PGMTT National Symposium

SHERATON PARK HOTEL, WASHINGTON, D.C., MAY 15–17, 1961

Monday Morning

8:00 A.M.
Registration

10:15 A.M.
Opening Address—Robert O. Stone, *Symposium Chairman.*

10:20 A.M.
Keynote Address—Andre G. Clavier, Retired, International Telephone and Telegraph Labs., Nutley, N. J.

10:45 A.M. Session I—Millimeter Waves

Chairman—Robert O. Stone, National Bureau of Standards, Washington, D. C.

10:45 A.M.
"Quasi-Optical, Surface-Waveguide, and Other Components for the 100 to 300 KMC Region," F. Sobel and J. C. Wiltse, Electronic Communications, Inc., Timonium, Md.

Analytical and experimental studies were performed to evaluate various components and techniques from 100 to 300 kMc. Phase-corrected Fresnel zone plates were studied in detail; some properties and applications of these plates are presented.

11:10 A.M.
"A Millimeter Wave Fabry-Perot Maser," W. Culshaw and R. C. Mockler, National Bureau of Standards, Boulder, Colo.

The characteristics and design considerations for the use of a Fabry-Perot resonator as part of a maser are presented. State-selection problems and the minimum number of molecules required for maser oscillation and amplification are discussed.

11:35 A.M.
"Broadband Isolators and Variable Attenuators for Millimeter Frequencies," C. E. Barnes, Bell Telephone Labs., Murray Hill, N. J.

Faraday rotators with rotation independent of frequency in a band greater than 20 per cent centered at 55 kMc have been developed. Broadband isolators and variable attenuators have been designed using these rotators.

Monday Afternoon

2:00 P.M. Session II—Parametric Devices

Chairman—W. W. Mumford, Bell Telephone Labs., Whippany, N. J.

2:00 P.M.
"Transmission Phase Relations of Four-Frequency Parametric Devices," D. B. Anderson and J. C. Aukland, North American Aviation, Anaheim, Calif.

The transmission phase properties of parametric amplifiers are discussed. This matter is of extreme importance in angular detection systems, such as monopulse radars and interferometers, which use parallel signal channels. The analysis follows the matrix representation of a nonlinear capacitive reactance, four-frequency device and is comprehensive in its covering of the various types of parametric amplifiers.

"A Traveling-Wave Parametric Amplifier," T. H. Lee, Lockheed Aircraft Corporation, Sunnyvale, Calif.

This paper presents an analysis of a broad-band traveling-wave parametric amplifier in which the variable capacitance diodes are connected in series with the signal line rather than in shunt, resulting in a structurally and operationally simpler amplifier.

"An Electronically Tuneable Traveling-Wave Parametric Amplifier," R. C. Honey, Stanford Research Inst., Menlo Park, Calif.

This paper discusses a TW parametric amplifier incorporating several novel features which enable it to amplify in a narrow band that can be electronically tuned over a very wide frequency range by changing the pump frequency. A theoretical analysis and a graphical design technique is presented. A completed version with selected pill varactors which is capable of being tuned from very low frequencies to 2.25 kMc is also discussed.

3:15 P.M.
"Practical Design and Performance of Nearly Optimum, Wideband, Degenerate Parametric Amplifiers," M. Gilden and G. L. Matthaei, Stanford Research Inst., Menlo Park, Calif.

The nearly optimum, wideband performance of a single diode, degenerate parametric amplifier is obtained by using a series-resonated diode (rather than shunt) in an almost lumped constant network, and a separate pump resonator which is very lightly coupled to the diode and signal circuits. At 1 kMc, the amplifier offers 15 db midband gain, 1 db double channel noise figure and 20 per cent bandwidth for the two-resonator type compared to 8 per cent using one resonator.

"Design Theory of Up-Converters for Use as Electronically Tuneable Filters," G. Matthaei, Stanford Research Inst., Menlo Park, Calif.

The single diode, upper or lower sideband up-converters discussed use a wideband filter at the signal port, a moderately wide-band filter at the pump port, and a narrow-band filter at the sideband output port, which permit selection of the input signal frequency by varying the pump frequency.

"Passive Phase-Distortionless Parametric Limiters," I. T. Ho and A. E. Siegman, Stanford University, Stanford, Calif.

