



PROFESSIONAL
GROUP ON
RADIO
FREQUENCY
INTERFERENCE

NEWSLETTER

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OCTOBER 1961

MESSAGE FROM THE CHAIRMAN

This issue of the PGRFI Newsletter contains some remarks by various committee chairmen concerning their activities. Your Chairman can therefore confine himself to brief comments of a general nature.

Two meetings of Professional Group Chairmen have been held during the summer, one in New York, and one in San Francisco, at which certain topics dealing with Professional Group activities and problems were reviewed. These topics included meeting proliferation, advertising in the Transactions, possible combinations of Professional Groups, etc.. In most cases no final solutions were forthcoming, but healthy discussions were held and various opinions expressed. In the absence of your Chairman, Mr. Peter Spencer, Chairman of the San Francisco Chapter, ably represented the PGRFI at the West Coast meeting.

The Armour Conference is the next event of major interest to be PGRFI and is discussed in some detail elsewhere in this Newsletter. A meeting of the Administrative Committee will be held during the conference at a time and place to be announced later.

Plans are already under way for the Technical Sessions to be held during the 1962 IRE Convention. PGRFI has tentative arrangements for one session to be held on Wednesday morning in the Main Ballroom. Since next year is the 50th Anniversary of the IRE, it is planned that all sessions will be of high caliber and chaired by IRE Fellows. Additional information will be made available as plans materialize. Mr. Warren Kesselman has been appointed as Sessions Organizer for the PGRFI.

Although the PGRFI is one of the younger and smaller of the Professional Groups, your Chairman is convinced that our Newsletter is one of the most interesting and informative among those issued by the various Groups. While the credit for this goes largely to its Editor, it requires the enthusiastic support of the membership. If you appreciate hearing about the activities of others, let others hear from you.

The Administrative Committee welcomes suggestions on improving our activities. Although we are growing, we must continually look to the future. Your support is solicited.

Harold E. Dinger

REPORT OF CHAIRMAN OF MEMBERSHIP COMMITTEE:

The PGRFI has grown from a small group of engineers to its present membership of over 1000 in a period of about 4 years. This growth reflects the desire of many of you, who are working in radio interference, to learn more about this subject in order to enable you to do a better job in predicting or controlling interference. We need a large

contributing membership to make it possible to issue more than one Transactions per year. I am sure there are many engineers working or interested in radio interference, in many corners of the globe, who would be glad to join our forces to contribute to our Transactions, our Symposiums and Conferences. If each of us will interest just one of our associates, not now a member, and persuade him to join PGRFI, we would double our membership and all would benefit from the added information which would flow into our Group.

REPORT OF CHAIRMAN OF AWARDS COMMITTEE:

The function of the Awards Committee is: (1) to nominate worthy PGRFI members for established IRE awards and (2) to establish awards for PGRFI.

The committee has taken action in making a nomination for the Browder J. Thompson Memorial Prize Award. This has just gone in to headquarters.

We have not yet formulated a plan for a PGRFI award but we feel that this is the right time and that PGRFI has now developed to the stage where this should be accomplished this year. Consequently, we would welcome suggestions, from the membership, as to the type of honor or award, nominations of individuals for a PGRFI award, and nominations of PGRFI members for IRE awards and honors.

REPORT OF CHAIRMAN OF TECHNICAL PAPERS COMMITTEE:

A. H. Sullivan, Jr. reports that the committee is interested in papers of many types and members of PGRFI should contact the Chairman at 515 Dorchester House, 2480 16th St., N.W., Washington 9, if they have a paper or an idea for a paper which they feel would be of interest to the members of the Group. The choice of papers will depend entirely upon interest of the papers to the members of PGRFI, regardless of whether this interest is theoretical, mathematical, experimental, or engineering application. Several persons have suggested that, even if a paper were previously published in another medium, not readily available to the average PGRFI member, it still might be a good idea to publish it in the PGRFI Transactions. It may be difficult to decide what is, or is not, considered available but each could be considered on its own merit.

REPORT OF CHAIRMAN OF LIAISON COMMITTEE:

R. M. Showers, Chairman of the Liaison Committee, reports as follows:

The Liaison Committee recommends: "to the Administrative Committee groups outside the IRE on which it would be desirable for this Group to be represented or have an observer present at meetings. This committee shall prepare its recommendations giving the reasons for Group participation on any outside body and recommending the duties, authority and name of the Group representative."

Active liaison is maintained through representation with ASA C63 on Radio Electrical Coordination, ASA C95, Electromagnetic Radiation Hazards Committee, the IRE Committee on Radio Frequency Interference (27), and the Electronic Industries Association

Committee M5.8 on Radio Frequency Interference. In addition, there has been active cooperation between PGRFI and the Society of Plastics Industries, which has a strong interest in interference.

REPORT OF CHAIRMAN OF CHAPTER ACTIVITIES COMMITTEE:

Increased PGRFI Chapter activity for the current year is indicated with new chapters being formed in New York City - Long Island - Northern New Jersey and Los Angeles.

Formation of NYC-LI-NNJ Chapter was approved by IRE Executive Committee action on September 12th after extended effort by Harold Schwenk and with the assistance of Paul Schreiber. Robert Safir, Professional Group Coordinator for the NYC Section was also instrumental in the advice and liaison necessary for the formation of this chapter.

Following the preliminary efforts of Al Parker, Fred Nichols, Andy Devot and Ray Meyers, John Eckert of Norair (Hawthorne) has organized the Los Angeles Chapter for this Group. Professional Group and IRE headquarters approval, final steps in Chapter activation, are expected by mid-October. In addition to the above, active Chapters are now located in Chicago, Philadelphia, Rome-Utica, San Francisco and Washington, D. C. Prospective chapter formation is being surveyed in Atlanta, Baltimore and Seattle.

Report submitted by Z. V. Grobowski, Chairman Chapter Activities Committee.

FINANCIAL DISCUSSION:

The Annual Budget estimates for PGRFI financing for 1961-62 indicate that a necessary Agenda item in the November meeting of the Administrative Committee will be the decision to retain the membership fee at \$2.00 or to increase this fee to \$3.00. The latter fee appears to be appropriate if PGRFI continues the printing and circulation of Armour Proceedings to those PGRFI members who do not attend the Armour Conferences.

