GOOD ANTENNAS
TERRIBLE MEASUREMENTS

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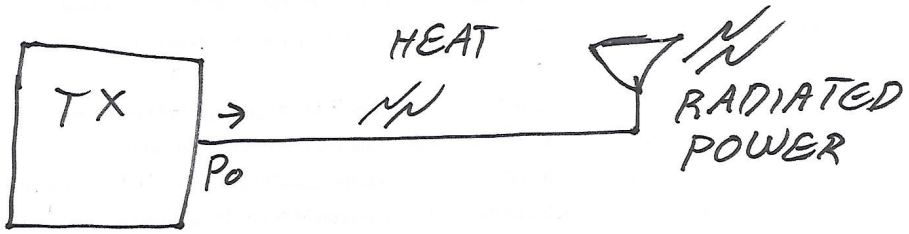
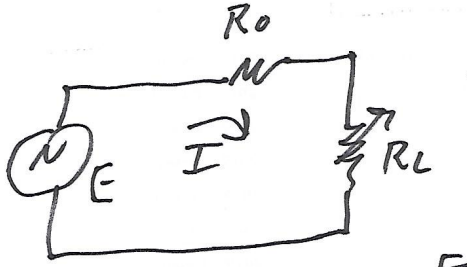
BASIC CONCEPT #1

CONSERVATION OF ENERGY (POWER)



BASIC CONCEPT #2
MAX POWER OUT



MAX POWER IN LOAD WHEN $R_L = R_0$

$$I = \frac{E}{R_0 + R_L} \qquad I^2 = \frac{E^2}{(R_0+R_L)^2} = \frac{E^2}{R_0^2 + 2R_0R_L + R_L^2}$$

$$P_L = I^2 R_L = \frac{E^2 R_L}{R_0^2 + 2R_0R_L + R_L^2}$$

$$\frac{dP_L}{dR_L} = \frac{(R_0^2 + 2R_0R_L + R_L^2)E^2 - E^2R_0(2R_0 + 2R_L)}{(R_0+R_L)^4}$$

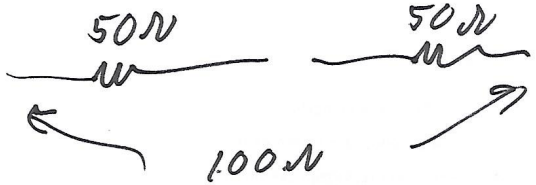
$$\frac{dP_L}{dR_L} = 0 \Rightarrow E^2(R_0^2 + 2R_0R_L + R_L^2) = E^2R_L(2R_0 + 2R_L)$$

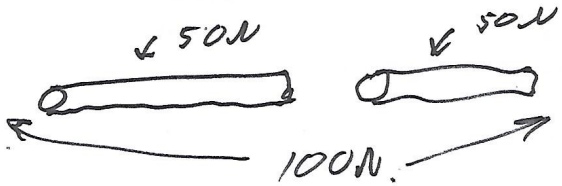
$$R_0^2 + 2R_0R_L + R_L^2 = 2R_0R_L + 2R_L^2$$

