Homework (2)

(3) Calculate the electric field strength for $\theta = 60°$ for antennas in problem 1. Express your results also in terms of dB relative to Emax i.e

$$20\log_{10} \frac{(|E(\theta)|_{\theta=60°})}{|E_{max}|_{\theta=90°}} = E(dB)$$

$L = 0.03\lambda$

Sol

$$F(\theta)\Big|_{\theta=60°} = \frac{\cos\left(\frac{\beta L}{2}\cos\theta\right) - \cos\left(\frac{\beta L}{2}\right)}{\sin\theta}$$

$$= \frac{\cos\left(\frac{\pi L}{\lambda}\cos\theta\right) - \cos\left(\frac{\pi L}{\lambda}\right)}{\sin\theta}$$

$$F(\theta)\Big|_{\theta=60°} = \frac{\cos\left(\frac{\pi(0.03\lambda)}{\lambda}\cos 60°\right) - \cos\left(\frac{\pi(0.03)\lambda}{\lambda}\right)}{\sin 60}$$

$= \cancel{0.00}$ $= 0.0038$

So $20\log_{10} \frac{|E(\theta)|_{\theta=60°}}{|E_{max}|_{\theta=90°}}$

$$= 20\log_{10}\left|\frac{0.0038}{0.0044}\right|$$

$$= -1.27$$

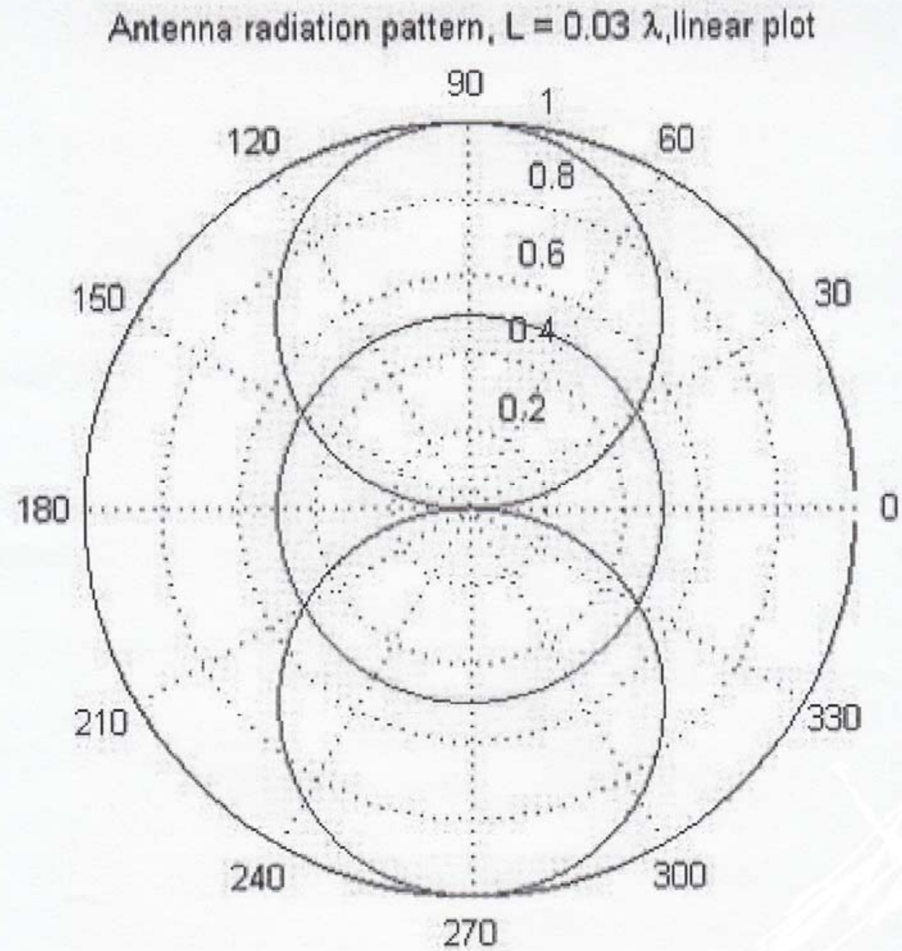
By doing similar calculations for

$L = 0.15\lambda$, $L = 0.5\lambda$, $L = 0.9\lambda$, $L = 1.3\lambda$

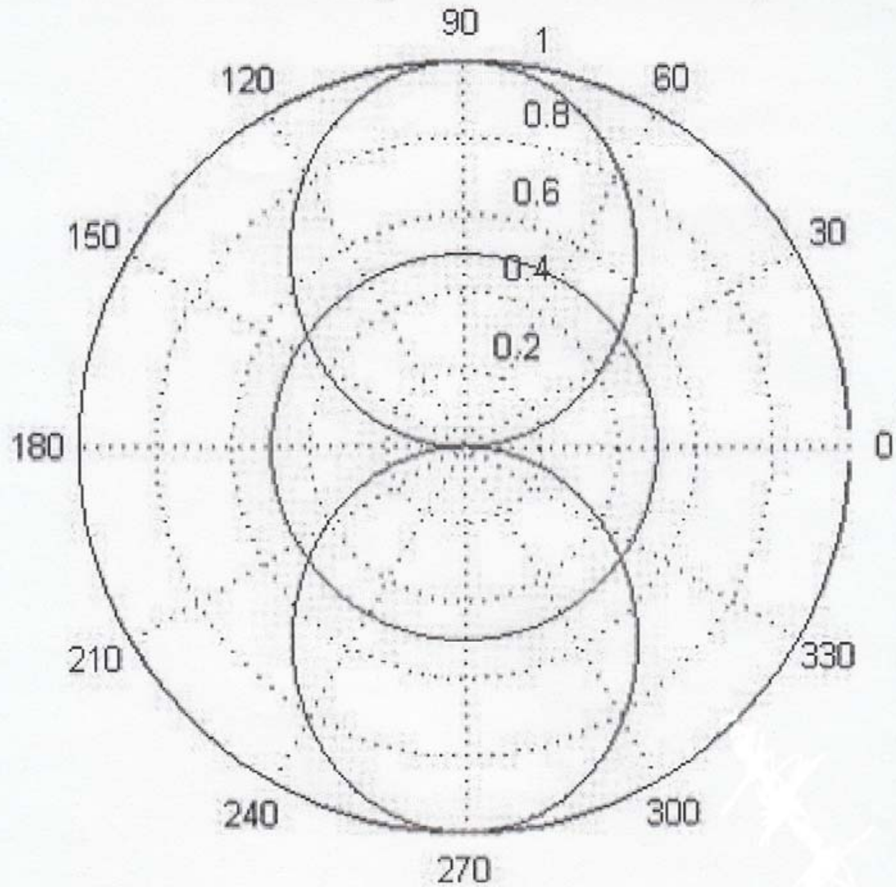
we get

L	E(dB)
0.03λ	-1.27
0.15λ	-1.28
0.5λ	-1.71
0.9λ	-2.99
1.3λ	-21.48

4) Plot the radiation patterns in the E-plane (i.e. as a function of □) for the antennas of Problem 1a, c, and e. Use a polar plot and both the log and the linear scales in plotting the radiation patterns. Determine the half power beamwidth (HP or HPBW) of the antenna for each of the cases.



Antenna radiation pattern, L = 0.5 λ,linear plot



Antenna radiation pattern, L = 1.3 λ,linear plot