

11. REFERENCES

The references given below include only selected papers referred to in the text of this report. A comprehensive survey of work in the field of tropospheric propagation, and an extensive bibliography will be found in the following report:

Shkarofsky, I. P. (March 1958), Tropospheric scatter propagation, Res. Rpt. No. 7-200-1, RCA Victor Co., Ltd. Res. Labs, Montreal, Canada.

Four recent bibliographies are:

Abbott, R. L. (Nov. 1960), Bibliography of tropospheric radio wave scattering, NBS Tech. Note No. 80.

Abbott, R. L., and E. R. Westwater (Dec. 1961), Bibliography of microwave thermal emissions by atmospheric gases, Private Communication.

Nupen, Wilhelm (1964), Bibliography on propagation of radio waves through the troposphere, NBS Tech. Note No. 304.

Dougherty, H. T. (Aug. 1964), Bibliography of fading on microwave line-of-sight tropospheric propagation paths and associated subjects, NBS Tech. Note No. 302.

Anderson, L. J., and E. E. Gossard (Oct. 1953a), The effect of the oceanic duct on microwave propagation, Am. Geophys. Union Trans. 34, No. 5, 695-700.

Anderson, L. J., and E. E. Gossard (Jan. 1953b), Prediction of the nocturnal duct and its effect on UHF, Proc. IRE 41, No. 1, 136-139.

Arons, L. D. (Oct. 1956), An analysis of radio-wave scattering in the diffraction region, Cornell University E. E. Report 312.

Artman, J. O., and J. P. Gordon (Dec. 1954), Absorption of microwaves by oxygen in the millimeter wavelength region, Phys. Rev. 96, No. 5, 1237-1245.

Bachynski, M. P. (1959), Microwave propagation over rough surfaces, RCA Review 20, No. 2, 308-335.

Bachynski, M. P. (July-Aug. 1960), Propagation at oblique incidence over cylindrical obstacles, J. Res. NBS 64D (Radio Prop.), No. 4, 311-315.

Bachynski, M. P. (March 1963), Scale model investigations of electromagnetic wave propagation over natural obstacles, RCA Review 24, No. 1, 105-144.

Barghausen, A. F., F. O. Giraud, R. E. McGavin, S. Murahata, and R. W. Wilber (Jan. 1963), Equipment characteristics and their relation to system performance for tropospheric communication circuits, NBS Tech. Note 103.

Barsis, A. P., and M. E. Johnson (Nov. - Dec. 1962), Prolonged space-wave fade-outs in tropospheric propagation, J. Res. NBS 66D (Radio Prop.), No. 6, 681-694.

Barsis, A. P., and R. S. Kirby (Sept. - Oct. 1961), VHF and UHF signal characteristics observed on a long knife-edge diffraction path, J. Res. NBS 65D (Radio Prop.), No. 5, 437-448.

Barsis, A. P., K. A. Norton, P. L. Rice, and P. H. Elder (Aug. 1961), Performance predictions for single tropospheric communication links and for several links in tandem, NBS Tech. Note 102. (See also IRE Transactions on Communication Systems CS-10, No. 1, 2-22, March 1962).

- Batchelor, G. K. (1947), Kolmogoroff's theory of locally isotropic turbulence, Proc. Camb. Phil. Soc. 43, 533-559.
- Batchelor, G. K. (1953), The theory of homogeneous turbulence, (Cambridge University Press).
- Bean, B. R. (May 1954), Prolonged space-wave fadeouts at 1,046 Mc observed in Cheyenne Mountain propagation program, Proc. IRE 42, No. 5, 848-853.
- Bean, B. R. (1956), Some meteorological effects on scattered VHF radio waves, IRE Trans. Comm. Syst., CS4(1), 32-38.
- Bean, B. R. (July-Aug. 1959), Climatology of ground-based radio ducts, J. Res. NBS 63D (Radio Prop.), No. 1, 29-34.
- Bean, B. R. (1961), Concerning the bi-exponential nature of the tropospheric radio refractive index, Beiträge zur Physik der Atmosphäre 34, No. 1/2, 81-91.
- Bean, B. R., and R. L. Abbott (1957), Oxygen and water vapor absorption of radio waves in the atmosphere, Geofisica Pura e Applicata - Milano 37, 127-134.
- Bean, B. R., and B. A. Cahoon (Nov. 1957), The use of surface observations to predict the total atmospheric bending of radio rays at small elevation angles, Proc. IRE 45, No. 11, 1545-1546.
- Bean, B. R., B. A. Cahoon, C. A. Samson, G. D. Thayer (1966), A world atlas of atmospheric radio refractivity, to be published as a Monograph.
- Bean, B. R., J. D. Horn, and A. M. Ozanich, Jr. (Nov. 1960), Climatic charts and data of the radio refractive index for the United States and the world, NBS Monograph No. 22.
- Bean, B. R., J. D. Horn, and L. P. Riggs (Oct. 1962), Synoptic radio meteorology, NBS Tech. Note 98.
- Bean, B. R., and G. D. Thayer (May 1959), Models of the atmospheric radio refractive index, Proc. IRE 47, No. 5, 740-755.
- Beard, C. I. (September 1961, Coherent and incoherent scattering of microwaves from the ocean, IRE Trans. Ant. Prop. AP-9, 470-483.
- Beard, C. I., I. Katz, and L. M. Spetner (April 1956), Phenomenological vector model of microwave reflection from the ocean, IRE Trans. Ant. Prop. AP-4, No. 2, 162-167.
- Beckmann, P. (1957), A new approach to the problem of reflection from a rough surface, Acta, Tech. Ceskosl. Akad. 2, 311-355; see also pp. 323-335. (1959).
- Beckmann, P. (1960), A generalized Rayleigh distribution and its application to tropospheric propagation, Electromagnetic Wave Propagation, (Symposium, Liege, 1958), (Academic Press, London, 445-449).
- Beckmann, P. (1961a), The statistical distribution of the amplitude and phase of a multiply scattered field, Inst. Rad. Eng. and Elec., Czechoslovak Akad. Sci., Paper No. 18. See also J. Res. NBS 66D, (Radio Prop.), pp. 231-240, 1962.

