Temasek Defence Systems Institute

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Modeling of Radiowave Propagation in Forested Environment

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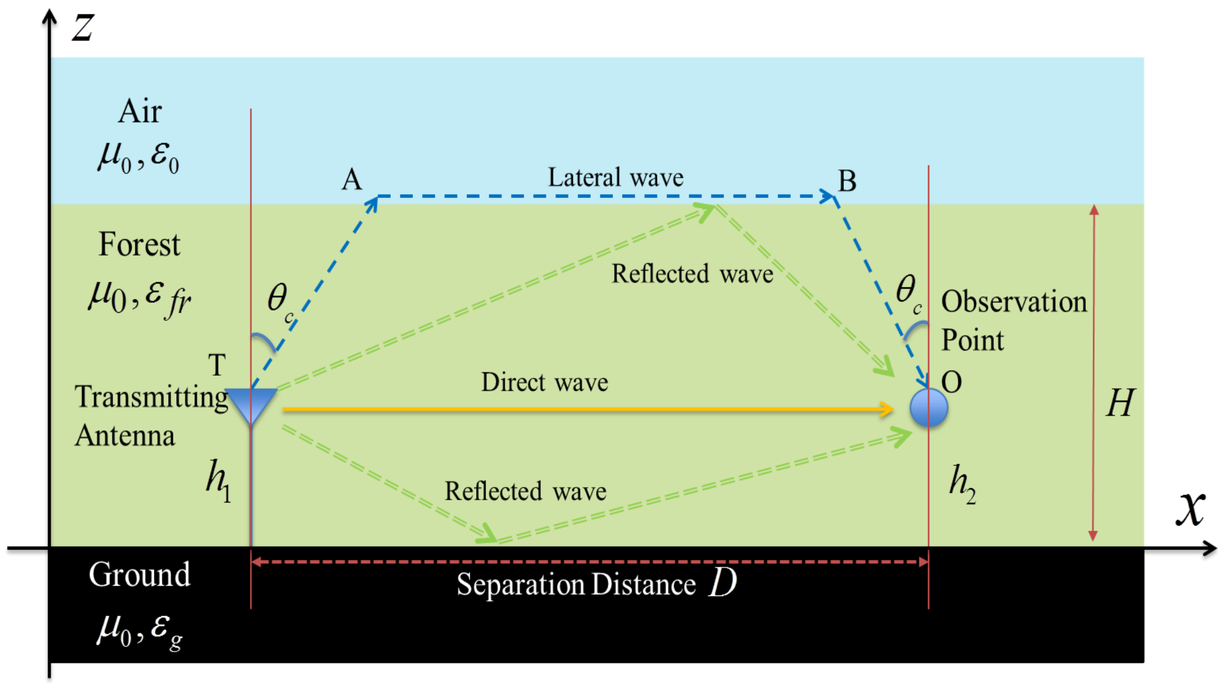

Figure 1. EM Propagation Mechanism in forest layer(After [1])

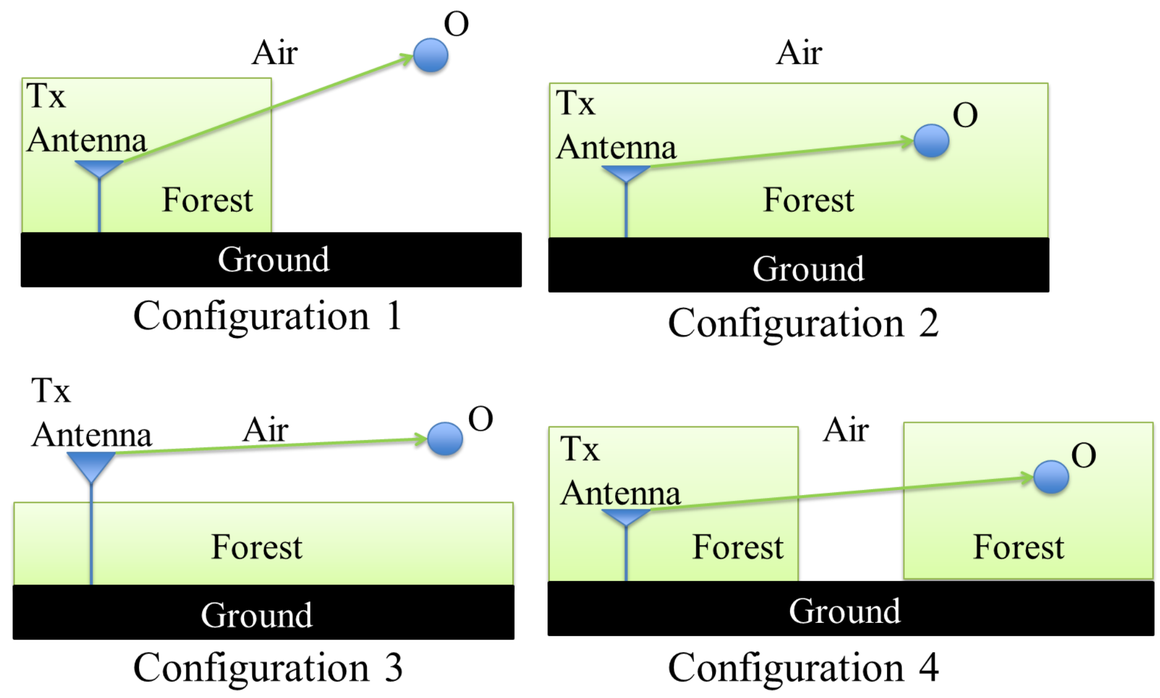

Figure 2. Possible configurations to model propagation loss (After [4])

Objective

Propagation loss model for communication link in Configuration 2 depicted in Figure 2.

Ray tracing model

The model uses ray tracing methods and a 3 layer-planar stratified homogeneous medium was coded in MATLAB software. The model is applicable for propagation loss prediction for communication link with separation distance beyond 1 km.

Benefit of the research

This model can be used to assist system engineers to predict propagation loss within forest up (maximum usage frequency up to100 MHz) which is an important factor for communication link analysis. The model served as an initial platform to allow modification to support other types of configuration shown in Figure

Recommendation

Methods to evaluate the effective parameters (permittivity and conductivity) of the forest layer and other types of communication setup

[1] T. Tamir, "On radio wave propagation in forest environments," IEEE Transactions on Antennas and Propagation, vol. AP-15, no. 6, pp. 806-817, November 1967.
[2] Y. Li and H. Ling, “Numerical modeling and mechanism analysis of VHF wave propagation in forested environments using the equivalent slab model,” Progress In Electromagnetics Research, vol. 91, pp. 17-34, 2009.
[3] R. K. Tewari, S. Swarup and N. R. Manujendra, "Radio wave propagation through rain forests of India," IEEE Transactions on Antennas and Propagation, vol. 38, no. 4, pp. 433-449, 1990.
[4] T. Tamir, "Radio Wave Propagation Along Mixed Paths in Forest Environments," *IEEE Transactions on Antennas and Propagation*, vol. AP-25, no. 4, pp. 471-477, 1977.
[5] Y. S. Meng, Y. H. Lee and B. C. Ng, "Study of propagation loss prediction in forest environment," *Progress In Electromagnetics Research B*, vol. 17, pp. 117-133, 2009.

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