

Wireless Networking

Course code: CS4222, Tutorial session: #3 (Non Graded, Optional Session)

Brief Instructions regarding the tutorial session

1. The attendance to tutorial sessions would NOT contribute towards the determination of final grade
2. Please review the questions before coming to the tutorial session
3. Make an effort to solve the questions before attending tutorial. The teaching assistants will help in case of issues
4. The designated time for the tutorial session is one hour. Please contact the teaching assistants or the instructor if you need any further clarification regarding the tutorials outside the allocated period. Please send them an email.

Question 1: When designing a beacon device, such as an Apple AirTag that is powered by small batteries or harvested energy from the environment, what wireless frequencies and data rate would you choose for the device to transmit small periodic information?

- a) When the device transmits to short distances (few meters)
- b) When the device transmit to large distances (hundreds of meters)

Possible frequencies for wireless communication: 30Hz – 40Hz, (ii) 30KHz – 40KHz, or (iii) 400MHz – 500MHz (iv) 800-950 MHz, (v) 2400-2480 MHz, (vi) 50GHz – 60GHz.

Question 2: Recently, there has been a growing interest in connecting Internet of Things (IoT) devices through a network of small satellites. One example of this is the service offered by Space X's Swarm. Lets put you in the role of a designer building these satellites, if the goal is to transmit small amounts of information from the satellite swarm to IoT devices on the ground. What should be the antenna on the IoT device and satellite?

- a) What would be the ideal gain and type of the transmit and receive antenna?
- b) What should be the maximum transmit power of the radio on the satellite to support a sufficient link budget? Please note that energy conservation on the satellite should also be considered.
- c) Finally, what frequency would you use for communication? Can you estimate path loss ($G_t, G_r = 6 \text{ dBi}$)? Minimum sensitivity of a receiver for transmit power of 30 dBm?