- Beckmann, P. (1961b), The depolarization of electromagnetic waves scattered from rough surfaces, *Inst. Rad. Eng. and Elect., Czechoslovak Akad. Sci., Paper No. 19.*
- Beckmann, P. (September 1964), Rayleigh distribution and its generalization, *J. Res. NBS 68D, (Radio Science), No. 9, pp. 927-932.*
- Beckmann, P. and A. Spizzichino (1963), The scattering of Electromagnetic waves from rough surfaces, *International Series of Monographs on Electromagnetic Waves, Vol. 4, (Pergamon Press, New York, N.Y.).*
- Biot, M. A. (Dec. 1957a), Some new aspects of the reflection of electromagnetic waves on a rough surface, *J. Appl. Phys. 28, No. 12, 1455-1463.*
- Biot, M. A. (Nov. 1957b), Reflection on a rough surface from an acoustic point source, *J. Acoust. Soc. Am. 29, No. 11, 1193-1200.*
- Booker, H. G. (1946), Elements of radio meteorology: How weather and climate cause unorthodox radar vision beyond the geometrical horizon, *J. Inst. Elec. Engrs. (London) 93, Pt. III-A, No. 1, 69-78.*
- Booker, H. G., and J. T. de Bettencourt (Mar. 1955), Theory of radio transmission by tropospheric scattering using very narrow beams, *Proc. IRE 43, No. 3, 281-290.*
- Booker, H. G., and W. E. Gordon (Sept. 1950a), Outline of a theory of radio scattering in the troposphere, *J. Geophys. Res. 55, No. 3, 241-246; see also Proc. IRE 38, No. 4, 401, (April, 1950b).*
- Booker, H. G., and W. Walkinshaw (April 1946), The mode theory of tropospheric refraction and its relation to waveguides and diffraction, *Report on Conference on Meteorological Factors in Radio Wave Propagation (The Phys. Soc., and the Royal Met. Soc., London), 80-127.*
- Bray, W. J., F. Hopkins, A. Kitchen, and J. A. Saxton (Jan. 1955), Review of long-distance radio-wave propagation above 30 Mc/s, *Proc. IEE, Paper No. 1782R, Pt. B, 102, 87-95.*
- Bremmer, H. (1949), *Terrestrial radio waves; theory of propagation, (Elsevier Publishing Co., Amsterdam and New York, N.Y.).*
- Bremmer, H. (Sept. 1957), Distortion in tropospheric scatter, *Phillips Telecomm. Rev. 18, No. 3, 137-154.*
- Bremmer, H. (May 1959), On the theory of the fading properties of a fluctuating signal imposed on a constant signal, *NBS Circular 599.*
- Bugnolo, D. S. (July 1958), Multiple scattering of electromagnetic radiation and the transport equation of diffusion, *IRE Trans. Ant. Prop. AP-6, No. 3, 310.*
- Bullington, K. (Jan. 1950), Radio propagation variations at VHF and UHF, *Proc. IRE 38, No. 1, 27-32.*
- Bullington, K. (Oct. 1955), Characteristics of beyond-the-horizon radio transmission, *Proc. IRE 43, No. 10, 1175-1180.*
- Bussey, H. E. (July 1950), Microwave attenuation statistics estimated from rainfall and water vapor statistics, *Proc. IRE 38, No. 7, 781-785.*
- CCIR (1955), *Atlas of ground wave propagation curves for frequencies between 30 Mc/s and 300 Mc/s, ITU, Geneva.*

- CCIR (1959), Atlas of ground wave propagation curves for frequencies between 30 and 10,000 Mc/s (Vertical polarization only; prepared by the Radio Research Laboratories, Ministry of Postal Services, Tokyo, Japan, January 1958), ITU, Geneva.
- CCIR (1963a), The concept of transmission loss in studies of radio systems, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. III, Recommendation 341, 29-31.
- CCIR (1963b), Transmission loss in studies of radio systems, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. III, Report 112, 84-89.
- CCIR (1963c), Optimum use of the radio spectrum, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. III, Resolution 1, 111.
- CCIR (1963d), Line frequencies or bands of interest to radioastronomy and related sciences, in the 30 - 300 Gc/s range arising from natural phenomena, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. IV, Report 223, 304-307.
- CCIR (1963e), Reference atmospheres, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. II, Report, 231, 74-75.
- CCIR (1963f), Estimation of tropospheric-wave transmission loss, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. II, Report 244, 191-213.
- CCIR (1963g), Propagation curves for VHF/UHF broadcasting in the African Continent, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. III, Report 240, 143-181.
- CCIR (1963h), VHF and UHF propagation curves for the frequency range from 40 Mc/s to 1000 Mc/s - Broadcasting and mobile services, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. II, Recommendation 370, 24-36.
- CCIR (1963i), Communication satellite systems-frequency sharing between communication satellites systems and terrestrial services, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. IV, Report 209, 221-232.
- CCIR (1963j), Influence of the atmosphere on wave propagation, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. II, Report 233, 76-120.
- CCIR (1963k), Propagation data required for radio relay systems, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. II, Report 242, 182-187.
- CCIR (1963l), Fading of signals propagated by the ionosphere, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. II, Report 266, 327-334.
- CCIR (1963m), Terms and definitions, Documents of the Xth Plenary Assembly, ITU, Geneva, Vol. I, Report 321, 239.
- CCIR (1964), Optimum use of the radio frequency spectrum, Document being prepared for the XIth Plenary Assembly, in accordance with Resolution 1 of the Xth Plenary Assembly, ITU, Geneva, Vol. III, 111.
- Chernov, L. A. (Jan. - June 1955), Correlation of amplitude and phase fluctuations for wave propagation in a medium with random irregularities, Akust. Zh. 1, 89; translation in Soviet Phys. - Acoust. 1, No. 1-2, 94-101.

