2.32 A base station cellular communication systems *lossless* antenna has a *maximum gain* of 16 dB (above isotropic) at 1,900 MHz. Assuming the *input power* to the antenna is 8 watts, what is the *maximum* radiated power density (in watts/cm^2) at a distance of 100 meters? This will determine the safe level for human exposure to electromagnetic radiation.

- Modify problem so that the maximum gain is 15 dBi and the input power is 10 W. Also, determine the maximum radiation intensity.

$\Rightarrow$ lossless antenna implies: $G_{max} = D_{max} = 15\,dB$ [see (2-47) + (2-49a)]

$P_{rad} = P_{in} = 10\,W$

Per (2-16a), $D_{max} = D_o = \dfrac{4\pi U_{max}}{P_{rad}}$

$\hookrightarrow U_{max} = \dfrac{P_{rad}}{4\pi} D_{max} = \dfrac{10\,W}{4\pi}\, 10^{15/10}$ ← dimensionless directivity

$$U_{max} = 25.1646\ (W/sr)$$

Per (2-12), $U = r^2 W_{rad} \Rightarrow W_{rad} = \dfrac{U}{r^2}$

Sub U_{max} into (2-12) w/ $r = 100\,m$ to get

$$W_{rad_{1max}} = \frac{25.1646}{100^2} = 2.51646 \times 10^{-3}\ W/m^2 \left(\frac{1m^2}{100^2 cm^2}\right)$$

$$W_{rad,max} = 2.51646 \times 10^{-7}\ W/cm^2$$
$$= 251.646\ \frac{nW}{cm^2}$$