



PROFESSIONAL
GROUP ON
RADIO
FREQUENCY
INTERFERENCE

NEWSLETTER

NUMBER 11

MAY, 1960

SECOND NATIONAL SYMPOSIUM

on
Radio Frequency Interference
June 13-14, 1960
Shoreham Hotel, Washington, D. C.

SCHEDULE OF PAPERS

FIRST DAY: 13 June, Morning Session, 9:15 - 12:30 A. M.

Introduction: J. Hill, Jansky and Bailey, Inc.

- A. Keynote Speaker: R. Randall, OSD-DDR&E,
"Getting on Top of the Nation's RFI Prediction and Measure-
ment Efforts".

- B. Section on RFI Prediction

Chairman: R. Showers, University of Pennsylvania

- B1. "Characteristics Needed for RFI Prediction", D. R. J.
White, Frederick Research Corp., Wheaton, Maryland
B2. "The Jansky and Bailey Computer Simulation Model",
D. Ports, Jansky and Bailey, Washington, D. C.
B3. "The AMF Computer Simulation Model", W. G. James,
American Machine and Foundry, Alexandria, Virginia
B4. "The GE Computer Simulation Model", J. Lambert,
General Electric Co., Syracuse, New York

FIRST DAY: 13 June, Afternoon Session, 2:00 - 4:45 P. M.

- C. Section on C-E Equipment Characteristic Measurements
(Techniques and Instrumentation)

Chairman: O. Salati, University of Pennsylvania

- C1. "Antenna Patterns", E. Jacobs, University of Penna.
C2. "Aerial Pattern Measurements", A. Albin, Filtron, Inc.,
Flushing, New York
C3. "Communications Transmitter and Receiver Spectral
Signatures", C. Blakely, Georgia Tech, Atlanta, Ga.
C4. "Radar Transmitter and Receiver Spectral Signatures",
H. Sacks, Armour Research Foundation, Chicago, Ill.
C5. "Strong Signal Receiver Problems", D. McClenon,
Naval Research Laboratory, Washington, D. C.

SECOND DAY: 14 June, Morning Session, 9:15 - 12:00 A. M.

- D. Round Table Discussion - "The Present Status of RFI and
Compatibility Standards".

Moderator: A. Loughren, Airborne Instruments, Mineola,
New York

- D1. Guest Speaker: A. R. Kall, ARK Engineering Company,
Philadelphia, Pennsylvania

- D2. Air Force Standards, N. L. Flinn, Wright-Patterson
Air Force Base, Ohio

- D3. Navy Standards, L. Thomas, Navy Department,
Washington, D. C.

- D4. Signal Corps Standards, J. Chappell, Hexagon, Fort
Monmouth, New Jersey

- D5. FCC Standards, E. Allen, FCC, Washington, D. C.

SECOND DAY: 14 June, Afternoon Session, 1:30 - 4:30 P. M.

- E. Section on Interference Considerations

Chairman: J. Egli, USASRDL, Fort Monmouth, New Jersey

- E1. "The Army's Electromagnetic Environmental Test Facil-
ity", J. Homsy, EETD, Fort Huachuca, Arizona
E2. "Making RFI Predictions in the hillField", J. McShulskis,
Frederick Research Corp., Wheaton, Maryland
E3. "Reducing Interference to C-E Systems Through Stand-
ardization", Major L. Yarbrough, GEEIA, Griffiss Air
Force Base, New York
E4. "Designing RFI Reduction Into Equipments", R. Keith,
Jansky & Bailey, Washington, D. C. - C. R. Billheimer
Navy Department, Washington, D. C.
E5. "Propagation Phenomena", H. Reed, University of Mary-
land
E6. "Signal Acceptability Criteria", R. Schwartz, University
of Pennsylvania

ADDITIONAL INFORMATION ON THE SYMPOSIUM:

