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Rexford Daniels, Editor
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EDITOR'S NOTE

The airline strike seems to have disrupted the schedule for including, in this issue of the Newsletter, a complete write-up of the 8th Symposium held in San Francisco, July 11 - 13, 1966. As there is already enough material of interest to our members, to fill this issue, we are rushing this issue to press and will follow it, as soon as possible, with another which will include the write-ups of the 8th Symposium and the AdCom Meeting. So, therefore, don't think that we have inadvertenly left certain information, out of the Newsletter.

EMC REVISITED - 1966

The following are two paragraphs from the talk presented by R. P. Gifford, General Electric Company, at the luncheon meeting of the Washington Section of IEEE, May 12th, 1966, sponsored by the Group on EMC. Mr. Gifford is also Chairman of the Joint Technical Advisory Subcommittee 63.1 on Electromagnetic Compatibility.

"Whoever devised the term 'electromagnetic compatibility' must have been a sinister man. Assuming he's outlived his fiendish way, he's probably now at ease on some South Pacific Island paradise chuckling to himself over the immense ingenuity of his calculating mind. As he will recall, it was over 10 years ago that he 'rescued' many great minds working on problems of spectrum utilization by throwing out the lifeline of 'electromagnetic compatibility'. It was a big, beautiful, impressive, technical title for just about any problem a communications engineer might have -- and management bought it. Appropriations could sail through industrial and government organizations so long as they made only oblique reference to electromagnetic compatibility. It was perhaps the most seductive term in business, ranking second only to profit.

"Don't get me wrong -- the term is great and it was needed; at least we can all spell it! But as I revisit electromagnetic compatibility in 1966, I find it being used in the same way as duty to God, Country and Motherhood. The term is on a pedestal -- inviolate and unassailable. Its purity of purpose, however, masks reality and dulls controversy. We have spoken well of EMC and flown its banner high; but where has a battle been won -- much less joined? There have been skirmishes -- resolution of discrete interference problems -- but, with all our understanding of our objective, where has there been developed any new way of fighting the war?"

U. S. LAGGING IN INTERNATIONAL STANDARDS

Electronic Design, May 24, 1966, carries the following news report under the above title:

"'U. S. electronics producers must work to amplify the voice of their industry in international standardization endeavors or endure the consequence of dwindling markets abroad'. So said Dr. Leon Podolsky, Technical Assistant to the President, Sprague Electric, at the recent Electronic Components Conference.

"According to Dr. Podolsky, the electronics industry has increased its foreign trade in recent years faster than any other industry. But, he declared, 'as our companies strive to compete more in foreign markets, they find that one of the strongest barriers to trade has nothing to do with tariffs, freight rates, money exchange rates, or interest - but rather with the inability to have our goods accepted because they don't meet with performance, test, size or safety standards of the customer overseas.'

"To remedy the situation, Dr. Podolsky called for expanded participation by U. S. electronic firms in the work of the International Electrotechnical Commission, a 40-member group for promulgation of international standards. This can be done, said Dr. Podolsky, through more company-supplied delegates to the commission, a firmer basis for industry-and government-financia support, enactment of legislation and establishment of a new federal program to expand the U. S. role, and more volunteers for 'expert committees' working in particular areas of electronic standardization."

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Editor's Note: Our European customers have, for years, deplored our lack of RFI suppression and our failure to recognize electromagnetic compatibility.

Powerline Filters for RFI: Illusions and Solutions

The Summary of the paper prepared by H. M. Schlicke, R. F. Neu~ns and H. Weidmann, Allen-Bradley Company, Milwaukee, Wisconsin, is as follows:

"This paper surveys the criteria and concepts of three significantly new, nonconventional, but most practical classes of filters which are expected to have a great impact on the whole, often rather frustrating, RFI filtering technique:

I. Miniature ceramic feed-through capacitors of 0.5μF, so small that they may be used in (low frequency cut-off) multiple pin electrical connectors.
II. Truly lossy, worst-case filters which work very effectively into all interfaces--in contrast to conventional RFI filters, meeting the meaningless 50 ohm condition of MIL-STD-220A but working often very poorly or even inversely in actual systems.
III. Efficient, small active filters which are highly desirable in work pertaining to Fed. Std. 222."

Copies of this paper are available from Mr. Schlicke at Allen-Bradley Company, Milwaukee, Wisconsin.

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Graphical Presentation of Spurious Responses in Tunable Superheterodyne Receivers

The Summary and Introduction to the paper prepared by E. W. Karpen and R. J. Mohr, Airborne Instruments Laboratory, Div. of Cutler-Hammer, Inc., Deer Park, New York 11729, is as follows:

"The paper briefly reviews the theory of intermodulation responses in superheterodyne receivers. The frequency bands of the responses are determined and factors affecting susceptibility levels as well as quantitative values for a typical crystal mixer input superheterodyne receiver are presented. On the basis of this groundwork, it is shown that the receiver's primary and spurious responses may be conveniently presented in graphical form. The graphical presentation can include the effects of input band-pass filters and tunable preselectors, and provides a grid upon which an electromagnetic environment may be superimposed.

Introduction

"A superheterodyne receiver is subject to numerous spurious responses. Usually the most troublesome type are the intermodulation responses. These result from harmonics of an interfering signal mixing with harmonics of the local oscillator to produce the intermediate frequency of the receiver.

"In the usual method of predicting the susceptibility of a receiver to a particular RF environment, the receiver's intermodulation frequencies are first calculated and then compared to the frequencies of the signals existing in the environment. If it is determined that frequency coincidences exist, the sensitivity of the receiver to these responses is measured or calculated to determine if the responses are above threshold.

"This procedure, when applied to a wideband tunable receiver in a complex environment, can be a time-consuming undertaking. This paper describes a procedure for obtaining a simple graphical presentation of the intermodulation response susceptibility of a tunable superheterodyne receiver to a single signal. The graphical presentation shows improvements to be gained with filtering. Further, it permits the effects of the RF environment to be readily studied."

Copies of this paper may be obtained by writing to Harold Hechtman, Director of Public Relations, Airborne Instruments Laboratory, Deer Park, Long Island, New York 11729.

A New Idea for Determining RF Gasket Attenuation

The Summary of the paper delivered by D. R. Awerkamp, Tl Boeing Company, Aerospace Group, Seattle, Washington, is as follows:

"In establishing electrocompatibility in a given system, interference reduction method most frequently employed is tl of electromagnetic shielding. Shielding is used to prevent ra ation from entering into susceptible equipments or for contai ing it at the source. For a given combination of parameters, continuous metallic enclosure offers the best shielding. How ever, there is a drawer, door, access panel, etc., or a com bination of these for every practical enclosure. As a result, gaps or seams exist around the edges of these discontinuities through which electromagnetic energy can leak. A diversity so-called radio frequency (RF) gasket materials have been developed to fill in these gaps or seams and eliminate or at least lessen the amount of leakage through them.

