INFINITESIMAL DIPOLE

$$A(x,y,z) = \frac{\mu}{4\pi} \int_{\ell} I_0 \hat{z} \frac{e^{-jkR}}{R} \, d\ell$$

$$A_z = \frac{\mu I_0 \ell}{4\pi r} e^{-jkr}$$

$$E_r = \eta \frac{I_0 \ell \cos\theta}{2\pi r^2} \left[1 + \frac{1}{jkr}\right] e^{-jkr}$$

$$E_\theta = j\eta \frac{k I_0 \ell \sin\theta}{4\pi r} \left[1 + \frac{1}{jkr} - \frac{1}{(kr)^2}\right] e^{-jkr}$$

$$H_\phi = j \frac{k I_0 \ell \sin\theta}{4\pi r} \left[1 + \frac{1}{jkr}\right] e^{-jkr}$$

FAR FIELD REGION ($kr >> 1$)

$$E_\theta = j\eta \frac{k I_0 \ell}{4\pi r} \sin\theta$$

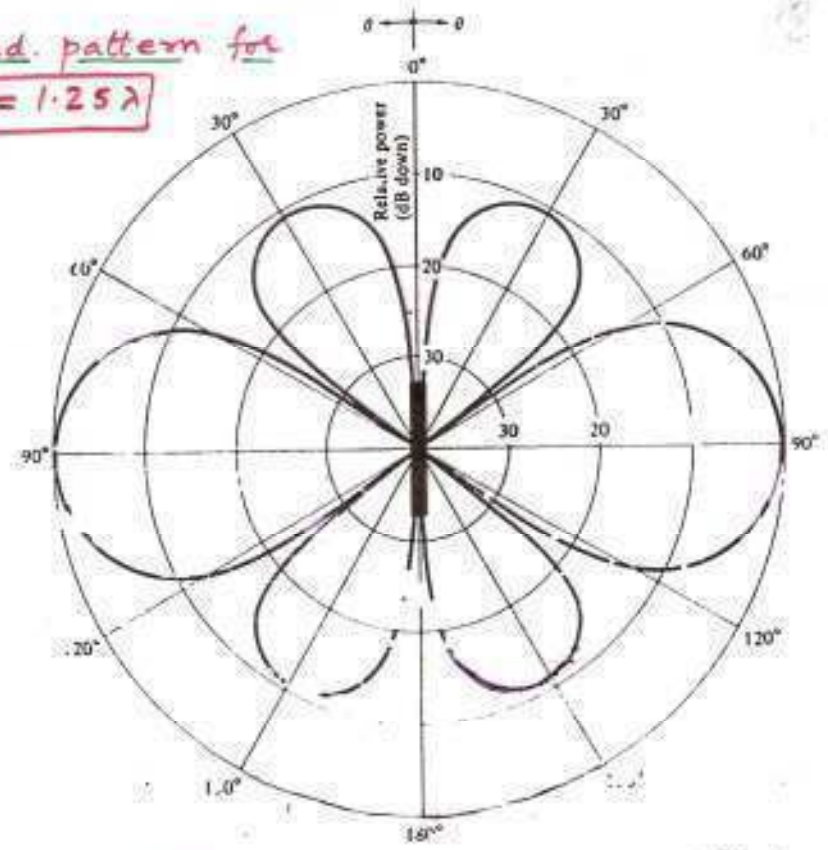
$$H_\phi = j \frac{k I_0 \ell}{4\pi r} \sin\theta$$

