

ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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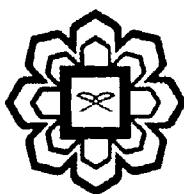
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Chapter 36

Worst-Month Statistics Modeling Based on Measured Data

Md. Rafiqul Islam¹, Jalel Chebil¹ and Tharek Abd. Rahman²

36.1 Introduction

The attenuation due to rain will pose a greater problem to communications as the frequency of occurrence of heavy rain increases. The annual worst-month statistics is an important tool for the design of a reliable communication systems. Average annual statistics can be very misleading because rain attenuation outages are concentrated in a few months of the year at most locations. In a tropical region, like Malaysia, where excessive rainfall is a common phenomenon throughout the year, the knowledge of the worst-month rainfall statistics is required for the design of any reliable terrestrial and earth space communication link. A study of the worst-month rainfall rate statistics for the Malaysian tropical climate will be presented based on rain rate and rain attenuation data collected from 10 locations of Peninsular Malaysia for 1 to 4 years period.

36.2 Definition of Worst-Month

In order to refer the performance criteria for radio communication systems it is necessary to consider “any month” as the period of reference. Statistics of propagation effects of the reference month that are relevant to the performance criteria is named as Worst-month statistics.

The worst month of a year for a pre-selected threshold for any performance degrading mechanism can be that month (or 30 days period) in a period of twelve consecutive calendar months, during which the threshold is exceeded for the longest time . The worst month is not necessarily the same month for all threshold levels. ITU-R Recommendation for worst-month can be applied to quantities such as rain rate, rain attenuation and cross polarization. A worst month can therefore be established for each threshold level. For ease of description, let X_{ij} be the probability of exceeding a threshold level j in the i th month. The worst month for level j is the month with the highest X_{ij} value, X_{h_j} . [1] The calendar month to which X_{h_j} belongs may vary from one threshold to another. The worst-month distribution for a particular year is given by X_{h_j} as a function of j and is the envelope of the highest monthly probability value of all the monthly cumulative distributions from that year. For multiple year data, the average annual worst-month

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