

# Microwave Abstracts

Based on technical merit and timeliness, microwave papers in journals published outside the United States have been selected and compiled below, many with annotations. Reprints of the papers may be obtained by writing directly to the author or to the source quoted.

—F. G. R. Warren, *Associate Editor for Abstracts*  
RCA Victor Company, Ltd., Montreal, Canada

## PAPERS FROM JOURNALS PUBLISHED IN GERMANY

Compiled by Dr. Wolfgang Schlosser, Bell Telephone Laboratories, Murray Hill, N. J.

**1** **A Generalized Reciprocity Theorem for Radiating Apertures**, by J. van Bladel; *Archiv für Elektrische Übertragung*, vol. 20, pp. 447-450, 1966.

A formula is given for the short circuit current on an aperture which allows the calculation of the power available from the antenna. (In English.)

**2** **Dielectrically Anisotropic Slabs as Microwave Resonators**, by G. Blechert; *Archiv für Elektrische Übertragung*, vol. 20, pp. 149-156, 1966.

Maxwell's equations are solved for a dielectric slab with anisotropic dielectric properties.

**3** **Broadband Tuning of Y-Circulators by Variable Line Transducers**, by F. Bosch and G. Schneider; *Archiv für Elektrische Übertragung*, vol. 20, pp. 526-528, 1966.

Variable strip line transducers of a simple construction are used to tune the Y-circulator. The 20 dB bandwidth of an untuned circulator could be increased from 7.7 to 43 percent. The VSWR at all three ports was smaller than 1.2 over the entire band.

**4** **Broadband and High Power Transition between Waveguide and Coaxial Line**, by G. von Dall'Armi; *Frequenz*, vol. 20, pp. 270-272, 1966.

A transition from a  $TE_{10}$  waveguide to a coaxial line is designed which is capable of transmitting a power of 50 kW and has a reflection coefficient 0.016 between 470 and 790 MHz.

**5** **Some Wide-Band Absorbers and Measuring Methods to Determine their Properties**, by J. Deutsch, H. J. Jung, and G. Vollhardt; *Zeitschrift für angewandte Physik*, vol. 20, pp. 511-516, 1966.

Construction methods are described and discussed. Two measuring methods for the reflection coefficient are given and the results are compared with calculations.

**6** **Wide-Band Absorbers with Low Reflection Coefficients**, by J. Deutsch, H. J. Jung, and G. Vollhardt; *Zeitschrift für angewandte Physik*, vol. 20, pp. 540-544, 1966.

In the second paper, the construction of simple wide-band absorbers is described.

**7** **Strip Line Circulator for Low Temperatures**, by P. Emmrich; *Archiv für Elektrische Übertragung*, vol. 20, p. 237, 1966.

A circulator has been built which can be used at temperatures as low as 40°K in the frequency range of 3.6 to 4.2 GHz. Ytrium-iron garnet has been used as ferrite material. The isolation was 25 dB.

**8** **The Microwave Filters and Combining Networks of the 6 Gc/s Wideband Radio Relay System for 1800 Voice Circuits**, by G. Ensslin and H. G. Maier; *NTZ Commun. J.*, vol. 5, pp. 220-224, 1966.

The design and operation of tunable bandpass filters and the coupling networks to the antenna are described. (In English.)

**9** **Transmission Properties of the Symmetric Waves in Dielectric Tubes**, by E. St. Ferdinandoff; *Hochfrequenztechnik und Elektroakustik*, vol. 75, pp. 105-108, 1966.

The propagation constant of circular symmetric waves in tubes with thin walls is determined approximately.

**10** **Random Imperfections of Lens Waveguides**, by D. Glogé; *Archiv für Elektrische Übertragung*, vol. 20, pp. 82-90, 1966.

The effects of random displacements of the lenses and bends of the guide are calculated taking into account the aperture of the lenses. A typical lens displacement of 0.16 mm in a guide with 10 mm diameter gas lenses, 5 m apart, causes 4 dB loss per kilometer.

**11** **The Eigenmodes of Dielectric Posts between Metallic Plates**, by W. Haas and H. D. Godtmann; *Archiv für Elektrische Übertragung*, vol. 20, pp. 97-102, 1966.