- Christiansen, W. N. (1947), Rhombic antenna arrays, A. W. A. Tech. Rev. [Amal. Wireless Australia] 7, No. 4, 361-383.
- Clemow, D. B., and E. H. Bruce-Clayton (Jan. 1963), Long range VHF air/ground communications, Brit. IRE J. 25, No. 1, 17-32.
- Cozzens, D. E. (June 1962), Nomograph for determining paraboloidal gain as a function of feed pattern and angular aperture, Microwave J. V, No. 6, 58-59.
- Crawford, A. B., and D. C. Hogg (July 1956), Measurement of atmospheric attenuation at millimeter wavelengths, Bell Syst. Tech. J. 35, 907-916.
- Crawford, A. B., D. C. Hogg, and W. H. Kummer (Sept. 1959), Studies in tropospheric propagation beyond the horizon, Bell Syst. Tech. J. 38, No. 5, 1067-1178.
- Crichlow, W. Q., D. F. Smith, R. N. Morton, and W. R. Corliss (Aug. 1955), Worldwide radio noise levels expected in the frequency band 10 Kc to 100 Mc, NBS Circular 557.
- Crysdale, J. H. (July 1958), Comparison of some experimental terrain diffraction losses with predictions based on Rice's theory for diffraction by a parabolic cylinder, IRE Trans. Ant. Prop. AP-6, No. 3, 293-295.
- Crysdale, J. H., J. W. B. Day, W. S. Cook, M. E. Psutka, and P. E. Robillard (April 1957), An experimental investigation of the diffraction of electromagnetic waves by a dominating ridge, IRE Trans. Ant. Prop. AP-5, No. 2, 203-210.
- Davenport, W. B., and W. L. Root (1958), An introduction to the theory of random signals and noise. McGraw-Hill Book Co., Inc., New York. Chapter 3.
- deJager, C. (1952), The spectrum of turbulence in the earth's upper atmosphere, Mem. Soc. Roy. des Sci., Liege 12, 223-252.
- Dickson, F. H., J. J. Egli, J. W. Herbstreit, and G. S. Wickizer (Aug. 1953), Large reductions of VHF transmission loss and fading by the presence of a mountain obstacle in beyond-line-of-sight paths, Proc. IRE 41, No. 8, 967-969. See also subsequent correspondence by Crysdale and rebuttal by Dickson, et al., in Proc. IRE 43, No. 5, 627-628 (May 1955).
- Doherty, L. H. (Sept. 1952), Geometrical optics and the field at a caustic with applications to radio wave propagation between aircraft, Cornell University School of Electrical Engineering Research Report EE-138.
- Dolukhanov, M. P. (1957), Investigations into the propagation of radio waves over the earth's surface in the USSR., Radio Engr. and Electronics (USSR) 2, No. 11, 39-61.
- Domb, C., and M. H. L. Pryce (Sept. 1947), The calculation of field strengths over a spherical earth, IEE 94, Part III, No. 31, 325-339.
- Dougherty, H. T., and L. J. Maloney, (Feb. 1964) The application of diffraction by convex surfaces to irregular terrain situations, J. Res. NBS 68D (Radio Science), No. 2, 239-250.
- duCastel, F. (1966), Tropospheric Radiowave Propagation beyond the Horizon, Pergamon Press. A translation from Propagation Troposphérique et Faisceaux Hertzien Trans-horizon, Editions Chiron, Paris, France.

- duCastel, F. (May 1957a), Different types of fluctuations of tropospheric fields and their physical interpretation, *L'Onde Electrique* 37, No. 362, 501-506.
- duCastel, F. (Nov. 1957b), The use of ultra short waves for long distance telephone links in Africa (Results of Tests in the Cameroons), *L'Onde Electrique* 37, No. 368, 1025-1035.
- duCastel, F. (Nov.-Dec. 1960), Experimental results from transhorizon tropospheric propagation, *Ann des Télécomm.* 15, No. 11-12, 255-259.
- duCastel, F., and P. Misme (Nov. 1957), Elements of radio climatology, *L'Onde Electrique* 37, No. 368, 1045-1052.
- duCastel, F., P. Misme, and J. Voge (March 1958), Reflection of an electromagnetic wave from an atmospheric layer with variable index of refraction, *C. R. Acad., Sci. Fr.* 246, No. 12, 1838-1840.
- duCastel, F., P. Misme, A. Spizzichino, and J. Voge (1962), On the role of the process of reflection in radio wave propagation, *J. Res. NBS* 66D, (Radio Science), No. 3, 273-284.
- Dutton, E. J. (June 1961), On the climatology of ground-based radio ducts and associated fading regions, *NBS Tech. Note* 96.
- Dutton, E. J., and G. D. Thayer (Oct. 1961), Techniques for computing refraction of radio waves in the troposphere, *NBS Tech. Note* 97.
- Fengler, G. (1964), Untersuchungen der elektromagnetischen Wellenausbreitung im 500 MHz-Bereich über Land unter besonderer Berücksichtigung der Meteorologie, *Berichte des Instituts für Radiometeorologie und Maritime Meteorologie an der Universität Hamburg*, Report No. 8.
- Fengler, G., J. Jeske, and G. Stilke, Radiometeorological papers II, *Berichte des Instituts für Radiometeorologie und Maritime Meteorologie an der Universität Hamburg*, Report No. 9.
- Florman, E. F., and J. J. Tary (Jan. 1962), Required signal-to-noise ratios, RF signal power, and bandwidth for multichannel radio communications systems, *NBS Tech. Note* 100.
- Fok, V. A., L. A. Vainshtein, and M. G. Belkina (1958), Radiowave propagation in surface tropospheric ducts, *Radio Eng. Electron. (USSR)*, 3, No. 12, 1-27.
- Friend, A. W. (June 1945), A summary and interpretation of ultra high frequency wave propagation data collected by the late Ross A. Hull, *Proc. IRE* 33, 358.
- Frills, H. T., A. B. Crawford, and D. C. Hogg (May 1957), A reflection theory for propagation beyond the horizon, *Bell Syst. Tech. J.* 36, No. 3, 627-644.
- Furutsu, K. (1956), On the multiple diffraction of electromagnetic waves by spherical mountains, *J. Radio Res. Labs., Tokyo* 3, 331.
- Furutsu, K. (1959), Wave propagation over an irregular terrain, I, II, III, *J. Radio Res. Labs., Tokyo* 4, 135, 349 (1957), and 6, 71 (1959).
- Furutsu, K. (Jan. - Feb. 1963), On the theory of radio wave propagation over inhomogeneous earth, *J. Res. NBS* 67D (Radio Prop.), No. 1, 39-62.