Any pro or con comments in regard to the above are invited from PGRFI members in advance of the November meeting. Send comments to Z. V. Grobowski, Secretary of PGRFI at 1339 Wisconsin Ave., N.W. Washington 7, D. C.

NOMINATIONS FOR PGRFI ADMINISTRATIVE COMMITTEE MEMBERSHIP

The PGRFI Nominations Committee hereby notifies the membership that nominations for the election of five (5) to the PGRFI Administrative Committee for a term of three years commencing June 30, 1962 are open. The By-Laws concerning these nominations and elections are as follows:

Article VI

- Section 1: On or before December 1 of each year all members of the Professional Group on Radio Frequency Interference shall be notified that nominations for members of the Administrative Committee are open. This shall be done either by notice in a Newsletter or by direct notification of each member by post card or letter.
- Section 2: Nominations shall be made by petition. The nominating petition for each nomination submitted shall contain at least 15 PGRFI members' signatures together with a short (not more than 100 words) biography listing the affiliation and background of the individual nominated. All nominations must be in the hands of the Nominations Committee by January 1 of each year. If the Nominations Committee receives less than 10 names (two for each vacancy) or if the Nominations Committee sees fit to make nominations in addition

to those received from the members, it shall be within the authority of the Nominations Committee to do so. Not less than 2 names for each vacancy shall be submitted by the Nominations Committee.

Section 3:

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

Please send your nominating petition by Jan. 1, 1962 for each nomination with at least 15 PGRFI members' signatures and a short (not more than 100 words) biography listing the affiliation and background of the member to:

Mr. W. E. Pakala
Ch. of Nominations Committee PGRFI
Westinghouse Electric Corporation
Research Laboratories
Pittsburgh 35, Pennsylvania

The present membership of the Administrative Committee with expiration date of membership is as follows:

Samuel J. Burruano	1964	Leonard Milton	1962*
Rexford Daniels	1962*	W. E. Pakala	1964
Harold E. Dinger	1963	Henry Randall	1964
John J. Egli	1963	Otmar P. Schreiber	1962*
Robert Fairweather	1962*	Ralph M. Showers	1964
Herman Garlan	1963	R. B. Schulz	1963
H. A. Gauper	1963	Leonard W. Thomas	1962*
Zigmund V. Grobowski	1964		

The above notice in this Newsletter complies with the requirements in Section 1 and will be the only notification for 1962 nominations which will be sent to members by the PGRFI Group.

ITEMS OF INTEREST IN PROCEEDINGS OF THE IRE, JULY, 1961:

Portable FM Radios Barred on Civil Aircraft

The following article on the above subject appears on page 28A:

"The use of portable FM radios on United States civil aircraft has been prohibited by the Federal Aviation Agency in a Special Civil Air Regulation issued recently and effective May 25, 1961. FAA said the rule was based on results of an investigation of the effect of portable electronic devices operated in aircraft, including radios, dictating machines and recorders. Only radios having oscillators operating within or very near the very high frequency band used in aircraft, 108 to 118 megacycles, affected instruments in the various aircraft on which the tests were made, the Agency said. More detailed tests will be made later in the year. The in-

interference discovered by the FAA affected the VHF radio navigation system of the aircraft, causing the appearance of the "red flag," indicating to the pilot that the navigation instrument was not working properly, FAA reported. The red flag warns the pilot not to trust the instrument, and thus prevents the instrument from giving faulty indications. In most cases of interference the flag alarm system worked satisfactorily. However, to preclude the chance that the interference might go undetected, the FAA established a rule to guide carriers and commercial operators. Pilots of other aircraft shall not permit use of such radio receivers when VOR navigating equipment is in use on their planes. The new rule, Special Civil Air Regulation SR 446, will remain in effect for one year unless superseded or rescinded by the FAA."

The Elimination of Intersymbol Interference by Input Signal Shaping

The above article by I. Gerst of Surface Communications Systems Labs., RCA, New York, N.Y. and J. Diamond of Autometric Corp., New York, N. Y., formerly of RCA, New York, N.Y. appears on page 1195. The first two paragraphs of the Introduction state:

"When a pulse, defined here as a waveform which exists in a time interval and vanishes outside the interval, is passed through a linear system, the output generally has a tail or asymptote which stretches out to infinity. This tail makes more difficult the resolution of succeeding pulses, especially in the presence, and so limits the minimum spacing which may be used between pulses. Thus any technique which reduces the tail increases the possible pulse rate, at least in a purely binary system in which only the presence or absence of a pulse conveys information, not pulse shape (leading edge, etc.).

"One possible technique is design of the system to reduce the tail. This is the transient synthesis problem and is not the approach we propose."

Noise in Beam-Type Parametric Amplifiers

Eugene I. Gordon of Bell Telephone Labs., Inc., Murray Hill, N. J. has a letter on the above on page 1208. Parts of the first two paragraphs are as follows:

"Beam-type parametric amplifiers employing separate input and output couplers or transducers are matched and unconditionally stable. The reason, as is well known, is that the beam passively loads the transducers and is capable of carrying signal power only in the direction of drift. Thus the combination of beam and properly matched lossless transducers can be thought of as a perfect isolator. The property of an isolator radiating thermal noise only in the direction of isolation is preserved, since the input transducer strips existing fast wave noise from the beam and sends it to the generator load. Ideally, no beam noise appears in the output transducer.

"The purpose of this letter is to point out that the above picture must be modified to include a small frequency-dependent forward attenuation which arises because of the finite electron temperature and size of the beam."

Noise Measure of Lossy Tunnel-Diode Amplifier Stages

A letter on the above by A. van der Ziel, Elec. Engrg. Dept. University of Minnesota, Minneapolis, Minnesota, appears on page 1211. The first paragraph states:

"The influence of losses on the noise figure of tunnel-diode amplifiers has been dealt with by several authors. Some have taken only circuit losses into account, others have included losses caused by the series resistance of the diode only. The author has included both types of losses, but his result was obtained for a series circuit,

which is not necessarily stable. Though this may not alter the results it is worthwhile to repeat the calculation for the stable parallel circuit by a slight extension of Nielsen's approach,"

A. van der Ziel also has a letter in the same issue, on page 1212, headed: "Noise Measure of Distributed Negative-Conductance Amplifiers".

