Problem & Solution.

Fall 2013 PhD Preliminary Written Exam

8 (a) Since Al is a good conductor we should use the good conductor equations

$$\frac{\sigma}{\omega\epsilon} = \frac{3.82\times10^{7}}{2\pi\times550\times10^{3}\times8.854\times10^{-12}}$$

$$= 5.7059\times10^{5} \gg 1.$$

Hence $\alpha = \beta = \sqrt{\pi f\mu\sigma} = \sqrt{\pi\times550\times10^{3}\times4\pi\times10^{-7}\times3.82\times10^{7}}$

$$= 9.143\times10^{3}.$$

We require

$$e^{-\alpha z} = 20\,dB = 0.01$$

Or $e^{-9.143\times10^{3}z} = 0.01$

ie $-9.143\times10^{3}z = \ln 0.01$ $z = 5.036\times10^{-4}\,m$

(i) Thickness of Al = 0.5036 mm.

(ii) $\alpha_{60Hz} = \sqrt{\pi\times60\times4\pi\times10^{-7}\times3.82\times10^{7}}$

$= 95.123\ Np/m.$

Hence attenuation in 0.5036 mm of Al

$= e^{-95.123\times5.036\times10^{-4}} = 0.95323$

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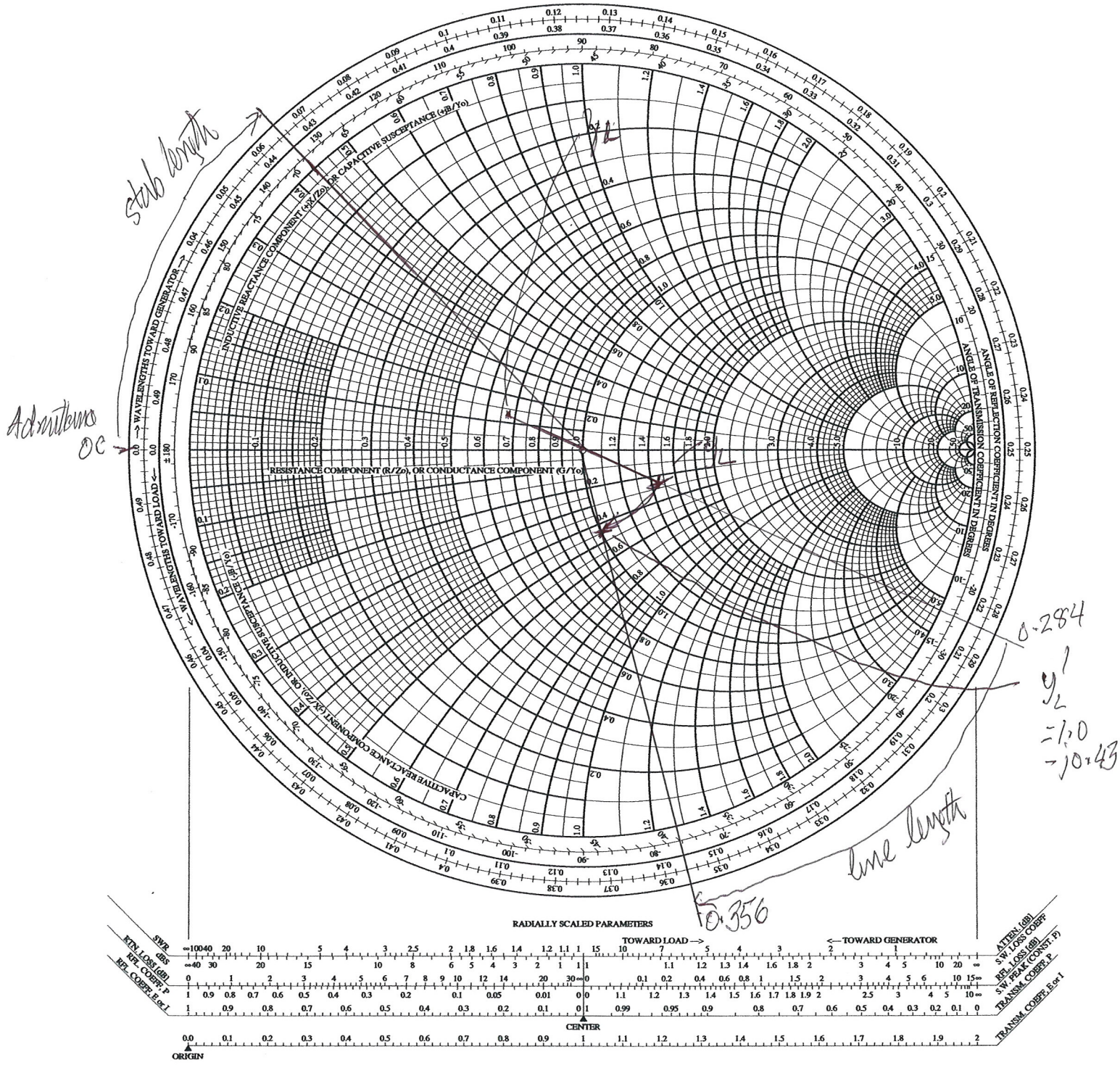
Smith Chart



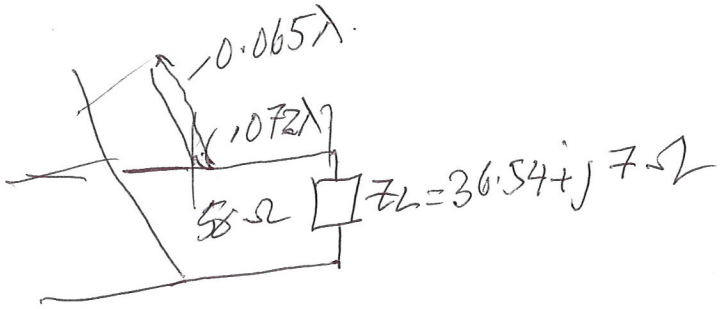
(b) (i) $Z_L = 36.54 + j7$, $z_L = \frac{36.54 + j7}{50}$

$= 0.731 + j0.14$

From Smith Chart

Line length = 0.350
− 0.284
0.072λ

OC shunt stub = 0.065λ



ii) $Z_L = 36.54$

$Z_T = \sqrt{36.54 \times 50} = 42.74\Omega$