Frequency Scaling in Urban Propagation

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Urban propagation is a complex problem to be approached and several methods have been proposed to be used to give some insight. Usually very large measurements campaigns are taken to create formulas for attenuation based on measures. Some methods are based on some characteristic of propagation as direct, reflected and diffracted average contributions and some others are deterministic methods based on models of propagation such as ray tracing.
All methods are usually valid for particular ranges of frequencies and this introduces the problem of having suitable predicting methods for higher frequencies than ones normally used for example for wireless communications.

A frequency scaling model has been proposed by Chu T.S. and Greenstein Larry J. in 1999 for NLOS propagation in urban areas. This model is based upon some considerations on the average percentage of diffracted and reflected contributions received, considerations validated with a large amount of measures taken in different cities in different times.

This work compares the model results with evaluations obtained with a validated ray tracing tool for different frequencies from 500 MHz up to 10 GHz. The correspondence is verified for an average model, but is not verified for each point to point connection channel. This result was expected because of considering the difference between propagations effects that describe a point to point connection from another.

Propagation effects from a transmitter to some receivers are similar if receivers are concentrated in a limited area, so we thought about obtaining a model that can take in account for different propagation effects due to different areas where receivers are positioned.

We have proposed a new model for urban propagation frequency scaling that considers position of transmitter, position of receiver and height of obstacles between them, all these informations are usually available for reality modeling for urban propagation simulation purposes.

The new model has been tested and results are discussed and compared with ray tracing simulations and with average model results.