ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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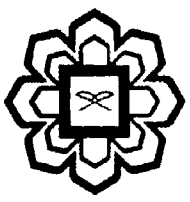

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Chapter 33

Frequency Scaling Methods for Rain Attenuation Prediction

Md. Rafiqul Islam[1], Jalel Chebil[1], Ahmad Fadzil Ismail[1] and Tharek Abd. Rahman[2]

33.1 Introduction

Frequency scaling models provide an alternative to rain attenuation models when data are available for a site. These methods are extremely useful since they tend to be excellent predictors, and provide a means for determining what to expect at a frequency for which there is no data. Because of the limited amount of reliable long-term rain attenuation statistics are available, frequency scaling method of rain attenuation can be used to obtain a rough estimate of the attenuation statistics at a desired frequency from attenuation values measured at another frequency.

Many scaling models have been developed from theory, empirical data, various propagation experiments, or from combination of the two. The rain attenuation can be estimated for a desired frequency by multiplying the measured rain attenuation with frequency ratio is named as simple power law models and have been proposed by Drufuca [1-3]. D.B. Hodge [4] proposed the model which uses the rain rate statistics and the a and b parameters of ITU-R specific rain attenuation prediction model for both frequencies. By making some approximations Kheirallah [5] proposed the model which is simpler than Hodge model. CCIR [6] proposed a model in which rain attenuation statistics has non-linear relationship with frequency.

Battesti Segal [7] proposed linear models based on rain attenuation statistics for terrestrial microwave link in Canada. A more complicated model that includes base attenuation as well as both of frequencies as the power is currently adopted by ITU-R [8]. After considering the variations in parameters such as drop size distributions, drop shape, canting angle and temperature, Timothy [9] proposed that a and b can be expressed as a function of frequency only and is used to predict the attenuation at higher desired frequency from lower frequency measurement.

33.2 Frequency Scaling Model

33.2.1 Hodge Model

If the attenuation at two different frequencies f_1 and f_2 are A_1 and A_2 respectively, from the simple relationship between specific attenuation and rain rate, recommended by ITU-R then

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