EXPERIMENT 4

Aim-To observe the effect of different propagation models on coverage distance

Software-Octave

Theory-

2-models are considered in this experiment

1. **Free Space Path Loss (FSPL):**

   The free space path loss is a simple model that describes the loss of signal power in free space, assuming no obstacles or reflections. It is given by:

   $$FSPL(dB) = 20\log_{10}(d) + 20\log_{10}(f) - 147.55$$

   Where:

   - d is the distance between the transmitter and receiver in meters.
   - f is the frequency of the signal in Hertz.

1. **Two-Ray Ground Path Loss:**

   The two-ray ground path loss model takes into account the direct path from the transmitter to the receiver and a reflected path from the ground. It is particularly relevant for scenarios where the antenna heights are low and signals can be reflected from the ground. The formula is:

   $$\text{Two-Ray Loss}(dB) = 40\log_{10}(d) + 20\log_{10}(h_t) + 20\log_{10}(h_r) + 20\log_{10}(f) - 147.55$$

   Where:

   - d is the distance between the transmitter and receiver in meters.
   - h_t is the height of the transmitter antenna in meters.
   - h_r is the height of the receiver antenna in meters.
   - f is the frequency of the signal in Hertz.

Conclusion-

Code for Performance(Dnt write code in writeup)

```matlab
transmit_power = 30; % Transmit power in dBm

frequency = 900e6; % Frequency in Hz

antenna_height_t = 40; % Antenna height in meters

antenna_height_r = 10;

% Distance range

d = 1:1:1000; % Distance in meters

% Path loss models

free_space_path_loss =  (20 * log10(d)) + 20 * log10(frequency) - 147.55;

two_ray_ground_path_loss = (40 * log10(d)) + 20 * log10(antenna_height_r) + 20 *
log10(antenna_height_t)+ 20 * log10(frequency) - 147.55;


% Calculate path loss for each model and distance

%free_space_losses = free_space_path_loss(distances);

%two_ray_losses = two_ray_ground_path_loss(distances);


% Plot results

figure;

plot(d, free_space_path_loss, 'b', 'DisplayName', 'Free Space Path Loss');

hold on;

plot(d, two_ray_ground_path_loss, 'r', 'DisplayName', 'Two-Ray Ground Path Loss');

xlabel('Distance (m)');

ylabel('Path Loss (dB)');

title('Effect of Propagation Models on Coverage Distance');

legend;

grid on;

hold off;
```