$$R_0^2 + R_L^2 = 2R_L^2$$

$$R_0^2 = R_L^2$$

$$R_0 = R_L$$

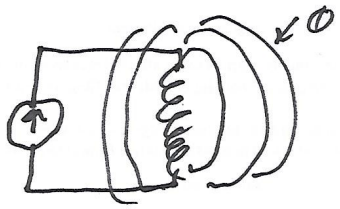


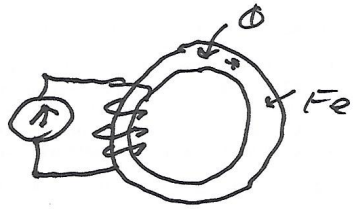


$$R = f(\varepsilon, I) = \frac{\varepsilon}{I}$$

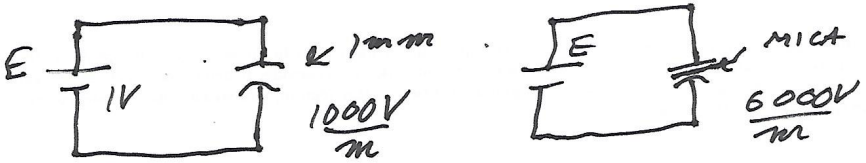
$$Z_0 = f(\mu, \varepsilon)$$

μ = PERMEABILITY $\left(\frac{H}{m}\right)$





ϵ = PERMATIVITY $\left(\frac{F}{m}\right)$



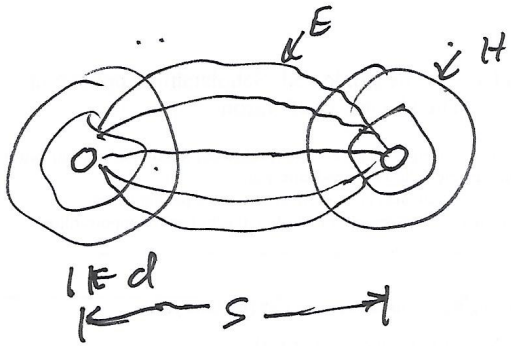
$$Z_0 = f(\mu, \epsilon) = \sqrt{\mu/\epsilon} \left(\frac{H}{F}\right)$$

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$\omega_0^2 = \frac{1}{LC}$$

$$\omega_0^2 L^2 = \frac{L}{C} \quad (\Omega^2)$$

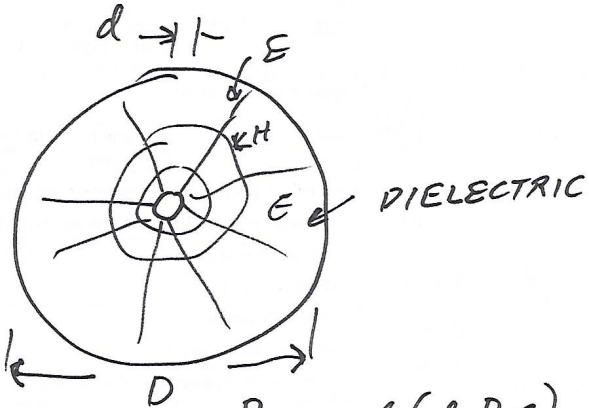
SO UNITS $\frac{H}{F} = \Omega^2$



TWIN LEAD

$$Z_0 = 276 \log \frac{2S}{d}$$

TYP 300Ω
450Ω
600Ω



COAX

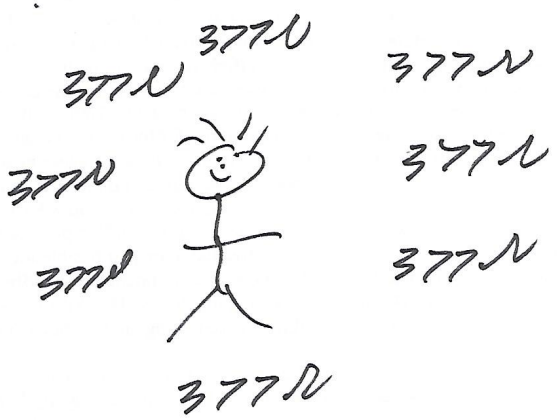
$$Z_{0\ AIR} = 138 \log \frac{D}{d} = f(d, D, \epsilon)$$

TYP 50Ω
75Ω

$Z_{0_{FS}} = \sqrt{\mu_0/\epsilon_0}$ $\quad \mu_0 = 4\pi \times 10^{-7} \frac{H}{m}$

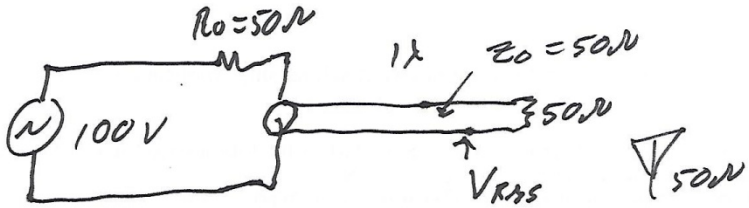
$\epsilon_0 = 8.85 \times 10^{-12} \frac{F}{m}$

