# CS4222/CS5422
# Programming Assignment #3

AY2020-2021 / SEM 2
DUE: March, 10 (Wednesday), 23:59

1. This is a group project (group size: 2 to 4).
2. Total marks: 40 (10% of total grade)
3. 10% penalty per-day for late submission.
4. For any clarification on this assignment, post your queries through email the TA (Lee Jinho e0212242@u.nus.edu).

## 1. Overview

In this assignment, you will learn (1) how RSSI changes depending on the distance, (2) what happens when a sender and a receiver are not in line-of-sight, and (3) how good is RSSI as a proxy to the distance between the sender and the receiver.

## 2. Configuration Settings

To use the programs you are given for this assignment, you need to specific the hardware address (Node ID) in the transmit_assignment3.c program. Pick a node to be the receiver. When the node starts and prints out its device and configuration information to the (USB) serial port, you can see its unique "Node ID" as below:

```
Starting Contiki-3.x-3345-g32b5b17f6
With DriverLib v0.47020
TI CC2650 SensorTag
IEEE 802.15.4: Yes, Sub-GHz: No, BLE: Yes, Prop: Yes
 Net: sicslowpan
 MAC: CSMA
 RDC: ContikiMAC, Channel Check Interval: 16 ticks
 RF: Channel 25
 Node ID: 52738
```

In the example shown above, the Node ID is 52738 (in decimal) or 0xCE02 (in hexadecimal). Enter this hex number in addr.u8 (e.g., addr.u8[0] = 0xCE, addr.u8[1] = 0x02). The Sender node is going to send packets to this Receiver using this "Node ID.

The receiver node captures these unicasted packets and prints out the delivered message and RSSI.

In the transmit_assignment3.c code, make sure you have a counter/identifier in the message sent. On the receiver side, use this counter/identifier to keep track of how many packets have been received successfully.

Set timer to send 4 packets every second for at least 10 seconds.

Put the programs in $CONTIKI_ROOT/examples/rime and add "receive" and "transmit" in Makefile in the directory.

## 3. Tasks

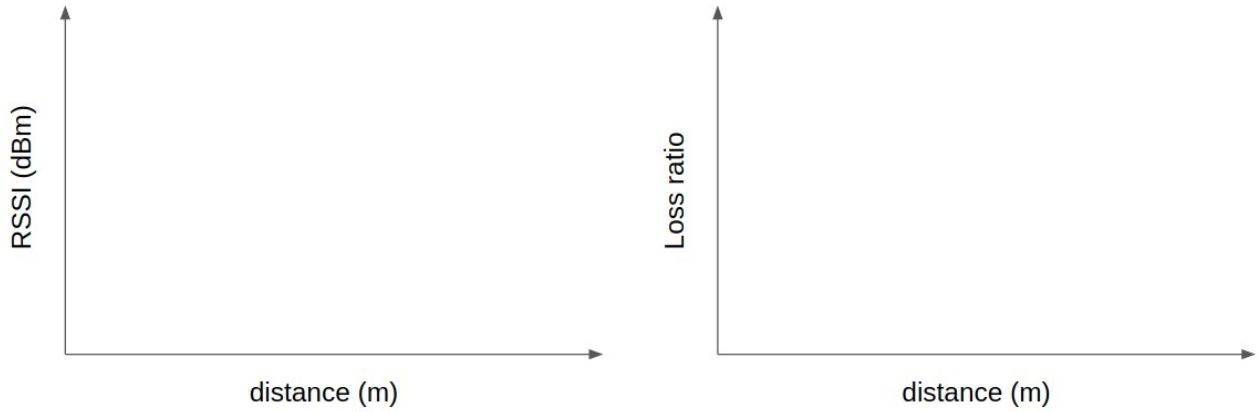
You have to complete 2 sets of measurement tasks in this assignment.

## 3.1 RSSI vs Distance

```
received packets: 0, message: Hi, RSSI: -40
received packets: 1, message: Hi, RSSI: -40
received packets: 2, message: Hi, RSSI: -41
received packets: 3, message: Hi, RSSI: -39
received packets: 4, message: Hi, RSSI: -39
```

(example output of the receiver)

3.1.1 Put the receiver and the sender at line-of-sight (no obstacle) and **observe how RSSI and packet loss ratio changes** (# of packet lost in 10 sec. / # of transmitted in 10 sec.) when you change the distance between them from 1m to 30m. Report your results using two graphs similar to the graphs shown below (RSSI vs distance and loss ratio vs distance).




(example data representation)

Repeat the experiments in another environment or some environment but different placement of receiver.

**Discuss your measurements in your report.**

### 3.2. RSSI with Obstacles

Let's see how different obstacles between the sender and the receiver affect RSSI & packet loss ratio. Let's measure RSSI at the same distance (1-5m, up to you. Need to specify and must be the same in all measurements) but with different type of obstacles between sender and receiver (at least 5 types).

| Obstacles (some examples) | RSSI |
|---|---|
| Door | ... |
| Coat | ... |
| Wall | ... |
| Human | … |

(example)

**Discuss your measurements in your report.**

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

## 4. Submission

Submit a single zip file ("**Assignment3 - YourGroupNumber.zip**") to folder "Assignment3 Submission" on LumiNUS by the due date. If you submit multiple times, only the latest submission will be evaluated.

Your submission should include the following:

1. Code used in your measurements.
2. A report in PDF format that contains the following:
    - (30%) Results and discussion for Section 3.1
    - (30%) Results and discussion for Section 3.2
    - (40%) Results and discussion for Section 3.3

**There can be a penalty of 10% if you do not follow the submission instructions.**