IEEE NEWSLETTER

ELECTROMAGNETIC COMPATIBILITY GROUP

Number 36 December 1964

TRI SERVICE CHICAGO CONFERENCE - COMMENTS:

RFI, as a general descriptive term, is being gradually up-dated to be included in the broader scope of electromagnetic compatibility (EMC), while electromagnetic energy, which produces electromagnetic interference, is being expressed as EMI and electromagnetic susceptibility as EMS. However, on the other hand, RFI is increasingly being used to describe any source of interference which comes from outside in order to differentiate it from any sources inside of systems or compatibility between systems which might be expressed as EMC, EMI and EMS.

"EMC has sneaked up on the military and now has sneaked up on the nation."

"EMC is the enemy of the electronic age. If we cannot control the enemy, we cannot control the electronic age. The electronic systems have become so complicated that an army cannot move randomly."

CPS, KC, KMC, etc., are all terms which are self-descriptive. The future scientist will not thank us for substituting hertzian and gigacycles, etc.

There is an educational responsibility for those who attended this Conference to pass on to their associates what has been presented here. Increasingly complex future systems imply that more difficult EMC problems will arise unless plans are made now to eliminate the known problems through technical education, adequate EMC specifications and engineering design work.

Management is the key to implementing the EMC program. The task of controlling electromagnetic interference (EMI) has become critical in many industries.

RFI measurements should be made with adequate accuracy but measurement procedures are cumbersome and the restrictions upon it prevent the gathering of comprehensive data. At the present time it is difficult to accurately measure a transient. Long transients can be recorded; but intense transient techniques in real time are still to be developed.

DC bonding is quite satisfactory but improved RF bonding techniques are needed including RF bonding measurements.

RF mixing in large metallic structures has not been eliminated. The general tendency is to design around this problem since there is too little information available to mechanical designers.

SEVENTH ANNUAL SYMPOSIUM ---- JUNE 28, 29 and 30, 1965

The Seventh Annual Symposium on EMC, sponsored by the IEEE Electromagnetic Compatibility Group will be held at the Waldorf-Astoria Hotel, New York City on June 28, 29 and 30, 1965.

This session promises to break all previous attendance records, because of both greater interest in the solution of EMC problems, and the opportunity to visit the New York World's Fair before or after the technical sessions.

The Symposium committee is striving to make this program one of broad general interest and is seeking abstracts of proposed papers on the following subjects, as well as others which would be of interest to the field:

1. Measurement Techniques
2. Suppression materials, components, and their application
3. Electro-Magnetic Pulse (EMP) Problems
4. Advanced EMC Theory
5. Radiation Hazards
6. Interference Prediction
7. Susceptibility - from DC to light
8. Specification considerations

A 500 word abstract of your paper should be submitted for review by the Technical Program Committee prior to February 26th.

Abstracts should be addressed to:

D. Fidelman, Chairman Tech. Program Comm.
Electro-Magnetic Measurement Co.
50 Baiting Place Road
Farmingdale, New York

Papers of a provocative nature may be the basis for a discussion session or Special Workshop at the Symposium, and authors of those papers will be asked to submit their complete paper by June 1st, 1965.

Milton Kant, Chairman
Sperry Gyroscope Co.
Great Neck, New York

There will be a top-level Panel Discussion of the Survey by the Joint Technical Advisory Committee of electromagnetic compatibility throughout the United States for the Telecommunications Director for the White House. This should be of vital interest not only to technical personnel but also to management.

NOMINATIONS FOR IEEE-G-EMC ADMINISTRATIVE COMMITTEE MEMBERSHIP:

The IEEE-G-EMC Nominations Committee hereby notifies the membership that nominating petitions for the election of five(5) members to the IEEE-G-EMC Administrative Committee for a three-year term commencing July 1, 1965 will be accepted up until January 1st, 1965. The by-laws concerning these nominations are as follows:

ARTICLE VI

Section 1: On or before December 1st of each year all members of the IEEE-G-EMC shall be notified that nominations for members of the Administrative Committee are open. This shall be done either by notice in a Newsletter or by direct notification of each member by post card or letter.

Section 2: Nominations shall be made by petition. The nominating petition for each nomination submitted shall contain at least 15 IEEE-G-EMC members' signatures together with a short (not more than 100 words) biography listing the affiliation and background of the individual nominated. All nominations must be in the hands of the Nominations Committee by January 1st of each year. If the Nominations Committee receives less than 10 names (two for each vacancy) or if the Nominations Committee sees fit to make nominations in addition to those received from the members, it shall be within the authority of the Nominations Committee to do so. Not less than 2 names for each vacancy shall be submitted by the Nominations Committee.

Section 3: On or before February 1st of the year a ballot containing the names of all members nominated for vacancies on the Administrative Committee and their biographies shall be sent to all members of the IEEE-G-EMC. The marked ballots shall be returned to the Nominations Committee on or before March 1st. The candidates receiving the highest numbers of votes shall be deemed to have been elected to the Administrative Committee. In case of a tie for any vacancy the names of the candidates receiving the same number of votes shall be put in a container and the name drawn from the container shall be deemed to have been elected to the Administrative Committee. The names of the elected members shall be transmitted to the Chairman of the Groups Committee and through him to the IEEE Executive Committee. Unless disapproval of such elected members is received within 60 days of such transmittal, the elections shall become final.

Each nominating petition (signed by at least 15 IEEE-G-EMC members and accompanied by a biographical sketch of not more than 100 words) should be sent before January 1st, 1965 to the Chairman of the Nominations Committee:

James J. Krotansky, Manager
Electromagnetic Compatibility
IIT Research Institute
10 West 35th Street
Chicago, Illinois 60616

The members of the Administrative Committee, whose term of office expires on June 30th, 1965, are: Stanton A. Bennett, James S. Hill, A. R. Kall, Leonard W. Thomas, D. R. J. White.

The above notice in this Newsletter complies with the requirements in Section 1 and will be the only notification for 1965 nominations which will be sent to members by the IEEE-G-EMC.

NOTE: Due to the change in Chairmanship of the IEEE-G-EMC Nominations Committee, publication of the above Notice did not appear at the proper time. The receipt of nominations by the Nominating Committee has, therefore, been extended to February 1st, 1965.

CHAPTER ACTIVITIES

Boston:

The Military Electronics/Electromagnetic Compatibility Group met on September 24th, 1964, attendance - 79, at which time James H. Burrows of Mitre Corporation, Bedford, Mass., spoke on the "USAF Systems Design Lab."