Saturday Evening Post Carries Article on RFI:

Under the title "RFI: Invisible Killer" the September 30, 1961 issue of the Saturday Evening Post carries an article by Richard Haitch. The sub-title states; "Does Radio Frequency Interference - today's electronic clutter of the air-waves - cause those mysterious plane crashes, missile failures and communications blackouts?"

ARTICLES OF INTEREST IN ELECTRONIC INDUSTRIES, JULY 1961:

Noise Properties of Beam Switching Tubes

On page 96 is an article with the above title by Gerald F. Ross, Sperry Gyroscope Co., Division of Sperry Rand Corporation. The sub-head states:

"In computer operations the noise properties of beam switching tubes are somewhat of a disadvantage. In electronic counter-measures, however, these same properties can be put to good use. This article describes how certain tubes, specifically designed for a higher broadband noise output, are employed as a gateable source, saving weight, power and space in ECM systems."

Electronic Ignition Systems Designs

An article with the above title by Dr. A. V. J. Martin, Director, Electronique Automatismes, 61 Rue de Moubegue, Paris 9, France, appears on page 164. The sub-head and first two paragraphs are as follows:

"Automobile ignition systems must operate under unfavorable conditions such as over or under voltage, high switching frequencies, and environmental extremes. New systems using semiconductors are being designed and built which will overcome these problems as well as others that plague today's conventional systems.

"The idea of applying electronic techniques in the automobile industry is not new. One of the first concepts was probably that of electronic ignition systems. A large number of troubles, with the usual automobile, originate in the ignition system, which must perform properly under unfavorable conditions of overvoltage, over-intensity, high switching frequency and temperature extremes.

"That there is large room for improvement is only too common knowledge. However, most ideas based on electronics did not reach practical application until the advent of semiconductors, with their characteristic ruggedness, small size, and also the possibility of working directly off the standard battery voltage. Besides ignition, there are of course a number of domains wide open to electronics in the automobile industry. Let us cite for example voltage and current stabilization, automatization of numerous functions, and various applications of photoelectronic cells."

RFI from TV Sweep Circuit Reduced by Compensation:

Electrical Design News, July 1961, page 59, describes a British patent with a block diagram included. The first paragraph states:

"Reduction of radio-frequency harmonic radiation from TV line-sweep circuits is obtained by reverse-phase compensating radiation. The source of disturbing radiation is coupled through an adjustable impedance to an extra radiating surface. This is located as near to the RFI radiating structure as possible, so that compensation is affected at any distance beyond the receiver."

Antenna Heights and Interference Reduction:

The Office of Technical Services, Dept. of Commerce, has made the above report available under No. PB 146 922E. It has 28 pages and costs \$2.70 on microfilm and \$4.80 photostated. The use of receiving antenna height adjustment to minimize interference effects is stated in detail. A working set of formulas and nomograms is provided to assist design and installation personnel in establishing antenna heights, in order to increase compatibility of equipments that are in close proximity.

Determining Waveguide Wavelength:

Electronic Industries, June 1961, carries a 1-page nomograph, under the above title, by B. R. Hatcher, Chu Associates, Littleton, Mass. The sub-head states:

"Nomograph provides microwave engineers with a quick, easy method calculating any one of the three significant waveguide characteristics, when two of them are known."

How to Evaluate DC Differential Amplifiers:

Electronic Design, August 2, 1961, contained an article by William G. Royce, of Kin Tel, Division of Cohn Electronics, Inc., San Diego, California, under the above title. The sub-head and a paragraph on noise are as follows:

"The principal features of dc differential amplifiers are much talked of, according to author William Royce, but they are little understood. Precise terms are being bandied about more and more loosely. As a result, design engineers are hard pressed to interpret manufacturers' data intelligently. In addition to the evaluation criteria he presents here, Mr. Royce gives simple tests for checking important features.

"Test for Noise - As with common-mode rejection and linearity, there is no practical adjustment to compensate for noise. In practice, the over-all noise also depends on the CMR, but a separate determination of amplifier noise sets a minimum level. The most significant way to measure noise is to simulate a typical source with a shielded resistor, set the amplifier at the maximum anticipated gain, and load the output with the output device normally used (e.g., oscilloscope, meter, A/D converter). If the output device is not available, insert a low-pass filter (simple one-section RC) between the output and a suitable scope or meter. The filter should have a bandwidth approximating that of the typical load device which is likely to be used."

Computing Noise Levels in Microwave Receiver Systems:

Electronics, August 4, 1961, has an article under the above title by Henry H. Grimm, Consulting Engineer, General Electric Co., Syracuse, N. Y. The sub-title and second paragraph are:

"This article gives an evaluation of all noise entering the system, from background space noise to that generated in the microwave receiver hardware.

"In 1956, development of the ammonia maser brought the possibilities of drastic noise reduction to the foreground. The group led by Townes presented their convictions that the ammonia maser could achieve unheard-of feats as a low-noise amplifier. It has subsequently been shown that maser devices do have remarkable low noise capabilities, with internal noise power near 4×10^{-14} milliwatts per megacycle of bandwidth. It is now customary to compare receivers in terms apparent equivalent input noise temperature."

Chopper Noise Sources and Measurement Techniques:

James Electronics Inc., 4050 North Rockwell Street, Chicago 18, Illinois, has brought out a 4-page discussion under the above title. The chapter headings are as follows:

Electrostatic Noise
Electrostatic Noise Measurement
Magnetic Noise
Magnetic Noise Test Procedures

Thermal Noise and Drift Electrochemical Noise Measurement Conclusions

Copies of this paper may be obtained by writing John A. Kennedy, President, at the above address.

Path Loss Measurements Versus Prediction for Long Distance Tropospheric Scatter Circuits:

National Bureau of Standards Report No. 6730 by A. F. Barghausen and C. F. Peterson of the U. S. Department of Commerce, National Bureau of Standards, Boulder Labs., Boulder, Colorado, has been published under the above title. The Report contains 15 pages of text and 9 figures. The abstract states:

"Tropospheric forward scatter circuits have established their place in the world-wide communications network of the military and it is the intent of this paper to illustrate by a specific example how the performance of a circuit of this type may be predicted with adequate accuracy without making costly transmission loss measurements over the intended path."