"The question presents itself--what constitutes a good gasket? It is not the purpose of this paper to answer this qu tion but to explain a method for obtaining a quantitative answ It should be emphasized that only shielding effectiveness of a gasket will be under consideration. Other properties which be considered such as electrolytic compatibility with adjacen metal surfaces, corrosion, continued resiliency with age an cyclic compression, air pressure sealing, bonding propertie caulking compounds, and effectiveness as a function of age a treated elsewhere and will not be discussed in this paper."

Copies of the paper may be obtained by writing to Mr. D. R. Awerkamp.

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EMC and National Forest Public Lands

The Summary of the paper delivered by William B. Morton, S. Department of Agriculture, Forest Service Electronics Cente Beltsville, Md., is as follows:

"When the U. S. Forest Service was established in 1905 manage forested public lands, no one could envision that a pa of its land management task would some day be called 'Elect magnetic Compatibility'. But those public lands included mountain peaks overlooking rapidly developing metropolitan areas. The sharply increasing usage of the electromagnetic spectrum in these areas led to concentration of receivers an transmitters on the favored mountaintops. As a result these public lands have developed into concentrated electromagneti environments, leading not only to the usual EMC problems, also to competition between electronics use and other uses o land by or for the public.

"This has required the Federal Agencies with separate responsibilities in electromagnetic spectrum management an public land management to combine their management efforts in these areas for greatest public benefit. Electronic engine techniques are needed to maximize the spectrum usage at ea site, and the equity of existing public land users, both electr and other, must be protected."

Copies of the paper may be obtained by writing to Mr. Morto at the U. S. Forest Service Electronics Center.

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EMC Symposium (cont'c

FABRIC, An Analysis Concept for Making Communications Systems Frequency Assignments

The Introduction to the paper delivered by Herbert Sachs of the :T Research Institute Staff at the Electromagnetic Compatibility .nalysis Center, Annapolis, Md., is as follows:

"This paper discusses a frequency assignment concept based upon the use of mutual interference charts. It can be used to assign frequencies among networks of communications equipments. The model is designated 'FABRIC', since it develops Frequency Assignment By Reference to Interference Charts. Designed to provide a logical development of frequency assignments for any arbitrary deployment of such equipments, the model can take into account both single interference signal coupling relationships such as spurious responses, spurious emissions, etc., and multiple interference signal effects, such as transmitter and receiver intermodulation and cross-modulation."

Copies of the paper may be obtained by writing to Mr. Sachs at : above address.

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The RF Welder - A Dilemma in EMC

This paper was delivered by Herman Garlan, Federal Commu-ications Commission, Washington, D. C., with six slides showing ıe general requirements to minimize radiation and re-radiation. 'he Introduction is as follows:

"This paper discusses the rules recently proposed by the FCC for RF Welding Equipment, also known in industry as High Frequency Stabilized Arc Welders or as RF Excited Arc Welders.

"These welders incorporate an RF generator with the RF energy coupled into the welding leads as shown diagrammatically in Figure 1. RF excitation is used for arc starting and stabilizing for

--metal arc welding at low currents with small consumable electrodes, and
--welding with nonconsumable electrodes, usually tungsten shielded by an inert gas.

A spark gap oscillator is used as a source of RF energy because it is rugged and simple. Furthermore, its broadband characteristics - energy is produced over an extremely broad band of frequencies, commonly 1 to 20 MHz - is insurance that a random change in circuit constants or welding conditions will have little effect on the RF energy available for excitation.

"These characteristics make the spark gas oscillator an ideal source of RF for welding. Unfortunately, this same broadband characteristic makes the RF Welder a prolific source of interference.

"To reiterate, the FCC Rules discussed herein are concerned with a device that generates RF energy and uses this energy to ionize a gas. Such a device falls into the general category of Miscellaneous Equipment under Part 18 of the FCC Rules. On the other hand, the ordinary arc welder that does not include an RF generator is classed as an incidental radiation device - a device in which RF energy is generated fortuitously as an undesired by-product of normal operation."

Copies of this paper may be obtained from Mr. Garlan as well s Report No. T-6401 "Field Measurements of Electromagnetic :nergy Radiated by RF Stabilized Arc Welders" by Herman iarlan, L. Glen Whipple and Irving L. Weston, Federal :ommunications Commission, Washington, D. C. 20554.

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Conclusions of the NASA/MAR Electromagnetic Compatibility Workshop-Seminar

S. S. DiMaggio, National Aeronautics & Space Administration, Office of Manned Space Flight, Washington, D. C.; W. D. Johnston, General Electric Company, Daytona Beach, Florida, and C. M. Clarke, General Electric Company, Daytona Beach, Florida, authored the above paper to acquaint the attendees with the contents and the availability of the Electromagnetic Compatibility Handbook and EMC Course Lectures which resulted from the NASA/EMC training courses. The Introduction is as follows:

"The success of the Apollo Program primary objective, i.e., to land America's astronauts on the lunar surface and assure their safe return to earth, unquestionably represents one of this generation's greatest engineering challenges. In accomplishing this mission, 20,000 contributing companies and federal agencies are endeavoring to meet exacting design standards. Many of these standards, we know, are pushing the state-of-the-art insofar as the capability, reliability and availablity of parts, components, equipments and systems are required for man-rated space systems. Moreover, it is acknowledged that existing EMI/EMC specifications have, in the past, and will likely in the future, follow developmental advances in phase-lagging step-like functions.

"Recognizing that this lag in the sequence of events might have a tendency to establish ex post facto EMC controls, wherein retro-fit might prove to be prohibitively expensive in terms of program schedules and budget limitations, an effort was initiated by the Apollo Program Reliability & Quality Assurance Office to make management and design personnel aware of EMC principles and practices. In order to be most effective in meeting this broad awareness objective, it was deemed advisable to appeal, via professional stimuli, to responsible Apollo Program contributors.

"Almost without saying, it was recognized that a single documented set of 'cook-book' procedures could not be developed to serve as an all-encompassing design panacea for eliminating electromagnetic interference (EMI). Yet something must be done to remove the 'black magic art' sobriquet enveloping the condition of interference-free operation or electromagnetic compatibility (EMC).

"It was felt that the need for EMC must be assimilated at all levels of program, project, system or equipment development. Typically, both the manager and the designer would have to consider the EMC aspects of the component, equipment or systems intended operational environment, from the conceptual stage through the use stage. Likewise, during the various stages of development, the methods and techniques of fabrication and test would also have to consider the item's final configuration for its intended operational environment.

"Considering the broad field of potential coverage for EMC awareness, a two-phase education program was deemed advisable.

"Part I. Part I of this effort was the development of the Handbook (NHB 5320.3) entitled, 'Principles & Practices of EMC'. Recognizing the magnitude of potential applications of this handbook, a cross-section of EMI/EMC experts were prevailed upon to contribute to chapters related to their specialities. On completion of this effort, an initial issue of this handbook was reviewed during the workshop-seminar, the subject of this report.

"Part II. Part II of this education program was the development of a seminar-lecture series relating to the chapters of the 'Principles & Practices of EMC Handbook.' The purpose of this seminar-lecture series was to provide a format for the EMC Workshop-seminar series to be conducted at NASA/Apollo Centers in 1966 and 1967."

