Empirical Maximum Permissible Loss (MPL) Modeling for Outdoor Wireless Links

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Abstract

It is very challenging for wireless network designers to estimate the path loss of transmitted signals to ensure the quality of service. Generally, the wireless signal is impacted by a variety of propagation mechanisms. These mechanisms include signal reflection, diffraction and scattering. Considering the GSM as the second mobile generation (2G) globally spread RF technology, many propagation models study the path loss and predict the signal strength at specific distance by predicting the Maximum Permissible Loss (MPL).

This project has focused on the Muscat MBD (Muttrah Business District) area with its extension in order to have a suitable propagation model for this area. The Okumura-Hata and the Extended-Sakagami models have been practiced and compared to the real measured data. The Root Mean Square Error (RMSE) was used as an error indicator and results validator. Both Okumura-Hata model and Extended-Sakagami model have been modified to provide lower RMSE value.

Then, the generalized equation for each model has been obtained by averaging the RMSE values for studied paths in each area. The generalized formulas have been tested and verified in different paths of the MBD area and the obtained results were within expected range.

Furthermore, the same methodology has been applied for modeling the Universal Mobile Telecommunication System (UMTS), the third generation (3G) for mobile technologies. Same as of GSM modeling methodology, the generalized equations of MPL has been obtained.

For verification purposes, both GSM and UMTS generalized models of the MBD area have been applied in another area with similar building structure and terrain. Part of Al Khuwair city has been selected and the results were acceptable.