Problem 6.1

Radio:

= 10log(/) = 20log(4πd/λ) = 20log(4π/λ) + 20log(d)

When d = 1, 20log(4π/λ) = 6

When d = 2, = 6 + 20log(2) = 12.021

When d = 4, = 6 + 20log(4) = 18.041

When d = 8, = 6 + 20log(8) = 24.062

When d = 16, = 6 + 20log(16) = 30.082

Wired:

Since it’s fixed number of Db per km, it is 3 dB per km in this example.

|  |  |  |
| --- | --- | --- |
| Distance(km) | Radio(dB) | Wire(dB) |
| 1 | -6 | -3 |
| 2 | -12 | -6 |
| 4 | -18 | -12 |
| 8 | -24 | -24 |
| 16 | -30 | -48 |

Problem 6.6

A)

N(dBW) = 10log(P2/1W) = 10log(50)dBW = 16.98 dBW

N(dBm) = 10log(P2/1mW) = 10log(50\*10^3) = 16.98 + 30 = 46.98dBm

B)

=(c^2)/(4πfd)^2

= (3\*10^8)^2\* / (4π\*(900MHz\*10^6)\*100m)^2

=3.52\*10^-6 W

P\_r = 10log(3.52\*10^-6W/1mW) + 30 = -54.53 + 30 = -24.53 dBm

C)

P\_r = 3.52 \* 10^-10 W

P\_r = 10log(3.52 \* 10^-10W/1mW) + 30 = -94.53 + 30 = -64.53dBm

D)

P\_r = 2\*3.52 \* 10^10W = 7.04 \* 10^-10

P\_r = 10log(7.04 \* 10^-10W/1mW) + 30 = -61.52dBm

Problem 6.7

a) 2.7 to 3.5

B)

P\_r=(c^2)/(4πfd)^2

P\_r= (3\*10^8)^2\* / (4π\*(900MHz\*10^6)\*100m)^2

P\_r=3.52\*10^-6 W

P\_r = 10log(3.52\*10^-6W/1mW) + 30 = -54.53 + 30 = -24.53 dBm

C)

P\_r = 3.52 \* 10^-10 W

P\_r = 10log(3.52 \* 10^-10W/1mW) + 30 = -94.53 + 30 = -64.53dBm

D)

P\_r = 2\*3.52 \* 10^10W = 7.04 \* 10^-10

P\_r = 10log(7.04 \* 10^-10W/1mW) + 30 = -61.52dBm

Problem 6.12

L\_ru = 10log(150\*10^3/10^-13)

L\_ru = 181.76 dbBW

L\_ru = L\_u – 4.78[log(76\*10^6)]^2-18.33log(76\*10^6) – 40.94

L\_u = L\_ru + 4.78[log(76\*10^6)]^2-18.33log(76\*10^6) + 40.94

L\_u = 663.49

= 69.55 + 26.16log(f) – 13.82logh\_b – A(h\_m) + (44.9 – 6.55log(h\_b))logd

A(h\_m) = (1.1logf – 0.7)h\_m – (1.56logf -0.8) = 0.46

663.49

= 69.55 + 26.16log(76\*10^6) – 13.82logh\_b – A(h\_m) + (44.9 – 6.55log(h\_b))logd

= 69.55 + 26.16log(76\*10^6) – 13.82logh\_b – 0.46 + (44.9 – 6.55log(h\_b))log(80\*10^3)

log(h\_b) = -3.66

h\_b = 0.0002 m

Problem 6.15

a)

T\_b = 1/(50000) = 0.00002s = 0.02ms

T\_c = 10 ms > T\_b, Slow Fading

b)

B\_c >> B\_s, Flat Fading