PAPERS OF INTEREST IN 1961 PGMTT NATIONAL SYMPOSIUM

The Digest of the above Symposium held in Washington, D. C., May 15-17, 1961 contains the following papers of interest:

"Spurious Outputs from High Power Microwave Tubes and Their Control" - by K. Tomiyasu, General Electric Company, Schenectady, New York. The first paragraph states:

"The emission of spurious outputs from microwave tubes has been known for a long time. With steady increase in transmitter power level, receiver sensitivity and number of radiating equipment, the problem of spurious outputs has taken on greater significance in terms of radiation interference. As the power levels of high power tubes have increased so have the spurious output power levels, and in a microwave system the presence of the spurious power may have deleterious effects such as arcing in chokes, arcing at flanges and signal transmission through ionized duplexers. In addition, if large amounts of spurious power are generated, the microwave tube may suffer in its own performance by decreased efficiency and by introducing an objectionable amount of amplitude and phase instability of the fundamental frequency output."

"Elementary Considerations of Noise Performance" is a paper by five authors. The first paragraph states:

"It is generally recognized that the output noise of a receiving system contains components contributed not only by the generator at the input of the receiving system but also by the receiver itself. Furthermore, the evaluation of the output signal-to-noise ratio of the system will depend not only on the output noise but also on the nature of the signal that is impressed on the input of the receiver and that appears in the output utilization circuit. Hence, any meaningful evaluation of noise performance of receivers when they are used in a particular system must include considerations, under operating conditions, of the sources that contribute to the output noise, the bandwidth and gain of the receiving system in all of its responses, the nature of the signal and the efficacy of the output utilization circuit. It is evident that no single number can describe completely how well a given receiver will perform in all kinds of systems."

Copies of the 1961 PGMTT National Symposium Digest can be obtained from IRE Headquarters at \$3.00 each.

Electronic Design Comments on Unsuccessful Missile Launchings:

Electronic Design, August 30, 1961, made the following comments in their News column:

Unsuccessful missile launchings have an extremely high correlation with the occurrence of magnetic storms, a survey shows. Of 98 launchings over a three-and-a-half year period, it was found, 40 total and eight partial failures coincided with magnetic storms. Forty-six successes occurred at times of geomagnetic calm. One failure was on a clear day, and three successes were accompanied by moderate magnetic disturbances. Interference Consultants, Inc., of Boston, has been checking missile correlation with magnetic storm forecasts.

Small Gun Lowers Noise in PPM-Focused TWT:

Electrical Design News, August 1961, carries an article under the above title. The first paragraph states:

"Palo Alto, Calif. - A new design metal-ceramic electron gun permits small-diameter permanent magnets to be used around the gun of a newly developed X-band traveling-wave tube. The small diameter means that commercially available magnets can be used to develop the strong magnetic fields necessary for low-noise operation. The noise figures of these periodic permanent-magnet (PPM) focused tubes approach within 1 db of the noise figures obtained with the much heavier and bulkier solenoid-focused TWT's."

Low-Noise Traveling Wave Tubes:

General Electric Company, Power Tube Division, Schenectady 5, N.Y. has published a 16-page bulletin titled "Low-Noise TWT"

R-C Networks for Relay Contact Protection:

Under the above title, Military Systems Design, July-August, 1961, summarizes a 10-page booklet prepared by the Presin Company, Inc., 2014 Broadway, Santa Monica, Calif.

Environmental Test Procedures Airborne Electronic Equipment:

The Radio Technical Commission for Aeronautics has published a 70 page report by RTCA Special Committee 90 under the above title. Approximately 31 pages are devoted to RF susceptibility tests (radiated and conducted) and Standards on Emission of Spurious Radio Frequency Energy.

Copies of the report, Paper 120-61/DO-108, may be obtained at a cost of 75 cents per copy, payment in either cash, check or money order payable to the Radio Technical Commission for Aeronautics and sent to: RTCA Secretariat, Room 1072, Building T-5, 16th & Constitution Avenue, N.W., Washington 25, D. C.

Inland Near Antarctic To Be Used As an Antenna:

Electronic Design, August 16, 1961, page 24 describes a use of Deception Island, in the Falklands off the southern coast of Argentina, as a long wave antenna. As an antenna, the island would test the characteristics of interference in the very-low-frequency region.

Nomogram Converts Signal-Level Terms:

In Electronic Design, August 16, 1961, page 125, is a nomogram, under the above title, by W. J. Connor, Engineering Leader, Defense Electronic Products, Radio Corporation of America, Camden, N. J. The first paragraph states:

"Engineers working on communications systems often must compare performance data that have been specified in different terms, or have been based on different references. Here is a straight-line nomogram which reduces considerably the time for converting between the terms currently in use. The terms compared are: Pico Watts, Watts, Milliwatts, dbm, db, ^{PN} dba, Psophometric EMF-E (mv)."

Interference and The RFI Meter:

Under the above title H. A. Favors, R. E. Bloom, R. J. Fleischer, of the Stoddart Aircraft Radio Co, Inc., have authored an article in Instruments & Control Systems, August 1961. The sub-title states:

"Accurate RFI measurements demand careful consideration of the type of signal measured, the RFI meter used, and the accuracy of which the meter is calibrated. This article discusses interference sources, the RFI meter, and calibration set-ups."

Tunnel Diode Noise Nomograph:

Under the above title, L. E. Dickens, Johns Hopkins University, Radiation Lab., Baltimore, Md., has written an article in the September, 1961, issue of Electronic Industries. The sub-title states:

"The tunnel diode amplifier is examined theoretically in relation to its noise figure. A nomograph is presented which simplifies the determination of noise, with the effects of frequency on this figure."

Reduce RF Interference from Radars:

BuShips Journal, September 1961, carried the following by John Roman, RAD HAZ Compatibility Group, Ship Electronics System Design Section, Bureau of Ships, under the above title:

Fleet activities have been reporting considerable radio interference from 200-megacycle and 400-megacycle radars. Most of this interference can be eliminated or reduced by applying one or more of a variety of techniques tailored to the particular receiver system.

