



PROFESSIONAL
GROUP ON
RADIO
FREQUENCY
INTERFERENCE

NEWSLETTER

Number 20

February 1962

PLANS FOR PGRFI - PGMIL PANEL

What promises to be one of the most important panel discussions ever held at an IRE International Convention is rapidly taking form. Its subject is:

ELECTRO-MAGNETIC COMPATIBILITY - ITS SIGNIFICANCE TO SURVIVAL

Session #29

March 28, 1962 10 A.M. - 12 noon

Grand Ballroom - Waldorf Astoria Hotel - New York

The panel discussion will be conducted by experts from government and industry and will include a critical review of the objectives and future planning of the DOD Electronics Compatibility Program - not only a vital part of our national defense but an increasingly important part of peacetime installations. The panel is being sponsored jointly by the Professional Group on Radio Frequency Interference and the Professional Group on Military Electronics. The Moderator and four of the five members of the panel are as follows:

Moderator: Frederick R. Lack, Director EIA Engineering Department

Gen. F. L. Ankenbrandt, RCA, Camden, N.J. - Cost of Radio Frequency Interference

Mr. Donald G. Fink, Philco Research Center, Bluebell, Pa. - Review of Radio Spectrum Conservation

Mr. Richard P. Gifford, General Electric Co., Lynchburg, Va. - Spectrum Pollution

Brig. Gen. John A. McDavid, Communications Electronics, Joint Chiefs of Staff, Washington, D.C. - Management of the Military Radio Frequency Interference Program

Because of the basic questions which will be discussed by this panel, the Session will be of particular interest to management and to project engineers who will have to incorporate compatibility into system design.

Publishers and manufacturers of equipments and components, who are affected by the DOD Electronics Compatibility Program, are being asked to have special exhibits at their booths, in the Coliseum, after the Session.

Chapter Activities:

The following papers were delivered at Chapter Meetings:

Chicago Chapter

October 10, 1961

"Designing Land Mobile Communication Systems to Minimize RFI" - by Curt Schultz, Motorola Inc., Chicago, Illinois.

Chicago Chapter

November 10, 1961

"Electromagnetic Compatibility Analysis Center" by Stanley I. Cohn, Armour Research Foundation, Chicago, Illinois.

"Spectrum Signature Measurements" - by Herb M. Sachs, Armour Research Foundation, Chicago, Illinois.

San Francisco Chapter

November 27, 1961

"Interference Considerations for Communications Satellites" - by J. J. Downing, Lockheed Missiles & Space Co., Palo Alto, Calif.

San Francisco Chapter

July 18, 1961

"Microwave Interference Problems and Solutions" by R. H. Stone, GE Microwave, Palo Alto, Calif.

Fort Worth Chapter

November 14, 1961

"Selective Signaling" - by D. W. Land, Motorola Comm. and Elec., Inc.

Los Angeles Chapter

October 19, 1961

"Purposes and Philosophy of the PGRFI" - by H. L. Malone, Genistron, Inc., Los Angeles.

"Systems Approach to Interference Control" - by K. R. Schuette, Filtron, Inc., Culver City.

Philadelphia Chapter

December 19, 1961

"Field Engineering and Monitoring Bureaus' Role in Interference Elimination" - by Frank M. Dratkovil, FCC.

CANAVERAL SECTION PETITIONS FOR CHAPTER:

John E. Bush, Temporary Chairman, PGRFI, Canaveral Section, Pan American World Airways, Patrick Air Force Base, Florida, states an organizational meeting will be held in January as a result of a petition for a chapter to the Canaveral Section of the IRE. Mr. Bush states:

"It is anticipated that through this medium, professional exchange of the Missileland's Interference Control problems and solutions can be accomplished for all concerned."

BIBLIOGRAPHY TO BE SHIPPED FEBRUARY 14, 1962:

The Bibliography on Interference, which has been mentioned in several previous Newsletters, is scheduled to be shipped February 14, 1962 to paid-up members of PGRFI. If any members know of others who are thinking of joining PGRFI, it would be well worth their while to be told that they can receive the Bibliography free of charge but that there will be a substantial cost thereafter.

WASHINGTON CHAPTER HOLDS DECEMBER MEETING:

A meeting of the Washington Chapter was held December 19, 1962, at which time D. R. J. White, of White Electromagnetics, Inc., Bethesda, Md., gave a talk on "Scoring Criteria for Determining RFI Damage to Communication-Electronics System".

REQUEST FOR LISTING OF LABORATORIES DOING RFI WORK:

The following letter has been received by your editor:

"As per your invitation I would like to suggest an addition I would like to see in the IRE Professional Group on Radio Frequency Interference Newsletter.

"Because of the fact that we are doing Radio Frequency Interference work, we are always asked to suggest the location and facilities of other laboratories doing this work.

"I would like to see in every issue of the Newsletter a listing of the following:

"1) The location of Laboratories doing Radio Frequency Interference work.

"2) Type of certification authorized.

"3) Type of service they can provide.

Yours truly,

L. Auerbach
Radio Frequency
Section of Code
932
Material Lab.
N.Y. Naval
Shipyard
Brooklyn 1, N.Y.

Your editor would also like to see such information available to the members of PGRFI because it would save him much time in answering telephone inquiries from all over the country on just this subject. Will all laboratories kindly send in the asked-for information and your editor will start running it in the next issue. Please include telephone number and name of person to call in each laboratory.

ITEMS of INTEREST in PROCEEDINGS of the IRE, DECEMBER 1961:

A special issue of the Proceedings of the IRE on Plasma has many articles of interest to those engaged in the control of spurious electromagnetic energy. It is not possible to mention all of them but the following are some pertinent excerpts:

From: "Plasma Physics - An Elementary Review" by M. P. Bachynski, Research Labs., RCA Victor Co., Ltd., Montreal, Canada, is a section on page 1760 on Plasma Noise as follows:

"As a result of the interaction between electrons, ions and neutral molecules in a plasma, electromagnetic energy is generated and emitted by the plasma. This emission of 'passive' radiation from the plasma can be due to a variety of physical processes such as: bremsstrahlung - the deceleration of particles due to an atomic encounter; the release of energy during recombination of an electron-ion pair; or Cerenkov radiation from the 'bow wave' formed when particle velocities exceed the velocity of light in the medium or unstable plasma oscillations arising from gradients of electron density which exist in nonuniform plasmas. The radiated energy is in general noncoherent, varying over a wide continuous spectrum of frequencies and thus appears principally as a noise signal.

