Professional Technical Group on Electromagnetic Compatibility

Number 30  October 1963

Ninth Tri-Service Conference on Electromagnetic Compatibility

Advance Program
Illinois Institute of Technology Research Institute in cooperation with PTG for Electromagnetic Compatibility of the IEEE.

Except as noted, conference sessions will be held in the Museum of Science and Industry: "A" sessions in the Main Auditorium, and "B" sessions in the Little Theatre.

Tuesday, October 15, 1963

8:00 AM  Registration
10:00 AM  Session I - General Main Auditorium

2. The Western Electric Company - Wide Program for Compliance With Part 18 of the Rules and Regulations of the Federal Communications Commission
   R. A. Kay
   Western Electric Co.
   Chicago, Ill.
3. RFI/EMI at the Crossroads
   P. J. Nichols
   Gemstaron, Inc.
   Los Angeles, Calif.
12:00  Luncheon
   Imperial Room of the Del Prado Hotel
   Chairman - Col. C.G. Woolwine
   Electromagnetic Compatibility Analysis Center, Annapolis, Maryland
   Address - Teamwork in Spectrum Conservation, James D. O'Connell
   Lt. Gen. USA (ret.)
   Chairman, Joint Technical Advisory Committee of IEEE-EIA

2:30 PM  Session II - Analysis I
Chairman - Z. V. Grobowki
Jansky and Bailey
Washington, D.C.
1. The Behavior of Nonlinear Mixing
   R. D. Trammell, Jr. and E. W. Wood, Georgia Inst. of Tech.
   Atlanta, Ga.
2. Mixer Analysis and Design
   R. W. Long
   Hughes Aircraft Co.
   Fullerton, Calif.
3. Off-Tuning Effects Produced by Interference
   R. J. Mayher
   Electromagnetic Compatibility Analysis Center
   Annapolis, Maryland
4. Radio Frequency Interference in Digital Two-Phase Coherent Communication Systems
   A. Krinitz, Adcom Inc.
   Cambridge, Mass.

2:30 PM  Session II B - Cables and Grounding
Chairman - Dr. J. H. Vogelman
Capehart Corp.
Richmond Hill, N.Y.
1. Low-Pass Transmission Lines for RFI Protection
   H. G. Tobin and J. L. Greenstein
   IIT Research Institute
   Chicago, Ill.
2. Realization of Compatible Structure Grounding Systems
   H. W. Ervin and D. R. Lightner
   White Electromagnetics, Inc.
   Bethesda, Maryland
3. Electromagnetic Coupling Between Coaxial, Single-Wire, Two-Wire, and Shielded Twisted Pair Cables
   M. Kablit
   University of Pennsylvania
   Philadelphia, Penna.
4. Achieving Electromagnetic Compatibility by the Control of the Wiring Installation
   G. I. King
   Douglas Aircraft Company
   Long Beach, Calif.

Wednesday, October 16

9:00 AM  Session III A - Modeling and Synthesis
Chairman - Q. Porter
Rome Air Development Center
Griffiss AFB, New York
1. Compatibility Analysis Sensitivity
   H. M. Sachs and T. N. Truske
   Electromagnetic Compatibility Analysis Center, Annapolis, Maryland
   R. B. Marcus
   HRB-Singer, Inc.
   State College, Penna.
3. Advanced Receiver Model Systems
   D. H. Cook, J. L. Pierzga, and F. N. Leisy, Electromagnetic Compatibility Analysis Center, Annapolis, Md.
4. Computer Processing of Antenna Patterns
   H. Kritikos and M. R. Dresp
   University of Pennsylvania
   Philadelphia, Penna.

9:00 AM  Session III B - Instrumentation I
Chairman - W. A. Kesselman
U. S. Army Electronics Research and Development Lab.
Fort Monmouth, New Jersey
1. The Use of Directional Couplers as Harmonic Pads
   L. Young
   Stanford Research Institute
   Menlo Park, Calif.
2. A Standard Response Indicator for Pulsed Systems
   W. R. Free
   Sperry Microwave Electronics Co.
   Clearwater, Fla.
3. RI/FI Instrumentation to 21 Gc.  
S. Abrams and E. Leibowitz  
Polarad Electronic Instruments  
Long Island City, N.Y.  