- Grosskopf, J. (June 1956), On the existing condition of research in the realm of tropospherically scattered radiation, *Nachrtech. Z.* 9, No. 6, 272-279.
- Grosskopf, J. (Nov. 1958), Some remarks on the analysis of fading in the meter and decimeter range, *Nachrtech. Z.* 11, No. 11, 577-586.
- Gunn, K. L. S., and T. W. R. East (Oct. 1954), The microwave properties of precipitation particles, *Quart. J. Roy. Meteorol. Soc. (London)* 80, 522-545.
- Harper, A. E. (1941), Rhombic antenna design, (D. van Nostrand Co., Princeton, N. J.).
- Hartman, W. J. (May 1963), Path antenna gain and comments on "Properties of 400 Mcps long-distance tropospheric circuits," *Proc. IEEE* 51, No. 5, 847-848.
- Hartman, W. J., and R. E. Wilkerson (Nov. - Dec. 1959), Path antenna gain in an exponential atmosphere, *J. Res. NBS* 63D (Radio Prop.), No. 3, 273-286.
- Hathaway, S. D., and H. W. Evans (Jan. 1959), Radio attenuation at 11 kMc and some implications affecting relay system engineering, *Bell Syst. Tech. J.* 38, No. 1, 73-97.
- Haurwitz, B. and J. M. Austin [1944], *Climatology*, McGraw-Hill Co. Inc., New York.
- Hay, H. G., and R. S. Unwin (Dec. 1952), Tropospheric wave propagation in a duct of non-uniform height, *Phys. Soc. London Proc.* 65, No. 396b, 981-989.
- Head, H. T. (June 1960), The influence of trees on television field strengths at ultra-high frequencies, *Proc. IRE* 48, No. 6, 1016-1020.
- Heisenberg, W. (Dec. 1948), On the theory of statistical and isotropic turbulence, *Proc. Roy. Soc. London* A195, 402-406.
- Herbstreit, J. W., and P. L. Rice (Sept. 1959), Survey of Central Radio Propagation Laboratory research in tropospheric propagation, 1948-1956, NBS Tech. Note No. 26.
- Hirai, Masaichi (May 1961a), Multipath properties of tropospheric propagation of very short radio waves beyond the horizon, *Jour. Radio Res. Lab., Japan* 8, No. 37, 147-174.
- Hirai, Masaichi (Sept. 1961b), Diversity effects in spaced-antenna reception of tropospheric scatter waves, *Jour. Radio Res. Lab., Japan* 8, 301-329.
- Hitchcock, R. J., and P. A. C. Morris (July 1961), The HF band: Is a new look required? *Wireless World*, 375,378.
- Hogg, D. C., and W. W. Mumford (March 1960), The effective noise temperature of the sky, *Microwave J.* 3, 80-84.
- Hogg, D. C., and R. A. Semplak (Sept. 1961), The effect of rain and water vapor on sky noise at centimeter wavelengths, *Bell Syst. Tech. J.* 40, No. 5, 1331-1348.
- Ikegami, F. (July 1959), Influence of an atmospheric duct on microwave fading, *IRE Trans. Ant. Prop.* AP-7, No. 3, 252-257.
- Ikegami, F. (May-June 1964), Radiometeorological effects in propagation over the sea and islands, *Rev. Elect. Commun. Lab., Tokyo*, Vol. 12, No. 5-6, 312-324.

- International Telephone and Telegraph Corporation (1956), Reference data for radio engineers, Fourth Edition, (ITT, New York).
- Janes, H. B., and P. I. Wells (Oct. 1955), Some tropospheric scatter propagation measurements near the radio horizon, Proc. IRE 43, No. 10, 1336-1340.
- Jasik, H. (1961), Antenna Engineering Handbook, (McGraw Hill).
- Johnson, M. A. (1958), A review of tropospheric scatter propagation theory and its application to experiment, Proc. IEE 105B, Suppl. 8, 165-176.
- Josephson, B., and A. Blomquist (April 1958), The influence of moisture in the ground, temperature and terrain on ground wave propagation in the VHF band, IRE Trans. Ant. Prop. AP-6, No. 2, 169-172.
- Josephson, B., and G. Carlson (April 1958), Distance dependence, fading characteristics and pulse distortion of 3000 Mc trans-horizon signals, IRE Trans. Ant. Prop. AP-6, No. 2, 173-175.
- Josephson, B., and F. Eklund (April 1958), Some microwave propagation experiences from a just-below-horizon path, IRE Trans. Ant. Prop. AP-6, No. 2, 176-178.
- Jowett, J. K. S. (Jan. 1958), The measurement and prediction of VHF tropospheric field strengths at distances beyond the horizon, Proc. IEE 105B, Suppl. 8, 91-96, and 122-126, Paper No. 2500R.
- Joy, W. R. R. (Jan. 1958a), The long-range propagation of radio waves at 10 cm wavelength, Proc. IEE 105B, Suppl. 8, 153-157, Paper No. 2522R.
- Joy, W. R. R. (1958b), Radio propagation far beyond the horizon at about 3.2 cm wavelength, Proc. IEE 105B, Suppl. 8, 158-164 and 184-188, Paper No. 2528R.
- Kales, M. L. (May 1951), Elliptically polarized waves and antenna, Proc. IRE 39, No. 5, 544-549.
- Kalinin, A. I. (1957), Approximate methods of computing the field strength of ultra short waves with consideration of terrain relief, Radio Eng. 12, No. 4, 13-26, Radiotekhn. i Elektron. 12, No. 4, 13-23.
- Kalinin, Iu. K (1958), Perturbation of plane radio wave by inhomogeneities of the earth's surface, Radiotekh. and Elektron 3, 557-561, Translation in Radio Engineering and Electronics 3, No. 4, 143-149.
- Kerr, D. E. (1951), Propagation of short radio waves, MIT Radiation Laboratory Series 13, (Boston Technical Publishers, Inc., Lexington, Mass.).
- Kirby, R. S., H. T. Dougherty, and P. L. McQuate (Oct. 1955), Obstacle gain measurements over Pike's Peak at 60 to 1046 Mc/s, Proc. IRE 43, No. 10, 1467-1472.
- Kirby, R. S., P. L. Rice, and L. J. Maloney (Oct. 1961), Characteristics of point-to-point tropospheric propagation and siting considerations, NBS Tech. Note No. 95.