"This noise can impose limitations on the sensitivity of an antenna receiving system by raising the noise level of

of the environment in which the environment in which the transmitting and receiving system operates and hence defeating the advantages gained in using masers, parametric amplifiers and other low noise receiving devices. The 'noise' radiated from a plasma is not, in all cases, necessarily a detrimental effect such as it is in communications. Thus if the spectral distribution of the emitted energy is characteristic of the plasma properties, a measurement of the microwave radiation provides specific information on the plasma. As an example, knowledge of the radiated power gives a measure of the electron temperature in the plasma, and this has been used as a powerful diagnostic technique. Further investigations have been focused on the microwave radiation from plasmas produced by hypervelocity bodies in the hope of providing a means for detection and discrimination of such vehicles as they enter the atmosphere.

A major difficulty in the above-mentioned applications is an understanding of the fundamental processes. For a plasma in a steady state, macroscopic radiative transfer concepts without detailed knowledge of the atomic processes can be applied and the emission spectrum determined from the electromagnetic wave absorption, transmission and reflection properties of the plasma. These determinations are complicated by the nonuniformity and geometrical configuration of the emitting plasma. However, most practical plasmas of interest are not in equilibrium, and as yet a considerable amount of theoretical work remains to be done on non-equilibrium radiation. Furthermore, few reliable quantitative measurements are available to guide the theoretical work."

Oscillations and Noise in Low-Pressure DC Discharges

This is an article by F. W. Crawford and G. S. Kino on page 1767. The following is the summary:

"This is a review paper concerned mainly with oscillations and fluctuations which have been observed to occur either spontaneously or as a result of deliberate excitation in low-pressure, hot-cathode plasmas. Experimental observations on high- and low-frequency effects occurring spontaneously are discussed, and speculations are made about the possible generation mechanisms. In many cases, theories of these mechanisms have been treated in experiments involving deliberate excitation of oscillations, and comparisons are made where relevant.

"For device applications, and to relieve the difficulties which occur in quantitative experiments in plasma physics, it is important that the sources of spontaneous oscillations be understood and suppressed, if possible. The paper includes a discussion of work which has been carried out to reduce these effects, and concludes with some suggestions for further lines of attack on the problems."

Low-Frequency Noise in Backward Diodes

In the Correspondence Section, page 1939, is a letter from W. C. Follmer, Philco Research Center, Blue Bell, Pa., with the above title. An excerpt from the last paragraph is as follows:

"The results of these experiments have indicated that it is possible to operate backward diodes as low noise mixers up to approximately one-tenth the cutoff frequency associated with the valley capacitance and the parasitic series resistance."

Law for Noise Loading of Multivoice-Channel FD

On page 1952 is a letter from C. A. Parry, Page Communications Engineers, Inc., Washington, D. C. The opening paragraph of the letter states:

"The concept of using a white noise signal with uniform power density over the baseband for the analysis and testing of multi-voice-channel systems using FD multiplex has now

become well-established in the art."

Narrow-Band and Wide-Band Noise Figures

On page 1954 is a letter from Paul J. Beneteau, Fairchild Semiconductor Corp., Mountain View, California. The Introduction states:

"There are at present two generally used methods of specifying transistor low-frequency noise figure (NF): a wide-band and a narrow-band method. The wide-band method averages noise over a wide audio range in a carefully controlled roll-off amplifier, while the narrow-band method measures noise over a very narrow band at a spot frequency, usually 1 kc. In the hope of removing some of the confusion regarding the relative merits of each measurement, they will both be very briefly discussed."

RFI FORECAST for 1962:

Electronic Industries, January 1962, on page 117, includes and RFI forecast for 1962 as follows:

"The government has a large order they want filled. The 'Inventions Wanted' publication contains the following: Interference Reduction Techniques. - Unintentional interference may seriously affect the performance of communication-electronic equipment/systems. Simplified and/or new means for reducing unwanted transmitter emissions and undesired receiver responses, especially on miniaturized equipments are required.

"We have heard it said that enough money has been spent on the general areas of investigating RFI, and that now the knowledge gained should be applied. This statement is not meant to imply that we stop investigating, only that we now build our equipment to overcome the problems. Equipment is still being built that generates or adds to the already existing RFI problems.

"Generally RFI is considered a very sophisticated subject, only for experts. Having attended several meetings ourselves, we must, to a certain extent, agree. This has been part of the holdback on more RFI-free equipment. The working engineer becomes 'snowed under' when he starts to look into the subject. A step in the right direction was accomplished when the IRE Professional Group on RFI held tutorial sessions in conjunction with their symposium at Washington, D. C., last June. However, more of this missionary type of work has to be done. Until it is, we will not make the necessary progress."

Shielding and Enclosure:

Electronic Industries, January 1962, carries a 2-page article under the above title by Cyril P. Durnovo, Adler Electronics, Inc., 1 LeFevre Lane, New Rochelle, New York. The sub-title states:

"The problem of protecting an area from excessive electromagnetic radiation is becoming increasingly important. But very little has appeared on the 'how to' aspect. Here's a thorough treatment of the subject."

Hallicrafters Sets Up RFI Design Consulting Service:

The Hallicrafters Company, Chicago, announces the establishment of a new radio frequency interference design and consulting program aimed at manufacturers of military and commercial systems which are required to meet RFI design specifications. Thomas B. Brown, director of the electronic compatibility laboratories is in charge of the program.

Instrumentation for Radio Interference Measurements:

Under the above title an article appeared in Electronic Industries, March 1961, by Fred Haber and Ralph M. Showers of the University of Pennsylvania. The sub-title states:

"Interference instrumentation is divided, generally, into two

agories - those for field survey use and those used by researchers studying the detailed properties of the noise. Instruments for these uses are discussed and described along with information about commercially available instruments."