Copies of the paper may be obtained by writing to Mr. S. S. DiMaggio.

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EMC Symposium (cont'd.)

The McDonnell Phantom II - A Comprehensive Program for Electromagnetic Compatibility

Walter D. McKerchar, Aircraft Systems Engineering Division, McDonnel Aircraft Corporation, Lambert-St. Louis Municipal Airport, Box 516, St. Louis, Mo. 63166, delivered a paper of which the following is a description of the Design and Development Program mentioned:

"All RF-4C weapon system subcontractors are required to submit Interference Control plans. Careful control is exercised by McDonnell management in cases where deviations are requested because of extreme costs or design compromise so that over-all system compatibility is not degraded. In some cases, preliminary reviews established design requirements exceeding existing Electromagnetic Compatibility and Interference Specifications. McDonnell had the responsibility of anticipating these needs and directing attention to them as early as practical in the design and development time period.

"Subcontractor Interference Control Plans

"A critical factor often overlooked by many Prime contractors is the usefulness of the Subcontractor Interference Control Plan. McDonnell has highlighted the Interference Control Plan in its Vendor Technical Data Requirements document. Further, the EMC group in the Aircraft Systems Engineering Division assists vendors by advising them of the intent and the detailed information that should be in, an Interference Control Plan. An Electromagnetic Interference (EMI) Control Plan advises the procuring activity of the effort a vendor will exercise to preclude the possibility that his product will adversely affect, or be affected by, other equipments located in close proximity to his installation. Adherence to this plan also serves to assure that the vendor's product is unlikely to be affected by stray external interference signals from other equipments.

"It is recommended that the following control plan topics be discussed by the vendor in as much detail as possible:

a. Circuits to be shielded.
b. Circuits to be filtered.
c. Method of selecting interference free components.
d. Methods of obtaining continuous shielding in equipment housing and enclosures, including access doors, and other apertures.
e. Definition of the frequency range for which the shielding is designed to preclude interference signals from affecting his equipment, and the attenuation to be expected.
f. Protective finishes to be employed on mating surfaces, and methods for maintaining good electrical conductivity when protective coatings are applied.
g. Suggested methods of bonding shock mounted units to the aircraft structure.
h. Methods for selecting ground points for circuits and suppression components to minimize stray couplings caused by common ground impedances and circulatory currents in the chassis.
i. Precautions to be taken to prevent susceptibility, spurious emanations, responses, and unwanted resonances.
j. Good engineering practices in suppression techniques, such as filtering, shielding, bonding, grounding and isolation.
k. Suppression measures that will be incorporated as an integral part of his system.
l. Facilities available for testing to EMI specification and requirements.
m. Administration of the vendor's EMI control plan, including:
    1. The number and qualifications of personnel assigned to the program.
    2. The company policy and the level of authority for influencing design to eliminate causes of interference.
    3. The vendor's designee for EMC liaison with the customer."

Copies of the paper may be obtained by writing to Mr. W. D. McKerchar, D-311-33-4, McDonnell Aircraft Corp., P. O. Box 516, St. Louis, Mo. 63166.

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Analysis and Application of Line-To-Line Filters

George A. Blase, McDonnell Aircraft Corporation, St. Louis, Mo. 63166, delivered a paper with this title. The Abstract is as follows:

"This paper describes a passive, low-pass, single phas power line, interference filter which provides required insert loss even though the line-to-chassis capacitance is limited to a comparatively small value. Various filter circuits are considered, and mathematical expressions for computing insertion loss are developed. Filter characteristics, obtained from a computer study which used these mathematical expressions, a presented graphically. Test data is included from prototype filter tests, as well as from qualification tests of equipment utilizing this type filter."

Filters which are discussed are: Line-To-Line Filter; Unbalanced Pi Filter, Unbalanced T Filter and Balanced Filter. Title of the various figures are as follows:

Figure 1 - Line-To-Line Filter
Figure 2 - Unbalanced Pi Filter
Figure 3 - Unbalanced T Filter
Figure 4 - Balanced Filter
Figure 5 - Circuit Used to Compute LSN Impedance
Figure 6 - Circuit Used to Compute Interference Voltage w Filter
Figure 7 - Circuit Used to Compute Interference Voltage w out Filter
Figure 8 - LTL Filter Insertion Loss vs Frequency for Different Values of LTC Capacitance
Figure 9 - LTL Filter Insertion Loss vs Frequency for Different Values of LTL Capacitance
Figure 10 - LTL Filter Insertion Loss vs Frequency for Different Values of Inductance
Figure 11 - LTL Filter Insertion Loss vs Frequency for Different Values of Load Impedance ($\theta = 0^{o}$)
Figure 12 - LTL Filter Insertion Loss vs Frequency for Different Values of Load Impedance ($\theta = 45^{o}$
Figure 13 - LTL Filter Insertion Loss vs Frequency for Different Values of Load Impedance ($\theta = 90^{o}$
Figure 14 - LTL Filter Insertion Loss vs Frequency for Different Values of Load Impedance ($\theta = 45^{o}$
Figure 15 - LTL Filter Insertion Loss vs Frequency for Different Values of Load Impedance ($\theta = 90^{o}$
Figure 16 - Comparison of Filters with 0.015 mfd Maximun LTC Capacitance
Figure 17 - Comparison of Filters with Same Total Inductar and Capacitance
Figure 18 - Prototype Filter Test Circuits
Figure 19 - Computed Insertion Loss (LTL) vs Measured Insertion Loss (LTL and Pi)
Figure 20 - Typical Age Qualification Test Data
Figure 21 - Typical Age Qualification Test (Multimeter)
Figure 22 - Typical Age Qualification Test Data (Test Set)

An Appendix includes the following figures:

Figure A - Circuit Used to Compute Interference Voltage wi Pi Filter
Figure B - Circuit Used to Compute Interference Voltage without Pi Filter
Figure C - Circuit Used to Compute Interference Voltage with T Filter
Figure D - Circuit Used to Compute Interference Voltage without T Filter
Figure E - Circuit Used to Compute Interference Voltage with L Filter
Figure F - Circuit Used to Compute Interference Voltage

Copies may be obtained by writing to Mr. G. A. Blase, D-311-33-6, McDonnell Aircraft Corp., P. O. Box 516, St. Louis, Mo. 63166.

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EMC Symposium (cont'd.

Reliability and Electromagnetic Compatibility

H. M. Hoffart and C. E. Miller, General Electric Company, Daytona Beach, Florida, delivered a joint paper in a rather unique manner. Mr. Hoffart discussed the similarity between reliability and electromagnetic compatibility concepts in a mutual question and answer format. Mr. Miller started the paper off with the following three paragraphs:

"The commonality of reliability and electromagnetic compatibility can best be perceived by considering that both disciplines are directed toward a common goal although one uses mathematical means and the other electronic. Parallelisms between specific work tasks indicate that this commonality is not 'far fetched'. It should be noted that although the disciplines overlap in principle, each on its own merits is an essential tool for discovering discrepant areas and applying corrective action before 'it is too late'.