Los Angeles:

On May 21st, 1964, Mr. F. J. Nichols, of Genistron, Los Angeles, California, spoke regarding "Future Advancements in Radio Interference Filters," at a meeting of the Electromagnetic Compatibility Group.

The Electromagnetic Compatibility Group met November 19th, 1964, to hear four Jet Propulsion Laboratory Engineers cite EMC efforts on Ranger Spacecraft. Mr. A. J. Nalbandian, Group Supervisor reviewed the EMC systems effort at J.P.L. A discussion on Cape Simulation Susceptibility Tests was lead by Mr. A.A. Olbeter. Also included in the discussion were reasons for the tests and how they were accomplished. Also speaking were Mr. W.R. Johnson, Senior Engineer at Northrop Space Labs on loan to J.P.L. who covered the implications and effects of electrostatic charging and discharging of rocket launched vehicles, and Mr. A.C. Whittlesey who spoke on Potential incompatibilities between the Ranger Spacecraft and ground receivers and the TV transmitter which shares a high gain antenna with the spacecraft transmitter.

Seattle:

The Electromagnetic Compatibility Group met May 20th, 1964, attendance - 17, and heard Robert E. Perdue of Boeing, Seattle, Washington speak on "An Introduction to Electronic Circuit Simulation on an Analog Computer."

On March 18th, 1964, Mr. Robert Cockrell of Boeing, Seattle, Washington spoke at a meeting of the Electromagnetic Compatibility Group, attendance - 34. Mr. Cockrell's topic was "Status Report on Micro-Electronics."

ITEMS OF INTEREST IN SEPTEMBER 1964 PROCEEDINGS OF IEEE:

"Orthogonal Detection to Reduce Common Channel Interference" is the title of a 7-page article by J. E. Bridges and R. A. Zalewski, of the IIT Research Institute, Chicago, Illinois. The summary and first paragraph are:

"An orthogonal detection system has been developed which can extract any one of two double-sideband signals sharing very nearly the same radio-frequency spectrum. No specific relationships in frequency, phase, or amplitude between the two double-sideband carrier waveforms are required. The presence of thermal noise or other uncorrelated waveforms degrades the signal-to-noise ratio of the desired separated signals from about 3 db to 10 db for 90 per cent of the possible co-channel carrier frequency differences. Departures from ideal component characteristics and signal processing may introduce further degradation.

"An experimental breadboard was developed and tested. An improvement over a conventional diode envelope detector of + 25 db was measured for - 12 db signal-to-interference ratio. If a sampling technique were employed, it is estimated that an additional 15 db improvement could be realized. The implication is that signals associated with other types of conventionally modulated waveforms sharing very nearly the same spectrum are reasonably separable provided that the channel capacity is not fully utilized.

"Interference can be roughly divided into two classes: adjacent channel interference and common or co-channel interference. The adjacent channel interference problem, while serious, can be solved theoretically at least, by additional receiver selectivity and improved receiver overload characteristics. Co-channel interference is more serious, and is defined when two or more signals unintentionally share virtually the same spectrum space. In the past, many have viewed the co-channel interference situation as 'hopeless', although a number of useful techniques have been employed to combat it as early as the 1930's."

Low-Noise Performance of Photo Diode Envelope Detectors in the Megacycle Range

On page 1067 is a 3-column letter on the above subject by D.J. Roulston, Département de Recherches, Physico-Chimiques, Compagnie Générale de Télégraphie Sans Fil Puteaux, Seine, France. The first paragraph states:

"Up to the present it has generally been assumed that photomultipliers are far superior to photo diodes for optimum detection of low-level amplitude modulated signals. In this communication we consider the detection of such a signal, modulated at a frequency of several megacycles (and giving an information band suitable for multichannel telephony or a small number of video channels), using 1) a classical photoparametric circuit of the up-converter type and 2) a modified circuit in which we introduce the concept of an up-converter with no electrical resonant circuit at the input frequency. With this latter circuit it is theoretically possible to have performances which are comparable to those of a typical photomultiplier

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On page 1075 is a letter titled "The Influence of Mismatch Error in Noise Performance Measurements" by M. Michael Brady, Norwegian Defence Research Establ., Kjeller, Norway. The first paragraph states:

"A mismatch between a generator and a device whose noise performance is being measured may affect large measurement errors. This communication presents a simplified expression for the effect of mismatch and points out a mismatch-dependent measurement limitation. In order to avoid questions concerning standard temperatures and computation methods for noise figures, the development used here employs the effective input noise temperature notation."

ASIA TO CAUSE FURTHER EMC PROBLEMS

The President of a company which makes components, among other products for the electronic industry, and who has just returned from Japan, the Philippines, and India made the following statements at a luncheon on November 2nd, 1964 and requested that his name be not involved.

"It has been stated, in various parts of Asia, that the small Japanese transistor radio is going to change the entire face of Asia. The reason is briefly this; that the native in the field and in his home can be reached in his own language and instructed along educational lines. When movable type was invented, people had to be taught how to read which was a slow process and one which often had to be forced on the individual. In Asia, however, all the individual has to do is to carry his transistor radio out into the rice field, or while he watches his herds, or while he sits in his home, and can have the affairs of the world described to him. We are thus witnessing a repetition of the slow surge in knowledge which followed the invention of movable type but this time it is an educational explosion because of movable teachers.

"This sudden spread of the availability of knowledge is stimulating enthusiasm through whole areas which were never reached before and causing ambitious youths to flock to centers of learning. The trouble is, now, that it is often very hard to get them to leave a center of learning once their courses are completed.

"I attended a business meeting in Japan and was astonished to find out that I was the only non-Ph.D. there. The white man is going to have an increasingly harder time competing with these young enthusiasts and will soon have to look to his trade laurels. One Indian plant I called on was already shipping machine tools to Switzerland and was not worried about European competition because of their own technical capabilities to keep ahead.

"I began to wonder what was going to happen to the electromagnetic spectrum when these millions begin to demand its use for their own purposes. The peasant no longer has to be sold on technical progress because he has an example of it now right in his own pocket. Don't look to Europe for your future problems in the spectrum but look to Asia."

ELECTROMAGNETIC COMPATIBILITY MEASUREMENT:

An article, on the above subject, appeared in the September 28th, 1964 issue, page 14, of Electronic News, by K. M. Miller, General Manager, Metrics Division, Singer Company.

The last four paragraphs in the article are as follows:

"The techniques of measurement will become less an art and more a science.

EMC/RFI instruments will become available during the next two years, offering degrees of sensitivity, dynamic range, high power density environment immunity, signature analysis and accuracy generally considered not possible with the present generation of instruments.

The automated EMI instrumentation system is imminent-removing practically all of the human element in the data accumulation process.