Below 32 Megacycles

Interference from 200-megacycle and 400-megacycle radars to receivers operating in the frequency range below 32 megacycles can be eliminated by installing filters in the antenna line at the receiver, if the receiver is connected to a whip or wire antenna either directly through a transfer panel or by a multicoupler. NT-53153 filters can be used for 200-megacycle radars only or Antran LP-101C can be used for either 200- or 400-megacycle radars.

Receivers Operating with AN/SRA-17 Antennas

Interference to receivers operated with the AN/SRA-17 antenna group can be reduced with a low-pass filter in the AN/SRA-17 tuner. Construction of this filter is described in Bureau of Ships drawing RE-47111A, TN-334/SRA-17 "RF Tuner Low-Pass Filter Installation." In addition, the 1N21B noise diode should be removed from the tuner and an NT-53153 filter (for 200-megacycle radars only) or an Antran LP-101C filter (for either 200- or 400-megacycle radars) installed in the antenna line at the receiver. These are interim measures since the Bureau of Ships is developing a field change to the AN/SRA-17 antenna group to remedy the condition.

Arcing

Receivers operating at any frequency are subject to interference from arcing between cable armors, ladders, and ship structure. The arcing occurs whenever these objects are illuminated by the main beam of the 200- and 400-megacycle radars. Generally, the objects are on the same mast as the radar antenna. Several are available to reduce the interference resulting from arcing.

- Passing the cables inside the mast or within a conduit for a vertical distance equal to the vertical main beam illumination. This distance can be estimated as being slightly larger than the vertical dimension of the offending radar antenna.

- Passing the cables along the opposite side of the mast from the radar. However, this method may be less satisfactory than that described in the preceding paragraph.

•Banding of cables, ladders, rigging, etc., to the ship's structure at short intervals.

•Stripping of the armor from coaxial cables within the radar main beam.

However, the armor from power and other non-shielding multi-conductor cables should not be removed, as arcing might then occur between conductors and induce conducted interference on these cables.

UHF Receivers

Certain types of interference to UHF receivers may be reduced by installing multicouplers, such as the CU-691, and by adjusting noise limiting circuits of the affected receivers.

Electronics Warns of Blinding by Optical Masers:

In the August 11, 1961 issue of Electronics, on page 11, is the following news item:

'Report 'Blinding' by Optical Maser - A word of caution to engineers working with optical masers:

"It has been reported that an optical maser 'blinding' incident occurred recently. A group of personnel from a large company was setting up maser equipment in the field when an engineer, standing a half mile away, looked in the direction of the unit when it accidentally began operating. He was temporarily blinded for several days, but has regained his sight."

How to Design Low-Noise Amplifiers, for Transistor Users:

Under the above title, Electronic Industries, August 1961, runs a 6 page article by Francis Opp, Application Engineer, Texas Instruments, Inc., Dallas 21, Texas. The sub-head states:

"Internal noise is always difficult to predict. As usual, two approaches are possible - mathematical and empirical. Using the latter this article shows how an accurate prediction can be made. And the required design data can be obtained by applying tests to the external terminals of the transistor."

Scientists Cited for Reducing Radio Noise:

Electronic Industries, September 1961, carried the following news item under the above title:

"Two scientists, inventors of a three-level solid state maser responsible for the reduction of noise in communication systems ranging from telephones to receiving stations for satellites, will be awarded Stuart Ballantine Medals by the Franklin Institute of Phila.

"Dr N. Bloembergen, Harvard University Professor, and Dr. H. E. D. Scovil, Bell Telephone Labs., Engineer will receive their awards at formal Franklin Institute ceremonies. The medal is being awarded "for the invention of the three-level solid state maser and its subsequent development for practical use."

"The Stuart Ballantine Medal founded in 1946 by the Boonton Foundation, is awarded for outstanding achievement in fields of communications which employ electromagnetic radiation."

Ions and Health:

In the August 25, 1961 issue of Electronics, in answer to a letter regarding the biological effects of atmospheric ions on the human system, the editor states they have a list of 26 references available.

Orbiting Needle Relay Belt Given Go-Ahead:

In Electronics, August 25, 1961, on page 11, the following appeared in the Newsletter Section:

"Policy statement by the National Aeronautics and Space Council, with approval of President Kennedy, apparently clears way for launching of Project West Ford. This is the orbital scatter communications experiment proposed by MIT Lincoln Lab., initially dubbed

Project Needles (Electronics, p 43, Sept. 30, 1960).

"The proposal triggered protests from optical and radio astronomers that the orbiting belts of tuned dipoles would interfere with their research. At the International Astronomical Union assembly in Berkeley, Calif., last week, for example, the Union's president termed the belt proposal a 'grave danger'.

"The Space Council's statement says the first exploratory test probably would not have an adverse effect on any branch of science. The U. S. has pledged no operational system will be launched until experimental results are analyzed. Astronomers have been invited to help determine if a needle belt would obscure astronomical observation or reception.

"In exploratory test, 75 pounds of dipoles tuned to 8,000 Mc will be released from a rotating dispenser of a satellite. After 30 days, the belt of 350 million dipoles will extend around the earth. It can be used with highly directive microwave antennas to provide many high-capacity, inter-continental communications circuits. Twin 60-foot antennas for initial test are ready at Millstone Hill, Mass., and Camp Parks, Calif., but launching date remains classified.

"Copper dipoles, 1.77-cm long, to be used in first test could last 10 to 20 years, depending on belt altitude and inclination. Lincoln Lab. is checking into use of white tin alloy dipoles, which would become transformed into gray tin powder pushed into the atmosphere by solar radiation pressure."

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BMEWS Radio Shielding:

Ground Support Equipment, August/September, 1961, contained a page description of the methods used to install over 2,250,000 square feet of precision copper wire cloth for static shielding at BMEWS Radar Sites.