1. We are reproducing the new Standards on Measurement Pro-
cedures. A copy will be given to each registrant.
2. Luncheon on Monday will feature color film on TIROS.
3. Reception Monday evening - free to all registrants - refresh-
ments.
4. Banquet Monday evening - Toastmaster - FCC Commissioner
Robert E. Lee. Speaker - Dr. John W. Findlay, Assistant
to Director, National Radio Astronomy Observatory, will
have illustrated talk on "Radio Astronomy".
5. Ladies Program - Hospitality Room serving coffee each
morning with information on sight seeing and shopping. An
Embassy Tea is being arranged.
6. A block of rooms is being held at the Shoreham Hotel for re-
gistrants. The Sheraton-Park Hotel is one block away.
7. Leonard Thomas will discuss new MIL-I-16910B Specification

8. There will be a Symposium Digest with summaries of papers, some complete papers and other information including a list of sponsoring firms.

the noise power involved at HF is not significantly different from that of cloud discharges. This letter gives the results of an analysis for substantiating 2).

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IRE WESCON Convention Record

FIELD TRIP

Laurel Monitoring Station - FCC Lab.

The Federal Communications Commission invites you to visit its facilities near Laurel, Maryland. Laurel is approximately 20 miles north of Washington. Commission Engineers will be on hand to show you around and to answer your questions. The following will be available for your inspection:

FCC Laboratory

- 1) Part 18 Measurement Range (Diathermy, Epilators, Electronic Stoves, etc.)
- 2) Receiver Oscillator and Transmitter Spurious Measurement Range
- 3) Ultrasound Line-Conducted Measurement Set-up
- 4) Radar Interference Measurement Facilities
- 5) T. V. Equipment and Interference Studies
- 6) Calibration of Field Strength Meters and Signal Generators
- 7) T. V. Mobile Unit for Field Measurements of TV Signals

Laurel Monitoring Station

- 1) HF and MF DF's for locating illegal stations and sources of RFI.
- 2) Radiotelegraph and radioteletype HF transmitters for monitoring net communications.
- 3) Monitoring antennas (rhombics, adcocks, etc.)
- 4) UHF automatic field strength recorders
- 5) Spectrum analyzer for bandwidth measurements and spectrum observations.
- 6) Automatic monitoring recorder
- 7) Frequency measuring equipment, including a frequency counter.
- 8) Radio net control position (Laurel is Eastern Radio Net Control for communications with Secondary Monitoring Stations and the Puerto Rico district office.

New air-conditioned buses will leave from the Shoreham according to the following schedule. Transportation charge for the entire tour is \$1.25.

		Bus Leaves	Return
TRIP 1	Monday, June 13	2 PM	5:40 PM
2	Tuesday, June 14	9 AM	12:40 PM
3	Tuesday, June 14	1 PM	4:40 PM

ITEMS OF INTEREST IN PROCEEDINGS OF IRE, MAY 1960:

Correspondence - page 935:

"Noise Figure of Tunnel Diode Mixer: - An analysis has been made of the noise figure of a tunnel diode as a mixer. The assumptions made were 1) the diode sees a short circuit at the image frequency, 2) the only source of noise in the diode is the shot noise associated with the tunnel current, 3) the series resistance of the diode and the losses of the input and output tuned circuits are negligible, and 4) the diode capacitance is constant. Because of the second assumption, consideration is limited to that portion of the i-v characteristic of the diode extending from reverse voltages up to, or somewhat beyond, the point of maximum negative conductance. In particular, the valley of the i-v characteristic is excluded from consideration because considerable excess 1/f-type noise has been observed in this region and this type of noise is not taken into account in the analysis".

Correspondence - page 955:

"HF Noise Radiators in Ground Flashes of Tropical Lightning - Previous analyses of this subject ignore ground flashes because 1) they constitute less than 10 per cent of all discharges in the tropics, and 2)

"Random Noise with Bias Signals in Nonlinear Devices - G. S. Axelby - A number of investigations have been made in recent years about the transmission of Gaussian noise through nonlinear devices. In many cases, simplification or approximations were needed to make analytical solutions possible, and only zero-average Gaussian input signals were used when the results were applied to feedback control systems.