- Kitchen, F. A., and I. J. Richmond (March 1957), Some characteristics of long distance scatter transmissions (two parts), *British Comm. and Electr.* 4, No. 2, 74-78 (Feb. 1957); 4, No. 3, 146-148, (March 1957).
- Kitchen, F. A., E. G. Richards, and I. J. Richmond (Jan. 1958), Some investigations of metre-wave radio propagation in the transhorizon region, *Proc. IEE* 105B, Supp. 8, 106-116, Paper No. 2509R.
- Kitchen, F. A., W. R. R. Joy, and E. G. Richards (Aug. 1958), Influence of the semi-permanent low-level ocean duct on centimetre wave scatter propagation beyond the horizon, *Nature* 182, No. 4632, 385-386.
- Kolmogoroff, A. N. (1941), Dissipation of energy in locally isotropic turbulence, *Comptes Rendus (Doklady) de l'Academie des Sciences de l'USSR* 32, No. 1, 16-18.
- Krasil'nikov, V. A. (1949), The effect of variations of the coefficient of refraction in the atmosphere upon the propagation of ultra-short waves, *Izvest. Akad. Nauk.S.S.S.R. Sev. Geografi Geofiz.* 13, No. 1, 33-57 (in Russian).
- Kühn, V. (Feb. and May 1958), Propagation investigation of the effect of various types of terrain in frequency bands I, II, and III, *Tech. Comm. Lab. for Commercial Radio and Telev., BRF, DDR*.
- Lane, J. A., and J. A. Saxton (July 1952), Dielectric dispersion in pure polar liquids at very high radio frequencies, *Proc. Roy. Soc.* A213, 400-408.
- Laws, J. O., and D. A. Parsons (Apr. 1943), The relation of raindrop-size to intensity, *Trans. Amer. Geophys. Union* 24, 452-460.
- Lewin, L. (July 1962), Diversity reception and automatic phase correction, *Proc. IEE* 109, Part B, No. 46, 295-304.
- McGavin, R. E. (May 1962), A survey of the techniques for measuring the radio refractive index, *NBS Tech. Note* 99.
- McGavin, R. E., and L. J. Maloney (Sept. - Oct. 1959), Study at 1046 Mc/s of the reflection coefficient of irregular terrain at grazing angles, *J. Res. NBS* 63D (Radio Prop.), No. 2, 235-248.
- McPetrie, J. S., and J. A. Saxton (Sept. 1942), Diffraction of ultra-short radio waves, *Nature* 150, 292.
- McPetrie, J. S., and L. H. Ford (1946), Some experiments on the propagation over land of radiation of 9.2 cm wavelength, especially on the effect of obstacles, *Proc. IEE* 93, Pt. 3-A, Nos. 1-4, 531-538.
- Megaw, E. C. S. (Dec. 1950), Scattering of electromagnetic waves by atmospheric turbulence, *Nature* 166, 1100-1104.
- Megaw, E. C. S. (April 1954), Interpretation of stellar scintillation, *Quart. J. Roy. Met. Soc.* 80, 248-251.
- Megaw, E. C. S. (Sept. 1957), Fundamental radio scatter propagation theory, *Proc. IEE*, Pt. C 104, No. 6, 441-455, see also Monograph 236R, May 1957.
- Merkulov, V. V. (1957), On the theory of propagation of electromagnetic waves in media with random inhomogeneities in the index of refraction, *Soviet Physics: Tech. Phys.* 2, 958-961, *J. Electro-Tech. Phys.* 27, No. 5, 1051.

