Chairman of the Group at his own discretion or upon request of three other members of the Committee, with at least 10 days notice.

Section 4. Eight members of the Administrative Committee shall constitute a quorum. All members shall have an equal vote. Ex-officio members will not have a vote unless the Bylaws specifically provide otherwise.

Section 5. A majority vote of those members of the Administrative Committee attending a meeting shall be necessary for the conduct of its business except or otherwise provided in this Constitution.

Section 6. Business of the Administrative Committee may be handled by correspondence, telephone, or telegraph where in the opinion of the Chairman matters requiring action can be adequately handled in that manner. A majority vote of the members of the Committee is necessary for approval of actions handled in that manner, unless otherwise provided.

Article VIII

Publications

Section 1. Publications undertaken by the Group shall be subject to IEEE policies and to any further guidance or controls prescribed by the Administrative Committee or its duly appointed committees. The Group shall be responsible for the financial aspects of its publication program.

Section 2. The Chairman, with the advice and consent of the Administrative Committee, shall appoint such editors as may be required to implement the publication program. The duties of an editor, and his compensation, if any, shall be prescribed in the Bylaws.

Article IX

Amendments

Section 1. Amendments to this Constitution may be initiated by petition submitted by 25 members of the Group or by the Administrative Committee, such petition being submitted to the IEEE Technical Activities Board, and to the Executive Committee of the IEEE for approval. After such approval, the proposed amendment shall be published in the Group Transactions or Newsletter, or otherwise publicized by direct mailing to the membership with notice that it goes into effect unless ten percent of the Group members object within 30 days. If such objections are received, a copy of the proposed amendment shall be mailed with a ballot to all members of the Group at least 30 days before the date appointed for return of the ballots, and the ballots shall carry a statement of the time limit for their return to the IEEE office. When a mail vote of the entire Group membership is made necessary, approval of the amendment by at least two-thirds of the ballots returned shall be necessary for its enactment.

Section 2. Suitable Bylaws, and amendments thereto, may be adopted by a two-thirds vote of the Administrative Committee present in meeting assembled, provided that notice of the proposed Bylaw or amendment, has been sent to each member of the Administrative Committee at least a week prior to such meeting; or a bylaw or amendment, may be adopted by a two-thirds mail vote of the members of the Administrative Committee provided a 30-day period is provided for such responses. In either event, the proposed bylaw or amendment shall be published in the Group Transactions or Newsletter. No bylaw, or amendment, shall take affect until it has been published and has been mailed to the Technical Activities Secretary of the IEEE, and he has obtained approval of the General Manager.