In summary the EMC/EMI instrumentation field is growing and it is profitable. It continues to be hard pressed to keep pace with the scientist who is needing more tools to solve the problem of EMC which is increasing at an explosive rate."

NEW NOISE FIGURE SLIDE RULE

Airborne Instruments Laboratory has brought out a new "noise figure slide rule" which is an improvement over the previous one. Improvements made are expansion of scales, and the addition of a universal Y factor scale and a loss correction scale. This new slide rule may be obtained by writing to:

J. F. Bisby
Mgr., Commercials Sales
Airborne Instruments Laboratory
Deer Park, Long Island, New York

EMC INSTRUMENTATION, INC., NEW NORTH HOLLYWOOD FIRM

EMC Instrumentation, Inc., has been formed by five former employees of Stoddart Aircraft Radio Co., Inc., Hollywood. D.M. Hish is President of the new firm and other founder members are: John R. Mahoney, James Currans, Kenneth Orcutt, and Gary Moser. The firm will make instrumentation for measurement of radio frequency interference. Mr. Hish said the first instrument, to measure RFI from 1 to 10.5 gigacycles, would be in production inside two months and available in about four months.

MOVIE AVAILABLE FOR "McDONNELL COMPACT WIRE HARNESS"

A paper titled "Electromagnetic Compatibility of High Density Wiring Installations By Design or Retrofix" was presented at the International Convention on Military Electronics in Washington, D.C., September 14-16, 1964. A movie film is now available on a short term loan basis for showing at IEEE-G-EMC Chapter Meetings. It is a 14 minute, 16 mm color and sound technical presentation which compliments the above paper. A copy of the movie may be obtained by writing to:

W. D. McKerchar
Department 311, B33, Level 4
McDonnell Aircraft Corporation
P. O. Box 516
St. Louis, Missouri 63166

TROPOSPHERIC RADIO PROPAGATION ON AN OVERSEA PATH IN THE GULF OF MEXICO

A report from National Bureau of Standards on Tropospheric Radio Propagation on an Oversea path in the Gulf of Mexico, (NBS Report #8429) by M. T. Decker and F. O. Guiraud is available. Information about the report may be obtained by writing to the Office of the Director, National Bureau of Standards, Washington, D. C., 20234.

EMC GOES INTO THE FOURTH DIMENSION:

An editorial in Insulation, October 1964, introduces a possible new dimension in electromagnetic compatibility. The editorial is titled "The Fourth Dimension" and is reprinted in its entirety as follows:

"Several months ago I had an opportunity to attend a conference at which an interesting new attribute of an electrical insulation material was described in a paper by F.F. Stucki of the Lockheed Missiles and Space Co., Palo Alto, California.

"It seems that the author found that the storage capabilities of a certain magnetic memory core could be maintained, as temperatures dropped, by the internally generated pressures of a properly selected thermosetting resin encapsulant. Where the storage capability of an unencapsulated core would be lost if temperatures dropped to around 0°C, the capability of an encapsulated one could be extended down to at least - 30°C, and probably much lower. In other words, the resin became a mechanical transducer and an integral part of the memory's overall design. It was upgraded from a passive element to an active element.

"It is the opinion of the managing editor that this development is indicative of things to come in the insulating materials field. In the future, insulation may be called upon to accept 'responsibilities' over and above those that it presently has. These new responsibilities could be termed insulation's 'Fourth Dimension'. By way of reference, one could say that insulation's 'First Dimension' is its ability to electrically insulate. Its 'Second Dimension' is its capability of sometimes serving a mechanical function or as a structural support. Environmental protection is its 'Third Dimension'.

"Sometimes an insulation is only called on to work in its 'First Dimension' as is the case of the air around us. On other occasions, it may be called on to work in two of its dimensions, such as a printed circuit board (insulating/structural), or an insulating oil (insulating/protective). An insulating varnish (which is also a bonding agent) is a good example of a material that often performs in three dimensions. However, all of these are passive roles. In Lockheed's application, the encapsulant is four-dimensional - it insulates, supports, protects, and acts.

"Many ideas come to mind as to possibilities for insulation operating in its active, fourth dimensional role. Imagine the potential of an insulation with a dielectric constant, dissipation factor, resistivity, thermal conduction, or magnetic properties which could change freely to adapt to a particular situation. Or think of the value of an insulation that could withstand high voltage electrical surges much like a rubber hose might take hydraulic surges. It wouldn't just stand there rigidly and either rupture or hold - it would adapt itself to 'give' enough to decrease the chance of rupturing, yet not give so much as to become permanently damaged itself, or to damage the equipment it is insulating.

"And going still further, what if an insulation could signal that breakdown was near, or that some other kind of trouble was near or had occurred? Such a property would be immensely helpful for safety, or in designing, operating, and maintaining a piece of equipment. Another, even more futuristic development possibility, is an insulation that could absorb heat generated by equipment and convert it to another, easily recoverable energy form. Such an insulation would be both a coolant and a source of power.

"These ideas presented here may seem a little far out - they are only intended to give an idea of the direction insulation materials development may someday take. But when you think about it, insulation's 'Fourth Dimension' does seem to have tremendous possibilities."

RESULTS OF WEST FORD COMMUNICATIONS EXPERIMENT:

The IG Bulletin, No. 86, August, 1964, of the National Academy of Sciences has an 11-page review of the background, conduct and results of Project West Ford. The summary and conclusions are as follows:

"Project West Ford was an experiment conceived in 1958 by W. E. Morrow, Jr., of Lincoln Laboratory, and Harold F. Meyer, then of Ramo-Wooldridge Corporation, in the course of a study conducted by the Massachusetts Institute of Technology at the request of the U.S. Army Signal Corps. Its aim was to test the feasibility of using an Earth-orbiting belt of minute copper-wire dipoles as passive reflectors of radio-frequency signals in order to provide reliable, long-range communications. Because of the possibility that such belts might endanger the conduct of other kinds of scientific activities involving space (in particular, optical and radio astronomy and experiments using spacecraft, which might be subject to damage by collision with dipoles) the MIT Lincoln Laboratory brought the project to the attention of the Space Science Board in 1959.

"Studies conducted by the Board substantiated the conclusion arrived at earlier by Lincoln Laboratory scientists that the first exploratory test belt would probably not have adverse effects on any branch of science. The Board recommended early publication of information on technical aspects of the initial experiment, and established an advisory committee of astronomers. This committee worked closely with the MIT scientists throughout the duration of the experiment.