Maxwell's equations are solved for an open resonator consisting of an isotropic dielectric rod between two metallic plates.

**12** **The Measurements of  $E$  and  $\mu$  at Centimeter Wavelengths with Resonators**, by H. W. Helberg and B. Wartenberg; *Zeitschrift für angewandte Physik*, vol. 20, pp. 505-510, 1966.

A measuring setup is described, which measures the complex permittivity and permeability of probes. The measurements were carried out at 6.8 and 9.7 GHz.

**13** **Field, Attenuation, and Resonant Frequencies of a Rectangular Parallelepiped with Nonzero Conductivity**, by M. Kohler and H. Bayer; *Zeitschrift für angewandte Physik*, vol. 20, pp. 387-392, 1966.

Maxwell's equations are solved.

**14** **The Influence of the Tolerances upon the Characteristic Impedance of Shielded Strip Lines**, by W. Krank; *Telefunken Zeitung*, vol. 39, pp. 215-222, 1966.

The influence of the tolerances is considered theoretically and manufacturing methods are developed, which allow to produce shielded strip lines with the same quality as coaxial lines but much smaller dimensions.

**15** **Diffraction in a Beam Waveguide with Statistical Irregularities**, by H. Larsen; *Frequenz*, vol. 20, pp. 1-10, 1966.

The attenuation due to the diffraction at statistically distorted elements of the beam waveguide are calculated approximately.

**16** **Reflection Coefficients at Offsets of Rectangular Waveguides**, by I. Lucas; *Archiv für Elektrische Übertragung*, vol. 20, pp. 683-690, 1966.

The reflection coefficients of the  $H_{01}$  mode at waveguide offsets are calculated.

**17** **The Reflection of the  $TE_{01}$  and  $TM_{01}$  Modes in a Conical Waveguide**, by R. Reitzig; *Frequenz*, vol. 20, pp. 113-118, 1966.

The planes of reflexion of the  $TE_{01}$  and  $TM_{01}$  mode below cutoff frequency in a conically tapered waveguide are calculated theoretically. For the  $TE_{01}$  mode, the results are verified experimentally.

**18** **The Coupling of Microwave Resonators for the Measurement of Material Properties**, by H. D. Rüpk; *Archiv für Elektrische Übertragung*, vol. 20, pp. 617-620, 1966.

The coupling is used to optimize the sensitivity of the measurement of material properties.

**19** **The Amplitude Dependence of Frequency Doubling with a Capacitance Diode**, by W. M. Rupp; *Archiv für Elektrische Übertragung*, vol. 20, pp. 506-514, 1966.

A varactor diode with an abrupt  $p-n$  junction is used. All interesting circuit parameters are given as functions of the amplitude of the input voltage. The nonlinearity is described

by a single auxiliary function. It is shown how the effects of a changed drive level can be eliminated by a change in the dc bias voltage.

20

**The Determination of the Complex Permittivity in a  $\text{TM}_{01}$  Microwave Resonator**, by E. Schanda; *Archiv für Elektrische Übertragung*, vol. 20, pp. 501-505, 1966.

Improved approximations for the permittivity are derived.

21

**The Frequency Behavior of Frequency Multipliers with Varactor Diodes**, by B. Schiek; *Archiv für Elektrische Übertragung*, vol. 20, pp. 515-526, 1966.

The output power of a frequency tripler and quadrupler is calculated for given source voltage and terminating impedances at the various harmonics. It is shown that the bandwidth of an idealized circuit is high compared to the practical circuit with filters that are necessary for separating the harmonics.

22

**Optimization of Launching Horns for Dielectric Waveguides**, by W. Schlosser; *Archiv für Elektrische Übertragung*, vol. 20, pp. 451-460, 1966.

A procedure is given to determine approximately the transition between a metallic and a dielectric waveguide.

23

**The Determination of Eigenmodes in Empty Waveguides with Arbitrary Boundary**, by W. Schlosser and G. Weinhausen; *Archiv für Elektrische Übertragung*, vol. 20, pp. 557-562, 1966.