4. Tracking Notch Filter for the rejection of CW Interference  
W. S. Warren, Jr.  
Georgia Institute of Technology  
Atlanta, Ga.  

2:00 PM  
Session IVA - Analysis II  
Chairman - C. R. Miller  
Rome Air Development Center  
Griffiss AFB, N.Y.  

1. Comparison of Transmitter Spectrum Signature Data and Radiated Field Strength Data for Transmitter Emissions  
P. F. Chen and C. E. Blakely  
Bell Aerosystems Co.  
Tucson, Arizona  

2. Analyses of Airborne Radio Frequency Interference Problems  
R. E. Hayden  
Federal Aviation Agency  
Washington, D.C.  
T. F. Barone, J. J. Grady, and T. E. Selby  
HRB-Singer, Inc.  
State College, Penna.  

3. Mutual Gain of Radar Search Antennas  
R. C. Johnson  
Georgia Institute of Technology  
Atlanta, Georgia  

4. Probability of Interference From Randomly Dispersed Sources  
P. Christopher  
Electromagnetic Compatibility Analysis Center, Annapolis, Md.  

2:00 PM  
Session IVB - Design for Interference Control  
Chairman - M. M. Morris  
U.S. Army Electronics Res. & Dev. Lab.  
Ft. Monmouth, N.J.  

1. Analysis and Evaluation of Electromagnetic Compatibility Tests  
Dr. W. B. McIntosh  
U.S. Army Electronic Proving Ground  
Fort Huachuca, Arizona  

2. A Wide-Stop-Band Filter for a High Power S-Band Radar  
J. P. Rooney  
General Electric Co.  
Palo Alto, Calif.  
F. P. Ventolieri  
Rome Air Material Area  
Griffiss AFB, N.Y.  

3. X-20 (Dyna-Soar) Communications and Tracking Subsystem RFI Control Program  
R. C. Follister and J. F. Manley  
Sprague Electric Co.  

4. A Technique for Determination of Filter Insertion Loss as a Function of Arbitrary Generator and Load Impedance  
S. M. Vakil  
The Boeing Co.  
Seattle, Wash.  

7:30 PM  
Session IVC - ECAC Interference Prediction Model  
(This session will be held in the Crystal Ballroom of the Del Prado Hotel.)  
Chairman - S. I. Cohn  

1. ECAC MSS - 2 Interference Prediction Program - General  
J. A. Zoellner  

2. ECAC MSS - 2 Interference Prediction Program - Call Model - J. B. Scott  

3. Automatic Terrain Information Processing System  
J. Issel  

4. A Propagation Model for Compatibility Analysis  
D. Anderson and W. Frasier  

5. Synthesis of Equipment Characteristics  
F. C. Pethel, R. W. Fleck, and J. W. Marini  

All session personnel are IIT Research Institute staff members at the Electromagnetic Compatibility Analysis Center, Annapolis, Maryland.  

Thursday, October 17  
9:00 AM  
Session VA - Shielding  
Chairman - R. F. Ficcki  
Radio Corp. of America  
Camden, N.J.  

1. The Application of Absorption and Scattering Coefficients for Concentric Spheres to the Problem of EMI-Free Enclosures  
R. A. Eldred, H. A. Lastker, and J. Roberts  
U.S. Naval Civil Engineering Lab., Port Hueneme, Calif.  

2. Shielding Theory and Practice  
R. B. Schulz  
The Boeing Co.  
Seattle, Wash.  

3. Shielding a Flight Vehicle Against Electromagnetic Interference During Test  
R. O. Lange  
General Dynamics/Astronautics  
San Diego, Calif.  