$$E_\theta / H_\phi = \eta = 120\pi$$

$$\boxed{R_r = 80\pi^2 (\ell/\lambda)^2}$$

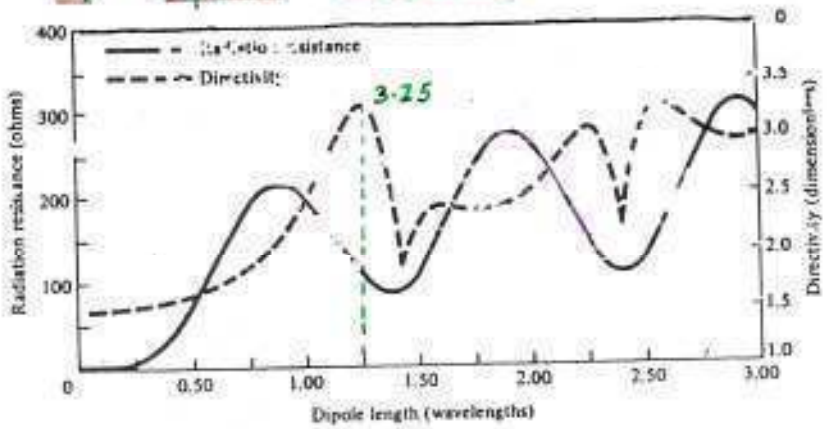
Rad. pattern for

$l = 1.25\lambda$

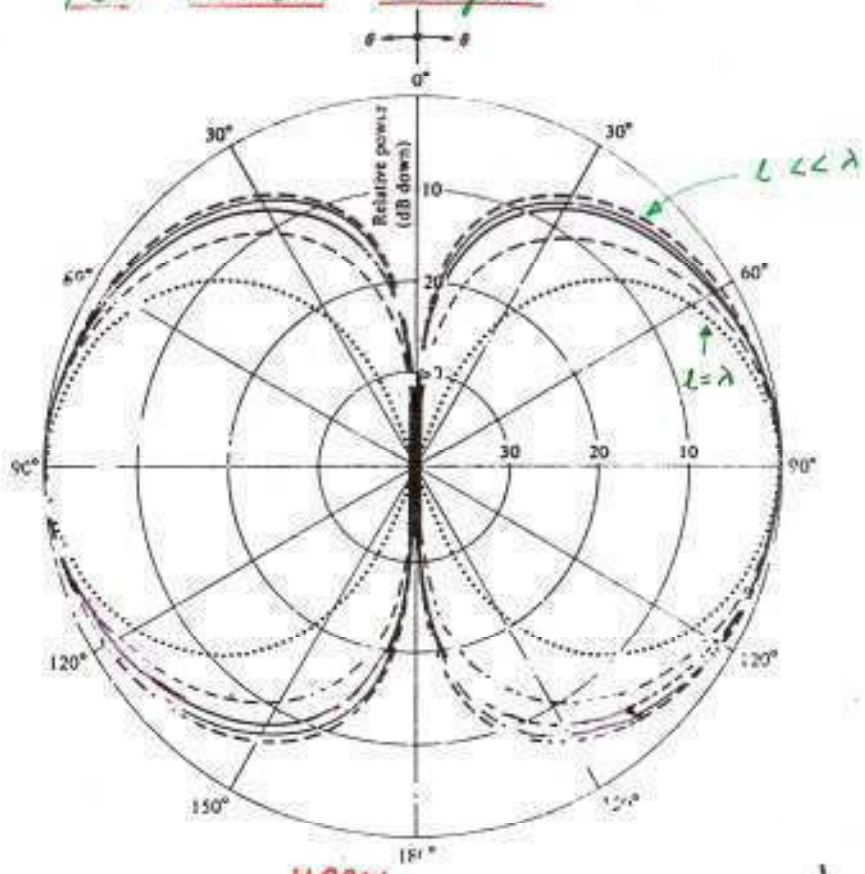


Elevation plane amplitude pat ern, for a thin ... = 1.25λ and sinusoidal curre. distribution.