Experiences Interference from Incandescent Lamps:

Victor H. Fischer, of the Electrical Engineering Division of the Battelle Memorial Institute, Columbus 1, Ohio, in a letter to your editor, states:

"With reference to our discussions on June 11, 1961, at the PGRE Symposium in Washington, D. C., we do not have any measured data concerning the investigation of the RFI properties of various incandescent lamps. But it has been our experience that when conducting RFI investigations inside a 10 x 20 x 8 foot screen room which had four ceiling-mounted 200 watt incandescent lamps, we experienced high background noise levels which approached or exceeded, at times, the radiated limits of MIL-I-16910A from 14 kc to 150 kc.

"I would like to point out that these limits in the lower frequency range are lower than natural atmospheric noise levels by 20 to 60 db when measured on land. These differences decrease almost to 0 db when measured at sea or in the extreme northern latitude from 70° to 90° north. Considerations of the ambient radio frequency noise levels should be made prior to concern of the effects of interference generated by incandescent lamps."

Don White Associates Changes Corporate Name:

Don White Associates, formerly at 7306 Honeywell Lane in Bethesda, Maryland, has changed its corporate name to White Electromagnetics, Inc., and moved to new and larger facilities at 4903 Auburn Ave., Bethesda 14, Maryland

The 4th in a series of technical bulletins with the title "Pulse Emission Spectra and Applications to RF Interference" has been issued and can be obtained by writing to the new

company at the new address.

The 5th in a series of technical bulletins with the title "Scoring Criteria for Determining RFI Damage to Communication-Electronic Systems" has also been issued and can be obtained by writing to the above address.

Genistron Opens Chicago Laboratory:

Genistron, Inc., Los Angeles 45, California, announces the opening of laboratory facilities in Bensenville which is a suburb of Chicago. They are presently engaged in RF hazard work.

Sam Burruano Forms Own Company:

Samuel J. Burruano, a member of PGRFI Administrative Committee and past vice chairman, has formed his own company, Burruano Associates, Inc., 51 Sullivan Street Westwood, New Jersey, telephone number - NOrth 6-1234. This new company is specializing in the field of systems interference prediction, control and analysis, mutual interference, radiation hazards, jamming and ECM, and shielding and grounding systems. Mr. Burruano was formerly Manager of Systems Engineering Division of Filtron, Co., Inc., New York and was also formerly associated with RCA in Camden and formed its first company-wide RFI Group.

How to Design Low-Noise Amplifiers:

An article titled "How to Design Low-Noise Amplifiers" has been authored by Francis Opp, Application Engineer, Texas Instruments, Inc., Dallas 21, Texas, in the August 1961 issue of Electronic Industries. The sub-title states:

"Internal noise is always difficult to predict. As usual, two approaches are possible - mathematical and empirical. Using the latter this article shows how an accurate prediction can be made. And the required design data can be obtained by applying tests to the external terminals of the transistor."

Computing Noise Levels in Microwave Receiver Systems:

Electronics, August 4, 1961, contained an article by Henry H. Grimm, Consulting Engineer, General Electric Company, Syracuse, New York, under the above title. The sub-title states:

"This article gives an evaluation of all noise entering the system, from background space noise to that generated in the microwave receiver hardware."

Article on Compatibility Packaging:

In the July/August 1961 issue of Electronic Packaging and Production is an article by Rexford Daniels. The sub-title states: "A total concept of packaging just gaining industry and military recognition."

Revision of Military Collection Plan for Spectrum Signatures Available:

The revised 1 September 1961 Military Collection Plan for Spectrum Signatures is now ready for distribution. This revision supersedes the Collection Plan dated 28 October 1960. Copies of the revised plan may be obtained by writing to any of the following:

Chief Signal Officer, US Army
Chief of Naval Operations (DNC)
Chief, Bureau of Ships
Director of Telecommunications, US Air Force (AFOAC-P/F)
Director of Research, US Air Force (AFDRD-IN)

Noisemanship - The Art of Measuring Noise Figures Nearly Independent of Device Performance:

On page 1223 of the July, 1961, issue of the Proceedings of the IRE appeared the following letter by J. C. Greene, Airborne Instruments Lab., Melville, New York, which takes up an aspect of RFI testing which is often overlooked by the ignorant and calls for strength of character by the wise:

"Almost everyone who has measured the noise performance of a sensitive amplifier or converter has found it possible to read noise-figure values considerably lower or higher than expected. The more exacting experimenters among us have refined their measurement techniques to eliminate such ambiguities and can even obtain accurate noise-figure values for the new, exotic, negative-resistance devices such as parametric amplifiers, masers, and tunnel diode amplifiers and converters. However, as yet, only a few astute practitioners have recognized the tremendous practical value of being able to read noise-figure values much lower or higher than actual. For example, when evaluating their own devices, they can manage to read unusually low noise figures by following certain experimental procedures. (Do not be anxious about their results being much better than theoretical, since they can usually postulate some plausible explanation such as space-charge smoothing.) Conversely, when evaluating their competitors' devices, they can just as readily manage to read exceptionally high noise figures. (Here, however, they usually do the gentlemanly thing and make the magnitude of the noise figures inversely proportional to their competitors' abilities.) To encourage the practice of noisemanship, and thereby bring these very effective practical advantages to all those interested in advancing the state of the art of low-noise devices, we have compiled a partial list of the correct experimental procedures to follow in these two cases.

Case 1 - PROCEDURES TO BE FOLLOWED FOR HIGH-NOISE-FIGURE READINGS

- 1) Use a post-receiver that is very nearly saturated; this makes the output indication almost completely independent of the device under test. By varying the degree of saturation, this one technique alone can lead to almost any desired high noise-figure value.
- 2) Place a grid-dip meter or sweep generator near the receiver IF amplifier; this is not as effective as procedure 1) but less readily detected by unfriendly observers.
- 3) Use an argon-discharge noise tube, but use a calibration chart for a neon tube. Since the argon tube has about 3-db less effective output-noise power, an error of 3 db in your favor is easily obtainable. This technique is especially useful if skilled unfriendly observers are present, since the discharge is not visible in any commercial noise generator (because the noise lamp is always located inside a waveguide or coaxial structure) and, therefore, they cannot tell the type of discharge present from its characteristic color.
- 4) Use a noise generator having the biggest possible difference in source impedance at the two reference noise levels (assuming that a Y-factor measurement is made, which is generally true above a few hundred megacycles where noise diodes are no longer useful). This causes a difference in the gain of the device for the two reference conditions. Here, however, one must be careful that the gain decreases when the higher reference temperature is connected. One should also allow sufficient time between the two reference readings so that the output indicator drifts well down scale before the higher temperature reference is connected. The use of a badly mismatched noise generator may also cause an unstable device to break into oscillation; if so, an immediate victory is scored.
- 5) Orient the noise generator for maximum TV, FM, and police radio pickup.
- 6) Assume that the device has at least three equal spurious responses and, therefore adds 5 db to the measured-noise-figure value. This gives you a knowledgeable air and usually impresses those present.

