Scatter function characterization of microwave radio signals by vegetation forms

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Abstract:

Very significant progress has been made over the years in the area of radio propagation modeling and measurement. A traditional approach to modeling the excess loss experienced by radio waves propagated through paths obscured by vegetation is to assume that this loss increases exponentially with distance through the vegetation media. From a review of some of the available propagation models, the empirical models do over estimate the excess loss.

In this paper, the author's report on measurements conducted in a controlled environment at 20 GHz to characterize the scatter function of ficus and cornifer plants. To establish the scatter function of this plants, the forward scattered signal level emerging from the vegetation media in single and multiple formation and its dependence on the azimuth direction of the receiving antenna is investigated. Based on this investigation, a comparison is made on the behavior of the scatter function of the ficus and cornifer plants.

Experimental measurement results show that the forward scattered signal distribution is rather uniform around its azimuth direction, hence the scatter function for the ficus and cornifer plants is characterized using a total effective scattering cross-section per unit volume of the vegetation media.

A theoretical model based on the radiative energy transfer (RET) is used to interpret some of the complex phenomenon observed in the scatter function results. Observation from experimental measurement result show a strong forward scattering and reduced attenuation rate for an increased vegetation in signal path. At regions of reduced attenuation rate, the scattered beam broadens out, which suggests that the coherent field component is trying to disappear within the incoherent field component.