A Rain Attenuation Model for Predicting Fading Effect on Wireless Communication Systems in the Tropics

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Abstract

Existing communication systems are generally affected by attenuations during unclear weather. This paper focuses on the effect of rain fade on wireless communication signals. In the course the paper, we assess the rain fade statistics in ITU-R P. 1623-1 (2005) and obtain, k, the time fraction due to fading durations less than the duration threshold. We also obtain from Paulson and Gibbins (2000) model, the fade duration effect, τₙ. To make our model generic for the tropics and equatorials, we use real life data of the average annual rain fall accumulation (mm/year) in Nigeria and compute the specific attenuation, γR (db/km) from the rain rate, R (mm/hr), using the power-law relationship in ITU-R P. 838-1 (1999). The attenuation prediction model is then derived by introducing a normal distribution component, \( \frac{1}{\sqrt{2\pi}} e^{-\frac{a^2}{2}} \), to predict the attenuation time intervals. A computer simulation is finally performed. Simulation results obtained truly predict the rain attenuation effect at millimeter wavelengths.

Keywords: Rain fading, Mobile communication, Raindrops, Specific attenuation.

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