There are an unusually large number of these procedures, which are too numerous to list here. However, by the use of the few tech-

niques listed above, one can readily pin the noise-figure indicator on the infinite end of the scale. For those pessimists who have only lately entered the low-noise arena, these techniques are guaranteed to lead to immediate positive results.

Case II - PROCEDURES TO BE FOLLOWED FOR LOW-NOISE-FIGURE READINGS

- 1) Undo procedures 1), 2) and 5) above.
 - 2) Reverse procedures 3) and 4) above.
 - 3) Neglect any spurious responses and quote only the radio-astronomy noise figure.
 - 4) If the observers are aware of the above procedures, place a carefully measured 100-db pad between the noise generator and the device under test. This will eliminate the gain variations caused by noise-generator mismatch, but when 100 db is subtracted from the overall reading, a low-noise figure is sure to result. An alternate procedure is to use a post-receiver with a 100-db noise figure and then carefully subtract its noise contribution.
- Again there are too many of these procedures to list here, but if only the few above are followed, noise figures below 0 db can easily be obtained. This maybe a little embarrassing in the presence of the theoretically inclined antagonists, but again one can postulate some elaborate thermodynamic mechanism as the probable cause. (If you are anxious about such a procedure, use only one or two of the above procedures, and the noise figure indicator will rest just slightly above the 0-db mark, which is much more readily explained.) For those adventurers who have only lately entered the low-noise arena, these techniques guarantee an immediate entrance into the innermost ring.

In conclusion, techniques have been listed to encourage the rapid growth of noisemanship. Here, however, we think it appropriate to paraphrase Oscar Wilde, who noted that people only like to give advice they will not follow themselves and with his characteristic wit denoted such advice as the depth of generosity."

Your editor would appreciate receiving the experiences of those who have made the acquaintance of "noisemanship"

International Conference on RF Interference:

An international conference, including radio experts from both sides of the iron curtain, began in Geneva in the first part of September, 1961. The conference is being held under the auspices of the International Telecommunications Union and the purpose is to determine the best means of reducing congestion in the radio frequency bands between 4 and 27.5 megacycles.

The American representative on the panel is Paul D. Miles, executive secretary of the interdepartment radio advisory committee of the Office of Civil and Defense Mobilization. He is being assisted by group of five advisors: Phillip F. Siling, Radio Corp. of America; George Jacobs, U.S. Information Agency; Dr. S. G. Lutz, Hughes Research Labs., Leonard G. Abraham, Bell Telephone Labs., and Col E. R. Reynolds, Department of Defense.

NEW BOOKS:

How To Locate and Eliminate Radio and TV Interference

John F. Rider, Publisher, Inc., 116 14th Street, New York 11, New York, announces a book by Fred D. Rowe, Chief Investigator, Radio Interference Division, Northern California Electrical Bureau, under the title "How To Locate and Eliminate Radio and TV Interference". The book has 160 pages and sells for \$2.90. The Table of Contents is as follows:

1. The Interference Problem
2. Antennas and Interference
3. Basic Interference Sources and Sounds
4. Interference Locating Equipment

5. Electrical Equipment and Appliances as Noise Sources
 6. Locating the Source
 7. Power-line Interference
 8. Power-line Noise Filters
 9. Electrical Equipment and Appliance Interference
 10. Fluorescent and Filament Lamp Interference
 11. Television Interference Suppression for Transmitters
 12. Eliminating Interference at the TV Receiver
- Appendix I. Questions and Answers
Appendix II. Federal Communications Commission Rules
Index

NEW PUBLICATIONS:

Interference Studies

"Research results are presented on the theory of interference prediction and interference measurement techniques. Eight separate sections are devoted to premissible interference levels or susceptibilities, data presentation, methods and devices for measuring spurious and harmonic radiation, out of band pulsed and cw interference in a microwave receiver, loss of radar information due to blanking, bandwidth conservation in pulsed radars, graphical techniques for great circle calculations, comments on military interference specifications, and prevention of moding in magnetrons. Interference Studies, O. M. Slati, R. A. Rosien and others, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia, Pa., April 1958, 210 pp., Microfilm \$9.30, Photostat \$31.80. Order PB 146366 from Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C."

RFI

"An investigation was made to determine a practical method for suppressing radio interference generated by a 25-lb wringer-type laundry washer. Measurements indicated that approximately every 20 sec (the time point at which the motor was reversed), narrow high-intensity pulses were radiated from the laundry washer. The magnitude of the pulses was of the order of 10^{-4} uv per meter at frequency of 200 kc to 20 mc, measured 5 ft from the machine. Interference of a higher repetition rate and a lower level was observed continually throughout the above frequency range. Radio Interference Suppression of a Proprietary No. 2C-jr. Laundry Washer, A. M. Intrator and E. D. Pettler, Naval Civil Engineering Labs., Port Hueneme, Calif., Feb. 20, 1953, 14 pp, Microfilm \$2.40, Photocopy \$3.30. Order PB 154651 from Library of Congress, Washington 25, D. C."

Reprint of FCC 3rd Symposium Paper Available:

An elaboration of the paper presented by Herman Garlan and L. Glen Whipple, titled "Control of Radio Frequency Interference from Nonlicensed Apparatus", delivered before the 3rd National PGREFI Symposium, 1961, has been reprinted as Report No. TR-6104 by the FCC. Tables of radiated limits and tolerances are given for Radio Receivers; Community Antenna TV Systems; Low Power Communication Devices; General Requirement; ISM Frequencies; Medical Diathermy; Industrial Heaters; Ultrasonic Equipment; R. F. Stabilized Arc Welders and Miscellaneous Equipment.