This paper presents a different approach to the problem of noise transmission through nonlinear single-valued elements. Basically, amplitudes removed by nonlinear saturation or deadzones are replaced by impulses in the amplitude distribution functions of the output signal; and the resulting first and second moments of the output distribution are computed to yield the average and rms value of the output signal. The solution may be found by graphical or mathematical integration, a visual representation of the phenomenon is obtained, and input signals with any distributions having non-zero average values may be considered.

It is shown that there is an equivalent transmission function or describing function for the average value of the noise, another for the rms value, and that one is a function of the other. Examples of the functions are given and the simpler functions with zero-average values are compared to the results obtained by other methods.

Finally, the application of the noise describing functions to feedback control systems is discussed. Theoretical results are compared with those obtained from analog simulations".

Abstracts and References - pages 984-986

"The Measurement of Atmospheric Radio Noise by an Aural Comparison Method in the Range 15-500 kc/s - J. Harwood and B. N. Haden. (Proc. IEE, Part B, Vol. 107, pp. 53-59; January 1960). 'Atmospheric noise received on a vertical aerial is compared with a locally generated keyed signal to estimate the level at which the signal is 95% intelligible. This method was used in earlier high-frequency equipment and has been adapted for the range 15-500 kc/s. The apparatus and its method of operation are described. Results obtained at a number of stations are discussed in relation to more objective measurements. In particular, deduced noise powers are compared with existing world-wide predictions revealing some differences."

"Ultra-Low Noise Measurements using a Horn Reflector Antenna and a Travelling-Wave Maser - R. W. DeGrasse, D. C. Hogg, E. A. Ohm, and H. E. D. Scovil. (J. Appl. Phys., vol. 30, p. 2013; December, 1959.) Sky noise has been measured at 5.65 km cps with an antenna having a 2 degree beam width pointed at an angle of θ to the zenith. When $\theta = 0$, the sky temperature was found to be $2-5^\circ\text{K}$ and it varied according to $\sec \theta$ up to $\theta = 80$ degrees."

"Methods of Calculation for Noise Phenomena - K. Lunze. (Nach. Tech., vol. 8, pp. 530-537; December, 1958). The calculation of the noise-power spectrum, and representation by equivalent noise quadrupoles are considered".

"Voice Radio Systems for High-Noise Paths - J. A. Greefkes and F. de Jager. (Electronics, vol. 32, pp. 53-57; December 11, 1959.) By transmitting speech amplitude and speech frequency on different channels a communications link can be operated under poorer noise conditions than with either SSB or FM systems. Operation is possible with a signal-to-noise ratio of 4 db".

"The Interference caused by Noise Fluctuations of Irregular Spectrum Distribution - E. Sennhenn. (Elektron. Rundschau, vol. 13, pp. 9-11; January, 1959.) Subjective tests were made to assess the dependence of the interference effect at different noise frequencies on picture brightness and content. The subjective noise sensitivity for the noise spectrum of conventional scanning tubes is evaluated".

"The Optimum Noise Performance of Tunnel-Diode Amplifiers - K. K. N. Chang. (Proc. IRE, vol. 48, pp. 107-108; January 1960.)

is shown analytically that for a given I/V characteristic a minimum noise figure exists for the product of the excess noise factor and a gain factor."

"Investigation of the Temperature Variation of Noise in Diode and Transistor Structures" - C. A. Lee and G. Kaminsky. (J. Appl. Phys., vol. 30, pp. 1849-1855; December 1959). Measurements of the white noise of transistors (principally diffused-base structures) and diodes have been made at temperatures ranging from $\sim 77^\circ\text{K}$ to 300°K for a range of about two decades in injection level, and from 10kc/s to 10Mc/s.

Comparisons of the noise measurements with calculated levels are presented. The germanium transistors show a progressively increasing deviation from the theory as the temperature is decreased, and most of the silicon transistors exhibited excess white noise at room temperature and below."