- Millington, G. (May 1958), Tropospheric scatter propagation, *Electronic Eng.* 30, No. 363, 248-252.
- Millington, G., R. Hewitt, and F. S. Immirzi (Sept. 1962a), Double knife-edge diffraction in field strength predictions, *Proc. IEE* 109, Part C, No. 16, 419-429. See also IEE Monograph No. 507E (Mar. 1962).
- Millington, G., R. Hewitt, and F. S. Immirzi (Sept. 1962b), The Fresnel surface integral, *Proc. IEE* 109, Part C, 430-437. See also IEE Monograph No. 508E (Mar. 1962).
- Millington, G., and G. A. Isted (July 1950), Ground wave propagation over an inhomogeneous, smooth earth, Part 2: Experimental evidence and practical implications, *Proc. IEE*, Part III 97, No. 48, 209.
- Misme, P. (July 1958), The correlation between the electric field at a great distance and a new radiometeorological parameter, *Trans. IRE Trans. Ant. Prop.* AP-6, No. 3, 289-292.
- Misme, P. (March-April 1960a), The equivalent gradient direct measurements and theoretical calculations, *Ann. des Télécomm.* 15, Nos. 3-4, 92-99.
- Misme, P. (Aug. 1960b), Comments on "Models of the atmospheric radio refractive index," *Proc. IRE* 48, No. 8, 1498-1501.
- Misme, P. (Nov.-Dec. 1960c), Some aspects of radiometeorology and radioclimatology, *Ann. des Télécomm.* 15, No. 11-12, 266-273.
- Misme, P. (May-June 1961), The influence of the equivalent gradient and atmospheric stability on transhorizon paths in the Sahara and the Congo, *Ann. des Télécomm.* 16, Nos. 5-6, 110-116.
- Moler, W. F., and D. B. Holden (Jan. - Feb. 1960), Tropospheric scatter propagation and atmospheric circulations, *J. Res. NBS* 64D (Radio Prop.), No. 1, 82-94.
- Nakagami, M. (Oct. 1940), Study on the resultant amplitude of many vibrations whose phases and amplitudes are random, *Nippon Elec. Comm. Eng.* 22, 69-92.
- National Bureau of Standards (1954), *Applied Mathematics Series* 32, Table of the sine and cosine integrals for arguments from 10 - 100.
- National Bureau of Standards (June 1964), *Applied Mathematics Series* 55, Handbook of Mathematical Functions.
- Neugebauer, H. E. J., and M. P. Bachynski (July-Aug. 1960), Diffraction by smooth conical obstacles, *J. Res. NBS* 64D (Radio Prop.), No. 4, 317-329.
- Newton, R. G., and T. F. Rogers (Nov. 1953), Dependence of total microwave atmospheric absorption on propagation path elevation, Air Force Cambridge Report AFRCR Tech. 53-54A.
- Nomura, Y. A., and K. Takaku (Aug. 1955), On the propagation of electromagnetic waves in an inhomogeneous atmosphere, *J. Phys. Soc. Japan* 10, No. 8, 700-714.

- Norton, K. A. (Dec. 1941), The calculation of ground-wave field intensity over a finitely conducting spherical earth. Proc. IRE 29, No. 12, 623-639.
- Norton, K. A. (1950), Addendum to Reference E to the report of Ad Hoc Committee of the F. C. C. for the Evaluation of the Radio Propagation Factors Concerning the TV and FM Broadcasting Services in the Frequency Range Between 50 and 250 Mc/s. (See Norton and Fine reference below.)
- Norton, K. A. (Jan. 1953), Transmission loss in radio propagation, Proc. IRE 41, No. 1, 146-152.
- Norton, K. A. (July-Aug. 1959), System loss in radio wave propagation, J. Res. NBS 63D (Radio Prop.), No. 1, 53-73.
- Norton, K. A. (July 1960), Carrier frequency dependence of the basic transmission loss in tropospheric forward scatter propagation, J. Geophys. Res. 65, No. 7, 2029-2045.
- Norton, K. A. (1962), Efficient use of the radio spectrum, NBS Tech. Note 158.
- Norton, K. A., and E. C. Barrows (1964), Observed vertical wavenumber spectra of refractivity near the ground, to be published.
- Norton, K. A., and H. Fine (Aug. 1, 1949), A study of methods for the efficient allocation of radio frequencies to broadcasting services operating in the range above 50 Mc, Reference E to the Report of Ad Hoc Committee of the F. C. C. for the Evaluation of the Radio Propagation Factors Concerning the TV and FM Broadcasting Services in the Frequency Range Between 50 and 250 Mc/s.
- Norton, K. A., and A. C. Omberg (Jan. 1947), The maximum range of a radar set, Proc. IRE 35, No. 1, 4-24.
- Norton, K. A., P. L. Rice, H. B. Janes, and A. P. Barsis (Oct. 1955), The rate of fading in propagation through a turbulent atmosphere, Proc. IRE 43, No. 10, 1341-1353.
- Norton, K. A., P. L. Rice, and L. E. Vogler (Oct. 1955), The use of angular distance in estimating transmission loss and fading range for propagation through a turbulent atmosphere over irregular terrain, Proc. IRE 43, No. 10, 1488-1526.
- Norton, K. A., H. Staras, and M. Blum (Feb. 1952), A statistical approach to the problem of multiple radio interference to FM and television service, IRE Trans. Ant. Prop. AP-1, 43-49.
- Norton, K. A., L. E. Vogler, W. V. Mansfield, and P. J. Short (Oct. 1955), The probability distribution of the amplitude of a constant vector plus a Rayleigh-distributed vector, Proc. IRE 43, No. 10, 1354-1361.
- Obukhov, A. M. (1941), On the distribution of energy in the spectrum of turbulent flow, Bull. Acad. Sci. USSR Geog. and Geophys. Ser. 4-5, 453. See also Comptes Rendus (Doklady) L'Academie des Sciences de l'USSR 32, No. 1, 19 (1941).
- Obukhov, A. M. (1953), On the effect of inhomogeneities of the atmosphere on sound and light propagation, Bull. Acad. Sci. USSR, Geog. and Geophys. Ser. 2, 155.