"The first attempt to launch a West Ford dipole belt, in October 1961, was unsuccessful. The dipoles were not dispersed from the dispenser package because of a mechanical failure. A full description of this launch attempt and probable reasons for the failure were circulated to the scientific community by the SSB and Lincoln Lab. in March 1962.

"On May 9th, 1963, another dipole package was launched. The dipoles were released on May 10th after it had been determined that the dispenser was in the proper orbit, forming, in the next few months, a near-circular belt with an average altitude of about 3650 km. Successful tests were conducted of the propagation and communications characteristics of the belt and much information was accumulated on its physical character and behavior.

"Studies showed that this test belt has not interfered with optical and radio astronomy. In addition, MIT studies indicate that the dipoles would present no significant hazard to spacecraft passing through the belt. It was determined that individual dipoles would re enter the atmosphere within five years after launch, although the clumps will remain in orbit longer.

"The West Ford Committee of the Space Science Board reported the following conclusions to the Board several months after launch of the dipole belt:

"(a) We conclude, as was originally forecast, that as of the time of this statement and with the observing techniques in use tod the present West Ford experiment has not been harmful to either optical or radio astronomy.

"(b) The predictions of the effects of the experiment have been reasonably well borne out by the observations. We may, therefor rely on essentially the same methods to predict the effects of any experiments similar to the West Ford experiment which may poss bly be proposed in the future, suitable allowance being made for t increased vulnerability that may be associated with future advance in observing techniques."

BIGWIGS PLUG RADIOS IN EARS?"

Electronics, October 19th, 1964, mentions a new potential sta tus symbol. It will soon be hard to tell the deaf from VIP's.

"Not only rock'n'rollers and baseball fans, but top-echelon officials will have their ears glued to transistor radios if securit aids have their way.

"The problem is this: If tragedy befalls the President, the m who would inherit his national security responsibilities must be reached immediately. Security officials are plugging the tiny tra sistor radio idea, but they don't disclose details or their success

"Lacking a Vice-President, President Johnson's next-in-lin is Speaker John W. McCormack (D., Mass.). Though he has a hot-line connection with the White House from his office, home a car, his movements are considerably less restricted than the President's, thus the need for the tiny radio, which is tuned into military command and control network."

CHORUS, HISS, WHISTLERS, ETC.

Under the title "Chorus, Hiss and Other Audio-Frequency Emissions at Stations of the Whistlers-East Network", by T. Laaspere, M.G. Morgan, W.C. Johnson, an article appeare in the November 1964 PROCEEDINGS OF THE IEEE. An abstra of the article is as follows:

"Ionospherics, electromagnetic waves originating somewhe in the ionosphere or the magnetosphere of the earth, have been corded for more than six years in the audio-frequency band at t Whistlers-East chain of ground-based receiving stations which tends approximately along the 0° geomagnetic meridian from La rador to Antarctica. This has made it possible to study the lati dependence: (1) the local time of maximum occurrence of the various types of audio-frequency emissions, (2) the shape of th diurnal occurrence curves, (3) the rate of occurrence, and (4) effects of geomagnetic disturbances upon the occurrence. Resu and conclusions of a comprehensive analysis of these synoptic c are presented and discussed in detail."

CONSIDERATIONS IN SELECTING A DIGITAL VOLTMETER

Under the above title, Thomas E. Nawalinski, Non-Linear Systems, Inc., has written a 9-page article in the November 1964 issue of Electrical Design News. Accompanying Fig. 9 in the article is the following text:

"Sinusoidal wave shape is superimposed on d-c signal to be measured. If noise frequency is not periodic with measurement interval, average value of shaded area will be algebraically summed with d-c signal, but at least 40-db ripple rejection is provided at 60 cps and much more at higher frequencies. With unidirectional DVM, however, a very large positive error will result if noise drives composite signal through zero because it reads the average value of the full-wave rectifier waveform as indicated by dotted line."

VLF FIELD STRENGTH MEASUREMENTS

Research Review, Office of Aerospace Research, Sept. 1964, carries the following comments under the heading "Greater Accuracy in VLF Field Strength Measurements" by R. P. Harrison and Dr. E. A. Lewis, Upper Atmosphere Physics Laboratory, Air Force Cambridge Research Labs., Laurence G. Hanscom Field, Bedford 31, Mass. as follows:

"Errors in the measurement of the field strength of VLF signals (3 - 30 Kcps) which, with present techniques, can sometimes run as high as 300 per cent, have been reduced to about 5 per cent using a novel measurement technique developed by AFCRL.

"Radio frequencies in the VLF band are of importance to reliable long-range communication, radio direction-finding, and location-finding applications because VLF waves can travel great distances in the shell-like space between the earth and the ionosphere with relatively little attenuation and great stability.

"Conventional methods of measuring field strengths of VLF waves use either a loop antenna or a whip antenna with a ground connection. Loop antennas frequently are used to measure the magnetic component of the EM wave and, from this, the strength of the electric component is extrapolated. Variations in the ionosphere cause phase and amplitude changes in a signal which consists of direct ground waves and reflected sky waves. These phase and amplitude changes cause the ratio between the magnetic and electric components of the signal to vary. For this reason, the loop antenna measurement technique can be in error by as much as 300 per cent.

"The electric field may be measured directly with a whip antenna connected to the input of a receiver. However, with the whip antenna, the proximity of the device to the earth and surrounding objects affects the antenna's apparent effective height.

"A new technique devised at AFCRL measures the electric field directly. No ground connection is required and field strengths may be measured conveniently and rapidly. Both keyed cw and steady signals have been measured to accuracies of five per cent. It is believed that even greater accuracies are obtainable.

"The instrumentation for the new technique has three main parts. An antenna-receiver unit is supported on a ten-foot, telescoping, nonconducting mast. This unit is coupled to a termination box located remotely from the antenna by a connecting cable. The cable was designed to carry wave-amplitude information from the receiver to the termination box without distrubing the radio-frequency field being measured.

"The only critical component is the antenna. It is calibrated by placing it in a strong uniform electric field. The strength of this field is referred to a small-scale laboratory field whose intensity is derived from fundamental standards of voltage and length."

HOW TO MEASURE NOISE

A 4-1/2 page article, under the above title, by Sol N. Koblick, Engineering Consultant, North White Plains, New York, appeared in the Nov. 1964 issue of Electronic Products. The sub-title and first two paragraphs are as follows:

"In determining noise of a circuit, frequently a d-c average meter is used when an rms meter is needed. Just how these instruments are related to noise measurement is presented here.

"Noise figure and noise measurement of a circuit are often essential data to the circuit designer. Fortunately, they are readily measurable with available laboratory equipment.

