ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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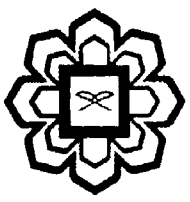

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Chapter 37

Worst-Month Rain Fade Statistics at 38 GHz

Ahmad Fadzil Ismail[1] and Khairayu Badron[1]

37.1 Introduction

In situations when system planning requires the critical attenuation value exceeded for a time percentage p_w of the worst month, a procedure in Recommendations ITU-R P.618-10 [1] can be used to estimate the attenuation exceeded for a specified percentage based on the average year probability p. The 'worst month' can be identified by comparing individual monthly distribution of the rain fades. ITU-R P.581-2 [2] proposes that the fraction of time during which a pre-selected threshold is exceeded in the worst month of a year is referred to as 'the annual worst-month time fraction of excess'. In other words, the probability distribution P_{wm} = probability that $s > s$ in the worst month period of the average year. In the ITU-R definition of 'average annual worst month', s is the random variable in question such as rain intensity or attenuation and s is a chosen threshold for exceedance measurement. The origin of the 'worst month' concept was initiated by condition where it has always been recognised by ITU that the average yearly exceedance of cumulative distribution may be irrelevant in illustrating the variability of attenuation from month to month, season to season or year to year. Hence, it is apparently worthwhile to take into account the occurrence of pronounced monthly or seasonality of a specific region.

The study of the worst-month rain induced attenuation statistics for tropical environment at V-band is a continuation from the previous analyses of the associated annual and monthly variability [3, 4]. In the study, the signal attenuation measurements at 1 second integration time were acquired using Ericsson MINI-LINKS terminals [5]. The data were utilised to derive the annual worst-month statistics and its relationship with the average annual distribution. The relationship between the measured worst month and the yearly probabilities was explored and evaluations were made against the ITU-R model. New values for the parameters Q_1 and β are proposed based on measurements in Johor Bahru, Malaysia.

37.2 Monthly Cumulative Distributions

The annual worst month for a pre-selected threshold is defined as the month with the highest probability of exceeding that threshold within the period of 12 consecutive months. A worst month can therefore be recognized for each threshold level. As can be observed in Figure 1; at probability exceeding 0.1 and 0.01 time percentage, the month of October 1999 is the worst month for the period from January 1999 to December 1999. The envelope of the highest monthly probability value of all the monthly cumulative

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