4. Propagation in Absorbent-Material-Lined Cavities  
J. W. Wright and W. E. White  
U.S. Naval Res. Lab.  
Washington, D.C.  

9:00 AM  
Session VB - Classified (IIT Student Union Auditorium)  
Chairman - Cdr. R. H. Lee  
Bureau of Ships  
Washington, D.C.  

1. Identifying Submarine Electromagnetic Noise by Correlation Techniques  
P. M. Hahn  
University of Pennsylvania  
Philadelphia, Penna.  

2. Mobile Spectrum Surveillance System  
J. H. Kress  
Pan American World Airways, Inc.  
San Diego, Calif.  

3. UHF Interference in the Southeast U.S.  
E. R. Freeman  
Electromagnetic Compatibility Analysis Center, Annapolis, Maryland  

4. Steerable Null Array  
V. L. Boaz and L. E. Kearns  
U.S. Army Electronic Research and Dev. Lab., Fort Monmouth, N.J.  

5. Modification of an FSK Converter for Interference Reduction  
R. H. Thompson and D. R. Ludwig  
General Electronic Labs., Inc  
Camor, Penna.  

2:00 PM  
Session VIA - Instrumentation II  
Chairman - H. M. Bartman  
Aeronautical Systems Div.  
Wright-Patterson AFB, Ohio  

1. A Spectrum Analyzer with 2 Gc. Display  
A. Fong  
Hewlett-Packard Co.  
Palo Alto, Calif.  

2. Interference Spectrum Analyzer with Automatic Frequency Scanning and Data Recording  
L. Valcik, J. E. Bats, and J. Faron  
IIT Research Institute  
Chicago, Ill.  

3. Measurement Techniques with a Spectrum Signature Monitor  
H. Cheadle  
Aeronautical Systems Division  
Wright-Patterson AFB, Ohio  

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and accompanied by a biographical sketch of not more than 100 words should be sent before January 1, 1964 to the Chairman of the Nominations Committee:

Harold E. Dinger, Code 5416
Naval Research Laboratory
Washington 25, D. C. 20390

The members of the Administrative Committee, whose term of office expires on June 30, 1964, are:

The above notice in this Newsletter complies with the requirements in Section 1 and will be the only notification for 1964 nominations which will be sent to members by the PTG-EMC Group.

CHAPTER ACTIVITIES

Seattle Chapter

Officers for the new 1963-64 year are:
Chairman A. E. Dorbman
Vice-Chairman H. H. Judson
Secretary-Treas. V. C. Plantz

Appointed committee chairmen are:
Papers and meetings V. L. Carlson
Arrangements J. W. Trumbolt
Membership H. K. Mertel

Meetings are planned bi-monthly for odd-numbered months on third Wednesdays, subject to availability of speakers. The first meeting of the season was held on August 19 with Dr. R. M. Schlick as the speaker. His subject was "New Concepts in RFI Filters."

PTG-EMC Redefines Its Areas-of-Interest

TO: R. M. Embersom, PTG Secretary
FROM: Herman Garlands, Chairman PTG-EMC (1962-63)
SUBJECT: Areas-of-Interest
Reference: Your Memo dated May 27, 1963

1) Pursuant to your request (paragraph 2 of Reference) the Administrative Committee for PTG-EMC reviewed the Area of Activity Survey revised to May 26, 1963. Our Committee felt that the listing shown for PTG-EMC did not adequately describe our areas-of-interest.

2) Will you, therefore, please revise the listing for PTG EM (G-27) to show the following:

1st Priority
Communications

2nd Priority
Instrumentation

3rd Priority
Industry & Industrial Applications

4th Priority
Power

5th Priority
Basic Science and Techniques

6th Priority
Computers and Data Processing

3) Notwithstanding the specific enumeration of seven areas of activity above, it must be understood that our Group has an active interest in each of the areas of "materials, components, production process" and "bio-medical electronics" to the extent that RFI is created or must be controlled and EMC must be achieved. While the area of "professional activities" (number 10), is not our major area of activity, it is an area in which we are active - particularly with respect to educating both the remainder of the engineering profession as well as management as to the importance of controlling RFI and producing compatible electrical/electronic equipment.