Radiation resistance and directivity of dipole antenna



Radiation pattern of dipole for various lengths

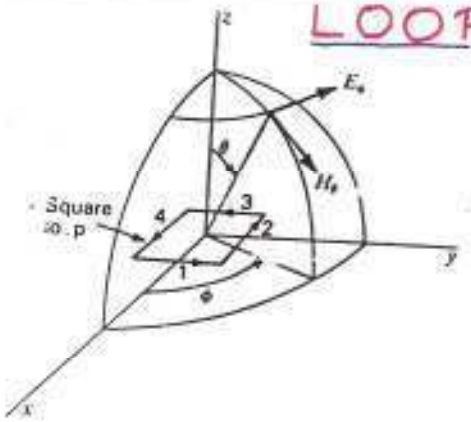


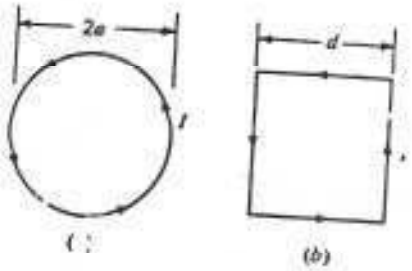
		HPBW
- - - -	$l << \lambda$	90°
———	$l = \lambda/4$	87°
———	$l = \lambda/2$	78°
- · - · -	$l = 3\lambda/4$	64°
·····	$l = \lambda$	48°

Elevation plane amplitude patterns for a thin dipole with sinusoidal current distribution ($l = \lambda/4, \lambda/2, 3\lambda/4, \lambda$).

$$E_\theta = j \frac{60 I_0}{r} \left[\frac{\cos\left(\frac{kl\cos\theta}{2}\right) - \cos\left(\frac{kl}{2}\right)}{\sin\theta} \right]$$

LOOP ANTENNA





Radiation pattern of circular loop

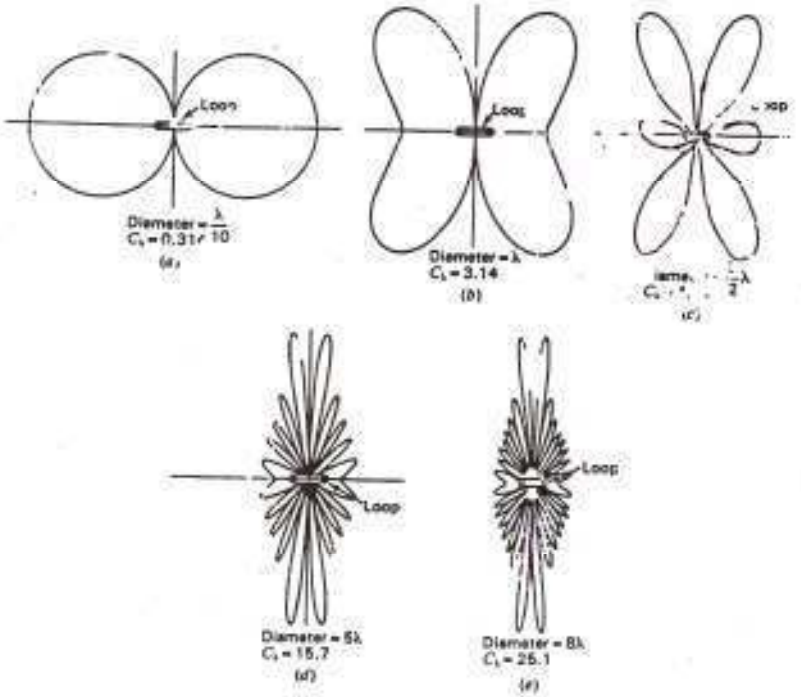
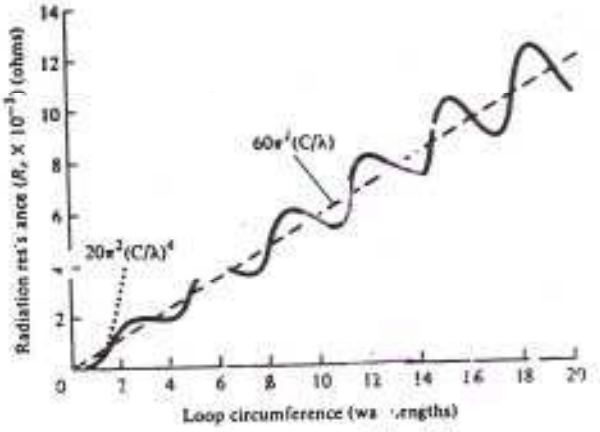
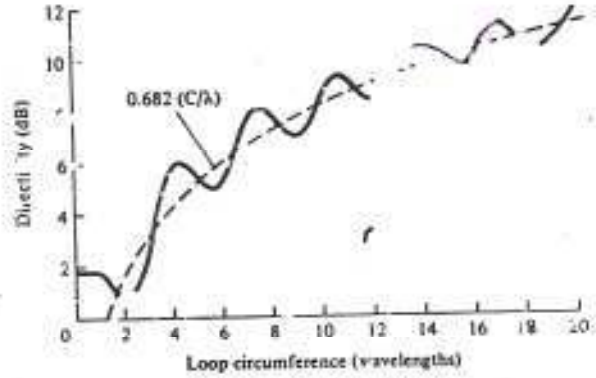