Signaling RFI-Free Communication Systems:

I. Maslotti and M. Engelson of the Polarad Electronics Corporation, Long Island City 1, New York, authored an article in the May 1961 issue of Electronic Industries under the above title. The sub-title states:

"There are three phases to the RFI reduction program in communications systems - prediction, design, and measurement. Equipment must be designed for a minimum of predicted interference and then tested to insure reaching this goal. Here the / is shown for achieving these steps."

Radiation Susceptibility Nomograph:

Fred Kugler and Albert R. Kall, of Ark Electronics Corporation, Willow Grove, Pa., have published a 3-page nomograph under the above title in Electronics, October 13, 1961. The first graph states:

"This Nomograph determines interference-susceptibility in complex electronic systems. Its use is demonstrated in a problem which a high-power pulsed radar and a receiving system are used near each other. The receiver is in a shielded building. The problem is: will the net radar field incident upon the receiving circuit exceed the threshold levels at which the latter will function?"

Technical Wire Products Adds to Staff:

Walter M. Breindel, formerly associated with Battelle Memorial Institute in Columbus, Ohio, has joined the staff of Technical Wire Products, Inc. as an engineering salesman.

Annual Radar Symposium:

The 8th Annual Radar Symposium, 5-8 June 1962, at the University of Michigan, Ann Arbor, Michigan, has sent out a call for papers. Further information may be obtained from Henry A. Biele, at 663-1511, Extension 313W, Ann Arbor (Area Code 313).

Re FCC Interference Cases:

"Interference was reported to electroencephalographs (instruments used to record brain waves) at veterans hospitals. A Chicago instrument was picking up programs of a local FM station. Inspection showed that the station was not at fault. The medical instrument was capable of acting as a radio receiver. Shielding it gave a truer picture of the patients' brain waves. FCC engineers also showed a Boston hospital how the same type of instrument was affected by a diathermy machine used in its clinic, for which the local FCC office received a letter of appreciation."

"'Rough Noise' on broadcast reception sent Arizona monitoring station engineers on a turkey hunt. The complainant used a neighbor, an amateur operator. However, the latter's hamster was in the repair shop. So the FCC investigators next visited an electrical plant. Here there was plenty of noise but no critical disturbance. So the searchers moved on to another possible source - a turkey farm. There they found a loose power line connection to a large pump. The electric power company made quick work of it."

Clear Blasts and Unreliability:

An article under the above title by John E. Hickey, Jr., Associate Editor, Electronic Industries, appeared in the December 1 issue of that publication. The sub-title states:

"Electronic equipment and systems can be affected by nuclear radiation pulses at a long distance from a blast area. While such pulses may not permanently disable the equipment, they do

cause a temporary 'failure'. Pulses can make a missile head for the wrong target, disrupt vital communications or upset a process control computer."

A Highly Versatile Corrector of Distortion and Impulse Noise:

A paper was delivered by Earl D. Gibson of ACF Industries, Inc., Riverdale, Maryland, under the above title at the National Electronics Conference, 1961, and appears in Volume 17 of the Proceedings of the Conference. Copies of this paper may be had by writing to J. A. Kersey, Product Line Manager, Data Transmission, ACF Industries, Inc., Riverdale, Maryland, and asking for Report No. 9201, Volume 3. The first three paragraphs of the Introduction are as follows:

"In high speed data transmission systems, the distortion remaining after conventional equalization is often sufficiently large to cause serious consequences, especially when combined with noise and various equipment imperfections. Impulse noise is widely recognized as the most troublesome source of interference in many data transmission systems. In the approach described in this paper, highly accurate and flexible distortion correction plus a large reduction in the effects of impulse noise are achieved."

"This approach utilizes a 'scrambler' (or predistorter) at the transmitting station and a 'descrambler' at the receiving station. The 'scrambler' consists of an adjustable device called the ISIC (Inter-Symbol Interference Corrector) and a fixed, 'smear' filter. The descrambler consists of another ISIC and a 'de-smear' filter. The use of a clipping circuit to clip the high noise pulses just above the signal level is also under investigation."

"For distortion compensation only, one ISIC alone is used. It is not completely necessary to use both a fixed and a variable predistorter for the impulse noise correction, but, as explained below, there are some important advantages of using both, especially in an experimental setup. A considerable savings in equipment is achieved by combining the distortion and impulse noise correction."

Determining Reliability by Measuring RF Noise:

More and more attention seems to be focused on how reliability of electrical components can be determined by measuring the amount of electrical noise they generate. Two articles have appeared in Electronic News by Leon Tolopko as follows:

"Corning Unit Utilizing Noise Tests to Insure Reliability of Resistors" - December 18, 1961 issue.

"Component Reliability Linked to Amount of Noise Produced" - September 25, 1961

Other literature on this subject is:

"Predicting DC Stability of Zener Diodes from Noise Measured at 1KC" - by Alan P. Stansbury, Chief Engineer, Quan-Tech Laboratories, Inc., Western Electronic News, July, 1961.

"A Practical Approach to Transistor Noise" - Published by Quan-Tech Laboratories, Inc., Boonton, New Jersey

Quan-Tech Laboratories manufactures electrical-noise instrumentation and information on this equipment and on its application may be had by requesting "Component Noise Files".

The Corning article and the article in Electronics, November 10, 1961, titled "Noise-Performance in Thin Oxide

Resistors" were written from a paper given by J. G. Curtis, Sr. Applications Engineer, Corning Glass Works, Electronic Components Department, Bradford, Pennsylvania, before the October 5, 1961, meeting of the Metropolitan Area Chapter of the Professional Group on Component Parts in New York City. Copies of the original paper titled "Using Resistor Current Noise As a Quality Indicator" may be obtained from Mr. Curtis.

Mentioned on page 4 of Newsletter No. 19.

ELECTRONIC DESIGN, JANUARY 4, 1962, ITEMS OF INTEREST IN:

DOD's Electromagnetic Compatibility Program

A 2-column discussion of the above Program and some of the answers to designer's questions which will come from the Electromagnetic Compatibility Analysis Center, Annapolis, Maryland, starts on page 35.