A method is derived to determine theoretically the cutoff frequencies and the field distribution of normal modes in empty waveguides.

24

**A Pulse Modulator for Millimeter Waves**, by E. Schuegraf; *Frequenz*, vol. 20, pp. 86-92, 1966.

Ten ns pulses were generated at 35 GHz using the principle of magnetically controlled Faraday rotation.

25

**A Superheterodyne Receiver for Millimeter Waves**, by E. Schuegraf; *Frequenz*, vol. 20, pp. 364-371, 1966.

A detailed description of a receiver in the frequency range between 35 and 105 GHz is given.

26

**The Transient Behavior of a Frequency Tripler**, by K. Schuenemann and B. Schiek; *Archiv für Elektrische Übertragung*, vol. 20, pp. 265-274, 1966.

The transient behavior of a frequency tripler is analyzed by solving the system of nonlinear differential equations numerically. The calculations are carried out for pulsed amplitude and phase.

27

**The Determination of the Dielectric Constant of Fluids from the Reflection Coefficient**, by M. Schünzel and M. Stockhausen; *Zeitschrift*

*für angewandte Physik*, vol. 20, pp. 508-512, 1966.

The measurement of the complex permittivity of fluids by measuring the reflection coefficient at millimeter waves is discussed.

28

**Microwave Resonators and Their Use in Observing Resonance Absorption of Gases**, by G. Schulten; *Frequenz*, vol. 20, pp. 10-22, 1966.

The properties of quasi optical resonators are calculated. Measurements at 4 mm wavelength and the application of resonators as frequency standards are described.

29

**A Contribution to the Long Haul Waveguide Technique**, by H. Schymura; *Frequenz*, vol. 20, pp. 377-384, 390-396, 1966.

Reviews of the concepts and experiments of  $\text{TE}_{01}$  waveguide technique developed in an industrial laboratory.

30

**$\text{TE}_{01}$  Mode Filters**, by S. Sedlmair; *Frequenz*, vol. 20, pp. 372-377, 1966.

Mode filters are realized by dividing the round waveguide by a damping layer. The surface resistance of the layer is optimized and a filter is described which has an attenuation of 16 dB for the  $\text{TE}_{12}$  mode and 0.03 dB for the  $\text{TE}_{01}$  mode.

31

**Ferrites at High Microwave Power Levels**, by H. Severin; *NTZ Commun. J.* vol. 5, pp. 169-178, 1966.

The effects of strong microwave fields upon the nonlinear behavior of ferrites are described and possible applications are given.

32

**The Theory of Wave Propagation in Solid State Plasma Waveguides**, by D. Wauer; *Hochfrequenztechnik und Elektrokustik*, vol. 75, pp. 185-188, 1966.

The propagation of microwaves perpendicular to the magnetic field in solid state plasma waveguides is investigated theoretically. The numerical calculations are compared to measurements given in the literature.

#### PAPERS FROM JOURNALS PUBLISHED IN THE UNITED KINGDOM

*Compiled by Dr. M. G. F. Wilson, University College London, London, England.*

33

**High Frequency Guided Electromagnetic Waves in Application to Railway Signalling and Control**, by H. E. M. Barlow (Dept. of Electrical Engineering, University College London, U. K.); *The Radio and Electronic Engineer*, vol. 33, pp. 275-281, May 1967.

It is proposed that a screened surface wave mode is most suitable for trackside radar and signalling purposes. A practical guide is proposed consisting of a coaxial guide longitudinally slotted along its whole length.

34

**A Simplified Theory of the Three-Port Junction Ferrite Circulator**, by J. Helszajn (Dept. of Electrical and Electronic Engineering, University of Leeds, U. K.); *The Radio and Electronic Engineer*, vol. 33, pp. 283-288, May 1967.

Coupled mode theory is applied to an equivalent lumped circuit. Theoretical results are compared with previous circulator theories.

35

**Calculation of Resonance Frequencies of Microwave Cavities Containing Electro-Optic Crystals**, by M. J. P. Musgrave and H. Pursey (Div. of Molecular Science, National Physical Laboratory, Teddington, U.K.); *The Radio and Electronic Engineer*, vol. 33, pp. 322-324, May 1967.

