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CMPE 206

Homework 2

Note: All Log calculations is to base 10.

Problem 1

- 1.1: Convert from W to dbm
  - First we convert from W to mW (1W= 1000mW)
  - Then apply the formula as per given in appendix : power in Dbm= 10 log (P in mW).
    - 1.25*10^-4 = 10 log (0.125) = -9.308 dbm
    - 2.5* 10 ^-4= 10 log (0.25) = -6.020 dbm
    - 5 * 10^-4= 10 log (0.5) = -3.0302 dbm
    - 1 * 10^-3= 10 log (1) = 0 dbm
    - 2 * 10^-3= 10 log (2)= 3.002 dbm
    - 4 * 10 ^-3= 10 log (4)= 6.0205 dbm
    - 8 * 10 ^-3= 10 log (8) = 9.03 dbm
  - The mW as per the sequence. A linear increase in the power.
- 1.2: from dbm to mW
  - -100 dbm = 10 log (x) mw
    - = 10^-10 mW
    - Now 1000W = 10^6 mW (microwave is high)
    - So 10^-16 times high.

Problem 2

- 2.1

According to long distance propagation model

$$Pr(d) = Pr(d_0)\frac{d^{\alpha}}{{d_0}^{\alpha}}$$

Take log *both sides*,

$$\log_{10}(Pr(d)) = \log_{10}\left(\frac{Pr(d_0)\ d^{\alpha}}{{d_0}^{\alpha}}\right)$$

Applying Log rules,

$$Pr(d) = 10\log_{10}(Pr(d_0)) + 10\log_{10}\left(\frac{d^{\alpha}}{{d_0}^{\alpha}}\right)$$

$$So,\ PL(d) = PL(d_0) + 10 \cdot \alpha \cdot \log_{10}\left(\frac{d}{d_0}\right)$$

- 2.2: Using the formula from 2.1
  - $$PL(d) = 30 + 10 \cdot 2.6 \log_{10}\left(\frac{2\,d_0}{d_0}\right)$$

    $$PL(d) = 37.826$$

    $$For\ d = 4\,d_0$$

    $$PL(d) = 30 + 10 \cdot 2.6 \log_{10}\left(\frac{4\,d_0}{d_0}\right)$$

    $$PL(d) = 45.653$$

- 2.3
  - $$PL(d) = PL(d) + 10 \cdot \alpha \cdot \log_{10}\left(\frac{d}{d_0}\right)$$

    $$56 = 30 + 10 \cdot 2.6 \cdot \log_{10}\left(\frac{d}{d_0}\right)$$

    $$\log_{10}\left(\frac{d}{d_0}\right) = 1$$

    $$d = 10\,d_0$$

Problem 3

- Path Loss from A to B

$$PL(20) = 30 + 25 \cdot \log_{10}(20)$$

$$So,\ PL(20) = 62.525db$$

- Path Loss from B to C

$$PL(30) = 30 + 25\log_{10}(30)$$

$$PL\ (30) = 66.9275\ db$$

Now we calculate the received or the transmission which will be the throughput

$$PL = 10\log_{10}\left(\frac{Ps}{Pr}\right)$$

$$PL(20) = 10\log_{10}\left(\frac{29.9}{Pr}\right)$$

$$So,\ 62.525 = 10\log_{10}\left(\frac{29.9}{pr}\right)$$

$$6.25 = \log_{10}(29.9) - \log_{10}(Pr)$$

$$Pr(20) = 0.49\ db$$

$$Now\ find\ B -> C$$

$$Now\ find\ Pr\ (30)$$

$$PL(30) = 10\log_{10}(29.9) - \log_{10}(PR)$$

$$So,\ Pr(30) = 0.507\ db$$

So from A->B we get 0.49 (depending on time 49% active) and from B->C we get 0.507 (50.7% active)

Problem 4 : Github Repo name: **arselan**

- 4.1
  - Graphs on Github.
  - In the DoRxCalc , I combined the DoRxCalc methods of both RandomPropagationLossModel and LogDistancePropagationLossModel.
- 4.2
  - As path loss exponent increases, the received power decreases. (Without considering the Absolute value)
- 4.3: Readings from the graph
  - (i) 200m
  - (ii) 200m
  - (iii) 250m
  - (iv) 200m

Question 5

- So for this question I used the book reference: *Wireless Networks, Nitin Vaidya*
- For the error correction I used the following approach as described :
    - If at most one bit error then transmitted. If more than one bit error than not transmitted.
    - Calculate data based on min errors
        - 0110 111-> 0010
        - 1010 101-> 1000
        - 1110 011-> 1100
        - 1110 110-> 1110
        - 1111 100-> 1110

Citations

- *Wireless Networks, Nitin Vaidya*
- *Lecture Slides*
- *Piazza help. (Professor Mahima S. and Wei)*
- *Ns3- RandomPropagationLossModel and LogDistancePropagationLossModel*