"This paper emphasizes the need for developing an integrated relationship between the electromagnetic compatibility concept and the reliability concept, so that duplication of effort can be eliminated without either function losing its individuality. To clarify my point, I am not suggesting that the two disciplines be combined in one effort, but rather that they be complementary; i.e., both efforts used jointly to increase the probability of mission success.

"It may not seem obvious that reliability is an essential facet of electromagnetic compatibility and, conversely, that electromagnetic compatibility is an essential facet of reliability. However, isn't it possible that these efforts have been dependent on one another and, as a result, neither has ever been fully developed? . . . . . "

Copies of the paper may be obtained by writing to Mr. Hoffart at the above address.

Measurement of Field Strength Attenuation in the Near Field

W. C. Dolle and W. E. Cory, Southwest Research Institute, San Antonio, Texas, authored a paper with the above title. The Introduction is as follows:

"The difficulty of predicting the manner in which the electric and magnetic field components vary in the near field is a problem of particular interest to those who deal with Electromagnetic Compatibility measurements. The standards and specifications which govern such measurements generally prescribe that data be measured at distances which are well within the near field at most frequencies. This is well and good as far as making standard measurements is concerned but the data are of little value for predicting field strengths at other locations if the point-to-point variation of the field components is not known. For example, it would be desirable to be able to translate interference data taken in accordance with one specification to include conformance (or non-conformance) to another specification.

"The authors have recently had the opportunity to briefly measure the attenuation of electric and magnetic components in the near field as a function of radial distance under what might be called typical fixed installation environmental conditions. From these measurements curves which can be used to predict field strengths in the near field have been developed. The experimental equipment and procedures and some of the data curves are discussed in the succeeding paragraphs. This work was done under the sponsorship of U. S. Air Force Contract No. AF 41 (609) - 1640. "

Copies of the paper may be obtained by writing to Walter C. Dolle, Senior Research Engineer, Department 14, Southwest Research Institute, 8500 Culebra Road, San Antonio, Texas 78206.

Electromagnetic Compatibility: A Position Paper

Woodrow W. Everett, Jr. and Robert Powers, Rome Air Development Center, Griffiss Air Force Base, New York 13440, co-authored a paper with the above title. The Summary and The Overall Problem are described as follows:

"Consideration is directed toward electromagnetic compatibility as viewed from the control aspect. Emphasis is upon an intersystem approach of improving the overall electromagnetic environment.

"The Overall Problem

"Our approach to electromagnetic compatibility might well be called the intersystem approach since our concern centers around the effect one system has on another. And, to be perfectly candid, we concentrate upon effects which are not immediately obvious to operational personnel, who are sometimes quite well versed in techniques of handling the common adjacent-channel or cochannel interference problems. It is the more subtle compatibility problems caused by spurious emissions or responses which command most of our attention.

"Let us interrupt our train of thought with some parenthetic comments. Our interest in intersystem electromagnetic compatibility is not stimulated by some intrinsic aspect of the problem itself. Compatibility commands attention because of the desire to communicate using frequencies in the electromagnetic spectrum. When physical space and frequency separation provide adequate communications facilities, then we could care less about electromagnetic compatibility. But when a crowded spectrum exists and space separation is not feasible (or possible), then we become very interested in compatibility--because our ability to communicate is degraded. We have no motivation to 'turn off' systems to 'cure' compatibility problems. We either use the system at reduced capability or 'live with' the degradation. It is, in fact, means of minimizing this degradation which focuses our interest on electromagnetic compatibility. "

Compatibility Prediction Accuracy as a Function of Spectrum Signature Data Inputs

Jacob Scherer, Rome Air Development Center, Griffiss Air Force Base, William G. Duff and Kenneth G. Heisler, Jr., Jansky & Bailey Research and Engineering Department, Atlantic Research Corporation, co-authored a paper under the above title. The Abstract and first paragraph of the Introduction are as follows:

"One important problem that arises in the development of an electromagnetic compatiblilty prediction process is that of defining the accuracy which one might expect to obtain as a result of utilizing the process in a compatibility analysis. However, before we can answer the question of the over-all accuracy that may be obtained from an electromagnetic compatibility prediction, it is necessary to examine the accuracy limitations imposed by the transmitter, receiver, and antenna functions which serve as inputs to the prediction process. This paper discusses the problem of input accuracy for the case in which statistical representations of the input functions are derived from spectrum signature data.

Introduction

"Spectrum signature data provides us with one of the major sources of input information for compatibility prediction. In general, spectrum signature data are obtained from a relatively limited set of data samples. We would like to use this information to derive statistical representations for our prediction input functions, but it is necessary to realize that because of limited data, the resultant input functions will contain an error of estimat[e] which will in turn produce an error in the compatibility answer. The primary objective of this paper is to define the accuracy of the prediction input functions in terms of the spectrum signature data base. "

EMC Symposium (cont'd.)

Simulating The Electrical Effects of Nuclear Detonations

Roy O. Lange, Lockheed Missiles and Space Company, Sunnyvale, Calif., delivered a paper with the above title. The Introduction is as follows:

"Nuclear detonations generate high level electromagnetic fields. The strengths, gradient characteristics, and locations of the fields have become prime study areas for the nuclear nations. With knowledge of these factors at hand a defending nation can utilize the electromagnetic field of its interceptor as the kill mechanism against an enemy attack missile. The attacker then has the problem of hardening its offensive weapon to survive the enemy defense. This report treats the problem from the point of view of the attacker."

Mr. Lange wrote your editor as follows:

"Dear Mr. Daniels:

"In response to your request, I enclose a copy of my paper Simulating the Electrical Effects of Nuclear Detonations. The title is more descriptive than that included in the program for the 8th IEEE Symposium on EMC and I made the change after the new title was cleared by Lockheed Security. This was done after consultation with Art Fong.

"I will fill any requests for copies directed to me at the address below.

"It would be interesting to know how many G-EMC members are currently working predominantly in EMP (Electromagnetic Pulse) instead of EMI or EMC. Personally, I find this field, which is currently attracting a lot of interest, more closely allied to EMC than to the associated nuclear environments (gamma, neutron, X ray, thermal, blast). To date, this subject has been dealt with through Technical Interchange meetings arranged by the military customer. Perhaps the time has arrived for the IEEE to become actively interested in EMP and to schedule classified and unclassified sessions for papers dealing with this phenomenon. I would be interested in hearing of any committee activities now in progress dealing with EMP.

Sincerely,

Roy O. Lange
Weapons Effects Environments Staff, Dept. 81-71
Lockheed Missiles & Space Co.
Box 504
Sunnyvale, Calif. 94086

"P.S.: The version to be printed in the Symposium minutes is considerably condensed from the enclosed copy."

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(Editor's Note: Are there any of our members who can supply Mr. Lange with the information on committee activities which he wishes? Your editor would appreciate a copy of any such letter for reproduction in a future issue of the Newsletter.)