"The noise figure of an amplifier means that the amplifier has a figure of merit insofar as its noise performance is concerned. From experience, confusions regarding the terms 'noise factor' and 'noise figure' have been observed. In fact, these terms have been used on an interchangeable basis. Though these terms are related to each other, they are not equivalents."

REPRINT OF EMI FILTER PAPER AVAILABLE

The paper titled "A Graphical Method For The Analysis and Synthesis of Electromagentic Interference Filters", presented at the 6th National Symposium on Electromagnetic Compatibility, Los Angeles Calif., by Jerrald C. Shifman, Genistron, Inc., Los Angeles, has been printed and is available for requests on company letterhead. It's number is EB-119 and inquires should be sent to 6320 West Arizona Circle, Los Angeles 45, Calif.

HISTORY OF THE CHICAGO SECTION GEMC'S RADIO-FREQUENCY INTERFERENCE PREDICTION & REDUCTION COURSE

On October 15, 1963, a form letter was sent to people in the Chicago area electrical and electronic industries which broached the possibility of a Radio-Frequency Interference Prediction and Reduction course.

Over 300 queries were sent and many replies were received, indicating that approximately 90 people would welcome such a course.

Ten lecture sessions were originally planned for Wednesday evenings, from 6:30 PM to 9:30 PM, beginning on April 22, 1964. However, due to the insufficient lead time, the course was postponed until Sept. 16, 1964. Major lead time difficulties occurred because of the inability of the small three-man committee to find enough "free" time to attend to the necessary contact work and other details.

The Navy Pier Branch of the University of Illinois provided a free lecture room seating 180 people. The request for this was made two months previous to the original starting date, although only one week elapsed before a letter granting permission was received. When the course was postponed, the University again granted permission to use the lecture room for the revised dates.

In March, 1964, two books were selected as being possible student texts for the course. These were "Electrical Interference" by Rocco F. Ficchi and "RF Interference Control Handbook" by Barron Kemp.

During April, 1964, letters were sent to potential instructors, describing the material to be covered in the ten lectures and inquiring whether the recipients would be interested in lecturing on the subjects.

The ten sessions were to cover the following areas of interest:

1. Management Aspects
2. Theory and Definitions
3. Measurements and Measuring Equipment
4. Military Specifications and Testing
5. Shielding Effectiveness and Shielded Enclosures
6. Filtering, Decoupling and Construction Techniques
7. Prediction Techniques
8. Suppression Techniques
9. System Suppression Techniques
10. Panel Session and Presentation of Certificates

The tenth session would have the primary purpose of having well-known and capable RFI and EMC experts available to answer the students questions regarding both material covered in the course and their own particular problems.

Acceptances from instructors were received sporadically up until August, 1964, when sufficient lecturers were committed to permit the course to be held.

Over 1000 descriptive letters and application blanks were sent to potential students during August and early September, 1964. These were sent to people who had answered the original form letter queries, to Chief Engineers of well-known Chicago area companies, and to Chief Engineers of lesser-known electrical and electronic companies listed in the Chicago Classified Telephone Book. In addition, some were enclosed with the GEMC's Vice President's technical mailing list.

A description of the course was placed in the September issue of Astron.

Tuition for the course was set at $25.00 for IEEE members and $40.00 for non-IEEE people, with the difference applicable to IEEE and GEMC memberships.

The book "Electrical Interference" by Rocco F. Ficchi was selected as text for the course after spirited discussion at a GEMC meeting by a visiting member.

Lecture No. 1 was held on Sept. 16, 1964, with Mr. James Krotansky as instructor.

As of November 16, nine sessions have been held, with average attendance of about 50.

A total of 60 students are registered representing 30 organizations. Only one-third of these people are IEEE members. Continuing efforts are being made to foster IEEE and GEMC memberships to these people.

After expenses are covered, the Training Committee expects to be able to turn over approximately $1,500.00 to the Treasurer of the Chicago Section.

Ray Elsner, the Sec-Treas. chaired the Training Committee, composed of:

Carl Jasperson - Motorola
Chuck Berry - Motorola
Ken Jauch - Microswitch

NBS TO DEVELOP RADAR STANDARDS

The Radio Standards Laboratory of the NBS Institute for Basic Standards is starting on a four-part program to set up standards for radar equipment; this work is being done at the NBS Boulder (Colo.) Laboratories. The program is needed because some aspects of radar equipment development have outstripped measurement standards. The program will concentrate on technical requirements in measurements of radar power, noise, and antenna patterns, as well as on exploratory research. It will also seek standards for microwave horn gain and phase shift. The project will be undertaken in discrete phase. For example for power, Phase One will start with an investigation of the basic methods of measurement. Phase Two will involve the evaluation selection, and establishment of standards and techniques of power measurement; prototype instrumentation will follow as Phase Three. Equally important, the NBS staff will also seek or adapt principles on which future radar measurement standards can be based.

WRONG KIND OF MUSIC

An article by Sam A. Angeloff in the Sept. 30, 1964 issue of the Seattle Post-Intelligencer is as follows:

"Melvin Berg's electronic organ plays music, which certainly seems natural enough. What disturbs Berg is that it plays radio music - with singing, yet.

It's been like that for a couple of months, ever since the Berg family moved into their new home at 9114 - 8th Ave. NE. The organ which they've owned for years, suddenly began picking up radio stations, some as far away as San Francisco.

Joan Berg, who is 11, sat down one afternoon and turned on the organ. She wanted to play Home Sweet Home.

When it warmed up, the darned thing was playing Tschaikowsky, which sounds about as much like Home Sweet Home as the Seattle Symphony sounds like the Bremerton Ferryboat.

Sometimes, the organ which seems to prefer classical styles, plays softly. Other days it sounds like the New York Philharmonic is having a jam session in the living room.

All this is very confusing to Berg, who admits that as an electronics expert, he'd make a good bookbinder. Berg works as a bookbinder.

Whatever is causing this phenomenon, Berg wishes it would stop. The organ cost him $1,500. and for that size bundle he'd rather play his own music.

Says daughter Joan: "I'll be playing something on the organ a pretty soon the radio station is louder than I am. It bugs me, it re bugs me."

Berg called some experts to see if they could get the bugs ou his organ, and they just shook their heads and said "we dunno."

Berg says he's been listening to a regular radio, trying to fi the stations his organ has been picking up, but none of them seem t be local. Last Sunday, when the organ was "so loud it sounded lik big Hi-Fi set," Berg said, he heard a San Francisco station.

Berg took the back off of the organ, displaying what looked li a substation for a small town. Tubes glowed and transformers hu and the speakers played Beethoven.

