**Question:**

Suppose a transmitter produces 50Watts of Power.   
a. Express transmit power in dBm and dBW.  
b. If a transmitter’s power is applied to Unity gain Antenna with 900MHz carrier frequency, what is the free space power in dBm at a free space distance of 100m?  
c. Repeat (b) for 10Km  
d. Repeat (C) for antenna gain 2

**Answer:**

1. *P*(dBW) = 10 · log10( *P*(W) / 1W)

 = 10 · log10( 50 / 1W)  
 = 16.98 dBW  
  
P(dBm) = P(dBW)+30

= 46.98 dBm

1. According to Friss’s transmission equation:  
   Pr = (Pt \* Gt\* Gr \* λ2)/(4π \* d)2

Pr = (50 \* 1\* 1 \* λ2)/(4π \* 100)2 [λ = c/f => 3\*108/900\*106 => (1/3)]  
Pr = (50 \* 1\* 1 \* (1/3)2)/(4π \* 100)2Pr = 3.51 \* 10-6 W

Pr = 10 · log10( 3.51 \* 10-6 W / 1W) +30

Pr = -24 dBm

1. According to Friss’s transmission equation:  
   Pr = (Pt \* Gt\* Gr \* λ2)/(4π \* d)2

Pr = (50 \* 1\* 1 \* λ2)/(4π \* 10000)2 [λ = c/f => 3\*108/900\*106 => (1/3)]  
Pr = (50 \* 1\* 1 \* (1/3)2)/(4π \* 10000)2Pr = 3.51 \* 10-10 W

Pr = 10 · log10( 3.51 \* 10-10 W / 1W) +30

Pr = -64.54 dBm

1. According to Friss’s transmission equation:  
   Pr = (Pt \* Gt\* Gr \* λ2)/(4π \* d)2

Pr = (50 \* 2\* 1 \* λ2)/(4π \* 10000)2 [λ = c/f => 3\*108/900\*106 => (1/3)]  
Pr = (50 \* 2\* 1 \* (1/3)2)/(4π \* 10000)2Pr = 5.75 \* 10-11 W

Pr = 10 · log10( 5.75 \* 10-11 W / 1W) +30  
Pr = -72.403dBm