Slip-Ring Contacts in RF Noise

An article titled "For Reliable Slip-Ring Contacts, Specify Surface Finish, Brush Pressure" by Benjamin Sachs, Paratron Division, USECO, Inc., Mt. Vernon, New York, starts on page 44. A section, particularly of interest from an interference standpoint, is headed "Poor Contact Causes Open Circuits, RF Noise".

Poor brush-to-collector ring contact resistance in precision rotating components such as synchros and resolvers causes open circuits, rf noise, electrical error and high null voltages. Two difficulties result from incorrect brush pressure: if the pressure is too low, vibration and shock will cause discontinuities in the circuit; if too high, increased wear of the brushes and slip rings will substantially reduce component life. (In some cases the additional mechanical friction also will be objectionable).

The consequences of poor surface finishes are relatively large variations in contact resistances and the attendant lowering of the units' signal-to-noise ratios. It has been found that both radiated and conducted noise in the rf spectrum are a function of contact resistance and each time the brush contact varies (if the brush 'bounces', for example) a random noise burst is generated which can approach the magnitude of the signal.

Resistance unbalance in stator windings of synchros can be the cause of electrical error and high null voltages; where the brushes are in the stator circuit, variations of contact resistance will contribute to these errors."

Applying Shielded Cables to Reduce Interference

A 2-page article by Arnold L. Albin, Filtron Co., Inc., Flushing, N. Y., under the above title starts on page 48. It contains 7 drawings and 2 photographs. The first paragraphs state:

"Audio crosstalk and interference coupling in electronic equipment can be reduced considerably if the interconnecting cabling is carefully selected and routed. The types of 'cables' that are available to the designer include:

- (1) Unshielded wire
- (2) Shielded wire
- (3) Coaxial cable
- (4) Twisted pair
- (5) Shielded twisted pair

"Shielded cables are available with either single or double shields. The choice of cable is dictated by the operating signal or power level, equipment-frequency range, susceptibility level and physical isolation.

"While it is not feasible to set specific rules for cable selection without making an analysis of signal levels and waveforms, certain general rules can be suggested."

Copies of this article may be obtained from Mr. Albin.

Pulse-Shape Discriminator Separates Signal From Noise

In the "Ideas for Design" Section, starting on page 96, is a 1-column discussion on the above subject by Peter M. Schmitz, Jr., Design Engineer, Dept. of Defense, Riverdale, Maryland. The first paragraph states:

"In a non-saturating magnetic core matrix, we had to discriminate between legitimate pulses. Fig. 1a, and noise pulses, fig. 1b, on the sense lines. The circuit we designed, Fig. 2, insured reliable equipment operation with an S/N ratio less than 1."

ARTICLES OF INTEREST IN ELECTRONIC DESIGN, JAN. 18, 1962:

How to Rapidly Calculate Sensitivity and Noise Figure of RF Sections

On page 40, under the above title, is an article by L. A. Weldon, Philco Corp., Lansdale Div., Lansdale, Pa. The sub-title states:

"A simple technique for converting rf sensitivity to noise figure values by graphical means. Two typical problems, involving multi-stage circuitry, are solved to illustrate the application possibilities."

How to Specify and Test Filters

On page 44 is an article, under the above title, by Lewis Burnell and Research Staff, Burnell & Co., Inc., Pelham, N. Y. The sub-title states:

"Requirements for filters and networks used in today's complex electronic systems have become increasingly more difficult to meet. Specifying and testing a filter is a process that can be accomplished in an orderly manner. The information needed for good filter design, the tests to be performed and practical design limitations are described."

Low Noise Vital to Ground Stations

On page 170 is an article under the above title. The first paragraph states:

"How sensitive must a ground antenna be for communication satellites? Telstar designers, working with a low-power, wide-band signal are not taking any chances. The maser-equipped 67-ft-diam parabolic horn going up at Andover, Me., will have a noise temperature of only 50 K."

Japanese Eliminate Rain and Snow Interference in X Band Radar:

Electronics, December 22, 1961, page 18, carries a two-column article on a Japanese method which reports successful elimination of rain and snow interference and sea clutter in X band radar by the use of circular polarization and logarithmic sensitivity receivers. This article is headed "Radar Tells Wood from Steel".

Noise Aspects of Low-Frequency Solid-State Circuits:

This paper by Prof. A. van der Ziel, of the University of Minnesota, was mentioned on page 6 of Newsletter No. 19. It will be published in the March issue of Solid State Design.

Weather "Eye" Splits Lightning Discharges:

Research/Development, January 1962, on page 19, contains a 1-page write-up, under the above title, of fundamental information about the nature of lightning discharges being gathered by a group working under Drs. E. J. Workman and Marx Brook at the New Mexico Institute of Mining and Technology, (NMIMT), Socorro, New Mexico. The third paragraph is as follows:

"Lightning research to date has uncovered the following general picture of a single lightning discharge. Each single discharge, as they are commonly called, actually consists of a number of individual discharges following the same ionized channel or path. The cloud-to-ground discharge can be typically described in this way: The discharge is initiated by a so-called 'stepped' leader stroke which lasts, on the average, about 0.010 sec. and emits only a faint amount of radiation. The leader is followed by a number of 'return' strokes which are separated by about 0.040 sec., each one lasting between 60 and 100 millionths of a second. There may be as many as ten to twenty strokes during each discharge."

Countering the Effects of Decreasing Solar Activity:

LCDR E. I. Finke, U.S.N., Office of Chief of Naval Operations, Washington, D. C., delivered a paper on the above subject at the 1962 National Winter Convention on Military Electronics, Los Angeles California. The conclusions state:

"The approaching period of low solar activity limits the use of the high-frequency spectrum by reducing the band of usable frequencies. This forces long-distance communications operations, particularly at night, into the lower portion of the high-frequency spectrum--a portion already occupied by many short distance users.

"In order to provide more accurate long lead-time propagation predictions, it will be necessary to identify objective indices of solar-geophysical parameters affecting ionospheric propagation and correlate these indices with optimum frequency. These objective indices will also be useful in forecasting disturbed propagation conditions.

"Techniques of ionospheric mapping and computer frequency prediction determination provide the basis for improved world-wide propagation predictions.

