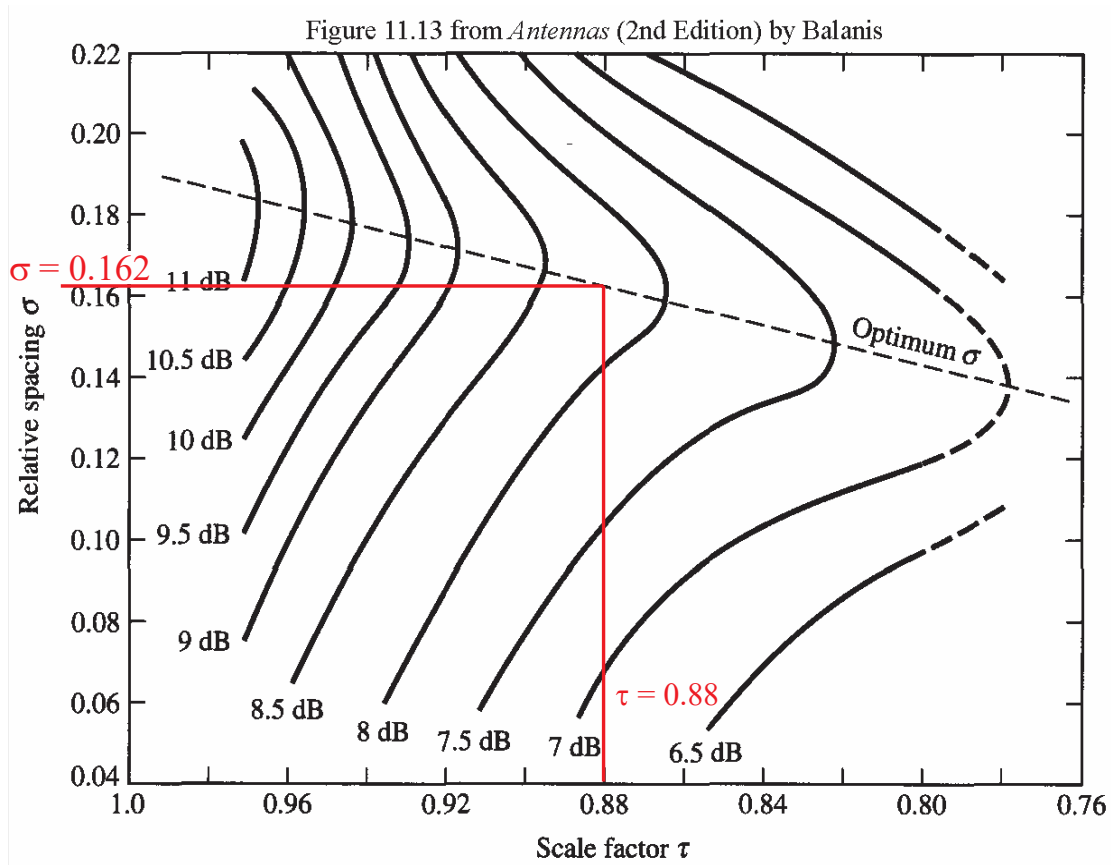


EE 483/583 Antennas for Wireless Communications Quiz #6 (Spring 2022)

Name KEY

Instructions: Open book & notes. Place answers in indicated spaces and show all work for credit.

For an **optimum** LPDA with a directivity of 8.25 dBi and frequency range of 470-608 MHz (covers UHF channels 14 to 36), find the relative spacing σ , scale factor τ , apex half-angle α (deg), longest λ_{\max} & shortest λ_{\min} wavelengths (cm), length l_1 (cm) & location R_1 (cm) of longest LPDA element, and estimated length of shortest element l_N (cm). **Show/label work** on given figures. Assume $c = 2.998 \times 10^8$ m/s in calculations.



$$\alpha = \tan^{-1} \left(\frac{1-\tau}{4\sigma} \right) = \tan^{-1} \left(\frac{1-0.88}{4(0.162)} \right) \Rightarrow \underline{\alpha = 10.491477^\circ}$$

