

Assignment 4: Review of Coverage in Workplaces

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Abstract—This report measures coverage in Indian workplaces by sampling the Wi-Fi signal at different distances from an Access Point. We have experimented with the 2.4 GHz and the 5 GHz band. The measurements allowed us to verify the theoretical values of the path loss exponent, RSSI reference and wall attenuation factor

I. TESTING METHODOLOGY

We used Wireshark to measure the RSSI. To generate a map of the surrounding we used SLAM(Simultaneous Localization and Mapping) with a 2-D LiDAR attached to a remote controlled robot. The connected device was kept stationary while the AP was was moved around the building along with the robot.

II. COMPARISON OF RSSI OF 2.4 GHZ AND 5 GHZ

In our experiments we consistently recorded an RSSI for 2.4 GHz compared to 5 GHz. Following is a scatter plot showing the comparison.

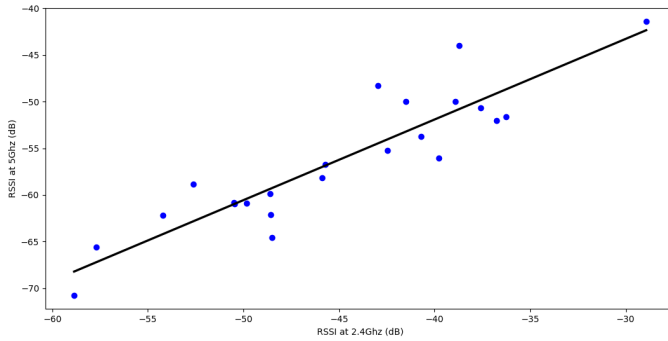


Fig. 1. RSSI at 5Ghz v/s at 2.4Ghz

The relationship obtained was:

$$RSSI_{5Ghz} = -17.35 + 0.864RSSI_{2.4Ghz}$$

III. PATH LOSS RELATION

A. Readings

Following barplot shows the variation of RSSI with distance from the AP for no walls. We also measured data for 4 different wall configurations.

Using these readings, we found the following numerical fit: for 2.4 GHz band:

$$RSSI = -39.6 - 11.4\log(\text{distance}) - 0.87\#Walls$$

for 5 GHz band:

$$RSSI = -52.3 - 8.5\log(\text{distance}) - 0.38\#Walls$$

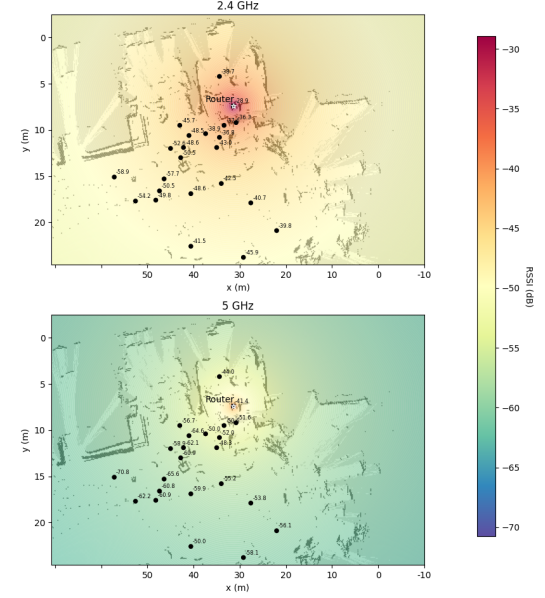


Fig. 2. Heatmap of fitted RSSI and measured RSSI at different locations.

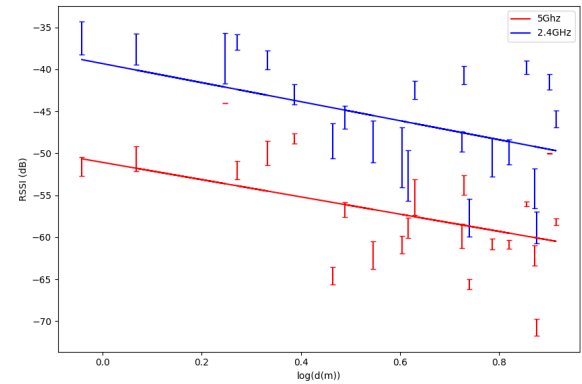


Fig. 3. RSSI v/s distance from AP

B. Inference

$RSSI_{ref}$ for 2.4 GHz is much 12 dB higher than $RSSI_{ref}$ for 5 GHz. Interestingly, the path loss exponent and wall attenuation factor for 5 GHz is less than that of 2.4 GHz. Possible explanations could be:

- Interference from other devices near the AP. The camera and GNSS module on the robot operate at 2.4 GHz, this could be a potential cause of error.
- Congestion in the 2.4 GHz network. There were many lower power devices, bluetooth devices in the testing space.