"The operational application of backscatter and oblique ionospheric sounding techniques will provide timely propagation data by instantaneous indications of optimum frequencies.

"Frequency control centers are envisioned which will provide best frequency selection through the automatic correlation of communications requirements, equipment characteristics, radio wave propagation information, geographic coordinates and frequency assignment factors.

"The military services have established progressive programs for improvements in propagation prediction, ionospheric disturbance forecasting and frequency control. Active pursuit of these programs will enable operating units to obtain more effective high-frequency spectrum utilization in the face of increasing spectrum congestion, ionospheric disturbances and low solar activity."

ITEMS OF INTEREST IN FEBRUARY, 1962, ISSUE OF PROCEEDINGS OF THE IRE

Origin of Noise in a Ferromagnetic Parametric Amplifier

On page 208, under the above title, R. T. Denton and W. B. Snow, Bell Telephone Laboratories, Inc., Murray Hill, N. J., have written a letter, the first paragraph of which is:

"Measurements on a ferromagnetic amplifier which have been reported elsewhere indicated a surprisingly high noise figure for the amplifier. The results were surprising because it had been commonly assumed that the ferromagnetic amplifier would share the low noise figure characteristic of most other parametric amplifiers. Further measurements on the amplifier are reported here which indicate that the noise is not thermal in origin."

On Cyclotron-Wave Noise Reduction

On page 227, under the above title, P. A. H. Hart, Philips Research Labs., N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands, has written a letter. A part of the first paragraph is as follows:

"Fast-wave beam noise must be low in Adler tubes to facilitate tuning. Brillouin beams have a high space-charge density and a fairly uniform axial electron velocity. Hence a large amplification and a low re-introduction of noise can be obtained. Unfortunately, the jump in the magnetic field (Fig. 1) increases the noise temperature. However, our experiment shows that this noise can be reduced without impairing the gun performance seriously."

RFI Shielding - Explained by Analogy:

Electronic Packaging and Production, January/February, 1962, carries an article under the above title by O. P. Schreiber, Vice-President, Technical Wire Products, Cranford, N. J. The first paragraph states:

"The problems of radio frequency interference (RFI) often fall to the package designer whose electrical or electronic background is limited. Although the principles of RF shielding involve concepts familiar to the mechanical or packaging engineer, the technical language used in it is largely electrical and communication is difficult. This article attempts to explain by analogy some of the principles of radio frequency interference and its control, without recourse to terms which may be unfamiliar to the nonelectrical engineer."

Hallcrafters Publishes RFI Booklet:

The Hallcrafters Company, 5th and Kostner Avenues, Chicago 24, Illinois, has published a 12-page booklet on the Analysis and Control of Radio Frequency Interference called "The RFI Story". It is a simply expressed description of what RFI is, and does, with many illustrations and drawings. It would make an excellent introduction to the subject for those who have had no previous knowledge of what RFI is and can do and the steps necessary to control it. Copies may be obtained from Mr. L. B. Alden.

Sprague to Investigate Sugar Grove Drive System:

Signal, February 1962, carried the following news item:

"Radio and Radar Interference Problems associated with the electrical drive system for the radio-telescope being erected at Sugar Grove, W. Va., will be investigated by Sprague Electric Co. Since the 600-foot diameter radio-telescope will be an extremely sensitive antenna when the construction is completed, spurious signals emanating from electrical equipment which turns the antenna and controls it and from all other electrical and electronic equipment in nearby areas must be controlled to the lowest levels ever specified, Sprague officials report."

RFI and Isolation Transformers:

Instruments and Control Systems, December 1961, page 2250, carries a 4-page article titled "Ultra-Isolation Transformers" by Robert C. McLoughlin, Topaz Transformer Products, Inc., 7460 Girard Avenue, La Jolla, California. The sub-title and first two paragraphs are as follows:

"Noise can jump across isolation transformers to disturb high-gain amplifiers and sensitive instruments unless special shielding techniques are used.

"Isolation transformers isolate one circuit from another

while magnetically coupling wanted energy from the one to the other. The familiar ordinary isolation transformer is shown in Fig. 1.

"Such a transformer is adequate for use with low-gain circuits or insensitive instruments. However, if the transformer must work into a high-gain load, noise in the primary circuit must be prevented from reaching the secondary because it will be amplified by the high-gain circuit. Special shielding techniques are required to prevent noise in the primary from reaching the secondary via interwinding capacitance and leakage resistance when the transformer load is a high-gain amplifier or a sensitive instrument."

Noisemanship:

Richard B. Adler, Department of Electrical Engineering, M.I.T., will be Moderator in connection with the informal discussion/WES on Noisemanship for the 1962 International Solid State Circuits Conference to be held at the University of Pennsylvania, Philadelphia, Pa., February 14, 15, 16, 1962. A short write-up of the subjects to be discussed by panel members is as follows:

The appearance of new devices such as masers, tunnel diodes and varactors has raised questions about the appropriate description of the noise performance of amplifiers in which the output impedance or the source impedance may have a negative real part. The classical definition of Noise Figure does not apply directly to such cases. Some modifications or extensions of the meaning of some of the terms used in that definition are necessary.

"One method recently used to circumvent the difficulties has involved the idea of introducing 'noise from the load' and 'transducer gain' into the Noise Figure definition.

"Another proposal suggests the use of 'exchangeable power' in place of 'available power' to take care of all cases.

Finally, a third possibility involves simply the presentation of the small-signal circuit model of the device in question, including the necessary noise generators, without making any attempt at all to specify a single number like Noise Figure for it.

The Panel will consider these proposals, present the current thinking of the IRE Sub-Committee on Noise, insofar as it relates to the particular matters involved, and try to highlight in general, and in terms of specific examples, the advantages and limitations of each of the procedures suggested above."