Figure – Far-field patterns of loops of 0.1, 1, 1.5, 5 and 8λ diameter. Uniform in-phase current is assumed on the loops.

Radiation resistance and directivity of circular loop antenna



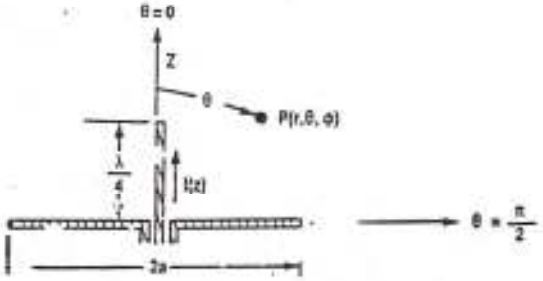
(a) Radiation resistance of circular loop

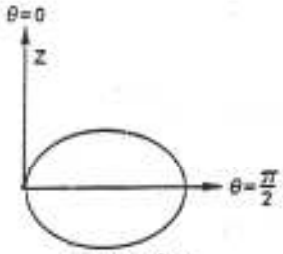


(b) Directivity of circular loop

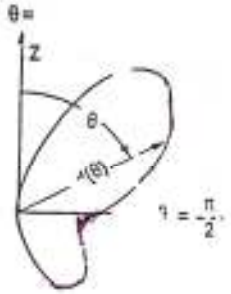
Figure — Radiation resistance and directivity for circular loop of constant current.

MONOPOLE ANTENNA

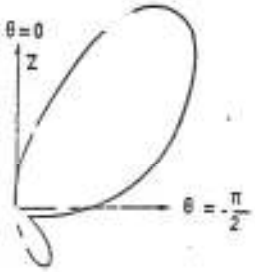




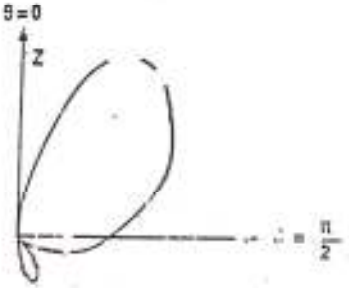
(a) $2\pi a/\lambda = 0$



(b) $2\pi a/\lambda = 3$

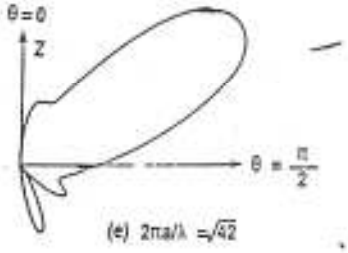


(c) $2\pi a/\lambda = 4$

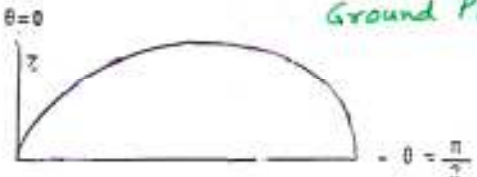


(d) $2\pi a/\lambda = 5$

Infinite Ground Plane



(e) $2\pi a/\lambda = \sqrt{42}$



(f) $2\pi a/\lambda = \infty$

Elevation Directive Gain Patterns, for any Azimuthal Direction, of a Quarter-Wave Element Mounted on a Ground Plane of Radius a (The Patterns are Polar Graphs on the Same Linear Scale)