- Onoe, M., M. Hirai, and S. Niwa (April 1958), Results of experiments of long distance over-land propagation of ultra-short waves, *J. Radio Res. Lab. (Tokyo)* 5, No. 20, 79-94.
- Onoe, M. and K. Nishikori (Oct. 1957), Microwave propagation over the sea beyond the line of sight, *Radio Res. Lab. J.* 4, No. 18, 395-406.
- Pearcey, T. (1956), *Table of the Fresnel integral*, (Cambridge Univ. Press, New York, N. Y.).
- Pekeris, C. L. (Feb. 1947), Note on scattering of radiation in an inhomogeneous medium, *Phys. Rev.* 71, No. 3, 268-269.
- Perlat, A., and J. Voge (Dec. 1953), Attenuation of centimeter and millimeter waves by the atmosphere, *Ann. des Télécomm.* 8, No. 12, 395-407.
- Price, W. L. (July 1948), Radio shadow effects produced in the atmosphere by inversions, *Proc. Phys. Soc. London* 61, No. 343, 59-78.
- Randall, D. L. (1964), A summary of tropospheric radio duct meteorology at V.H.F. and UHF as observed on a trip around the world, *World Conference on Radio Meteorology* Boulder, Colorado, September 14-18.
- Rayleigh, Lord (Aug. 1880), On the resultant of a large number of vibrations of the same pitch and of arbitrary phase, *Phil. Mag.* 10, 73-78.
- Riblet, H. J., and C. B. Barker (1948), A general divergence formula, *J. Appl. Phys.* 19, 63.
- Rice, P. L., and F. T. Daniel (Apr. 1955), Radio transmission loss vs. distance and antenna height at 100 Mc, *Trans. IRE Ant. Prop.* AP-3, No. 2, 59-62.
- Rice, P. L., and J. W. Herbstreit (1964), Tropospheric propagation, (to be published in Vol. 20 of *Advances in Electronics*, Academic Press).
- Rice, S. O. (Jan. 1945), Mathematical analysis of random noise, *Bell. System Tech. J.* 24, 46-156.
- Rice, S. O. (1954), Diffraction of plane radio waves by a parabolic cylinder, *Bell System Tech. J.* 33, 417-504.
- Rider, G. C. (1953), Some VHF experiments upon the diffraction effect of hills, *The Marconi Rev.* 16, No. 109, 96-106, 2nd quarter.
- Rowden, R. A., L. F. Tagholm, and J. W. Stark (1958), A survey of tropospheric wave propagation measurements by the BBC, 1946-1957, *Proc. IEE* 105B, Suppl. 8, 84-90 and 122-126, Paper No. 2517R.
- Ryde, J. W. (1946), The attenuation and radar echoes produced at centimetre wavelengths by various meteorological phenomena, *Conference on meteorological factors in radio-wave propagation*, Phys. Soc. (London) and Royal Meteorological Society, 169-188.
- Ryde, J. W. and D. Ryde (1945), Attenuation of centimeter waves by rain, hail, fog, and clouds, General Electric Co., Wembley, England.

- Saxton, J. A. (Sept. 1951), The propagation of metre radio waves beyond the normal horizon, Part 1, Proc. IEE 98, Part III, No. 55, 360-369.
- Saxton, J. A., and J. A. Lane (May 1955), VHF and UHF reception-effects of trees and other obstacles, Wireless World 61, 229-232.
- Saxton, J. A., J. A. Lane, R. W. Meadows, and P. A. Matthews (Feb. 1964), Layer structure of the troposphere, Proc. IEE 111, No. 2, 275-283.
- Schelkunoff, S. A. and H. T. Friis (1952), Antennas, theory and practice, Wiley and Sons, New York City.
- Schelleng, J. C., C. R. Burrows, and E. B. Ferrell (Mar. 1933), Ultra-short wave propagation, Proc. IRE 21, No. 3, 427-463.
- Schünemann, R. (Sept. 1957), Mechanism of ultra short wave propagation over great distances, Hochfreq. u. Elektroak. 66, No. 2, 52-61.
- Sherwood, E. M., and W. L. Ginzton (July 1955), Reflection coefficients of irregular terrain at 10 cm., Proc. IRE 43, No. 7, 877-878.
- Shkarofsky, I. P. (Mar. 1958), Tropospheric scatter propagation, Res. Rpt. No. 7-200-1, RCA Victor Co., Ltd. Res. Labs., Montreal, Canada.
- Siddiqui, M. M. (March-April 1962), Some problems connected with Rayleigh distributions, J. Res. NBS 66D (Radio Propagation), No. 2, pp. 167-174.
- Silverman, R. A. (Apr. 1957), Fading of radio waves scattered by dielectric turbulence, J. Appl. Phys. 28, No. 4, 506-511. Also New York Univ. Inst. of Math. Sci., Electromagnetic Res. Division, Res. Rept. EM 101 (Jan. 1957).
- Staras, H. (Oct. 1952), Scattering of electromagnetic energy in a randomly inhomogeneous atmosphere, J. Appl. Phys. 23, No. 10, 1152-1156.
- Staras, H. (Oct. 1955), Forward scattering of radio waves by anisotropic turbulence, Proc. IRE 43, No. 10, 1374-1380.
- Staras, H. (April 1957), Antenna-to-medium coupling loss, IRE Trans. Ant. Prop. AP-5, No. 2, 228-231.
- Starkey, B. J., W. R. Turner, S. R. Badcoe, and G. F. Kitchen (Jan. 1958), The effects of atmospheric discontinuity layers up to and including the tropopause on beyond-the-horizon propagation phenomena, Proc. IEE 105B, Suppl. 8, 97-105 and 122-126, Paper No. 2486R.
- Stokes, G. G. (1922), Mathematical and physical papers, Vol. III, On the composition and resolution of streams of polarized light from different sources, (Cambridge University Press, London), 233-258.
- Straiton, A. W., and C. W. Tolbert (May 1960), Anomalies in the absorption of radio waves by atmospheric gases, Proc. IRE 48, No. 5, 898-903.
- Sutton, O. G. (1955), Atmospheric turbulence (John Wiley and Co.).
- Tao, K. (Jan. 1957), On the relationship between the scattering of radio waves and the statistical theory of turbulence, J. Radio Res. Lab. (Tokyo) 4, No. 15, 15-24.
- T.A.S.O. (March 1959), Engineering aspects of television allocations, Report of the television allocations study organization.

