

ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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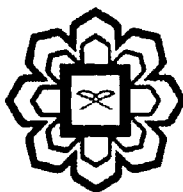
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Chapter 20

Rain Rate Distribution for Microwave Link Design in Malaysia

Jalel Chebil¹ and Tharek Abd. Rahman²

20.1 Introduction

Rainfall is a serious source of attenuation for microwave communications at frequencies above 10 GHz. It causes absorption and scattering of radio waves which result in a reduction of the received signal level. Rain attenuation can be so severe that the transmitted paths must be restricted to a few kilometers or less. It is important to predict accurately the fading outage due to rain attenuation so that the longest transmission path can be achieved. Since many mobile and satellite communication systems use this frequency spectrum, then it is important to predict accurately the rain attenuation. Most of the rain attenuation prediction methods presented in the literature require one-minute rain rate data [1]. However, the availability of such data are limited. Most investigations of rainfall have been carried out for meteorological or hydrological purposes. The rain data is usually taken for intervals of one hour or longer. Such data are useful for the radio engineer to obtain an overall picture of the rainfall patterns and to estimate the equivalent one-minute rain rate distribution. The ITU-R [2] has divided the world into 15 rainfall climatic zones, and the one-minute rain rate distributions have been estimated for each zone based on the best available experimental data. Malaysia falls in the P-zone.

In this chapter, one-minute rain rate distributions are determined at three locations in Malaysia, and compared with six theoretical models including the ITU-R model. In the last section, the hourly rain rate data were analyzed.

20.2 Data Collection

Rainfall data with an integration time of one-minute were collected at the University of Technology Malaysia-Kuala Lumpur (UTM-KL) from January 1992 until May 1995. Also, rain data were obtained from the University of Science Malaysia at two locations, USM-Tronoh and Sekolah Menengah Vokasional-Bota (SMV), from January 1992 until June 1994. Hourly precipitation data were obtained from the Malaysian Meteorological Service (MMS) for 37 stations at various locations in Malaysia for a period of about 12 years.

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