"I think the trouble's in there," said Berg, keeping a straigh face, and pointing at a few dozen sets of wires. "I took all the tub out once - a huhdred and three of 'em - and dusted, but it didn't do much good. I sure wish it would stop. I'd like to play the organ."

But the organ, it seems, prefers to play itself."

THE NEW COMSATS AND INTERFERENCE CONTROL

The October, 1964 issue of Space/Aeronautics carried the fo ing text in an article by Bernard Kovit, Associate Editor:

"If the nuclear threat to comsats has diminished, it follows t the threat of jamming and other electronic interference must have increased, for a nuclear stalemate would not make a potential ener any less eager to knock out our satellite communications. Jampro in fact is being emphasized in the new milicomsat - partly for this reason and partly because there appears to have been some import new developments in both offensive and defensive electronic warfa (Just what these developments are naturally is classified informati

Countermeasures still work - The traditional basic electron countermeasures, of course, are still as effective as ever; freque hopping, or transmitting on one frequency for the shortest possibl time and then going on to another: spread-spectrum techniques, b which jamming signals are smeared across a wide band of freque and pseudo-random coding, in which information is hidden among dom signals. In addition, some of the features of advanced coms provide very effective new methods of insuring message security jamproof operation. Direct signals processing in the satellite, fo example, is being developed for digging signals out of the routine environment, but obviously it can also be used to cope with the ad tional noise produced by jammers."

"BEEPING PILL" SPY TRAP

Under the above heading, Phyllis Battelle, in the Boston Re American, October 29, 1964, had the following:

"New York - the latest gimmick in espionage circles is said be a "radio pill" which, if swallowed, makes an international age (or just a common crook) easy to trail.

The pill, which is coated to taste like tuna fish, ham or ste is merely slipped into the suspect's meal and he'll eat it unknowi Of course, it takes a clever agent to slip a pill into a steak, but i you're not a clever agent you may as well be dead, so let's not wo about it.

Once the criminal has swallowed the pill, which actually is tiny radio transmitter, he sends off radio beams which can be pic up easily by a small radio received carried in some one's pocket purse 100 yards away.

If this pill catches on, the old cliche, "follow that cab!" wil become obsolete. What spies will be saying is, "Follow that ston

SHIELDING FOR HIGH-ENERGY ELECTRON ACCELERATOR INSTALLATIONS

The National Bureau of Standards has brought out a seventy Handbook, under the above title, known as Handbook 97. It may l obtained from the Supt. of Documents, U. S. Govt. Printing Offic Washington 2, D. C. Price 30 cents. The foreward is as follows

"This Handbook, prepared by the National Committee on Radiation Protection and Measurements, extends the Committee's recommendations for protection against the radiations from high-energy, high-power electron accelerators. In part, this Handbook is an extension of NCRP Report No. 14 on 'Protection Against Betatron-Synchrotron Radiations Up to 100 Million Electron Volts' (NBS Handbook 55), issued in 1954.

"Since 1931, recommendations of the National Committee on Radiation Protection and Measurements (for many years known as the Advisory Committee on X-ray and Radium Protection and later as the National Committee on Radiation Protection) have been published as National Bureau of Standards Handbooks. The Bureau is pleased to have the continuing opportunity to increase the usefulness of these important reports by providing the publication outlet.

"Since the publication of Handbook 55, high-energy accelerators, particularly of the linear type, have come into much wider use in research and industry. Their applications in such areas as food processing and general sterilization have developed radiation control problems not encountered with earlier devices. Actual experience in the protection of personnel around such accelerators is limited and much more information is needed before the most economical shielding design can be developed. The NCRP plans to actively follow new developments in this general field.

"The Handbooks prepared by the National Committee on Radiation Protection and Measurements (listed on the inside front cover) have expanded and kept up to date the principles of radiation protection first gathered together in NBS Handbook 15 in 1931. The present publication sets forth new principles, making reference to other Handbooks where more detailed information may be obtained."

BIBLIOGRAPHY ON INTERFERENCE IN LOW LEVEL CIRCUITRY

The IEEE Transactions on Industrial Electronics and Control Instrumentation, Vol. IECI-11, No. 2, Sept. 1964, carries a bibliography under the above title. There are 107 entries each of which is provided with a brief abstract. There are also 11 foreign entries with brief abstracts. The scope of the bibliography has been described as follows:

"The primary concern of the Committee is electrical interference with measuring and control instrumentation from sources external to the instruments. Although a considerable body of literature pertinent to this concern exists, it is widely scattered. Thus, while isolated segments may be known to interested workers, the entire body, or even comprehensive coverage of parts of the field have not been easy to locate. Because interference problems are becoming more numerous and more serious as electronic instrumentation becomes more common and more complex, the Committee felt a need for this Bibliography as an aid in bringing the published information to the attention of those needing it.

"The Committee has tried to limit the entries in the Bibliography to those dealing with its field of primary concern. Large contiguous areas of interest exist, for example those of interference with radio communications, and noise generation within active electron devices, where in each case the literature is very extensive and multifaceted. We have tried not to overlap these fields except for entries which aid substantially in understanding and dealing with our problems by providing information not readily obtained otherwise."

SIGNAL-TO-NOISE RATIO ON MAGNETIC TAPE

Part II of a series of articles in The Right Angle, published by the Industrial Division of Sanborn Company, Waltham 54, Mass. appears in the October issue under the title "The Application of Magnetic Tape Systems in Data Recording" by John P. Brady, Jr., Senior Project Engineer, Sanborn Co. A section, in the article, of interest is as follows:

"Signal-to-Noise Ratio - in the discussion of the Direct-mode we found that frequency, tape velocity and wavelength of a signal on the tape were related to each other by the formula

$$v = f\lambda$$

This equation tells us that an increase in tape velocity, while recording at a constant input frequency, produces the same increase in signal wavelength on the tape that would have resulted from a proportional decrease in input frequency at a constant tape velocity.

"So also, in reproduction, a change of tape velocity produces the same effects as a proportional change of wavelength, thereby producing an output frequency change. Since in a typical system, ± 40% frequency deviation (80% of carrier frequency total) produces full-scale output, a 1% p-p flutter produces an output signal which is 1%/.8 or 1.25% of full-scale signal (or a 37.5 db p-p signal-to-noise ratio). Assuming a 5:1 relationship between p-p and rms flutter, the rms flutter would be 0.2 x 1.25% or .25% of full scale (p-p) output. Since rms noise is the ratio of the rms value of a full scale output (.35% of p-p) and rms noise, the rms-noise-to-rms-signal is .25%/.35 or about .7% (43 db signal-to-noise ratio). To summarize, a system with 1% p-p flutter will have about .2% rms flutter, 37.5 db p-p signal-to-noise level, and 43 db rms signal-to-noise level."