- Taylor, G. I. (1922), Diffusion by continuous movements, Proc. London Math. Soc. II 20, 196.
- Thourel, L. (1960), The antennas, translated by H. de Laistre Banting (John Wiley and Sons, Inc., New York, N. Y.).
- Tolbert, C. W., and A. W. Straiton (Apr. 1957), Experimental measurement of the absorption of millimeter radio waves over extended ranges, IRE Trans. Ant. Prop. AP-5, No. 2, 239-241.
- Troitski, V. (May 1956), The propagation of ultra-short waves at great distances beyond the horizon, Radio Technika 11, No. 5, 3-20.
- Troitski, V. N. (Jan. 1957a), About the influence of the form of the structure function of non-homogeneous dielectric permeability of air on long distance tropospheric propagation of ultra short waves, Radio Eng. 2, 34-37.
- Troitski, V. N. (1957b), Fading of ultra-short waves in radio relay systems. Electrosviaz 10.
- Ugai, S. (May-June 1961), Characteristics of fading due to ducts and quantitative estimation of fading, Rev. Elect. Comm. Lab., Japan 9, No. 5-6, 319-360.
- Ugai, S., S. Aoyagi, and S. Nakahara (May 1963), Microwave transmission across a mountain by using diffraction gratings, Electronics and Communications in Japan 46, No. 5, 7-17.
- Unwin, R. S. (Nov. 1953), Ultra-short-wave field-strength in a ground-based radio duct, Nature 172, No. 4384, 856-857.
- Van Vleck, J. H. (Apr. 1947a), The absorption of microwaves by oxygen, Phys. Rev. 71, No. 7, 413-424.
- Van Vleck, J. H. (Apr. 1947b), The absorption of microwaves by uncondensed water vapor, Phys. Rev. 71, No. 7, 425-433.
- Van Vleck, J. H. (1951), Theory of absorption by uncondensed gases, Propagation of Short Radio Waves, (McGraw-Hill Book Co., New York, N. Y.), 646-664.
- Villars, F., and V. F. Weisskopf (Oct. 1955), On the scattering of radio waves by turbulent fluctuations of the atmosphere, Proc. IRE 43, No. 10, 1232-1239.
- Voge, J. (Mar. 1953), The troposphere and wave propagation (Summary of Proceedings of Commission II, 10th General Assembly URSI (1952),) L'Onde Electronique 33, No. 312, 136-150.
- Voge, J. (1955), Radioelectricity and the troposphere, part I, theories of propagation to long distances by means of atmospheric turbulence, L'Onde Electrique 35, 565-581.
- Voge, J. (Nov. 1956), Useful bandwidth in scatter transmission, Proc. IRE 44, No. 11, 1621-1622.
- Voge, J. (Nov. - Dec. 1960), Theories of transhorizon tropospheric propagation, Ann. des Télécomm. 15, No. 11, 260-265.
- Vogler, L. E. (July 1964), Calculation of groundwave attenuation in the far diffraction region, Radio Sci. J. Res. NBS/USNC-URSI 68D, No. 7, 819-826.

- Vogler, L. E., and J. L. Noble (Sept. - Oct. 1963), Curves of ground proximity loss for dipole antennas (a digest), J. Res. NBS 67D (Radio Prop.), No. 5, 567-568.
- Vvedenskii, B. A., and A. G. Arenberg (1957), Long distance tropospheric propagation of ultra-short waves, Radio Eng. 12, No. 1, 3-13; Radio Eng. 12, No. 2, 10-25.
- Vvedenskii, B. A., and A. V. Sokolov (1957), Investigation of tropospheric propagation of meter, decimeter, and centimeter radio waves in the USSR, Radio Eng. and Elect. (USSR) 2, No. 11, 84-105.
- Vysokovskii, D. M. (1957a), Calculation of multiple scattering in the diffusion propagation of ultra-short waves in the troposphere, Radio Eng. and Elect. (USSR) 2, No. 6, 183-187.
- Vysokovskii, D. M. (1957b), Geometrical characteristics of the scattering of radio waves by turbulent inhomogeneities in the troposphere, Telecommunications (USSR) 9, 11-20.
- Vysokovskii, D. M. (1958), Diffused propagation of ultra-short waves in the troposphere with high-directivity antennas, Telecommunications (USSR) 5, 488-497.
- Wait, J. R. (1958), On the theory of propagation of electromagnetic waves along a curved surface, Can. J. Phys. 36, No. 1, 9-17.
- Wait, J. R. (1959), Electromagnetic radiation from cylindrical structures (Pergamon Press, New York, N. Y.).
- Wait, J. R. (April 1959), Transmission of Power in Radio Propagation, Electronic and Radio Engineer, Vol. 36, Series No. 4, pp. 146-150.
- Wait, J. R. (1962), Electromagnetic waves in stratified media, International Series of Monographs on Electromagnetic Waves 3, (Pergamon Press, New York, N. Y.).
- Wait, J. R. (Nov. 1963), Oblique propagation of ground waves across a coastline, part I, J. Res. NBS 67D (Radio Prop.), No. 6, 617-624.
- Wait, J. R., and A. M. Conda (Sept. - Oct. 1959), Diffraction of electromagnetic waves by smooth obstacles for grazing angles, J. Res. NBS 63D (Radio Prop.), No. 2, 181-197.
- Wait, J. R., and C. M. Jackson (Nov. 1963), Oblique propagation of ground waves across a coastline, part II, J. Res. NBS 67D (Radio Prop.), No. 6, 625-630.
- Wheelon, A. D. (June 1957), Relation of radio measurements to the spectrum of tropospheric dielectric fluctuations, J. Appl. Phys. 28, 684-693.
- Wheelon, A. D. (Sept. - Oct. 1959), Radio-wave scattering by tropospheric irregularities, J. Res. NBS 63D (Radio Prop.), No. 2, 205-234; also, J. Atmos. and Terr. Phys. 15, Nos 3, 4, 185-205 (Oct. 1959).
- Wilkerson, R. (1964), Multiple knife-edge diffraction, (private communication).
- Williamson, D. A., V. L. Fuller, A. G. Longley, and P. L. Rice (Mar. 1960), A summary of VHF and UHF tropospheric transmission loss data and their long-term variability, NBS Tech. Note 43.