

CS4222 Assignment 3 Report

3.1 Line-of-sight Experiment

For the first task, the nodes were tested in a long hallway at various distances, which is at COM1 Level 2. The transmitter node is programmed to continuously send packets once every 0.25s and the RSSI values are collected within a 10-second window and averaged out. The results of the first test are shown below.

Distance (m)	RSSI (dBm)	Loss Ratio (%)
1	45	0
5	65	0
10	76	0
15	85	0
30	90	0

Figure 1: Table of distance, RSSI and loss ratio

RSSI vs Distance

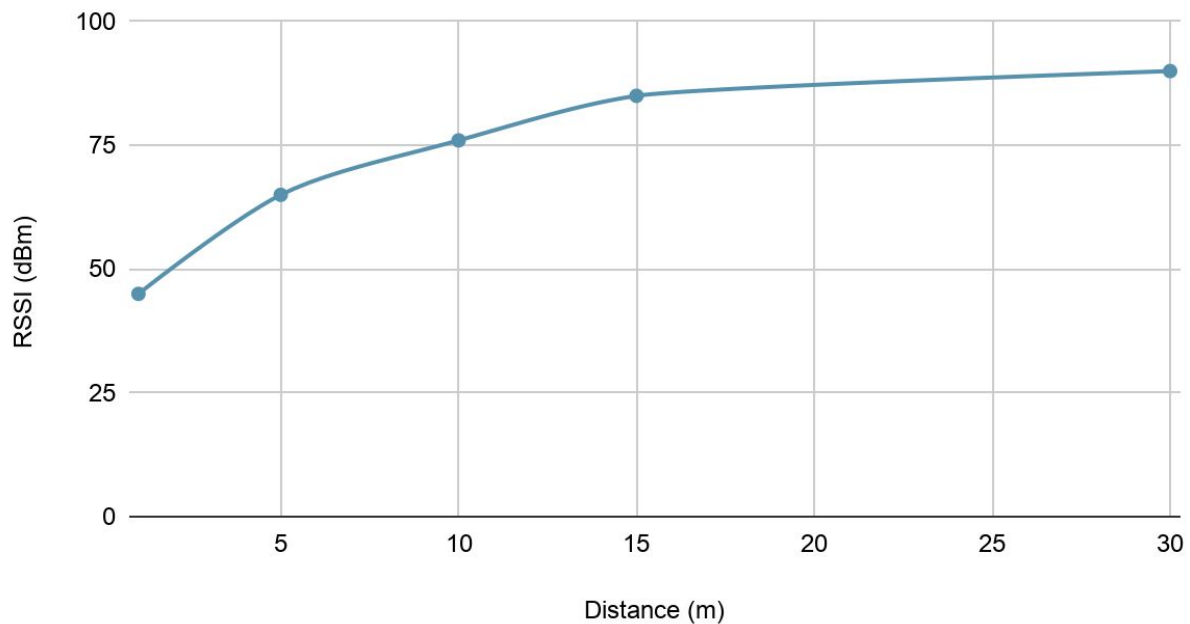


Figure 2: Graph of RSSI against distance

Because there were 0 loss packets during testing, a different approach of transmitting packets was used. The alternative method is where the transmitter sends 4 packets in bursts every second. However, there is still 0 packet loss.

The experiment is repeated in a more open area but received similar results. As such, the results are not taken down to keep the report concise.

3.2 Obstacle Experiment

In the second task, the nodes were tested between different obstacles of similar distances. Same as the previous task, the results are taken from a 10-second window and averaged out.

Obstacles (distance in m)	RSSI (dBm)	Loss Ratio (%)
Door (3m)	70	0
Coat (3m)	60	0
Wall (3m)	75	0
Human (3m)	65	0
2 Human (10m)	75	0
Double Wall (10m)	87	0
Double Wall (15m)	90	72.5
Triple Wall (15m)	92	100
Downloading application near receiver (5m)	65	0

Figure 3: Table of obstacles, RSSI and loss ratio

During testing, the packets are constantly being received by the receiver at various obstacles. As such, extreme cases of obstacles had been used to observe packet loss during transmission. One such case is when there were 2 walls (2 rooms in between a hallway) between the nodes where we observed a 72.5% loss ratio. In another situation, an area where there are 3 walls within 15m was located and tested as well. A 100% loss ratio was observed in this case.

Sample data collection:

```
message: , RSSI: 0
message: , RSSI: 0
message: :::::0:::::, RSSI: -91
message: , RSSI: 0
message: , RSSI: 0
message: , RSSI: 0
message: , RSSI: 0
message: , RSSI: 0
message: , RSSI: 0
message: , RSSI: 0
message: :::::0:::::, RSSI: -89
message: :::::1:::::, RSSI: -90
message: :::::4:::::, RSSI: -91
message: :::::8:::::, RSSI: -90
message: , RSSI: 0
message: :::::2:::::, RSSI: -90
message: :::::6:::::, RSSI: -90
message: :::::0:::::, RSSI: -90
message: :::::4:::::, RSSI: -89
message: , RSSI: 0
message: :::::8:::::, RSSI: -89
message: :::::9:::::, RSSI: -89
message: :::::0:::::, RSSI: -89
message: :::::1:::::, RSSI: -89
```

Figure 3: Observed packet loss in double wall (15m) test

Figure 3 shows data collected by the receiver when the transmitter is about 15m away with 2 wall separation. As seen in the image, about 6 packets were lost in the first count iteration from 0 to 9.

3.3 Observations and Discussion of Results

(1) Are there any other factors that can affect RSSI other than distance and obstacles? Design new experiments and analyse the test results as needed.

The orientation of the receiver and slight movement may affect the RSSI as well. Additional experiments where the transmitter is fixed with the debugger side facing the receiver. Different orientation of the receiver has been tested where different RSSI values are observed during testing. The results are reported below.

Orientation (Transmitter fixed)	RSSI (dBm)	Loss Ratio (%)
Receiver orientated horizontally	45	0
Receiver orientated vertically	55	0
Slight shaking of receiver	50	0

Figure 4: Table of orientations of the receiver, RSSI and loss ratio

Other factors such as a smartphone downloading a 50MB application using Wi-Fi near the receiver was also tested and shown in Figure 3. However, the RSSI values received is similar to clear line-of-sight at 5m and deemed that signals from different sources are not a factor affecting RSSI.

(2) How good is RSSI as a proxy for distance? Justify your answer based on experimental results.

Based on experimental data, RSSI is not a good proxy for distance. As seen in the line-of-sight experiment, the value of RSSI increases exponentially from 1m to 15m and the value increases very slightly from 15m to 30m. Although this can be regulated by weighing the RSSI values, obstacles between nodes can further complicate RSSI values. If there are obstacles between the 2 nodes, RSSI values will also increase even at the same distance, thus making RSSI an inaccurate measurement for distance.