Chapter 5 solutions

1.

(a)

	47–74MHz, 87.5–118MHz, 174–230MHz, 470–862MHz	Other frequencies below 1GHz	Frequencies above 1GHz
Emission limit (dBm)	-53.98	-36.02	-30
Relative to 30 dBm carrier (dBc)	-83.98	-66.02	-60

(b) The minimum transmit phase noise requirement is -84 dBc.

(c) When the transmitter operates at 20 dBm, the transmit noise requirement drops to -74 dB.

2. Sensitivity = thermal noise floor (50Ω, -174 dBm/Hx) + receiver noise figure + required Eb/No for demodulation + data rate represented in dB=

[DISP]
-174 + 15 + 15 + 10*log10(75e3) = -95 dBm

[DISPX]

3. (a)

[DISP]

Path loss = $10*\log10(4 * \pi*d/\lambda)^2$

1m – path loss 40dB

2m – 46 dB

[DISPX]

(b)

[DISP]

Pr = Pt + Gt +Gr – polarization loss –path loss (all in dBs)

1m – 19.74uW

2m – 4.94 uW

[DISPX]

(c)

[DISP]

Pr = Pt + Gt + Gr –Ltag –round trip path loss

1m requires -73 dBm receiver sensitivity

2m requires -85.13 dBm receiver sensitivity

[DISPX]

(d) If the tag cannot harvest enough energy, the range can be improved by improving the reader antenna gain, the tag antenna gain, or increase the power conversion efficiency of the tag.

[BT]If the range is limited by the back scattering, the range can be improved by increasing the reader antenna gain, the reader receiver sensitivity, or increasing the tag reflected power.