1 efficiency $e_t = e_r e_{cd}$

$e_r = 1 - |\Gamma|^2 = 1 - \left|\frac{Z_{in} - Z_0}{Z_{in} + Z_0}\right|^2$

$e_{cd} = \frac{R_r}{R_r + R_\ell}$ → lossless $R_\ell = 0$

→ short dipole $R_r = 80\pi^2\left(\frac{\ell}{\lambda}\right)^2$

effective Aprerture A_e

$Gain = e_t \cdot D$

$P_{rad} = e_t \cdot P_{in}$

2 $D = \frac{4\pi A_e}{\lambda^2} = \frac{41253}{\theta_{HP}^\circ \phi_{HP}^\circ}$ & $D_{max} = \frac{4\pi A_{em}}{\lambda^2}$

→ $A_e = e_t A_{em}$

→ $P_{ower} = \frac{I^2 R_r}{\text{termind}} = \frac{1}{2} I_{0\,\text{max}}^2 R_r = \frac{1}{2}\iint \frac{E^2}{Z} \cdot dA$

3 Friis equation

$\frac{P_r}{P_t} = G_r G_t \left(\frac{\lambda}{4\pi R}\right)^2$

4 Polarization (-Z direction)

→ linear $\phi_y - \phi_x = \pm n\pi$

→ Circular $|A| = |B|$

RH CW: $\Delta\phi = \pi(2n + \frac{1}{2})$

LH CCW: $\Delta\phi = -\pi(2n + \frac{1}{2})$

$|A| \neq |B|$

RH CW: $\Delta\phi = \pi(2n + \frac{1}{2})$

LH CCW: $\Delta\phi = -\pi(2n + \frac{1}{2})$

→ Elliptical

% (+Z)

Replace CW by CCW & vice versa

5 PLF $= |\hat{\rho}_w \cdot \hat{\rho}_a| = |\cos\psi|^2$

6 BW → narrow $= f_{upper} - f_{lower}$

→ wide $= f_{upper}/f_{lower}$

→ $f_c = \frac{f_{upper} + f_{lower}}{2}$

Axial Ratio

$1 \le AR \le \infty$

$AR = \frac{\text{Major}}{\text{minor}}$

SS

SS