ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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Chapter 34

Proposed Frequency Scaling Method Based on Measured Rain Attenuation Data

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

34.1 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. The frequency behavior of rain attenuation over the 15 – 37 GHz frequency range has been examined based on rain attenuation data measured for one year in Malaysian tropical climate.

One year data sets for which data exist simultaneously on all four frequencies are used in a comprehensive study of frequency scaling of both instantaneous and statistical attenuation. Statistics of instantaneous attenuation ratio has been utilised to investigate the adequacies of statistical frequency scaling models. The results of an in-depth study on real-time frequency scaling of attenuation are used to evaluate the accuracy of available scaling models in chapter 33. Finally a new model is proposed based on one-year measured data.

34.2 Comparison Between Prediction Model and Malaysian Measurement

Instantaneous ratio of attenuation (RA) is defined as the measured rain attenuation value in dB at an upper frequency divided by the measured rain attenuation value in dB at a lower frequency evaluated at each sample time t as follows[1-3]

$$RA_{f_U/f_L}(\mathrm{t}) = \frac{A_{f_U}(\mathrm{t})}{A_{f_L}(\mathrm{t})} \tag{34.1}$$

Each RA value is assumed to represent the entire 1-sec sample interval. The RA values were smoothed in order to remove scintillations by averaging 60-sec as follows

$$\mathrm{A_{avg}}(\mathrm{t_i}) = \frac{1}{60}\sum_{j=0}^{j=59} \mathrm{A}(\mathrm{t_j}) \tag{34.2}$$