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A New Near-Zone Electric Field-Strength Meter

Frank M. Greene, Radio Standards Engineering Division, National Bureau of Standards, Boulder, Colorado 80302, authored the above paper. The Abstract and Introduction are as follows:

"Abstract - The National Bureau of Standards has recently completed the development of prototype instrumentation for measuring the electric-field components of complex, high-level, near zone electromagnetic fields from 0.1 to 1000 volts per meter, at frequencies from 150 kHz to 30 MHz with a present uncertainty o less than ± 2 dB. The successful design of the NBS meters is based on the use of a novel form of telemetry, employing a completely non-metallic electrical transmission line, which apparent has not been fully exploited heretofore. This avoids the perturbing effects on the field being measured, usually caused by field-strength meters employing metallic RF transmission lines.

Introduction

"The National Bureau of Standards, under the sponsorship of the Defense Atomic Support Agency, has recently completed the development of prototype instrumentation for measuring the electric-field components of complex, high-level, near-zone electromagnetic fields. This represents one step in the effort to develop accurate and meaningful measuring and calibrating instrumentation, for use in evaluating hazards of electromagneti radiation to electro-explosive ordnance devices. It is well known that high-level fields of powerful nearby radio transmitte may cause premature detonation of missile and rocket-type weapons during storage or loading operations on shipboard, or a other military installations.

"The successful design of the NBS meters is based on a novel form of telemetry, employing a completely non-metallic electrical transmission line to avoid perturbing the field being measured. This approach has apparently not been fully exploited heretofore. The high line-loss involved necessitates placing the receiving and calibrating instrumentation and the associated battery supplies inside the measuring antenna. The field information contained in the detected DC-AF output of the receiver is transmitted over the line to a remote readout unit, where the strength of the electric-field component parallel to the axis of the antenna is read directly.

"Interim electric-field standards and calibration techniqu were also developed at NBS to evaluate the performance of the field-strength meters during their development, as well as to provide a tentative calibration of the completed instruments. The present uncertainty of the standards is believed to be less than ±2 dB, but further development effort is expected to reduce this to less than ± 1 dB."

The availability of the paper is described by Mr. Greene as follows:

". . . . I am planning to publish the complete version in the NBS Journal of Research (Section C) late this year. This w be available from the U. S. Government Printing Office, Washington 25, D. C., after January 1967."

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EMC Symposium (cont'd.)

Survey of Techniques for Measuring RF Shielding Enclosures

S. L. O'Young, R. Goldman and L. Jorgensen, Commercial Airplane Division, The Boeing Company, Seattle, Washington, presented the above paper. The Summary and Introduction are as follows:

"An intensive literature survey has been conducted to review existing techniques for measuring the effectiveness of RF shielding enclosures. Prevalent methods of measuring E- and H-field components and for sensing the total field are discussed and evaluated. The procedures described in the literature are tabulated into groups determined by their similarities in method or theory, and are compared by listing the advantages and disadvantages inherent in each. (A weighting system is devised to aid in evaluating each of the principal methods discussed.) Also discussed are the theoretical considerations underlying each of the methods listed, as applicable to the measurement of shielding effectiveness. Among these are the concepts of the 'resultant wave impedance' of the E-M field at a point inside a shielded enclosure, and the relationship of low impedance and high impedance fields in the 'near field' regions of antenna systems. Techniques for extending the frequency and intensity of illuminating fields are also discussed, as well as the insertion loss method of determining leakage from a shield. Limitations and deficiencies of this latter procedure are noted.

"The widest variations in existing enclosure measurement techniques occur in the methods of generating the illuminating fields. Detection of the field is, in almost every instance, accomplished by a small, precalibrated loop or dipole.

"An ideal illuminating field is one of constant strength and impedance over a wide frequency range. Field strength should be sufficient to permit measurements over a minimun dynamic range of 120 db. More important, the shielding effectiveness values obtained should be consistent with those predicted by theory."

Copies of the paper may be obtained from S. L. O'Young, Electro-Dynamics Staff, The Boeing Company, Org. 6-7711, Mail Stop 73-48, Renton, Washington 98055.

Field Intensities Around a Dipole Antenna for Distances Comparable to Antenna Length

A. H. Mills and P. L. Pelland, General Dynamics Convair, San Diego, California, co-authored the above paper. The Summary and Introduction are as follows:

"The Electromagnetic Compatibility Engineer is often interested in the magnitudes of the electric and magnetic field intensities near a radiating device. Equations describing the field intensities around a radiating dipole antenna valid at all distances from the antenna, including distances which are a fractional part of the antenna's length, have been evaluated using a digital computer as a function of antenna length, frequency and distance to the point of interest. This paper discusses the assumptions made, the normalization and evaluation of the equations, the resulting curves showing the variations of field intensities as a function of frequency, distance and antenna length, and possible uses for these curves.

"The need to predict field intensities near a radiating dipole antenna arises on several occasions. In performing radiated susceptibility tests, shielding effectiveness measurements and calibration of measuring equipment in known fields, it is necessary to be able to predict the field intensities near the radiating dipole. The shape and variation of intensities with distance of the radiation field of a dipole of any length is commonly known. Also the shape and variation of intensities with distance of the near field of a short dipole antenna are relatively simple provided certain restrictions on the minimum distance from the dipole to the point of interest and on the current distribution are satisfied. However, the results are quite different when other current distributions are assumed and when the distance from the dipole to the point of interest is within the same order of magnitude as the length of the dipole."

Copies of the paper may be obtained by writing to Mr. Mills at General Dynamics Convair, Dept. 542-00, P. O. Box 1128, San Diego, California 92112.

Log Conical Antennas for RFI Specification Measurements

G. F. Roberts, D. R. Malone and F. J. Morris, The Electro-Mechanics Company, P. O. Box 1546, Austin, Texas 78767, presented a paper under the above title. The Abstract and first two chapters of Technical Discussion are as follows:

Abstract

"The recommended use of log conical antennas for specification measurements is discussed. Antenna factors to be used with various measurement setups is described as well as the methods for determining the correct factors to be used. The radiation characteristics of the log conical antennas is described and the advantages of using circular polarized antennas is discussed. The advantages of using the antennas for measurements made with spectrum analyzers and sweep receivers on a broadband basis is given. Experimental and theoretical considerations are described and the range of variations permissible for specification measurement use is discussed.

"The use of the log conical antenna at distances other than the one meter described in the specification is discussed and procedures for adapting the antenna factors are described.

Technical Discussion

"The present trend in electromagnetic interference measurements is towards the use of broadband automated techniques. In order to achieve a practical approach to this objective one of the primary requirements is to incorporate a broadband antenna having reproducible characteristics which can be used with existing measurement receivers. A pair of antennas which meet this requirement are designated in MIL-STD-826, as log conical antennas patterned after USAF drawings 62J-4040 and 62J-4041. Several improvements were made over the original design which subsequently resulted in approved versions now designated as EMCO CLP-1A and CLP-1B log conical antennas.

"The CLP-1A antenna is designed to operate into a 50-ohm receiving system over the frequency range from 200 to 1000 MHz. It is approximately 33 inches tall and 12 inches in diameter at the base."

Copies may be obtained by writing to Mr. F. J. Morris at the above address.