Design detail is given for a cavity containing an optically uniaxial crystal. Results are given for KDP, KD\*P, ADP, and ADA.

36

**The Practical Design of Interdigital and Comb-Line Filters**, by B. F. Nicholson (The Marconi Research Laboratory, Great Budworth, Essex, U.K.); *The Radio and Electronic Engineer*, vol. 34, pp. 39-52, July 1967.

Existing design data is suitably arranged for computer calculation. Group delay, dissipation loss, harmonic suppression, and breakdown are considered.

37

**Waveguide Structures for Double-Beam Leaky-Wave Antennas**, by P. J. B. Clarricoats and P. E. Green (Dept. of Electronic Engineering, University of Leeds, U. K.); *Proc. IEE*, vol. 114, pp. 604-610, May 1967.

The behavior of two types of leaky-wave antenna is described in which more than one mode of propagation is supported. The radiation pattern of such an antenna has a mainlobe for each mode of propagation.

38

**Diffraction by a Deeply Modulated Random-Phase Screen**, by E. N. Bramley and M. Young (Science Research Council, Radio and Space Research Station, Ditton Park, Slough, U. K.); *Proc. IEE*, vol. 114, pp. 553-556, May 1967.

A study is made of intensity fluctuations of waves diffracted by a random screen which imposes large phase changes of an incident wave.

39

**Admittance of the Fat Cylindrical Antenna: Experimental Study**, by S. Prasad and Y. N. Rama Ran (Dept. of Electrical Engineering, New Mexico State University, U.S.A.); *Proc. IEE*, vol. 114, pp. 709-712, June 1967.

40

**Analytic Determination of Dipole Reactance by Radiation-Pattern Integration**, by P. C. J. Hill (British Broadcasting Corporation, Teddington, Surrey, U. K.); *Proc. IEE*, vol. 114, 853-858, July 1967.

It is shown that the reactance of a cylindrical dipole may be obtained by integrating the power pattern in the far field region. Comparison is made between this method and the usual Poynting vector and induced EMF methods.

41

**Current Distributions in Short-Circuited Rectangular Loops**, by T. S. M. Maclean (Dept. of Electronic and Electrical Engineering,

University of Birmingham, U. K.); *Proc. IEE*, vol. 114, pp. 859-863, July 1967.

This has direct application to methods whereby a small modulated loop is used to measure incident magnetic fields.

42

**Numerical Solution of Waveguide Discontinuity Problems**, by P. J. B. Clarricoats and K. R. Slinn (Dept. of Electronic Engineering, University of Leeds, U. K.); *Proc. IEE*, vol. 114, pp. 878-886, July 1967.

A computer method is described which may be used to determine the behavior of waveguide discontinuities which lie in a plane transverse to the direction of propagation. Several examples are considered and comparison is made with other methods.

43

**Experimental Data on X-Band Surface Waveguides and Launchers**, by H. Bialous (Plessey Co. Ltd., Roke Manor, Romsey, Hants., U.K.); *Proc. IEE*, vol. 114, pp. 1021-1029, August 1967.

Attenuation coefficients are given for several wire guides together with details of the mode launchers.

44

**Effect of Degenerate  $E_{11\nu}$  Mode in  $H_{01\nu}$  Mode Cavity on the Measurement of Complex Permittivity**, by C. P. Aron (Dept. of Electrical Engineering, Imperial College of Science and Technology, London, U. K.); *Proc. IEE*, vol. 114, pp. 1030-1034, August 1967.

45

**Oblique-Incidence Millimetre-Wave Plasma Diagnostics**, by M. M. Z. Kharadly and A. L. Cullen (Dept. of Electrical Engineering, University of Sheffield, U. K.); *Proc. IEE*, vol. 114, pp. 1035-1044, August 1967.

A beam of millimeter wave radiation enters a plasma at some angle of incidence  $\theta$  and emerges by refraction a distance  $D$  from the point of entry. It is shown that the electron-density distribution can be deduced from the way  $D$  varies with  $\theta$ .