INTERFERENCE FROM FM?

Radio-Electronics, November 1964, carries a short news brief under the above title. The news brief stated:

"The large number of new FM stations is reflected in an increasing number of complaints of interference in the upper vhf television band - in almost exact second-harmonic relationship to the FM band.

"A serious but sometimes unexpected trouble is caused when the FM signal overloads the input stage of the TV receiver, generating additional harmonics. In one city, such severe interference was created that an FM station had to shut down after running only one day. It was later given a different channel.

"The problem is said to be especially severe in fringe areas where boosters are used to push up weak TV signals."

GROUND WAVE PORTION OF ATMOSPHERIC WAVEFORMS STUDIED

The following is from a 3-column write-up in the IEEE Spectrum, Sept. 1964, page 180:

"Scientists of the National Bureau of Standards (NBS) Central Radio Propagation Laboratory are examining the ground wave portion of atmospheric waveforms in the investigation of the radiation fields that follow lightning discharges. Recently, a scientist at the NBS Boulder (Colorado) Laboratories selected for study 69 representative waveforms received at five NBS recording stations from 21 thunderstorms in the Oklahoma-North Texas area. Analyses of amplitude and phase relationships showed the atmospherics to fall into several well-defined categories. The findings have significance in studying propagation characteristics, radio interference from lightning discharges, and thunderstorm mechanisms and movements."

FCC TO PROVIDE FOR OPERATION OF RADIO DOOR CONTROL

Notice of proposed rule making as an Amendment of Part 15 of the Commission's Rules, to provide for the operation of radio door controls, has gone out for comment. Extracts are as follows:

"2. The Commission has before it a petition (RM-524) from the Door Operator and Remote Controls Manufacturers Association, (DORCMA) requesting that the Commission make an exception to the duty cycle requirement of §15.211(a) (3) of the Rules, and permit the use of transmitters without a timing restriction at frequencies above 225 Mc/s for radio control of garage door operators. This petition is supported by statements filed by a number of individual manufacturers of door controls urging favorable action on the DORCMA petition.

"3. DORCMA is a nationwide trade association whose membership is comprised of companies engaged in the business of manufacturing and selling automatic door operators and associated radio transmitters and receivers. According to DORCMA, 90% of the garage door equipment produced in this country is manufactured by members of the Association. DORCMA estimates that there are some 500,000 residential garage door operators in use today and the present market indicates 90,000 to 100,000 garage door operators are being manufactured annually. Approximately 90% of these will be equipped with radio controls and about 50% of these will operate in the frequency range above 70 Mc/s. Annual production according to DORCMA will increase for the next 10 years. Along with the increasing market for new installations, there is at present a significant demand for replacement of obsolete openers that are common sources of interference.

"4. In its petition, DORCMA enumerates three basic requirements for radio controlled garage door equipment:- It must be legal, it must be safe, and it must be in the best interest of the public. Present regulations governing such equipment are alleged not to be compatible with these requirements. DORCMA, therefore, requests that specific rules be promulgated for garage door operators in the frequency range above 225 Mc/s.

"5. They argue that the present rules have in effect restrained the market for reputable manufacturers who are forced to produce equipment for operation on frequencies below 70 Mc/s where there is no transmitter on/off requirement. Such equipment is bulky, more expensive and generally less appealing to customers than equipment operated on frequencies in the 225 Mc/s range. On the other hand, customer acceptance has been established for equipment designed for operation at VHF frequencies, due to its overall desirable characteristics.

"6. The average radio controlled garage door requires about 8 seconds for one complete operation. Under normal use, the operator activates the transmitter by a switch. The transmitter radiates a coded signal of about .6 second duration, and an additional .3 second is required for relay action to energize the motor. The door travels at the rate of one foot per second over a distance of about seven feet.

"7. Under the present rules, §15.211, radio control equipment operating above 70 Mc/s is required to be provided with means for automatically limiting operation so that the duration of each transmission shall not be greater than one second followed by a silent period of not less than 30 seconds. Thus, even for safety purposes, a second signal may not be transmitted until some 22 seconds after the door has completed its first operation. Also, in cases when the transmitter is activated just beyond the receiver range, a full 30 seconds must elapse before another attempt may be made to operate the door.

"8. DORCMA asserts that fly-by-night "loft" manufacturers have taken advantage of this situation and are producing inferior radio controls for operation in the 225 Mc/s range without regard to the rules requirement. Because of customer acceptance of these compact controls, they are taking an increasing share of the market. The design of this "loft" manufactured equipment according to DORCMA is several years behind the state of the art. DORCMA states further, that these illegal receivers are the primary source of interference from radio controlled garage door openers, and that some of these receivers have been found to radiate an order of magnitude above the level permitted by FCC Rules. Regardless ofthe claimed illegality of the equipment produced by the "loft' manufacturers our records of interference from garage door openers tend to confirm that the prime source of interference is the radiation from the receiver.

"9. DORCMA petitions the Commission to provide for operations of radio controls for door operators on frequencies above 225 Mc/s without the present timing restriction of one second on followed by a 30-second off or silent period. They suggest that the limits for the transmitter radiated field be the same as the radiation limits of §15.63 for receivers. In addition to this, they propose that the receivers associated with garage door operators be required to reduce the radiated field about 6 db in order to reduce the interference potential. More specifically, DORCMA proposes that the RF radiation limits for these receivers be 50 uv/m at 100 ft. at 130 Mc/s and increase linearly to 500 uv/m at 100 ft. at 1000 Mc/s.

"10. Normal operation of a radio control for use with a garage door opener says DORCMA, requires an alert receiver creating a radiation field for 24 hours a day whereas the transmitter is on for short periods, a few times a day. Receiver radiation, DORCMA continues, is almost the totally significant determining factor in the possible creation of a potential interference problem. DORCMA suggests therefore that any reduction of the radiation level from a receiver can very significantly reduce the interference potential of the control and will do more to decrease potential interference than a duty cycle limitation on the transmitter. The DORCMA statement says that field strength measurements show that some garage door receivers, that are in compliance with present limits radiate more RF energy than the companion transmitter and cause interference to other garage door receivers. Because of this, DORCMA has adopted a program to reduce receiver radiation to the lowest level possible.

"11. The timing restrictions of §15.211(a)(3) were intended to preclude the operation of voice communication transmitters and the indiscriminate use of signalling and control devices on frequencies above 70 Mc/s. It appears that this restriction has simultaneously introduced a safety hazard in the operation of radio controlled door operators by preventing a second operation when for safety purpose it is necessary to stop the door during its travel.