The Application of Spectrum Signature Data to Interference Analysis

John F. Spina, Rome Air Development Center, Griffiss Air Force Base, William G. Duff and Thomas E. Baldwin, Jr., Jansky & Bailey Research and Engineering Department, Atlantic Research Corporation, co-authored a paper under the above title. The Abstract and first two paragraphs of the Introduction are as follows:

"Equipment characteristics for compatibility analysis can be obtained from statistical reduction of spectrum signature data. However, practical measurement limitations such as dynamic range, receiver sensitivity, and signal generator power impose limitations on the resultant data. As a result of these limitations, certain transmitter outputs, receiver responses, or regions of an antenna pattern may be beyond the range of the measurement instrumentation. If such data are reduced without regard to the bias thus introduced, the statistical representations derived from the data samples will be in error. This paper discusses the significance of data samples obtained from a population that is 'truncated' as a result of measurement limitations, and discusses the consequences of overlooking the fact that some of the data samples are missing.

Introduction

"In order to perform an electromagnetic compatibility analysis, it is necessary to specify the characteristics of transmitter spurious outputs, receiver spurious responses, a antenna directivity. These spurious characteristics must be expressed in a form that is consistent with the input functions required for compatibility analysis. Because of the character tics of compatibility input functions, the application of statisti techniques appear to provide the most satisfying method of modeling input functions, and spectrum signature data is one the major sources of information for deriving statistical representation.

"The primary objective of this paper is to identify the ir portant factors associated with spectrum signature data samp obtained from a population that is truncated as a result of mea urement limitations. Typical examples of spectrum signature data are presented to demonstrate the effect of data truncatior Several methods that may be used for reducing truncated data are presented and discussed specifically in terms of their applicability to the derivation of transmitter, receiver, and antenna input functions for interference prediction and analysi Examples are presented to demonstrate the application of thes methods to spectrum signature data reduction, and the results are compared to those obtained without consideration of trunca

PUBLICATION AVAILABLE

Copies of the 8th EMC Symposium Digest may be obtained for the sum of $5.00 from Jerry F. Kirk, Lockheed Missiles and Space Company, Sunnyvale, California.

SYSTEM REJECTS HEAVY NOISE, FINDS SIGNAL

Electronics, June 27, 1966, page 138, has a column describing the paper authored by S. C. Fralick and G. L. Slenkovick, of Sylvania, at the IEEE International Communications Conference in Philadelphia, June 1966. Paragraphs of interest are as follows:

"An adaptive pattern-recognition system is making possible a signal interceptor that can strain from heavy noise an unknown and irregular radio signal. At Sylvania Electric Products, Inc., a mathematical model showed the system could pick out a correct signal from a signal-to-noise ratio of -23 decibels with a probability of $1 - 10^{-5}$

"The adaptive system, whose characteristics are classified by the Defense Department, effected a remarkable capability. The false alarm rate - at first high because the system responded equally to noise and signal - began to fall off. The system had learned to reject the noise and zero in on the signal."

COMMON GROUND FOR SHIELDED CABLES

Raymond A. Courter, The Thomas & Betts Company, Elizab New Jersey, has authored an article under the above title in the June 1966 issue of Electronic Packaging and Production. The introduction and first paragraph are as follows:

"A problem that has plagued the electronics and communications industry for years is how to handle the groundin several shielded conductors in a convenient, reliable manne without producing an 'onion.' This article discusses a meth how this may be accomplished.

"To the man who first developed a shielded conductor, modern electronics industry owes a great deal of gratitude. also owes him, or rather his successors, some rather pesty headaches. For with the advantages and extended capabilitie shielded cables brought, came also problems in using and te nating it. While this was not too much of a problem back in t days of the single coaxial television cable, with today's high density wiring, maintenance of shield to point of termination be more than a bother, especially if you are particularly concerned with weight, space and above all, reliability."

New Conductor Shielding for Lo-Hi Electromagnetic Interference Control

Joseph W. Murphy, Senior Project Administrator, Special Projects Group, Northrop Corporation Norair Division, Hawthorne, California, presented the above paper. The Abstract and Introduction are as follows:

Abstract

"This paper discusses a new electromagnetic interference (EMI) shielding for conductors. The shielding was especially developed to contain or exclude interference energy initiated by both magnetic and electrical fields over a broad frequency range. Incorporating a unique shielding concept, the new shielding minimizes (1) interference propagation from power or signal wiring, (2) low to high frequency (60 c/s to 10 Gc/s) interference pickup from external sources, and (3) requirements for segregation and special routing of power and signal wiring and interconnecting cables. Composed of two or more layers of braided magnetic materials, the shielding has demonstrated significant improvements in shielding effectiveness compared with conventional shielding over standard conductors and coaxial cables. In-service use has attested to its effectiveness.

Introduction

"Being system oriented, most of you are well acquainted with that gremlin that brings on so many troublesome and often mysterious electrical problems of reduced system availability, safety, and reliability. This gremlin is better known as electromagnetic interference, which is propagated by induced magnetic fields at power and higher frequencies, by transient magnetic fields, or by a combination of electrical and magnetic fields. An extremely wide frequency range is involved -- from less than 60 c/s to more than 10 Gc/s.

"The fundamental nature of the problem was succinctly stated in a 1961 ASD Technical Report as follows: 'The interference between any two circuits having long conductors in physical proximity arises from either or both of two phenomena; magnetic induction and electrostatic induction. A changing current in one circuit can induce a voltage in the other, via their mutual inductance, or a changing potential difference between conductors of adjacent circuits can induce a current in each, via their mutual capacitance. Present day circuit complexity, sensitivity and power levels require that electromagnetic compatibility be given major consideration at the earliest conceptual design stage to avoid later, expensive corrective measures.

"Consider, for example, the following incompatibilities that can cause malfunctions to sensitive circuitry within electrical or electronic equipment:

1. Magnetic coupling at 400 cps and harmonic frequencies on wiring and interconnecting cables.

2. Errors in data handling, occurring while the data are in analog form, caused by noise (EMI) pickup on signal interconnecting wiring.

3. Digital computer susceptibility to transient (pulse) electromagnetic interference radiation. Such interference may be caused by high power radar modulators and power switching circuits creating electromagnetic interference that is picked up by interconnecting wiring.

4. Jettison or launch circuits (with squibs or igniters) which are susceptible to spurious signals induced when certain equipment is energized, resulting in inadvertent release or firing of external stores, rockets, missiles, and ammunition.

"Northrop Norair has recently developed and patented a new type of conductor shielding designed to overcome the shortcomings of conventional shielding and filtering techniques. The purpose of this paper is to describe the new shielding, and to indicate both new and 'field fix' design techniques utilizing this shielding to minimize interference propagation from power or signal wiring, low to high frequency (10 c/s to 10 Gc/s) interference pickup from external sources, and requirements for segregation and special routing of power and signal wiring and interconnecting cable."

Copies of the paper may be obtained by writing to Mr. Murphy, c/o Northrop Norair, 3901 W. Broadway, Hawthorne, California, Organization 3991, Zone 31.

