Radio Wave Diffraction by Terrain Irregularities

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Abstract

This paper deals with the problem of diffraction by terrain irregularities. It is well-known that this problem is quite complex, the general solution requiring an integral equation normally solved by numerical methods. To avoid the difficulties associated to this solution, simplified methods are available for the evaluation of radio wave attenuation in practical cases. However, the accuracy of these methods depends on restrictions imposed by frequency, link parameters (path distance and antenna heights) and terrain profile. Propagation mechanisms such as ground wave over a smooth spherical earth and multiple diffraction by isolated obstacles are examples where the accuracy is closely related to specific topographical features. In this paper emphasis is given to the work that is being carried out in the Study Group 3 of ITU-R (Radiocommunication Sector of the International Telecommunication Union). In the Recommendation ITU-R P.526-10 there are consolidated algorithms to solve the above limiting cases. Nevertheless, an important question remains, i.e., how to handle a situation where the variations of the relief are within the limits between smooth earth and isolated obstacles? Numerical results derived from the solution currently adopted by Recommendation 526-10 to this case do not fit well when compared to experimental data. In this context, the present paper discusses some fundamental points to be taken into account in the development of a possible solution to this problem. The analysis of interaction between the terrain and the propagating wave is based on the concept of penumbra region derived from a mathematical model consisting of a smooth spherical earth surmounted with a knife-edge obstacle. A preliminary conclusion indicates that an empirical hybrid model which considers the two limiting cases referred to in the above comments seems to be the best compromise to solve the problem.

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