UTD analysis of foliage penetration for use in propagation modeling

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One of the key challenges in propagation modeling for point-to-point links is including the effects of foliage. Foliage is a volume scatterer and much of the work that has been done on modeling foliage is statistical in manner. However, such statistical models often do not fit easily into existing propagation models. Our past propagation modeling work has used MOMI to solve the scattering from a perfectly conducting or dielectric ground, and volume scattering media do not fit well into the two dimensional integral equation method. Similarly, such volumetric statistical models would not be a good fit for diffraction based propagation models. Thus, we sought a simple continuous medium which might adequately, though not perfectly, match the foliage layer attenuation and reflection.

To obtain the constituative parameters, a fit was made to measured data. The data used was from a set of foliage measurements carried out at the National Radio Astronomy Observatory in Green Bank, West Virginia. Data was available at 904 MHz, 926 MHz, 1296 MHz and 2303 MHz. These measurements were performed around and through a wedge of dense foliage over flat ground. This simple geometry allowed for the creation of a UTD propagation/scattering model that was a close fit to the actual measurement setup. The model utilized penetrable wedge diffraction coefficients, as well as antenna patterns for the transmitter and receiver. By varying the assumed continuous complex permittivity of the foliage wedge, the best-fit permittivity was independently found for each frequency. Because the result is a lossy simple medium, it can be used in any propagation model that can include such a lossy layer.