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Bonding and Grounding in Aerospace Vehicles and Ground Equipment

T. R. Wilson, Research Engineer, and E. M. Skene, Research Specialist, The Boeing Company, Aerospace Group, Seattle, Washington, co-authored a paper under the above title. The Summa and Introduction are as follows:

Summary

"Safety and reliability in aerospace vehicles and associate ground equipment are directly affected by basic design concepts in power system grounding and bonding practice. The three major objectives covered in this paper are; avoidance of static charges, protection from lightning, and safe containment of power system faults. Effective measures are outlined which hold static charges to insignificant levels incapable of sparking. Basic precautions which improve safety from lightning are specified. A number of alternate schemes for safe handling of power system faults are discussed. In addition, some simple and effective methods of obtaining effective electric bonding of equipment and structure are described and illustrated.

Introduction

"Missiles and other type aerospace vehicles and associate launch sites are alike in that large numbers of solid state static switches and pulse-sensitive elements are employed in their checkout, control, and operating circuits. Another common attribute is the frequent use of ordnance devices to accomplish c initiate mechanical functions such as stage separation, or to provide ignition of stages, actuation of batteries, and like object

"It is the purpose of this paper to point out a number of wa in which the safety and reliability of the vehicle and launch site may be enhanced by proper design practices in power system grounding and in electric bonding."

Copies of this paper may be obtained by writing to Mr. Wilson at the above address.

AES Conference (cont'd.)

Design Approaches to Enhance Electromagnetic Compatibility of Aerospace Ground Support Systems

A paper presented by N. J. Ockene, TRW Systems, under the above title, has the Abstract and first two paragraphs as follows:

"A generalized approach to the electromagnetic compatibility problem in electrical aerospace ground equipment (EAGE) systems is presented first by a control plan approach. This is augmented by the formulation of a grounding plan as the basis of good EAGE design. Criteria for packaging, shielding, and other control techniques is offered with emphasis on those elements which have the greatest effect on the final design.

"Aerospace ground support systems are somewhat unique in their relationship to EMI control technology in that they must perform compatibly with the aerospace flight hardware they are supporting and, at the same time, must not interfere with outside systems in which there are no direct compatibility requirements. The development of electrical aerospace ground equipment (EAGE) to support an existing set of aerospace requirements is, in most cases, a straight-forward design problem. However, the problems of satisfying the conditions of a third (perhaps unknown) system in regard to interference (susceptibility and generation) does not permit a simple infallible approach.

"The evolution of EMI control specifications has indicated no discernible trend in a given area of control technology. Early EMI control specifications were mainly concerned with conducted and radiation effects. As more experience was gained in this field, it eventually was seen that too many restraints were placed in one area while none were imposed in other areas. The consequences of this were revised control specifications which included such measurements as susceptibility to interference, antenna-conducted interference, and intermodulation. The pending revision of MIL-STD-826, which was originally released in January 1964, does not change any existing concepts of EMI measurements that have been employed, but merely provides further refinements of automating the RFI testing techniques. The inference that can be grasped here is that the control of EMI must proceed along a broad front with the eventual goal being improved criteria based upon intra- and inter-system compatibility.

Copies may be obtained from Mr. Ockene by writing to him at Mail Station R4/2050, TRW Systems, 1 Space Park, Redondo Beach, California 90278.

Computer Analysis of Signal Transfer In Complex Common Impedance Networks

This paper authored by J. E. Maynard, H. L. Rehkopf, and D. R. Awerkamp, The Boeing Company, Aerospace Group, Seattle, Washington, which was mentioned in the May, 1966 issue of the Newsletter, may be obtained from: Mr. J. E. Maynard, MS-23-31, The Boeing Company, Aerospace Group, P. O. Box 3707, Seattle, Washington 98124.

IEEE Transactions on Aerospace and Electronic Systems

Phase-Shift-Keyed Signal Detection with Noisy Reference Sigr

W. C. Lindsey, Jet Propulsion Laboratory, Pasadena, Califc has written a 9-page article under the above title. The Abstract i as follows:

This paper derives and graphically illustrates the performance characteristics of Phase-Shift-Keyed communica systems where the receiver's phase reference is noisy and derived from the observed waveform by means of a narrowban tracking filter (a phase-locked loop). In particular, two phas measurement methods are considered. One method requires transmission of an auxilliary carrier (in practice, this signal usually referred to as the sync subcarrier). This carrier is tracked at the receiver by means of a phase-locked loop and th output of this loop is used as a reference signal for performin a coherent detection. The second method is self-synchronizin in that the reference signal is derived from the modulated data signal by means of a squaring-loop.

"The statistics (and their properties) of the differenced-correlator outputs are derived and graphically illustrated as a function of the signal-to-noise ratio existing in the tracking filter's loop bandwidth and the signal-to-noise ratio in the data channel. Conclusions of these results as well as design trends are presented."

On Signal and Noise Level Estimation in a Coherent PCM Chann

Robert B. Kerr, College of Engineering, Duke University, Durham, N. C., has written a 5-page article under the above title. The Abstract and first paragraph are as follows:

"Joint maximum likelihood estimators are presented for th signal amplitude and noise power density in a coherent PCM channel with white Gaussian noise and a correlation receiver. The estimates are based upon the correlation coefficient outputs of the receiver. From these estimators, an estimator for the quantity

$$\frac{(\text{received signal energy}) / \text{bit}}{(\text{noise power}) / (\text{unit bandwidth})},$$

upon which the error probabilities depend, is derived. This estimator is shown to be useful as

1) a point estimator for the signal-to-noise ratio for the higher values of this ratio (about 4 dB or greater), anc

2) an easily calculated statistic upon which to base data acceptance or rejection criteria. The acceptance or rejection levels are obtained by the use of confidence interval curves in conjunction with word error probability data.

"The advantages of phase-coherent PCM (and, as a specia case, PFM) communications have been widely recognized (1)-(4) and utilized in the recovery of information from scientific satellites. The optimum (Bayes) receiver for such a channel is one which computes the conditional probability for each of the possible code words, given the received (noisy) data word. If the transmission of each of the possible code words is a priori equally likely, then maximizing the conditional probability is equivalent to mazimizing the likelihood function. If the received words (i.e., the signal parts of the received waveforms) are all of equal energy, the likelihood function is maximized by choosing the word which yields the largest correlation coefficient when correlated with the received 'data' word (5), (6)."

CONDUCTIVE BALL BEARINGS

Miniature Precision Bearings, Inc., Precision Park, Keene, New Hampshire, has an advertisement in Metalworking News, June 6, 1966, with the following description of the properties of their conductive ball bearings:

"MPB's R & D Laboratory has identified and proven the capabilities of a conductive ball bearing design for use as a circuit component in electro-mechanical devices.

"The transmission of electric current between the rotating inner and outer rings of a ball bearing has previously been limited to the use of slip rings external to the bearing. The new design utilizes an integral slip ring as a part of the ball bearing.

"The conductive ball bearing, incorporating a design licensed from the Federal-Mogul Corp., is a standard bearing with a precious metal plate on the inner ring and a high conductivity contact wire between the bearing rings.

"These bearings are ideal for signal transmission across a rolling element assembly. Tape guide sensing rolls would be a typical application. They have long life without loss of conductivity or increase of contact resistance.