Results of PTG-EMC Post Card Questionnaire:

The following is a tabulation of the first hundred replies to the post card questionnaire, sent out by our Chairman, on "What Should PT EM Do to Be More Helpful To The EMC Community?" The top twelve reasons are:

(1) Continue sponsorship of EMC workshop (standardization; coordinate CIGR, CISPR, AIA, ASA, EIA, SAE, RESA) (9 replies)
(2) Press for a Standard Tri-Service Interference Specification (7 replies)
(3) Encourage members to present EMC papers outside of PTG-EMC, Armour, and March IEEE Conference (5 replies)
Isolating the Causes of Common-Mode Noise:

Under the title, R. B. Fradella, Senior Design Engineer, Gianinini Controls Corp., Duarte, Calif., has written a three-page article in the August 30, 1963 issue of Electronic Design. The sub-head states:

"Differential systems are becoming increasingly popular in military or industrial instrumentation because of their ability to transmit millivolt signals in the face of hundreds of volts of area noise. Here is an approach to pinpointing the two causes of common-mode noise in such systems."

Influence of Natural Radio Noise Upon Antenna Performance:

Albert R. Giddis, Engineering Specialist, Antenna Systems Lab. Philco Corp., 3825 Fabian Way, Palo Alto, Calif., gave a paper before the First International Conference Exhibit on Aerospace Support under the title "Influence of Natural Noise Upon Antenna Systems Performance." Mr. Giddis informs your editor that a version of this paper will appear in the October and/or November issues of Microwaves magazine. It will also appear in the Transactions of the Conference and in a near-future issue of the IEEE Transactions on Communications and Electronics. Availability request, however, is a limited supply of his report titled "Effect of the Sun upon Antenna Temperature", Philco Technical Report WDL-TR-E320, which he will be glad to send to inquirers while they last.

Naval Medical Research Institute Report on RFI:

A Research Report No. MR/005. 09-1401. 04 under the title "Interference and Its Elimination" has been prepared for the Naval Medical Research Institute, Bethesda, Maryland, by Myron L. Wohbarsh, Physicist. The report consists of 15 pages and covers many problems connected with electromagnetic incompatibility in medical equipment, medical tests, recording instrumentation, and grounding, shielding, filtering, etc. An interesting section is devoted to mechanical interference where mechanical shocks on electrical components and test procedures give erroneous results. Copies may be obtained, until the supply is exhausted, by writing to John R. Seal, Captain, MC, USN, Commanding Officer.

Conducting Glass Has Other Uses:

Windshields for jet planes that withstand the impact of a bird at 400 and more miles per hour employ conducting glass to keep the resin layer in the glasssandwich soft and resilient.

Instrumentation Requirements to Measure and Define RF Fields:

A paper, under the above title, was delivered to the Institute of Environmental Sciences, April 17-19, 1963, at Los Angeles, Calif. by G. P. Rothhammer, Staff Engineer, Stoddart Aircraft Co., Inc., 6644 Santa Monica Boulevard, Hollywood 38, Calif. Copies of the paper may be obtained by writing to Mr. Rothhammer at the above address.

Permission has kindly been given to reproduce Fig. 4 of the above paper for the use of PTG-EMC members.

