**Report - 1**

**Bandwidth and Capacity of Wireless Communication Systems**

**Overview**

* This is an **individual** report.
* In this report, you shall investigate issues relevant to the bandwidth and capacity of practical wireless communication systems.
* You must submit a report (in pdf format) in Moodle.
* All text in the report must be searchable for Moodle **to detect** **plagiarism**.
* The outline (and some requirements) of the report is listed below.

**Content**

* Cover page
  + Logo of UPRM, Title, Course, Student Name, Student ID, Department
* Table of content
* Introduction
* The basics
  + The three components to define the bandwidth of a given signal
  + The three components to define the bandwidth of a given wireless channel
  + The Shannon capacity of a wireless communication system
* The regulations
  + Read the article in the link (<http://www.afar.net/tutorials/fcc-rules>) then answer
    1. What is the maximal transmission power fed into the antenna?
    2. What is the meaning of EIRP?
    3. What is dBi?
    4. What kind of antenna (with image) can achieve 30dBi?
    5. How much it cost?
* The standards
  + Read the IEEE 802.11-2020 standard (see Moodle site - References) and answer
    1. How IEEE specify the requirements for power spectral density for a 20 MHz channel in Chapter 17?
    2. Why some people claim that the same channel has a bandwidth 18MHz?
    3. Why some people claim that the same channel has a bandwidth 22MHz?
  + Use a table to summarize the following features
    1. Standard (or standards if there are many)
    2. Spectrum band (or bands if there are multiple options)
    3. Bandwidth (or bandwidths if there are multiple options)
    4. Maximal transmission power
    5. Typical transmission distance, and
    6. Maximal data rate (with the corresponding bandwidth)

of the following systems

* + 1. Near field communication (NFC)
    2. Bluetooth version 5.0
    3. Zigbee
    4. Wi-Fi 5
    5. WiGig
* The Starlink system
  + Find documents available online (need references) and answer
    1. What are the main altitudes of orbits used in the Starlink satellite system?
    2. What are the frequency bands for each of the above orbits?
    3. What are the bandwidths for each of the bands above?
    4. What is the range of received power at an existing user terminal?
    5. What is the maximal uplink data rate observed at an existing user terminal?
    6. What is the maximal downlink data rate observed at an existing user terminal?
    7. What is the minimal uplink latency observed at an existing user terminal?
    8. What is the minimal downlink latency observed at an existing user terminal?
    9. Visit <https://satellitemap.space/indexA.html> and
       - Take a screen shot when Puerto Rico is covered by a Starlink satellite.
* Conclusions
* References
  + **Need at least 20 references (IEEE style)**.