This paper presents the theoretical analysis and experimental results of a parametric limiter at *S*-band under CW or pulsed excitation. Theoretical expressions for the limiting threshold, bandwidth and dynamic range in terms of varactor diode characteristics are compared with experimental results.

Monday Evening

7:30 P.M.
"The Business of Inventing," Jacob Rabinow, President, Rabinow Engineering Co., Washington, D. C.

Tuesday Morning

9:00 A.M. Session III—Ferrites

Chairman, Frank Reggia, Diamond Ordnance Fuze Lab., Washington, D. C.

9:00 A.M.
"Field Displacement Devices," G. J. Wheeler, Sylvania Electric Products, Mountain View, Calif.

The field displacement effect in a ferrite-loaded waveguide has been utilized to obtain an absorption modulator for high-speed switching or amplitude modulation of microwave energy. This ferrite modulator, when used as a microwave switch, is capable of high isolation and low insertion loss with small magnetic control fields.

9:25 A.M.
"A Field Displacement Isolator at 57 KMC," C. E. Fay and E. F. Kankowski, Bell Telephone Labs., Murray Hill, N. J.

This paper describes a field displacement isolator which makes use of oriented barium ferrite with a very high anisotropic field to considerably reduce the high field requirements of isolators at millimeter wavelengths. This isolator has an insertion loss of approximately 1 db in the forward direction and an isolation of 60 db in the reverse direction over the 56 to 58 kMc frequency range.

9:50 A.M.
"Solid State *X*-band Power Limiter," W. F. Krupke, T. S. Hartwick, and M. T. Weiss, Hughes Aircraft Co., Culver City, Calif.

This paper describes recent ferrite limiter results and reports on a new limiter concept which makes use of a reflection-type diode limiter and a ferrite limiter in tandem. These ferrite-diode combination limiters, which have an operation bandwidth of 700 Mc at X-band, have been successfully operated in the medium power range.

10:30 A.M.
"Frequency Doubling with Planar Ferrites and Isotropic Ferrites with Large Saturation Magnetizations," I. Bady,

USASC Research and Development Lab., Ft. Monmouth, N. J.

Experiments conducted with long thin ferrite slabs in rectangular waveguide show that planar ferrites are more efficient for frequency doubling than isotropic ferrites. This efficiency is increased further by making use of a traveling ring circuit. The fundamental frequencies used for the experiments ranged from 8500 Mc to 9400 Mc.

10:55 A.M.

"Octave Bandwidth UHF/*L*-Band Circulator," F. Arams, B. Kaplan, and B. Peyton, Airborne Instruments Lab., Melville, L. I., N. Y.

A broad-band four-port phase-shift-type circulator for the UHF/*L*-band has been developed which makes use of an aluminum-substituted yttrium-iron-garnet with a low saturation magnetization. This circulator has an insertion loss of 1 db or less, a minimum isolation of 20 db and an input VSWR of approximately 1.15 over the 665 Mc to 1320 Mc frequency range.

11:20 A.M.

"A New Balanced Type Ferrite Switch," T. Kuroda and A. Cho, Nippon Electric, Tokyo, Japan.

This paper describes a reactive microwave switch which makes use of a longitudinally-magnetized ferrite rod in a modified rectangular waveguide system. Two of these reactive ferrite devices are then used in conjunction with two hybrid junctions to obtain a balanced type microwave switch which makes use of noncritical control field and is insensitive to changes in temperature.

Tuesday Afternoon

2:00 P.M. Session IV—High Power Microwave Techniques Panel

Chairman, Clarence Jones, Massachusetts Institute of Technology, Cambridge, Mass.

"Spurious Outputs from High Power Microwave Tubes and Their Control," K. Tomiyasu, General Electric Company, Schenectady, N. Y.

"Windows," D. B. Churchill, Sperry Gyroscope Co., Great Neck, L. I., N. Y.

"High Power Duplexers," E. Muehe, Mass. Inst. Tech., Lincoln Laboratories, Lexington, Mass.

Panel Members

C. R. Beitz, Cornell Aeronautical Lab., Buffalo, N. Y.

J. B. Griemsman, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

L. Gould, Microwave Associates, Burlington, Mass.

2:00 P.M. Session V—Low-Noise Microwave Amplifiers

Chairman, G. Wade, Raytheon Company, Burlington, Mass.

"Traveling Wave Tubes," D. A. Watkins, Stanford University, Stanford, Calif.

"Parametric Amplifiers," R. D. Weglein, Hughes Aircraft Co., Malibu, Calif.

