5. SUMMARY

Fresnel-Kirchhoff theory has been used to derive an expression for attenuation caused by multiple knife-edge diffraction assuming plane wave propagation over perfectly absorbing half planes. The complex attenuation derived in this manner differs from that derived from Furutsu's generalized residue series only in the phase, the phase difference factor being given explicitly in (28). This phase difference arises from the fact that the reference free-space path in the residue series consists of the path segments joining the tops of the knife-edges, whereas the Fresnel-Kirchhoff reference path is the straight line distance from source to receiver locations.

An improved computational procedure based on the partitioning of multiple integrals has been developed. The integrals are partitioned as in (29) until all the arguments of the repeated integrals of the error function are positive, which eliminates problems of retaining significant figures when negative arguments are involved. The key step in the analysis is to show that the multiple integral containing the limit going from $-\infty$ to $+\infty$ is exactly the expression for the MKE attenuation over the path with one less knife-edge. This is demonstrated in (33) and the related equations. Comparisons of results from a computer program using partitioning (PAMKE) with the original program (FAMKE) are presented in Figures 2 and 3.

Finally, in section 4 results of other approaches to the MKE diffraction problem are presented and their relationship to the MKE attenuation function of this paper is discussed. In particular, it is shown that the first term of the MKE series expansion reduces to the Geometrical Theory of Diffraction (GTD) solution for certain ranges of the diffraction angles θ (see equations (40) and (44)). Other solutions considered include Lee's formulas, (38), and the approximations of Epstein-Peterson and of Deygout, (46).

6. REFERENCES

Abramowitz, M., and I.A. Stegun (1964), Handbook of Mathematical Functions, National Bureau of Standards, AMS 55.

Deygout, J. (1966), Multiple knife-edge diffraction of microwaves, IEEE Trans. Ant. Prop. AP-14, pp. 480-489.

Epstein, J., and D.W. Peterson (1953), An experimental study of wave propagation at 850 Mc, Proc. IRE 41, pp. 595-611.

Furutsu, K. (1963), On the theory of radio wave propagation over inhomogeneous earth, J. Res. NBS (Rad.Prop.) 67D, pp. 39-62.

Kellar, J.B. (1962), Geometrical Theory of Diffraction, J. Opt. Soc. Amer. 52, pp. 116-130.

Lee, S.W. (1978), Path integrals for solving some electromagnetic edge diffraction problems, J. Math. Phys. 19, pp. 1414-1422.

Millington, G., R. Hewitt, and F.S. Immirzi (1962), Double knife-edge diffraction in field-strength predictions, Proc. IEE, Monograph No. 507E, pp. 419-429.

Pogorzelski, R.J. (1982), A note on some common diffraction link loss models, Radio Sci. 17, pp. 1536-1540.

Vogler, L.E. (1981), The attenuation of electromagnetic waves by multiple knife-edge diffraction, NTIA Report 81-86. (Available as PB82-139239, Natl. Tech. Inf. Serv., Springfield, Va.).

Vogler, L.E. (1982), An attenuation function for multiple knife-edge diffraction, Radio Sci. 17, pp. 1541-1546.