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Path loss models for outdoor environment—with a focus on rain attenuation impact on short-range millimeter-wave links

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Abstract
The deployment of a millimeter wave over a short path is one of the keys to enabling technologies for the next generation of wireless communication systems. Path loss (PL) is the most important parameter to indicate the performance of the mm-wave wireless channel. However, the accuracy and efficiency of each model are limited to characterize path loss for an environment that is different in terms of weather conditions and geographical arrangement from that for which they have been designed. This paper analyzed path loss for accurate signal estimation in Malaysia based on outdoor microcellular at 38GHz on a 300 m path length. The impact of rain attenuation on path loss, path loss exponent (PLE), and shadow fading (SF) have been investigated. This paper also presents two-channel models utilized for simulations in terms of the outdoor Large-Scale Path Loss, the statistical spatial channel model NYUSIM (version 2) developed in 2019 by New York University (NYU) and the 3rd Generation Partnership Project (3GPP) TR 38.900 Release 14 channel mode. Even though the CI and 3GPP models are accurate and suitable in the area where the measurement campaign was carried out in the temperate climate and must need modification for different regions, such as tropical climate. The underestimation can be interpreted because of the difference in AF's attenuation factors (pressure, humidity, temperature, rain rate) calculated by the CI model in the NYUSIM simulations and the attenuation factor (AF) obtained from measurement data. The NYUSIM channel model better estimated the measured data of path loss compared with 3GPP. Thus, the CI model is suitable for outdoor environments. © 2023 The Author(s)

Author Keywords
Channel model; Millimeter-wave; Outdoor environment; Path loss; Propagation channel; Rain attenuation; Short range

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