### TABLE 4. INTERFERENCE MEASUREMENT TERMS

<table>
<thead>
<tr>
<th>TYPE OF INTERFERENCE</th>
<th>MIL-I-16910A (Ships)</th>
<th>MIL-I-6181B</th>
<th>MIL-I-11746B (Sig C)</th>
<th>MIL-I-6181D</th>
<th>MIL-I-28500 (USAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDUCTED NARROWBAND</td>
<td>Microvolts</td>
<td>Microvolts</td>
<td>db above one Microvolt</td>
<td>db above one Microvolt</td>
<td></td>
</tr>
<tr>
<td>ANTEna CONDUCTED NARROWBAND</td>
<td>dbm or Micromicrowatts</td>
<td>Microvolts</td>
<td>Micromicrowatts</td>
<td>db above one Microvolt</td>
<td></td>
</tr>
<tr>
<td>RADIATED NARROWBAND</td>
<td>Microvolts per-Meter</td>
<td>Antenna Induced Microvolts</td>
<td>db above one Microvolt</td>
<td>db above one Microvolt</td>
<td></td>
</tr>
<tr>
<td>CONDUCTED BROADBAND</td>
<td>Microvolts per-Kilicycle</td>
<td>Microvolts per-Kilicycle</td>
<td>db above one Microvolt-per-Megacycle</td>
<td>db above one Microvolt-per-Megacycle</td>
<td></td>
</tr>
<tr>
<td>RADIATED BROADBAND</td>
<td>Microvolts per-Meter-per-Kilicycle</td>
<td>Antenna Induced Microvolts-per-Kilicycle</td>
<td>db above one Microvolt-per-Megacycle</td>
<td>db above one Microvolt-per-Megacycle</td>
<td></td>
</tr>
</tbody>
</table>
Missile Tracking Studies Aimed at Ground Clutter:
Electronic News, September 2, 1963, has a page article under the above title. A paragraph of interest is as follows:

"Until now one danger has been that ground clutter at the horizon would so distort the radar return signal that the radar system could not get an accurate fix on the rising missile. When the vehicle did come into good radar view, the radar antenna might have been considerably off the trajectory. And, by the time the antenna could be locked on to the target, it could be gone especially in the case of a fast rising missile."

Designing Input Circuits With Lowest Possible Noise:
John J. Rado, Precision Instrument Co., Palo Alto, Calif., has a 4-page article in the August 2, 1963 issue of Electronics under the above title. The sub-title and editorial box state:

"Getting lowest possible noise means juggling input transistor types, source and impedance levels, and other factors. Field-effect transistors, for example, come into their own when source impedance levels are high."

"Until all amplifier design is completely analyzed and computer programmed, the circuit designer will have to do some blind flying. Call it the art of engineering. Rules like keeping source impedance low to minimize noise and pickup are vital, but sometimes basic rules have exceptions. Even if amplifier design could be done by computer, there would still be times when it might be simpler to do it yourself."

Low-Frequency Electromagnetic Radiation Under Study:
Naval Research Reviews, July 1963, has the following article under the above title:

"Low-frequency electromagnetic radiation will be the subject of a North Atlantic Treaty Organization Advanced Study Institute scheduled for July 22 through August 2 in Bad Homburg, Germany.

"The Institute will bring together top scientists in this field for a review and discussion of the current knowledge of the theory, measurement, and instrumentation of low-frequency electromagnetic radiation. Supported by NATO, the Institute is jointly sponsored by the U.S. Naval Ordnance Laboratory, White Oak, Maryland, and the London Branch Office of the Office of Naval Research.

"The basic purpose of the Institute is to stimulate new, basic research on low-frequency electromagnetic radiation. Of particular interest is that radiation in the frequency range of zero to 3000 cycles per second which emanates from the earth's ionosphere as a result of bombarding high-energy particles from the sun. Limited research on this subject has been conducted in the past.

"Advanced research on this radiation will tell scientists much about inter-solar plasma and radiation belts resulting from solar activity. It will also increase knowledge about the ionosphere and the disturbances in the earth's magnetic field which are caused by low-frequency electromagnetic radiation. One particularly important result which such advanced research could provide is the level of the background noise caused by this radiation.

"Interest in low-frequency electromagnetic radiation has increased in recent years as the result of the observation of phenomena related to it. These phenomena include micro-pulsations, magnetic storms, high-altitude nuclear explosions, and fluctuations in the earth's magnetic field. Another observable phenomenon related to this radiation is 'the conjugate point effect' in which a disturbance generated at one of the earth's magnetic poles is propagated along a line of the magnetic field and felt at the other pole. Probably the most dramatic phenomenon associated with the low-frequency electromagnetic radiation is the Aurora Borealis.