46

**Guided Waves in an Infinite Cylindrical Cavity in a Magneto-Ionic Medium**, by S. R. Seshadri and K. L. Bhatnagar (Applied Research Laboratory, Sylvania Electronic Systems, Waltham, Mass., and Dept. of Electrical Engineering, University of Toronto, Canada); *Internat'l J. Electronics*, vol. 22, pp. 239-275, No. 3, 1967.

The characteristics of the guided waves supported by an infinitely long cylindrical cavity of free space immersed in a magneto-ionic medium are investigated.

47

**Tunable Microwave-Frequency Light Modulator**, by A. J. Fox and J. R. Mansell (Mullard Research Laboratories, Redhill, Surrey, U. K.); *Proc. IEE*, vol. 114, pp. 741-744, June 1967.

A tunable microwave-frequency light modulator using A.D.P. operates from 1.2 to 4.8 GHz. A modulation depth of 10 percent at 3.5 W was measured.

## Contributors



**John W. Bandler** (S'66-M'67) was born in Jerusalem, Palestine, on November 9, 1941. He received the B.Sc. (Eng.) degree of the University of London in electrical engineering at the Imperial College of Science and Technology, London, England, in 1963 and the Ph.D. degree of the University of London and the Diploma of Imperial College in 1967. He held a Research Studentship from the Science Research Council at Imperial College from 1963 to 1966. His work in the Department of Electrical Engineering concerned the stability and optimization of microwave tunnel-diode amplifiers.

He joined the Microwave Diode Applications Group at Mullard Research Laboratories, Redhill, Surrey, England, in 1966 and continued with research in the same field and with diode measurements. In 1967 he became a Postdoctorate Fellow at the University of Manitoba, Winnipeg, Canada. He is currently engaged in the Department of Electrical Engineering, with the support of the National Research Council of Canada, in studies of computer-aided optimization of microwave networks; he also lectures on microwave circuits.

Dr. Bandler is an Associate of the City and Guilds of London Institute and an associate member of the Institution of Electrical Engineers (Great Britain).



**Edmond S. Gillespie** (S'50-A'51-M'56) was born in Birmingham, Ala., on May 13, 1928. He received the B.E.E. degree in 1951 from Auburn University, Auburn, Ala., and the M.S. and Ph.D. degrees in engineering from the University of California at Los Angeles in 1961 and 1967, respectively.

During 1946 and 1947 he served in the U. S. Air Force as an Instructor at the USAF Radar School at Boca Raton, Fla. From 1951 through 1955 he was employed by the Sandia Corporation, Albuquerque, N. M., where he was primarily concerned with the development of telemetry antenna and transmission-line systems. From 1955 to 1963 he was a Senior Research Specialist with the Lockheed Aircraft Corporation, Burbank, Calif., where his duties included research and development of aircraft antennas and studies of surface wave phenomena with emphasis on the antenna problem. While studying for the doctoral degree, he received a teaching appointment as Associate in the Department of Engineering at UCLA. From 1963 to 1965 he was a Senior Engineer at UCLA's Institute of Geophysics and Planetary Physics. In 1965 he joined the faculty of the San Fernando Valley State College, Northridge, Calif., as an Associate Professor in the School of Engineering.

Dr. Gillespie is a member of Eta Kappa Nu and Tau Beta Pi.



**Jacob J. Gustincic** (S'61-M'65) was born in Cleveland, Ohio, on October 3, 1938. He received the B.S., M.S., and Ph.D. degrees in electrical engineering from Case Institute of Technology, Cleveland, Ohio, in 1960, 1962, and 1963, respectively. In 1963 he held a Case Engineering Fellowship.

Since 1963 he has been an Assistant Professor in the Department of Engineering at the University of California at Los Angeles. He is presently engaged in research and teaching in the field of applied electromagnetics.

Dr. Gustincic is a member of Sigma Xi.



**Curtis P. Hartwig** (S'59-M'66) was born in Boston, Mass., on July 13, 1939. He received the S.B. and S.M. degrees in 1962 and the Ph.D. degree in 1966, all in electrical engineering, from the Massachusetts Institute of Technology, Cambridge.