NEW PRODUCTS:

Brushless DC Motor Operates with Tunnel Diode:

A direct current motor with only three essential parts - a winding with two terminals, a rotating magnet, and a tunnel diode - has been developed by Dr. Harry E. Stockman of Sine-Ser Company, 543 Lexington St., Waltham, Mass. This device is free from the bugaboo of making or breaking contact and, therefore, does not generate the type of interference which is typical for a conventional DC motor. There, however, exists an audio frequency oscillation but the spectrum of harmonics is quite limited since the pulses have long rise time. The present model is intended for

educational purposes only says Dr. Stockman, also Professor of electrical engineering at Lowell Technological Institute of Lowell, Mass. The application of the motor principle for industry depends on the development of suitable tunnel diodes for motors.

Zippertubing Brings Out Shielded Zippertubing:

The Zippertubing Company, 13000 South Broadway, Los Angeles 61, Calif. is bringing out a series of laminated vinyl-impregnated fiberglass cloth with aluminum and copper foil and laminated vinyl-impregnated nylon cloth and aluminum foil jacketing for RF shielding purposes. This Zippertubing can be used in original design applications and also for helping to reduce radiation levels from wiring in existing equipments.

Raytheon Brings Out Low-Noise Switch:

The "Raysistor" made by the Raytheon Company, 55 Chapel St., Newton 58, Mass., is described in the literature as follows:

"The Raysistor is a four terminal electro-optical device consisting of a light source and a photocell assembled in a Monel casing. A variation of the input to the light source causes a change in the photocell resistance. No electrical connection exists between the control (light source) and signal (photocell) circuits.

"A wide variety of switching and control functions are possible by different light source and photocell combinations. These Raysistors provide low noise pedestal-free switching of AC or DC signals over a wide dynamic range without transients. Since they have no moving parts they are exceptionally rugged with an inherent long life."

New Line of Shielded Coils:

Cambridge Thermionic Corporation, 445 Concord Ave., Cambridge 38, Mass., announces a new line of shielded wound coils with overlapping inductance range. Electrostatic shielding and magnetic shielding compensate each other and provide in many cases a coil with values of inductance and Q higher than those with only an electrostatic shield.

AiResearch Brings Out New Type Filters:

The AiResearch Manufacturing Division of the Garrett Corporation, Los Angeles 45, California, has brought out a special purpose interference filter known as "Filter-Grips" which is a combination of a highly efficient interference filter and the famous Garrett Corporation "Williams-grip" connector. It is claimed that the combination makes possible far greater efficiency in packaging and handling by minimizing components as well as mounting and connection hardware.

Airpax Brings Out New Chopper:

Airpax Electronics, Seminole Division, Fort Lauderdale, Florida, announces a series of new Low-Noise Choppers. A typical reference to noise, taken from the literature, is as follows:

"NOISE: The induced or stray noise appearing between each contact and ground does not exceed 0.6 microvolts RMS across 100 ohms or 8 microvolts across one megohm. This chopper noise is that residual signal appearing between a contact and ground across a resistance, with the chopper operating and no signal applied to its contacts. The driving source to the coil is balanced to ground; all leads are shielded and secured to minimize pickup and generation of spurious signals. Noise is expressed in RMS

volts."

Piezoelectric Transducer Claims Low-Noise Level:

A new variable piezoelectric transducer incorporates a mount which claims to eliminate more than 85% of the noise produced by more conventional designs. Called the "Variducer", the miniaturized unit is designed for use in missile component testing and modification as well as in various other environmental and laboratory tests where a high-quality, high-accuracy, low-noise sensing unit is required. Designed to meet any pressure in the transducer field, the unit will also withstand temperatures up to 300C. It is produced by the Mirax Chemical Products Corp., St. Louis, Mo.

Resistor in Preamp Ground Reduces Interference:

Electrical Design News, September 1961, page 73, has the following information in a 1-column item. The schematic and the values of the resistors have been omitted. The text states:

"A resistor, introduced into the ground lead of an oscilloscope preamplifier, minimizes interference caused by differing chassis potentials. The resistor absorbs the bulk of the interfering voltage drop and diminishes it over the remaining ground leads.

"It is a common experience that separate equipments, plugged into the power line and grounded by a third wire to the power circuits or by separate wires to a ground busbar, can still be at different interfering potentials. These potentials arise from large circulating ground currents. Such potentials introduced into oscilloscope-amplifier circuitry cause spurious signals in the display.

"In this arrangement, a resistor is included in the ground wire between the preamplifier and the oscilloscope, so that current flow in ground wires is reduced. As a result, the potential drop in the ground wire from equipment to preamplifier is reduced by the same amount. This ground circuit feature was introduced by Marconi Instruments, Ltd."

RF Metal Detector:

RF (radio frequency) metal detectors are used for locating all metals and alloys, whether they occur as large or small pieces of steel, manganese, aluminum, brass or any other metal or metal alloy. Their usual application involves indicating the presence of "tramp" metal in rubber, plastics, food, drugs, minerals or any other non-conducting materials that will not affect a radio frequency field...

The primary components of the Metabloc are a search coil and a main control unit. The search coil forms part of the tuned circuit of a Hartley oscillator. When energized, this circuit generates a radio frequency field in the area of the search coil. Energy is absorbed when a metallic object moves through this field, causing an upset voltage to be generated by the oscillator. This voltage triggers a thyatron, activating a sensitive relay which, in turn controls a power relay...

Additional information can be obtained from the Morehouse Machine Co., 1742 Sixth Ave., York, Pa., by writing for Bulletin 203.

NOTE FROM THE EDITOR:

The editor wishes to thank the increasing number of members of PGRFI who are sending in material to go into the Newsletter. What is especially desired is information about new products which will make the control of RFI both easier and less expensive. Both industry and government are becoming more and more concerned over the mounting costs of RFI control which can very well slow up the progress of the entire state of the art. If you know of anybody who has a new product, a new circuit or a new way of doing something, please tip off your editor and he will follow it up. REXFORD DANIELS, Editor, Monument Street Concord, Mass.