"Masers," H. E. D. Scovil, Bell Telephone Labs., Murray Hill, N. J.

Panel Members

K. K. N. Chang, RCA Labs., Princeton, N. J.

J. W. Meyer, Mass. Inst. Tech., Cambridge, Mass.

J. Weber, University of Maryland, College Park, Md.

Tuesday Evening

7:00 P.M. **Banquet**

Speaker, Dr. John R. Pierce, Director of Research, Communications Principles, Bell Telephone Labs., Murray Hill, N. J.

Wednesday Morning

9:00 A.M. Session VI—Plasma

Chairman, N. Marcuvitz, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

9:00 A.M.

"Microwave Instrumentation for Plasma Research," E. G. Schwartz and H. H. Grimm, General Electric Co., Syracuse, N. Y.

Instrumentation has been developed to make extensive microwave measurements on shock introduced plasmas, each of which exists for a small number of milliseconds. The equipment operates at two frequencies, one near 8 kMc and the other near 60 kMc. All the components are capable of withstanding 100 kw peak power levels at 8 kMc.

9:25 A.M.

"Precision Measurements of Plasma Afterglows," E. H. Holt, K. C. Stotz, and S. Pike, Rensselaer Polytechnic Inst., Troy, N. Y.

The general problem of plasma study becomes simplified by the removal of any energy input. The plasma "decays" by processes of radiation and various types of particle interactions. The paper describes a scheme to determine two to three orders of magnitude change in the plasma density by detection of very small rapidly changing phase shifts.

9:50 A.M.

"Electromagnetic Properties of Weakly Ionized Argon" F. L. Tevelow and H. D. Curchack, Diamond Ordnance Fuze Lab., Washington, D. C.

Electromagnetic properties of weakly ionized argon are determined by approximating that the gas is a dielectric slab inclosed in a waveguide. The measurements are made in a shock tube at 10 kMc and are time resolved with total test time less than 300 microseconds. Curves of electron density, complex propagation constant and reflection coefficient are given as a function of distance behind a shock front for shock Mach numbers 7 to 9.

10:30 A.M.

"The Radiation Field and *Q* of a Resonant Cylindrical Plasma Column," W. D. Hershberger, University of California at Los Angeles, Calif.

A cylindrical plasma column placed across a waveguide or situated in free space in such a fashion that the electric field of an incoming wave is perpendicular to the axis of the column displays a series of resonant responses constituting a reflection and absorption spectrum. The paper discusses the electromagnetic field associated with the assumed electronic motion for the principal member of the spectrum and the factors which determine the width of the resonant response of this member.

10:55 A.M.

"A Plasma Guide Microwave Selective Coupler," W. H. Steier and I. Kaufman, Space Technology Lab., Canoga Park, Calif.

A selective plasma guide coupler is described. The coupling of plasma guide coupler can be continuously varied from less than −40 db to 8.5 db and it is believed that maximum coupling can be increased still further. Pulse power levels of greater than 100 watts at *X*-band can be handled.

Wednesday Afternoon

1:30 P.M. Session VII—System and Receiver Noise Performance Clinic

Chairman, Herman Haus, Mass. Inst. Tech., Cambridge, Mass.

Speakers

"Measurement of System and Receiver Performance," R. S. Engelbrecht, Bell Telephone Labs., Whippany, N. J.

The concept of operating noise temperature is employed in order to compare the noise performance of various receiving systems in terms of their environment (sky noise, etc.), component characteristics (noise figure, effective input noise temperature, gain, bandwidth, etc.), and intended use (one or two channel, radar or radiometry, etc.).

"Some Typical Examples," Robert Adler, Zenith Radio Corporation, Chicago, Ill.

Parametric amplifiers accept signal and noise inputs on more than one channel. To evaluate their weak-signal performance in a given installation we must know not only about the amplifier itself but also about the antenna system and the type of signal. The last two factors have surprisingly large effects and may swing the balance in favor of one or another type of amplifier. This is illustrated by practical examples.

"Commentary on Methods of Measurements," M. T. Lebenbaum, Airborne Instruments Lab., Melville, L. I., N. Y.

The general methods of noise figure measurement will be briefly reviewed. The special problems introduced by the peculiarities of negative resistance devices are emphasized, and some precautions suggested. Hot and cold body loads for measurement of very low noise temperature systems are described.