Lab 5: Ground Reflection Model

EE432: RF Engineering for Telecommunications

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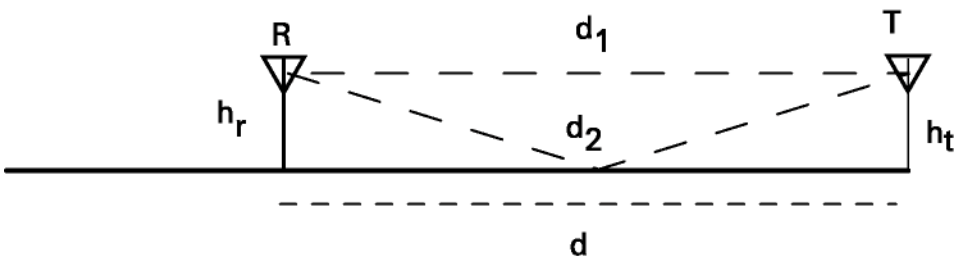
Objectives

- To measure the characteristics of radio propagation near the ground.
- To use a simple ground reflection model to understand your measurements.

Equipment Needed

- ISM (900-930 MHz) transmitter
- ISM field strength receiver
- Tape measure
- Yard stick
- Platform to hold transmitter
- Computer running Matlab

Procedure



The setup is diagrammed above. The ISM transmitter (at 915 MHz) is placed on a metal cart on the sidewalk outside of the second floor of the EME building, across the bridge. You move along the sidewalk with the ISM receiver measuring field strength every 5 feet out to 270 feet. Keep the receiver at the same known height for all measurements.

Analysis

In the two-ray model the received power (in dBm) is $P_r = P_0 + 10\log\left|\frac{r_0}{r_1} + \Gamma e^{-j\frac{2\pi}{\lambda}(r_2 - r_1)}\frac{r_0}{r_2}\right|^2$ where r_1 is the distance along the direct path between transmitter and receiver, and r_2 is the distance along the reflected path. Γ is the reflection coefficient of the ground, and P_0 is the power that would be received at a distance r_0 in free space (i.e., when $\Gamma = 0$).

1. Plot your measurements on a log-log scale as dBm vs. decades of distance (i.e., $\log\left(r/r_0\right)$). Take r_0 to be 5 feet.
2. Taking Γ = 0, find the value of P_0 that gives the best fit to your data. Plot this line on the same graph used above. You can “eyeball” the fit by trial and error or, preferably, compute it.

3. Consider values of Γ between -1 and +1. You can limit yourself to increments of 0.1 if you wish. Find the value that gives the best fit to your measured data. Remember that you can vary P_0 also. Again, you can eyeball the fit or compute it.
4. Attach a plot showing your data and the fits from steps 2 and 3.