"MPB S6316 RE bearings with a radial play of .0002" to .0005" and a .006" diameter contact wire were tested with varying speeds, lubricants and plating materials.

"Resistance of the bearings during dynamic testing was 0.6 to 0.8 ohms. In a static condition the bearings showed an average resistance of 0.2 ohms to 0.35 ohms, depending on the plating material. Resistance measurements without the conductive wire averaged 65 ohms.

"Important conclusions from the test program include:

"(1) This design yields a highly conductive ball bearing.

"(2) The lubricant used is not critical to conductivity.

"(3) The increase in torque due to the contact wire is acceptable.

"(4) Electric current transmission does not damage these bearings.

"Complete results of the test program are contained in Volume 12, No. 3, MPB Engineering News, or may be obtained from your MPB field sales engineer."

QUAN-TECH LABORATORIES "NOISE FILE"

During the past years, Quan-Tech Laboratories, Inc., 43 South Jefferson Road, Whippany, New Jersey 07981, has been bringing out technical papers which are available in what they call a "Noise File". A descriptive page describes this file as follows:

"Attached is the Quan-Tech 'Noise File' which contains a number of technical reports dealing with the nature and origin of electrical noise, together with specifications of equipment for its measurement.

"The effects of noise in terms of impaired performance have been widely recognized for a number of years. Now the relationship between noise and component reliability is increasingly being accepted by the electronics industry. Thus the analysis of electrical noise generated by components is not only vital to the development and production of low-noise circuits, but also is becoming of major importance in achieving maximum reliability of instruments and systems.

"If we can provide any further information, or if we can help you with your particular noise problem, please do not hesitate to call on us."

The titles of the papers in this file are as follows:

"Electrical Noise & Component Reliability" - A brief summary of the origin, nature and implications of noise in electronic components.

"Current Noise Tests Indicate Resistor Quality" - by J. G. Curtis, Senior Applications Engineer, Corning Electronic Components, Bradford, Pa.

"Techniques of Transistor-Noise Analysis"

"Noise Analysis and Potential Failure Mechanisms in Semiconductor Diodes" - by Alan P. Stansbury and Richard A. Struble

"Table of Electrical Noise"

"Role of Noise in Failure Mechanisms in Transistors" - by Alan P. Stansbury

REDUCTION OF NOISE IN LOW-LEVEL MEASUREMENT AND CONTROL SYSTEMS THROUGH PROPER USE OF ISOLATION DEVICES

Elcor, Div. of Halliburton Co., 2431 Linden Lane, Silver Spring, Md. 20910, has a 4-page Bulletin 95-765 devoted to this subject. Paragraphs of interest are:

"A poor ground system may be a conductive path with various impedances (the usual capacitance, inductance, and resistance plus non-linear impedances) and inherent noise sources (electrochemical, piezo, resistive, thermo-electric, piezo-electric, and magneto-electric) which is shared by an almost unknown number of other circuits. If earth is involved, a large electrochemical or electrolytic cell is involved whose properties vary with distance between ground points, electrode materials, substrate materials of the earth's crust, rainfall, lightning, temperature, time, and proximity to other environmental disturbances. Even ground or common systems not involving earth share these problems in varying degrees.

"As the retrieval of lower and lower signal levels and greater system accuracies is pursued, every technique to reduce unavoidable noise and prevent the generation or transference of avoidable noise must be brought to bear on the problem. One powerful technique is the utilization of well-isolated power supplies for energizing the system. These devices allow the design of highly selective ground systems with a high degree of limitation of spurious ground signals. The use of this type of power supply enables electric energy (generally from an ac power distribution system) to be transferred and transformed to power the data processing system while maintaining a high degree of conductive isolation from the power distribution system. . . "

There are three schematics with the following titles:

"Energizing, Isolating, and Grounding the Measurement Circuit"

"Noise Sources of the Isoply and Ground - And The Circuits Coupling Them Through the Amplifier Input Resistance"

"Equivalent Circuit of Isoply and Ground Circuit as Noise Sources"

AMENDMENT TO THE COMMUNICATIONS ACT OF 1934 PASSES IN THE SENATE

The following Act, S. 1015, passed in the Senate June 2, 1966 and has been referred to the House of Representatives. The full text of the Act is as follows:

"To amend the Communications Act of 1934, as amended, to give the Federal Communications Commission authority to prescribe regulations for the manufacture, import, sale, shipment, or use of devices which causes harmful interference to radio reception.

"Be it enacted the by Senate and House of Representatives of the United States of America in Congress assembled, that the Communications Act of 1934, as amended, is further amended by adding thereto a new section 302 to read as follows:

"DEVICES WHICH INTERFERE WITH RADIO RECEPTION

"Sec. 302 (a) The Commission may, consistent with the public interest, convenience, and necessity, make reasonable regulations governing the interference potential of devices which in their operation are capable of emitting radio frequency energy by radiation, conduction, or other means in sufficient degree to cause harmful interference to radio communications. Such regulations shall be applicable to the manufacture, import, sale, offer for sale, shipment, or use of each devices.

"(b) No person shall manufacture, import, sell, offer for sale, ship, or use devices which fail to comply with regulations promulgated pursuant to this section.

"(c) The provisions of this section shall not be applicable to carriers transporting such devices without trading in them, to devices manufactured solely for export, to the manufacture, assembly, or installation of devices for its own use by a public utility engaged in providing electric service, or to devices for use by the Government of the United States or any agency thereof. Devices for use by the Government of the United States or any agency thereof shall be developed, procured, or otherwise acquired, including offshore procurement, under United States Government criteria, standards, or specifications designed to achieve the common objective of reducing interference to radio reception, taking into account the unique needs of national defense and security."

Passed the Senate June 2, 1966.

Attest: Emery L. Frazier
Secretary.

JUST HOW GOOD IS BRAIDED COAX?

Frank Jayne, Chief Electrical Engineer, Borders Electronics Co., Pennsauken, N. J., has written a 6 1/2 page article under the above title in MICROWAVES, June 1966. The sub-title states:

"Not bad in short lengths but less than good for long-line applications. Reflection 'hash', which plays havoc with vswr, is charted for several commonly used cables. Causes and possible cures of random noise are explored."

There are 17 charts of cable characteristics and one table of NOMINAL PHYSICAL PROPERTIES OF CABLES TESTED.

ELECTRONIC DESIGN BRINGS OUT SEMICONDUCTOR DIRECTORY

Electronic Design, published by Hayden Publishing Company, In 850 Third Avenue, New York, N. Y. 10022, has brought out a Semiconductor Directory Reference Issue, May 17th, 1966. A descriptio of its contents is supplied by them as follows:

"When the chips are down, an applications-oriented semiconductor directory is your best bet for optimum device selection. Bipolars, FETs, UJTs and integrated circuits are listed by key parameters. You also learn who-makes-what in diodes, SCRs and rectifiers. Articles show design basics, trade-offs."

IEEE

ELECTROMAGNETIC COMPATIBILITY GROUP

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.
345 EAST 47TH STREET, NEW YORK, NEW YORK 10017

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