Space Communications and Cooperation with Iron Curtain Countries

Under the above title appeared an article by Andrew G. Haley, General Counsel, American Rocket Society, in the December, 1961, issue of SIGNAL. Two paragraphs of especial interest are:

"A significant factor in Soviet policy evaluations may be the favorable geography of the Soviet Union, which makes international cooperation less necessary for the Soviets than for the United States. As Edward Wenk points out in the Senate Space Committee print, Radio Frequency Control in Space Telecommunications, 'The great land mass of the USSR and the exercise of rigid internal discipline over emissions within its borders permits the Soviets to control use of the airwaves and thus to prevent harmful interference over a much greater portion of a satellite traverse than is possible within the more compact boundaries of the United States. That is, orbiting satellites are simply over Russian territory a longer time than over the United States. Both data-reception centers and tracking stations can be more widely separated than is possible in our country. Thus, through domestic control over spectrum use, the Soviets can be relatively well assured

of freedom from interference, at least in certain bands.'

Mr. Wenk adds that the network of Minitrack stations established by the United States by treaty with countries throughout the world is subject to severe though unintentional interference from domestic stations in these friendly countries. The greater geographical coverage of the non-Communist world may be more than compensated for by the quality of tracking in the Soviet Union."

Low-Pass Filter Design

In the December, 1961, issue of Electrical Design News, starting on page 66, is an article by Rex B. Cline under the above title. There are four nomograms and eight schematics for different types of filters.

The Uses of the Moon

In the December, 1961, issue of Harper's Magazine, Arthur C. Clarke, Chairman of the British Interplanetary Society, has written an article on the possible future uses of the moon. Two paragraphs which are of especial interest are:

"Nor have we yet finished with the Moon's advantages from the view of those who want to send (and receive) signals across space. It turns so slowly on its axis that the problem of tracking is much simplified; and it is a quiet place. Or, to be more accurate, the far side of the Moon is a quiet place--probably the quietest that now exists within millions of miles of the Earth. I am speaking, of course, in the radio sense: for the last sixty years, our planet has been pouring an ever-increasing racket into space. This has already seriously inconvenienced the radio astronomers, whose observations can be ruined by an electric shaver a hundred miles away.

"But the land first glimpsed by Lunik III is beyond the reach of this electronic tumult; it is shielded from the din of Earth by two thousand miles of solid rock--a far better protection than a million miles of empty space. Here, where the earthlight never shines, will be the communications centers of the future, linking together with radio and light beams all the inhabited planets. And one day, perhaps, they will reach out beyond the solar system to make contact with those other intelligences for whom the first search has already begun. That search can hardly hope for success until we have succeeded in escaping from the braying of all the radio and TV stations of our own planet."

On a Mathematical Description of Noisy Measurement System Performance:

Page 1701 of the November, 1961, issue of the Proceedings of the IRE, J. L. Hammond, Jr., Georgia Institute of Technology, has a letter under the above title. The first two paragraphs are as follows:

"There are many practical measurement systems for which internal noise is the factor which limits the quality of system performance. Such systems, which might be termed noisy measurement systems, have many features in common with the type of random experiments which have been the subject of much discussion in the literature of mathematical statistics. In spite of the available mathematical work, quantitative expressions for the performance of noisy measurement systems do not seem to be commonly used in the engineering literature.

"The purposes of this note are: 1) to call attention to the precise definitions of two statistical parameters which can be used as measures of the performance of certain noisy measurement systems; and 2) to formulate quantitative expressions for measurement-system performance in terms of these quantities."

Humans Hear Transmitted R-F Pulses:

Electronics of November 3rd, 1961, carries an article under the above title. The first two paragraphs state:

"Experiments have established that the human auditory system can respond to electromagnetic energy at radio frequencies. The r-f energy is detected directly without requiring conversion to acoustic energy for perception.

"These findings result from a continuing series of experiments at the General Electric Advanced Electronics Center at Cornell University. They were reported at the Fourth International Conference on Medical Electronics in a paper by A. H. Frey. (See Electronics, p 41, Aug. 21.)"

Genistron Recovering from Destructive Fire:

Genistron, Inc., Los Angeles, reported on their recovery from a destructive fire in the January 29, 1962, issue of Electronic News. Their new quarters are back in the old Genistron facilities at 2301 Federal Ave., Los Angeles 64, California. Telephone No. GR8-3775. Genisco, Inc., their parent company, has set up their manufacturing facilities in other Genisco facilities.

Trouble on the Power Lines:

The Washington, D. C. Post, January 29, 1962, carried a news item under the title "Gadget Seen As Obstacle to Alarm Plans". The pertinent paragraphs are as follows:

"A household gadget is pushing the Defense Department's 'plug-in' civil defense alarms into a higher frequency and further field tests.

"The device, a silicon control rectifier, can dim lights, vary the heat level of electric stoves and do other household jobs by controlling the flow of electricity.

"Unfortunately, the device might also set off-or silence-receivers designed for the National Emergency Alarm Repeater system, a spokesman for the Office of Civil Defense reported.

"The receivers, which can be plugged into ordinary electrical outlets and activated from power stations equipped with special generators, operate on a frequency too close to that of the silicon control rectifiers, he said.

"Civil defense officials expect the rectifiers to come into widespread use in the next few years, and they want to modify the alarm receivers now to avoid any later conflicts on the power lines, the spokesman said."

FCC Issues Interesting Reports:

The Technical Research division of the Office of the Chief Engineer, Federal Communications Commission, has issued a report, TR-6104, "Control of Radio Frequency Interference from Non-Licensed Apparatus."

It covers incidental and restricted radiation devices; industrial scientific and medical equipment; methods of control of harmful interference; the problem of measurement of radiation to insure compliance; and a list of industry and professional committees and organizations active in frequency interference control.

Another report, TR-6103, gives a listing of reports of the division for the period from Aug. 1, 1946 through July 1, 1961.

Recent Papers Are Available:

The following papers may be obtained from A. L. Albin, Technical Director, Filtron Co., Inc. 131-15 Fowler Ave., Flushing 35, New York:

"An Integrated Approach to Bonding, Grounding, and Cable Selection" by I. M. Newman and A. L. Albin

"The Role of Systems Management in Interference Control" by A. L. Albin

Article on Shielded Rooms:

The Architectural Record, September, 1961, carried a 2-page article titled: "Shielded Rooms for Electronic Equipment" by C. C. Borden, Vice-President, Ace Engineering & Machine Co., Huntington Valley, Pennsylvania. The subtitle states:

"Electronic equipment in hospitals, military installations and industry whose operation is disturbed by extraneous electronic waves is being shielded by panelized enclosures covered with wire screen or metal sheets. Special techniques are required to insure complete efficacy of the installation."