$= 377\Omega$



SO ANTENNAS MATCH Z_0 OF TL (50Ω)

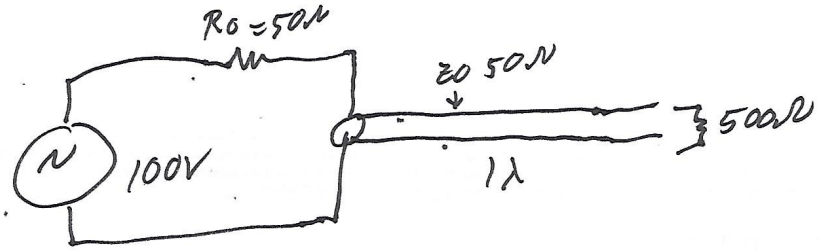
TO $Z_{0_{FS}}$ (377Ω)

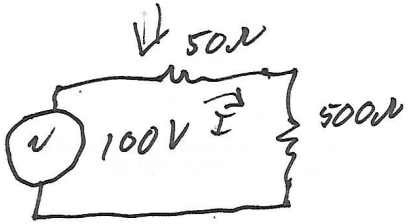


$V = IR = 50V$

$I = 1A$

$P = I^2R = 50W$





$$I = \frac{100V}{550\Omega} = 182mA$$

$$P = I^2R = 16.5W$$

$$E_{MAX} = E_L = 100V\,\frac{500\Omega}{550\Omega} = 90.8V$$

$$\rho = \frac{R_L - Z_0}{R_L + Z_0} = \frac{450}{550} = 0.818 = \frac{E_R}{E_F}$$

$$E_R = 0.818\,E_F$$

$$E_R + E_F = E_{MAX}$$

$$0.818\,E_F + E_F = E_{MAX} = E_L$$

$$1.818\,E_F = E_{MAX} = 90.8V$$

$$E_F = 50V \quad E_R = 40.8V$$

$$E_{MIN} = E_F - E_R = 50V - 40.8V = 9.2V$$

$$\frac{E_{MAX}}{E_{MIN}} = \frac{90.8V}{9.2V} = 10 = SWR = \frac{R_L}{Z_0}$$

$$\rho = \frac{E_R}{E_F}$$

$$\rho^2 = \frac{E_R^2}{E_F^2} = \frac{E_R^2/Z_0}{E_F^2/Z_0} = \left(\frac{P_R}{P_F}\right)$$

$$\rho = \sqrt{P_R/P_F}$$

$$P_L = P_F - P_R$$

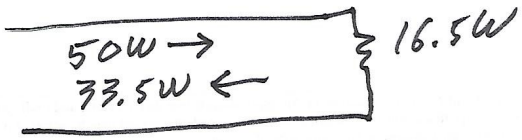
$$P_R = \rho^2 P_F$$

$$P_L = P_F - \rho^2 P_F$$

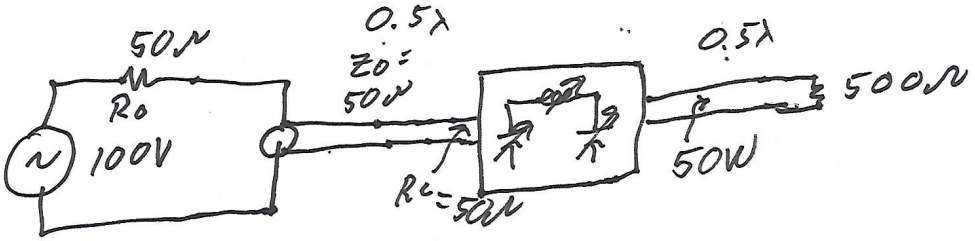
$$= (1-\rho^2) P_F$$

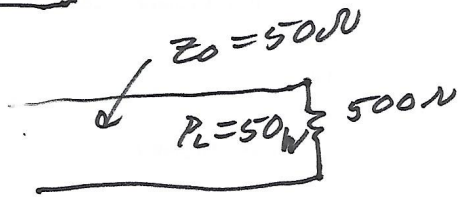
$$P_F = \frac{P_L}{1-\rho^2} = \frac{16.5\,W}{1-.818^2} = 50\,W$$

$$P_R = 50\,W - 16.5\,W = 33.5\,W$$



FIX IT!