"Dr. David F. Ebel, Associate Director for Research at the Naval Ordnance Laboratory, organized the Institute and is one of its two directors. His co-director is Dr. I. Estermann, Director of Research of the London Branch Office of the Office of Naval Research.

NEW PRODUCTS

New Transparent RFI Shielding:
The Sierracin Corp., 903 N Victory Blvd., Burbank, Calif., has developed a new metallic conductive material which can be deposited onto the surface of glass and plastics, and is marketed under the name of Sierracote. Its electrical resistance is 9 ohms per square and will provide a transparent shield permitting approximately 75% to 80% light transmission. Engineering test reports are available showing that the lowest shielding effectiveness measured was 60DB throughout both the electric and plane wave fields. Additional information may be obtained by writing to W. H. Lawson, Jr., Market Development Engineer, and asking for Technical Bulletin, No. 506, titled Sierracote Engineering Handbook, and Bulletin No. 510, titled Applications in Sierracin.

Tecknit Brings Out New Data Sheet on Air Cooling Panels:
Tecknit, Air Products, Inc. 129 Dermody St., Cranford, N. J., has brought out a new RFI Shield-Air Coding Panel Brochure, Data Sheet RF-300. It covers the design parameters to be considered in the dual problem of RFI shielding with forced air cooling, including both electrical and mechanical aspects.

Solar Electronics Brings Out Two RFI Products:
Solar Electronics Co., 5909 Melrose Ave., Hollywood 38, Calif., has brought out an RFI Transient Generator for conducted transient susceptibility testing and an Audio Isolation Transformer for audio frequency susceptibility testing. The Model 6254-1 RFI Transient Generator is capable of providing up to 275 volts peak. The Isolator Transformer is capable of handling up to fifty watts of audio power into its primary over the frequency range 50 cps to 15 kc.

Ferroxcube Corporation Develops Noiseless Rheostat:
Ferroxcube Corp. of America, Box 359, Saugerties, N.Y., and acts as a noiseless rheostat of infinite resolution. It is designed as a plug-in unit which incorporates a standard seven-pin miniature socket male connection.

The varying light intensity from the lamp falls on a cadmium sulfide cell connected across the output circuit. As the light increases, the resistance of the cell decreases from a minimum resistance of 10 megohms to a maximum of 500 ohms with 6 volts across the lamp.

Noise Reduction Unit from Micromega:
Electronic News, August 19, 1963, has a page story with a schematic included. The first two paragraphs of the article state:

"Micromega Corp. 4134 Del Ray Ave, Venice, Calif., has developed a 400 megacycle monopulse parametric amplifier subsystem that reduces noise to 1.2 db, believed by the company to be the lowest noise figure currently offered by such equipment.

"Other subsystem performance characteristics were said to be 30 db gain, 5 mc bandwidth, and gainstability of less than 1 db for 24 hours. Differential phase stability is typically 2º per 8 hours, Micromega, officials said."

Brush Lightbeam Recorder Eliminates RFI with Silent Light:
Brush Instruments, Division of Clevite, 37th and Perkins, Cleveland 14, Ohio has brought out a unique incandescent optical system for this new direct-print oscillograph which is claimed to completely eliminate confused data caused by generation of RF interference into associated equipment. It meets RFI Specs MIL-I-26600 and MIL-I-66181D.

EDITORIAL NOTE:
Your editor has received several comments from members of PTC-EMC that we are not doing enough to separate the hard facts from their empirical applications. As a result, the subjects of RFI and EMC are still being treated as an art and not as good engineering practices. It is, therefore, suggested that we publicize our good engineering practices so as to increasingly minimize the personal element. In other words we want to become recognized more as a branch of engineering rather than a gathering of magicians.

Redford Daniels, Editor
PTC-EMC Newsletter
Monument Street
Concord, Massachusetts.