A copy of this article may be obtained by writing to Mr. C. C. Borden.

Spectrum Signatures and RFI Predictions:

A. H. Sullivan, Jr. and H. D. Zink, of Frederick Research Corporation, Wheaton, Maryland, have prepared a 32-page paper with the above title. Section headings are

- I. Compatibility in Military Electronic Systems.
- II. Spectrum Signature Requirements.
- III. Theoretical and Practical Problems in Obtaining Spectrum Signatures.
- IV. Considerations in RFI Prediction.
- V. RFI Prediction Procedures
- VI. Future Approaches to Spectrum Signature Measurements and RFI Prediction.

Copies of this paper may be obtained from Mr. A. H. Sullivan, Jr.

Anti "Chase-me-Charlies":

From the book "Walker R. N." by Terence Robertson, Pan Books Ltd: London, 1958, on page 135 is the following paragraph:

"Against the 'Chase-me-Charlies' there was no defense until, one day in the Bay, an escort was attacked by an aircraft which launched its 'glider bomb' just as a scientist aboard switched on his electric razor to test out a theory. To the amazement of the ship and the enemy aircraft, the new weapon gyrated about the sky in a fantastic exhibition of acrobatics, finally giving chase to its own 'parent'. In some inexplicable way, the 'Chase-me-Charlie' control system had been affected by electric waves given off by the razor. This method was never officially admitted by the Admiralty as a defense measure, but the ships which sailed into the 'Chase-me-Charlie' areas found it foolproof. In Liverpool there was a sudden run on shops selling all makes of electric razors."

How to Make Reliable Welds:

On page 116 in Electronics, January 5, 1962, is a 2-page article with 13 illustrations, under the above title, by E. J. Messner, Raytheon Company, Newton, Massachusetts. The last paragraph states:

"Welded joints have already achieved a mean-time-before-failure of over 500,000,000 hours on one computer module made at Raytheon and it is expected that this figure can be improved substantially. The present goal for soldered connections is 20,000,000 hours mtbf; a projected future goal for soldered connections is 100,000,000 hours mtbf.

Electromagnetic Shielding with Coke:

In PGRFI Newsletter No. 13, page 6, mention was made of the Interim Report, NRL (Naval Research Laboratory) Report No. 5473 which covered the study of coke aggregate concrete as a shield to electromagnetic radiation.

A subsequent report has been made by P. F. Nicholson, Radio Physics Branch, titled "Electromagnetic Shielding with Coke" and is NRL Memorandum Report 1080. A copy may be obtained by writing to Mr. Nicholson, Radio Physics Branch, U. S. Naval Research Laboratory, Washington 25, D. C. A paragraph from the "Final Comments" is as follows:

"Initial investigations have led us to the conclusion that coke has excellent shielding properties. With a certain amount of care, a blanket of coke can be made to completely envelop a small structure. This blanket will remain in place with retaining walls, etc. However, as we move to full scale structures which must be constructed and shielded to last for several years, more sophisticated retainers, including facilities for drainage, need be employed. Cost and labor involved may rise to a degree that may rival the more orthodox methods for shielding. It is expected that this will not be the case, but nevertheless, account should be taken of these factors before a decision for employment of coke shielding."

Designing for Electromagnetic Compatibility:

The December, 1961, issue of Space/Aeronautics carries a 7-page article under the above title by Samuel Burrano, Burrano Associates, Inc., 51 Sullivan St., Westwood, New Jersey. The article contains a comparison between Specifications Mil-I-6181D, Mil-I-16910A, Mil-I-11748B, a Table of RFI Sources, a Table of Receiver Interference Characteristics, Charts for Attenuation Losses for Copper and Iron Shielding, Attenuation (DB per Inch of Length) for different sizes of Wave Guides, Impedance advantage of a 5 1/2 x 1 x 1/16-in. Beryllium copper bonding strap over an eight-inch length of No. 12 wire, and Cable Coupling for various methods and lengths of shield termination at a signal generator output of 2. IV.

A Practical Approach to R-F Shielded Enclosure Design:

The paper presented by Jerry W. Kenny and Barton L. Conard, of Ace Engineering & Machine Company, Inc., at the 7th Armour Conference has been printed up for distribution. Copies may be obtained by writing to Ace Engineering and Machine Company, Inc., Tomlinson Road, Huntingdon Valley, Pennsylvania.

Filtron Shielding Report Reprinted:

The paper given by William Jarva of the Filtron Co., Inc. before the 7th Armour Conference has been reprinted for distribution. The title is:

"Shielding Efficiency Calculation Methods for Screening, Waveguide Ventilation Panels, and other Perforated Electromagnetic Shields"

Copies may be obtained from the Systems Engineering Division, Filtron Company, Inc., 131-15 Fowler Ave., Flushing 55, New York.

Signal Corps Offers Interference Tests:

The Army Signal Research and Development Laboratory Field Station No. 1 at Milwaukee will receive requests for road band radio interference reduction investigations relating to the design and test of broad band radio interference reduction systems required on interference-producing equipment used by the Army. This includes vehicles and vehicular subassemblies, engine generators and miscellaneous engine driven equipment, certain electrical and electronic equipment, railway rolling stock and maintenance of way equipment and watercraft.

Requests for investigations should be addressed to the Commanding Officer-USASRD Field Station No. 1, P. O. Box 6262, Milwaukee 9.

NEW BOOKS:

Handbook on Radio Frequency Interference

Volume 1 of Handbook on Radio Frequency Interference will be available in several weeks. The pre-publication price for the set of 4 is \$60.00 per set. Pre-publication prices of the individual Volumes are:

Volume 1 Fundamentals of Electromagnetic Interference	\$14.50
Volume 2 Electromagnetic Interference Prediction and Measurement	\$16.50
Volume 3 Methods of Electromagnetic Interference - Free Design and Interference Suppression	\$16.50
Volume 4 Utilization of the Electromagnetic Spectrum	\$12.50
After March 15, 1962, the price for the set will be \$80.00	

NEW PRODUCTS:

Four Packaged Microwave Preselectors Introduced:

Empire Devices, Inc., Amsterdam, New York, is introducing four packaged tunable microwave preselector filters for frequency ranges between 850 and 10,000 megacycles. They permit separation of wanted signals from high amplitude interference for receivers or measuring instruments whose own selectivity is inadequate for the purpose. They are designed for use in laboratories, as instrument accessories, as well as for screen room and field applications. The four standard units cover the frequency ranges of 850-2, 100 MC; 2,000-4,000 MC; 3,900-7,200 MC and 7,000-10,000 MC. Other ranges can be furnished to meet special requirements.