"12. Accordingly, to promote the safety of these radio control door operators, the Commission proposes to grant the DORCMA request in part, and remove the duty cycle limitation on frequencie above 70 Mc/s. However, the Commission insists that these devic be designed and constructed to be as interference-free as possible. insure that harmful interference is minimized, the Commission is hibiting operation on the aeronautical radionavigation and emergenc frequencies and is proposing to require about 10 db greater suppre: sion of radiation both from the receiver and the transmitter part of the control. The radio control is also required to be certificated w a detailed report of measurements filed with the Commission. The specific rules that are proposed are set out in the Appendix to this Notice.

"13. A further consideration with respect to radio controls fo door openers is the fact that these controls may be caused to opera by the reception of an interfering signal that fortuitously carries t necessary coding. They may also be caused to operate by a signal from a high-powered transmitter in the vicinity of the radio control receiver. Such unintentional operation may constitute an inconveni or a safety hazard which, the Commission feels, should be called t the attention of the user. It is, therefore, important that the user aware that under §15.3 of the rules he must accept any interference which his device may receive. We propose, therefore, (§15.244) t require that each radio control be labelled with the following inform tion:

> "Operation of this device is subject to the condition that no harmful interference is caused and that any interference received, including undesired operation of this device, must be accepted."

"We propose that this information be incorporated as part of the cer fication required to attest compliance with the technical standards o these rules."

TV FOULED BY 2-WAY RADIO BAND

The following article under the above title by George Eagle, Staff Reporter, appeared in the October 15, 1964 issue of the Washington Post:

"Television viewers are complaining in increasing numbers across the country that citizens' band makes more racket than Mac Namara's Band ever did.

"Citizens' band is a frequency used by amateur operators of t way radio communication systems. These are home-to-car, office to-car and similar hookups - not the ham radio systems, which mus be up to strict standards.

"The citizens' band operation can get in the way of television reception, although Federal Communications Commission officials believe that in many cases the TV receiver and not the radio transmitter is at fault.

"FCC field offices received about 27,000 complaints about TV reception in the last fiscal year, of which about 9000 concerned citi zens' band stations.

"An FCC spokesman said a majority of the complaints were believed to be traceable to the TV sets rather than the radio trans- mitters.

"The interference takes the form of wavy lines giving a herrin bone effect to the TV picture and of citizens' band transmissions wh the TV sound should be.

"New York, Boston and Atlanta have been especially plagued b the problem. Citizens' band systems operate on a frequency of 27 megacycles and sometimes the signals leak out on frequencies relat to 27, such as 54 and 81.

"The 54 frequency is used for Channel 2, and 81 for Channel 5 Most of the trouble has been with Channel 2, not in operation in Wa ington. Washington viewers sometimes have trouble if they are watching Baltimore's Channel 2, but citizens' band interference has been 'no particular problem' in Washington, the FCC says.

"The FCC issues a list of technical standards which citizens' band equipment is supposed to meet. One FCC man says many TV receivers have deficiencies which render them unable to reject a citizens' band signal. A piece of equipment called a trap, costing $3.50 to $4. can be installed in a TV receiver to correct such deficiencies, according to the FCC spokesman.

"However, he concedes that citizens' band transmission can also be at fault and can also cause interference with such equipment as high-fidelity radios and phonographs.

"The FCC has proposed new regulations limiting use of citizens' band, but the rules, originally scheduled to take effect Nov. 1, have been held up pending disposition of six petitions by equipment manufacturers. These petitions are now under consideration."

NEW PRODUCTS

De-Polarized Knitted Wire Mesh in EMC-Glas

Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J., has brought out a report on the RFI shielding effectiveness of their De-Polarized Knitted Wire Mesh in EMC-Glas. The insertion loss using .0045 diameter tin-plated, copper-clad steel varied 39 db at 0.5mc in the E field and 9 db in the H field to 38 db for the E field and 31 db for the H field at 960 mc.

New RF Interference Tester by WEI

White Electromagnetics, Inc., 670 Lofstrand Lane, Rockfille, Maryland, announces a new Automatic Electromagnetic Spectrum Scanning and Plotting System. It is claimed that in one configuration the frequency spectrum from 100 cps to 1000 mc (23 octaves) is automatically scanned through 15 bands in 3 minutes time. This can be slowed up to an over-all spectrum scan of 8 hours. The new equipment is known as Model 120A and its instruction and operational details may be obtained from WEI Technical Bulletin Vol. 4, No. 4.

EMC Instrumentation, Inc. Brings Out New RFI Measuring Equipment

EMC Instrumentation, Inc., 7338 Varna Ave., North Hollywood, Calif., has brought out new equipment in the RFI measuring field. Their first instrument is called "Electro-Magnetic Analyzer EMA 910" and covers the frequency range from 1 to 10.5 gc with a state-of-the-art design to meet present and future requirements for accurate, automatic, and rapid collection, analysis, and recording of electro-magnetic interference data. It is composed of two units: the Frequency Selection Unit and a Data Evaluation Unit. Technical information may be obtained from the company at the above address.

GE Developes Nuclear Radiation Resistant Circuitry

In the October 1964 issue of Electronic Industries appears the following news item:

"Electronic circuitry that can operate for long periods in strong nuclear radiation have been tested successfully at General Electric for the Air Force. Two miniature tape recorder amplifiers using a new type of ceramic vacuum tube were the first pieces of vacuum tube circuitry known to function continuously, amplifying a signal below 100 kc, while bombarded with pulsed gamma-neutron doses of nuclear radiation. There was minor interruption of the signal below 100 kc, reports engineer H. L. Olesen."

Technical Summary Available on "VG Switching Module"

Vitramon, Inc., Box 544, Bridgeport, Conn., announces a Technical Summary S 10 of "VG Switching Module." The feature of the "VG Switching Module" is the claim that it creates no measurable electrical noise in the switch operation.

EDITORIAL NOTE

Due to the urgency in getting the notice of the Nominations Committee out as soon as possible, comments about the Tenth Tri-Service Electromagnetic Compatibility Conference have had to be kept to a minimum. A fuller report of what went on will appear in the next newsletter.

Nominations for members of the Administration Committee should be handed in as soon as possible as there will be only too short a time to the histories printed up and distributed to the membership. The membership has been asked to vote immediately on candidates and to vote whether all candidates are known or not. It is only in this way that G-EMC can get nation-wide representation on the Administration Committee.

Rexford Daniels, Editor
IEEE G-EMC Newsletter
Monument Street
Concord, Mass.