"Noise in Electron Beams and in Four-Terminal Networks" - M. T. Laardingerbroek. (Phillips Res. Rep., vol. 14, pp. 327-336; August 1959.) Calculation of the minimum noise figure of electron-beam amplifiers, obtained by varying the properties of the drift space, is shown to be analogous to the calculation of the minimum noise figure of a quadripole by varying the signal-source impedance."

"Noise Propagation on Uniformly Accelerated Multi-velocity Electron Beams" - W. M. Mueller and M. R. Currie. (J. Appl. Phys., vol. 30, pp. 1876-1880; December 1959.) Low values of beam noiseiness can be obtained by reducing the slope of the potential profile. Adjustment of this parameter provides a practical possibility of attaining low noise figures in slow space-charge wave amplifiers as the frequency is increased."

ITEMS OF INTEREST IN ELECTRONIC INDUSTRIES, MAY 1960:

2-Year Program in RFI

"The Army Signal Corps has awarded a \$18.8 million contract to Pan-American World Airways, Inc. (prime contractor) to set up an electronic environmental test facility and a drone test range near Fort Huachuca, Ariz. Bell Aircraft's Avionics Div., principal subcontractor to Pan-Am, has been awarded a \$7.6 million contract for its part.

Bell will operate a test facility to evaluate existing and potential radio interference which handicap all kinds of Army communications under combat conditions. Bell will supply telemetry ground stations and drone flight control equipment, and track down the source of interference, submit recommendations for corrective action, and initiate procedures to eliminate these conditions in the future."

Predicting the Antennas's Role in RFI

On page 97 is an article with the above title by Ernest Jacobs, Associate, Moore School of E. E., Univ. of Pennsylvania, 220 S. 33rd Street, Philadelphia 4, Pa. This is the fourth in a planned series of editorial features on Radio Frequency Interference arranged for by the editors of Electronic Industries. The sub-head states:

"Through good antenna design RFI problems can be drastically reduced. However, even in antennas of the same exact type RFI levels will vary. This is caused by minor differences in tolerances during manufacture. Equations given here will aid in the prediction of interference from antennas as well as facilitate calculations of other antenna parameters."

Under Tele-Tech's Electronic Operations on page 149:

"Stanford Research Institute engineers have designed a device which eliminates radio static caused when aircraft fly through snow or clouds of ice particles. The device allows noise-producing corona discharges to occur, but prevent the generated noise from reaching the antenna."

Foreign News - page 221:

"Evaluation of Noise Properties of Ultra High Frequency Tubes" - B. I. Kurilin. 'Radiotekhnika', 14, No. 12 (1959). 1 p. Normally the noise property of tubes is determined by their equivalent noise resistance and cathode to grid conductance, the latter quantity being a function of

frequency. It is proposed to calculate the noise properties of tubes by means of a parameter which only depends on the construction of tubes. A list of Soviet UHF tubes with relevant noise parameters is appended. (U. S. S. R.)"

BRITISH USE TERM "INTERFERENCE" IN CATHODIC PROTECTION:

In a pamphlet "Cathodic Protection of Buried Structures", prepared by The Joint Committee for the Co-ordination of the Cathodic Protection of Buried Structures, London, England, the term "interference" is used to describe the action of the current used in cathodic protection. Mention of this is made so that if the term is encountered in connection with cathodic protection in England, the true connotation will be known. The paragraph describing the use of this term is as follows:

"General:

Every cathodic protection scheme operates by the injection of direct current into the general mass of earth in the vicinity of the protected structure. This current is likely to traverse any other underground structure which may be in the immediate neighbourhood, and that structure therefore tends to become corroded at points which act as anodes. This action has been termed "interference" and it poses what is probably the most complex problem in the practice of cathodic protection."

NEW BOOKS:

John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. announces the following books:

"Circuit Theory of Linear Noisy Networks" by Hermann A. Haus, and Richard B. Adler, both of Massachusetts Institute of Technology. This monograph presents a systematic treatment of n-terminal-pair networks with internal noise. A Technology Press Research Monograph, 1959, 79 pages, \$4.50.

