

ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

MD. RAFIQUUL ISLAM B.Sc., M.Sc., Ph.D., MIEEE
International Islamic University Malaysia

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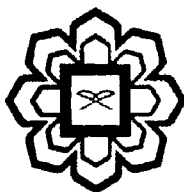
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Chapter 29

Development of A Modified Rain Attenuation Prediction Model

Ahmad Fadzil Ismail¹ and Khairayu Badron¹

29.1 Introduction

The development of a modified rain-induced attenuation model for tropical V-band satellite- Earth link was inspired from the notable inconsistencies of the existing models including the ITU-R P618-9 [1]. Prominent researchers namely Ippolito [2] and Ajayi [3] do believe that most available models may not be directly applicable for predicting rain attenuation in tropical region. Specific consideration and attention at V-band frequency are now eminent since there are escalating usages of the lower bands. The key concern now is that the commonly adopted ITU-R model may also not be appropriate, as can be observed in [1]. After all, the ITU-R model is based on among the earliest developments of specific attenuation $\gamma = aR^b$ by Olsen and Rogers somewhat way back in 1976 [4]. The issues are:

- a) Most experiments in deriving the model were carried out in temperate climate. Temperate climate characteristics are completely different from tropical climate that requires profound attention on the issues of rain fade.
- b) Olsen and Rogers [4] clearly stated that the possibilities of more than 10% error will occur if the frequency used and rain rate experienced are outside the specified limits of:
 - i. $f > 34$ Ghz and $R = 5$ mm/hr
 - ii. $f < 11$ GHz and $R = 25$ mm/hr
 - iii. $f < 3$ GHz and $R = 100$ mm/hr
- c) The development of high frequency asymptotic expansion for attenuation, A is indeed more difficult and complex due to the volatile varying rain drops size distribution especially the case of tropical rain.
- d) The calculations for water spheres involved only 41 frequencies but then manipulated for the whole range from 1 to 1000GHz.
- e) The values for the rain rates stated by the Laws and Parson [5] for the higher rain rates; 101.6 and 152.4 mm/h were obtained by mere extrapolation and must therefore be viewed with extreme caution since the actual sizes and velocities of the rain drops may vary radically.

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