1. Recall (9.18)

$$\mathbf{H}(\mathbf{x}) = \frac{ck^2}{4\pi}(\mathbf{n}\times\mathbf{p})\frac{e^{ikr}}{r}\left(1-\frac{1}{ikr}\right) \tag{1}$$

$$\mathbf{E}(\mathbf{x}) = \frac{1}{4\pi\epsilon_0}\left\{k^2(\mathbf{n}\times\mathbf{p})\times\mathbf{n}\frac{e^{ikr}}{r} + [3\mathbf{n}(\mathbf{n}\cdot\mathbf{p})-\mathbf{p}]\left(\frac{1}{r^3}-\frac{ik}{r^2}\right)e^{ikr}\right\} \tag{2}$$

Let $\mathbf{p}$ be along the $\hat{\mathbf{z}}$ direction, then

$$\mu_0|\mathbf{H}|^2 = \frac{\mu_0 c^2 k^4|\mathbf{p}|^2}{(4\pi)^2 r^2}\sin^2\theta\left(1+\frac{1}{k^2r^2}\right) = \frac{|\mathbf{p}|^2}{(4\pi)^2\epsilon_0}\sin^2\theta\frac{k^2}{r^4}\left(1+k^2r^2\right) \tag{3}$$

Hence

$$\int\mu_0|\mathbf{H}|^2 d\Omega = \frac{|\mathbf{p}|^2}{(4\pi)^2\epsilon_0}\frac{k^2}{r^4}\left(1+k^2r^2\right)\overbrace{\int\sin^2\theta\, d\Omega}^{8\pi/3} = \frac{|\mathbf{p}|^2}{(4\pi)^2\epsilon_0}\frac{k^2\left(1+k^2r^2\right)}{r^4}\cdot\frac{8\pi}{3} \tag{4}$$

For the electric part, we have

$$\epsilon_0|\mathbf{E}|^2 = \frac{1}{(4\pi)^2\epsilon_0}\left\{\frac{k^4}{r^2}\overbrace{|(\mathbf{n}\times\mathbf{p})\times\mathbf{n}|^2}^{|\mathbf{p}|^2\sin^2\theta} + \left(\frac{1+k^2r^2}{r^6}\right)\overbrace{|3\mathbf{n}(\mathbf{n}\cdot\mathbf{p})-\mathbf{p}|^2}^{|\mathbf{p}|^2\left(1+3\cos^2\theta\right)} - 2\frac{k^2}{r^4}\overbrace{[(\mathbf{n}\times\mathbf{p})\times\mathbf{n}]\cdot\mathbf{p}}^{|\mathbf{p}|^2\sin^2\theta}\right\} \tag{5}$$

giving

$$\begin{aligned}\int\epsilon_0|\mathbf{E}|^2 d\Omega &= \frac{|\mathbf{p}|^2}{(4\pi)^2\epsilon_0}\left[\frac{k^4}{r^2}\int\sin^2\theta\, d\Omega + \left(\frac{1+k^2r^2}{r^6}\right)\overbrace{\int\left(1+3\cos^2\theta\right)d\Omega}^{8\pi} - 2\frac{k^2}{r^4}\int\sin^2\theta\, d\Omega\right]\\ &= \frac{|\mathbf{p}|^2}{(4\pi)^2\epsilon_0}\left[\frac{k^4r^4+3\left(1+k^2r^2\right)-2k^2r^2}{r^6}\right]\cdot\frac{8\pi}{3}\end{aligned} \tag{6}$$

and finally

$$\int\left(\epsilon_0|\mathbf{E}|^2-\mu_0|\mathbf{H}|^2\right)d\Omega = \frac{|\mathbf{p}|^2}{2\pi\epsilon_0 r^6} \tag{7}$$

2. By (6.140), the reactance outside the sphere of radius a is

$$\begin{aligned}X_a &= \frac{4\omega}{|I_i|^2}\int_a^\infty r^2dr\int(w_m-w_e)\,d\Omega\\ &= -\frac{\omega}{|I_i|^2}\int_a^\infty r^2dr\int\left(\epsilon_0|\mathbf{E}|^2-\mu_0|\mathbf{H}|^2\right)d\Omega\\ &= -\frac{\omega|\mathbf{p}|^2}{2\pi\epsilon_0|I_i|^2}\int_a^\infty\frac{dr}{r^4}\\ &= -\frac{\omega|\mathbf{p}|^2}{6\pi\epsilon_0|I_i|^2a^3}\end{aligned} \tag{8}$$

3. The center-fed antenna of 9.2 has a dipole moment of

$$p = \frac{iI_0d}{2\omega} \tag{9}$$

which gives a reactance of

$$X_a = -\frac{d^2}{24\pi\epsilon_0\omega a^3} \tag{10}$$