EFFECTS OF TREES ON PATH LOSS IN A VEGETATED RESIDENTIAL ENVIRONMENT - ANGULAR SPECTRAL APPROACH

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Future wireless communication systems require a more precise prediction of the propagation loss between the transmitter and the receiver to improve the capacity of their systems. These systems are expected to have the base-station transmitters located close to the surrounding rooftops so that propagation takes place over the buildings. When the transmitter and/or the receiver is in a vegetated residential environment, then it is important to understand the effects of trees and buildings on the propagation loss in order to maximize the throughput of the system.

The aim of this work is to improve the approach presented by Torrico and Lang [2005 IEEE AP-S International Symposium and USNC/URSI National Radio Science Meeting, pp. s017p02u, July 3-8 2005], by taking into account the off-angle attenuation effects on the incoherent scattered fields produced by the trees. As in Torrico and Lang, the incoherent intensity produced by multiple trees/houses is added to the coherent intensity in order to predict more accurately the propagation loss between a base-station transmitter and a mobile receiver in a vegetated residential area. The vegetated residential area is modeled by parallel rows of houses/buildings each with an adjacent tree canopy. A row of houses/buildings is modeled as a half plane absorbing screen that is perpendicular to the ground. The tree canopy is modeled as an ensemble of leaves and branches all having prescribed location and orientation statistics. The shape of the tree canopy adjacent to each row of buildings is modeled as an elliptical cylinder.

The total field after the nth-row of trees and buildings is found by adding the diffracted field from the half-plane for the nth-row of buildings and the scattered field from the canopy of the nth-row of trees. The diffracted field from the half-plane of the nth-row depends on the total field at its aperture and is found by employing the Kirchhoff-Huygens technique. The total field at its aperture consists of two parts: the incident field from the previous aperture attenuated by the effective canopy medium and the scattered field from the preceding tree canopy. The scattered field from the nth-row of trees is obtained by treating the canopy by the distorted Born approximation. The total propagation loss is then computed by repeating this procedure from the first to the last aperture. The analysis is simplified by employing a transverse spectral representation of the field quantities. It is assumed that only forward scattering is important and that only single scattering within each tree canopy contributes. Results of these calculations will be presented in order to characterize the effects of trees on the propagation loss in a vegetated residential area.

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2. F - Wave Propagation and Remote Sensing

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4. C - Contributed Paper

5. No special instructions