Applying MOMI to a dielectric foliage layer above ground for propagation prediction

Daniel E. Davis*, Benjamin A. Westin, and Gary S. Brown
Virginia Polytechnic Institute and State University, Blacksburg, VA, 24060, USA

Past work has shown that solutions of the magnetic field integral equation (MFIE) or the combined field integral equations (CFIE) through the method of ordered multiple interactions (MOMI) can be used to provide predictions of irregular terrain loss for point-to-point links. This method uses the terrain profile along the point-to-point path to solve the two dimensional scattering problem. However, in comparison to measured data, paths with heavy foliage obstruction have not fit the predicted results very well. Usually, the predicted loss is less severe than that measured. However, diffraction and integral equation based models cannot easily include most of the statistically oriented volume scattering models for foliage. One way that foliage can be included in the model is to put a lossy layer over top of the ground at the foliage location. It is understood that such a model will not capture the time varying multiple scattering effects of foliage, but it can provide the basic mean or average attenuation and diffraction by the foliage.

Based upon the simple media results obtained from fitting a UTD model to measured foliage attenuation, the propagation path was modeled as a lossy layer over a dielectric ground. The location of the foliage layer was based on overhead photography of the transmission path. The height of the foliage layer was unknown, so an estimated height was used. The CFIE was then solved for the layered problem using MOMI. The results showed that the foliage layer introduced significant attenuation compared to the un-foliated calculations. When compared to measurements, some of the foliated results show accurate predictions, while others produced more attenuation than was necessary to correct the un-foliated predictions. The over-correction is suspected to be the result of the significant amount of unknown information about the actual foliage cover along the path.