"Principles and Applications of Random Noise Theory" by Julius Bendat, University of Southern California. Clearly explains the principles and applications of random noise theory known to be of importance in statistical communication theory, systems analysis, automatic control, and many other fields. 1958. 431 pages. \$11.00.

"Noise in Electron Devices" by Louis D. Smullin, and Hermann A. Haus, both of the Massachusetts Institute of Technology. Emphasizing fundamental processes, the material presents background for the understanding of such devices as masers and parametric amplifiers. Gives the modern viewpoint regarding cathode noise phenomena, signal amplification in microwave tubes, and solid-state noise. A Technology Press Book, M. I. T. 1959. 413 pages. \$12.00

THE FREQUENCY SPECTRUM JUST CAN'T TAKE IT:

An article in the April 1960 issue of Signal by W. Dean, Jr., Frequency Allocation Section, Plans and Policy Branch, Office of Naval Communications, outlines some of the problems connected with the use of the spectrum and the limitations imposed upon the military services by the lack of suitable radio frequencies.

RUMOR:

It is rumored that there is a new Mil Spec on Interference coming out in about two months time. Further details will be given in the next Newsletter.

RADIO FREQUENCY CONTROL IN SPACE TELECOMMUNICATIONS:

A report on radio frequency control in relation to space telecommunication and research prepared for the use of the Senate Committee on Aeronautical and Space Sciences. 1960. 235 p. il. chart. Catalog

RECTIFICATION OF NARROW-BAND NOISE:

An article with the above title by Keefer S. Stull, Jr. of Westinghouse Electric Corporation, Baltimore, Maryland, appeared in the May 1960 issue of Electronic Industries. The following is an excerpt from the first paragraph:

"During a discussion on the rectification of narrow-band noise the following questions were asked: As the bandwidth of random noise is reduced and the noise spectrum approaches a single frequency, does the noise wave shape approach sinusoidal form? Is the ratio of rectified dc output to rms input affected?..... The above questions are answered in a way that may be of interest".

ARMOUR SENDS OUT CALL FOR PAPERS FOR 6th RFI CONFERENCE

S. L. Cohn, Conference Chairman, has sent out a call for papers for the 6th Conference on Radio Frequency Interference which is planned for October 4, 5, and 6, 1960 in Chicago. The Conference will be sponsored jointly by the three military services and again conducted in cooperation with the IRE Professional Group on Radio Frequency Interference. The title and speaker for papers should be sent to Mr. Cohn by 1 June 1960 and a copy of the paper or an abstract of about 150-words-should be submitted by 15 June 1960. Approximately 45 minutes will be allowed for presentation and discussion.

BIONICS SHOULD BE WATCHED FOR RFI SOLUTIONS:

In an interview with John E. Keto of the Wright Air Development Division, who is chairman of the session on bionics at the National Aeronautical and Electronics Conference, Brainard Platt summarized some of the future developments in that field in Electronic News, May 2, 1960. He quoted Mr. Keto as stating that there is a need to discover more sophisticated methods of efficiently separating useful data from noise.

Bionics is a new word that represents the age old longing of man create devices to emulate the performance of living beings or perform in the manner of living things. Mr. Platt wrote "The time is ripe for expediting our thinking and activity in exploring bionics for national security and the general welfare of mankind."

NOTE FROM THE EDITOR:

To those of us who have been in interference reduction and control work for many years, we have found that there is no substitute for knowing our "opposite numbers" in the various military and government departments who are charged with the preservation of the electromagnetic spectrum for the good of the country. This Symposium offers every member of PGRFI a unique opportunity to meet those in Washington who can help them in their problems, or can refer them to other nearer home who can also be of help. The Committee is well aware of the many and diverse interests of many who will be attending the Symposium and is making an effort to see that all questions can be answered. Your editor cannot urge you too strongly to attend this Symposium and meet the people in the government who can be continually of value to you in your work.

Rexford Daniels
Editor - PGRFI Newsletter
Monument Street
Concord, Massachusetts

 **NEWSLETTER**
IRE PROFESSIONAL GROUP ON
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1 EAST 79 STREET, NEW YORK 21, N. Y.