$P_L = \frac{E_L^2}{R_L}$ $\quad E_L = \sqrt{P_L R_L} = 158V$

$\rho = 0.818 = \frac{E_R}{E_F}$ $\quad E_R = 0.818 E_F$

$E_R + E_F = 158V$

$0.818 E_F + E_F = 158V$

$1.818 E_F = 158V$ $\quad E_F = 86.9V$ $\quad E_R = 71.1$

$E_{MAX} = E_F + E_R = 158V$

$E_{MIN} = E_F - E_R = 15.8V$

$\frac{E_{MAX}}{E_{MIN}} = 10 = SWR$

$$\rho = \sqrt{P_R / P_F}$$

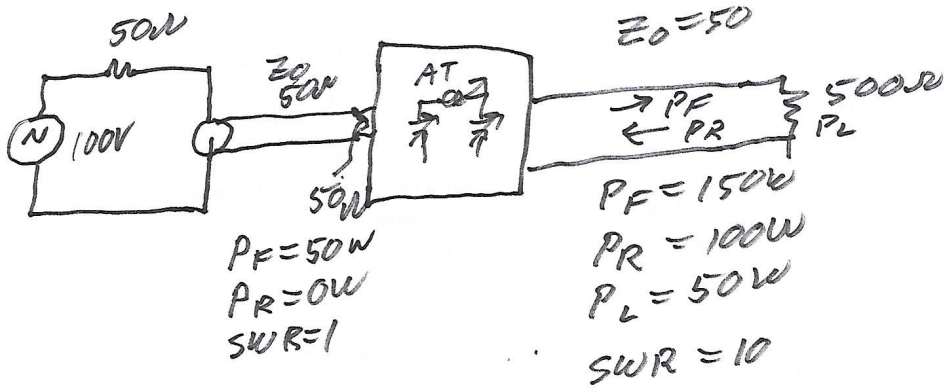
$$P_L = P_F - P_R$$

$$\rho^2 = P_R / P_F \qquad P_R = \rho^2 P_F$$

$$P_L = P_F - \rho^2 P_F$$

$$P_F = \frac{P_L}{1-\rho^2} = \frac{50W}{1-\rho^2} = 150W$$

$$P_R = 150W - 50W = 100W$$



$$\rho = \frac{E_R}{E_F} \qquad E_{MAX} = E_F + E_R = \rho E_F + E_F = (1+\rho) E_F$$

$$E_{MIN} = E_F - E_R = E_F - \rho E_F = (1-\rho) E_F$$

$$SWR = \frac{E_{MAX}}{E_{MIN}} = \frac{(1+\rho) E_F}{(1-\rho) E_F} = \frac{1+\rho}{1-\rho} = \frac{1+\sqrt{P_R/P_F}}{1-\sqrt{P_R/P_F}}$$


Menu
Edit
QRP Labs
MFJ DELUXE VERSA TUNER II
WATTS
FORWARD
REFLECTED
SWR
ANTENNA SELECTOR
TUNED
BYPASS
COAX 2
COAX 1
BAL. LINE WIRE
TRANSMITTER MATCHING
INDUCTOR SELECTOR
ANTENNA MATCHING
ON
300W
PEAK
OFF
30W
AVG
DUMMY LOAD
LAMP
METER
MODEL MFJ-949E


VECTRONICS™
LAMP
ON
OFF
RANGE
3kW
300W
LEVEL
OFF
DELAY
Peak Forward Power
Watts
FORWARD
REFLECTED
SWR
DIRECT
TUNED
INDUCTOR
COAX 2
COAX 1
COAX 1
COAX 2
BYPASS
WIRE/BAL
ANTENNA
TRANSMITTER
Model HFT1500 Digital Peak Reading Antenna Tuner