New Impact Noise Analyzer:

The General Radio Company, West Concord, Massachusetts, announces a new Impact Noise Analyzer for measuring both electrical and acoustical noise peaks. It is designed to check private wire circuits to and from computers and other business machines and to evaluate telephone-line noise to permit better rating of a line for its adequacies in its application.

Electrically Conductive Cloth:

Swift Textile Metalizing and Laminating Corporation, 10 Love Lane, Hartford 1, Connecticut, is making electrically conductive cloth of nylon, metalized with silver. These materials have a resistance of ten ohms or less per square with resistances running generally two or three ohms. They are claimed to provide shielding at high or very high frequencies.

New RF Filters Without Access Covers:

RF Interonics, Inc., 15 Neil Court, Oceanside, L. I., New York, announces a line of shielded room filters which includes wave guide fittings as an integral part of the filter, thus doing away with removable covers which can be a source of RF leakage. All seams are welded instead of soldered.

New Conductive Plastic Systems:

Chomerics, Inc., 341 Vassar St. Cambridge, Mass. has developed a new type of conductive filler which equals the performance of silver filled plastics but at a claimed materially reduced cost. Besides being used for forming electrical junctions as a replacement for metal soldering, these systems can be used as casting compounds to form

shapes amendable to electroplating, as joint adhesives for grounded aluminum structures, in microwave guide assemblies, as a molding resin to form conductive bushings, and in many other new applications for which the silver filled plastics are unsuitable because of their expense.

Technical Wire Products Adds to Its Products:

Technical Wire Products, Inc., 129 Dermody St., Cranford, N. J., has brought out two new products; TECKSTIK and TECKCELL. TECKSTIK is an adhesive-backed RFI gasket and fluid seal, details of which can be obtained by asking for Preliminary Data Sheet RF-15. TECKCELL is a honeycomb structure which has been manufactured in combination with a shielding gasket to provide the designer with a ready-to-install shielded panel. Further details may be obtained by writing for Preliminary Data Sheet RF-16.

Empire Extends RFI Measurements to 15 KMC:

The frequency range of Noise and Field Intensity Meter NF-112, manufactured by Empire Devices, Inc., of Amsterdam, N. Y. has been extended to 15,000 MC with the addition of new plug-in tuner Model T-5/NF-112.

New Slip Ring Contacts to Reduce RFI:

Stackpole Carbon Company, St. Marys, Pa., has produced several new electrographitic and silver graphite contact grades to offer significant reductions in noise levels operated against silver, gold, or electrographitic rings. The more uniform current conduction realized by this type material reduces the random type noise voltage generation with little or no sacrifice in other important characteristics such as life and ring wear.

New Conductive Vinyl Compound:

Apex Tire & Rubber Company, Pawtucket, R. I., announces the development of a semi-rigid vinyl compound with electrical conductive and anti-static properties. It is called APEX 750. Volume resistivity is claimed to be 5 Ohm-cms.

New Radio Interference Measurement Meter:

A transistorized radio interference measurement meter has been developed by the Interference Testing and Research Laboratory, Inc. (Intrelab), covering the frequency interval from 150 Kc to 400 Mc using 8 bands in two heads. It measures Field Intensity, Quasi-Peak and Peak magnitudes of detected signals, and is calibrated by means of an internal impulse generator in terms of peak signal. The meter can detect the presence of all types of signals, ranging from sine wave to impulse type and any complex variation thereof. It is capable of measuring radiated signals and can be used as a two terminal microvoltmeter with a 50 ohm input over the entire frequency range.

This newly developed unit was designed to be compact and have as few controls as possible, thus making it easy for untrained personnel to make maximum use of the equipment in making measurements of the presence of RFI. The direct reading peak circuit permits the operator to scan the frequency range and determine the frequency at which the highest level of peak energy occurs.

Further information may be obtained by writing to INTRELAB, 150 Causeway Street, Boston 14, Massachusetts.

FOURTH PGRFI NATIONAL SYMPOSIUM:

The 4th PGRFI National Symposium, as previously reported, will be held June 28 and 29, 1962 in San Francisco. Paper summaries, 500 words in length, have been invited. They should be received by the Technical Program Chairman by March 2, 1962.

Those persons, who would have contributions to make in the areas listed below are particularly urged to submit a summary.

- a. Progress in the field of microwave power sources free of

unwanted frequencies and harmonies.

- b. Methods of increasing channel capacity within the present spectrum.
- c. Reducing interference by means of receiver-to-transmitter feedback of radiated power requirements.
- d. Co-channel communication techniques.
- e. Measurement of spurious emissions from high-power microwave sources.
- f. Aerospace vehicle design for minimizing RFI.

The emphasis, this year, will be on design. Papers that focus attention on other areas within the field, however, will be given careful consideration. At least one session will be devoted to subjects of this type. Paper summaries should be sent to:

R. G. Davis
Technical Program Chairman
Department 58-24
Lockheed Missiles & Space Co.
Post Office Box 504
Sunnyvale, California

Note:

PGRFI and PGMIL are, this year, privileged to put on one of the most important Sessions in the history of electronics. It will be looked upon, I am sure, as one of the mile-stones in electronic development and, therefore, should not be missed by a single member of both PGRFI and PGMIL. As it will probably be hard to try and go back and tell management what went on, every member should try to get his management to attend also. Frederick R. Lack accepted the job of Moderator only on condition that he would have a free hand to dig out the answers to many questions which have arisen concerning the DOD Program. Pass the word on and bring your friends.

Rexford Daniels, Editor
PGRFI Newsletter
Monument Street
Concord, Mass.