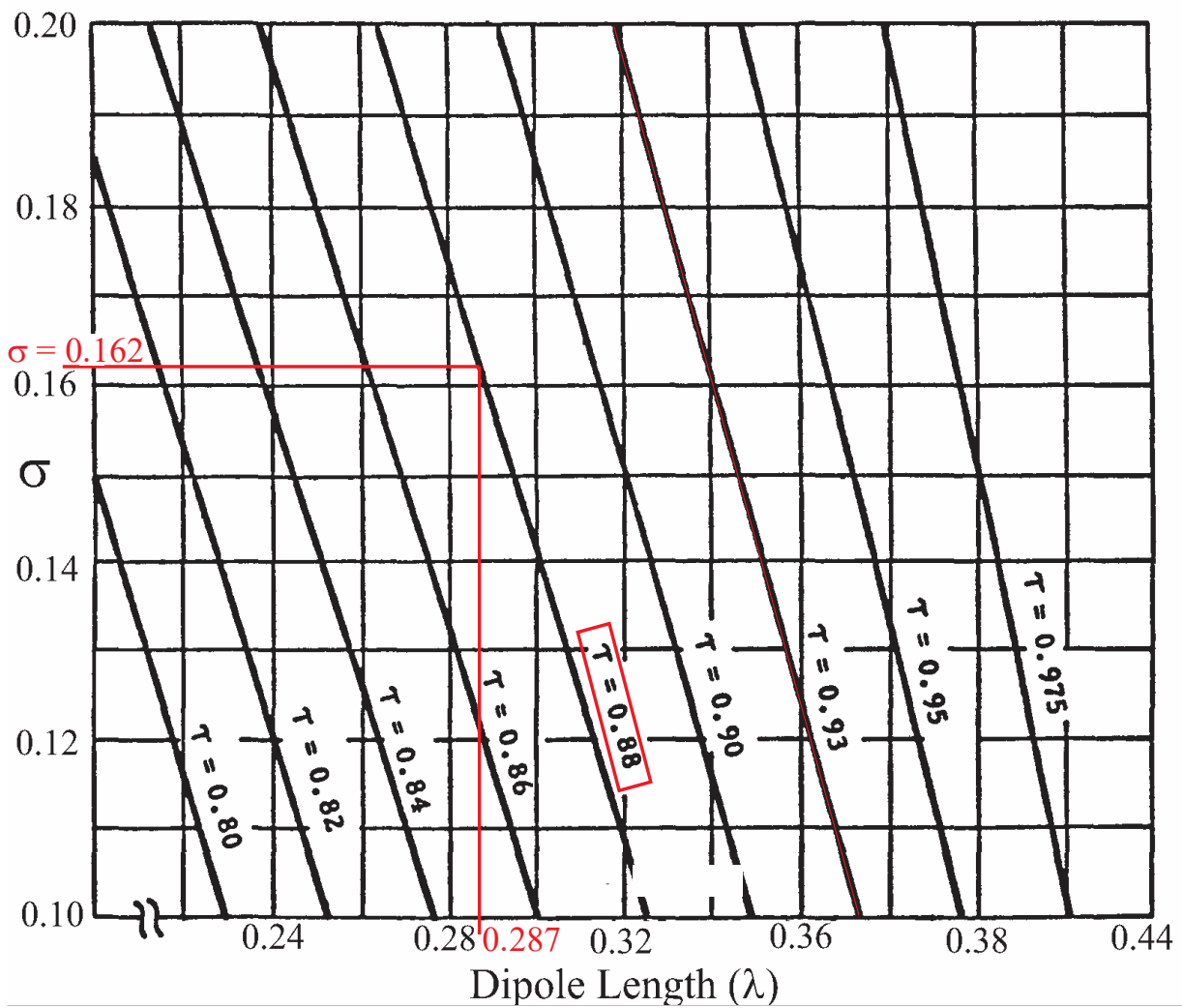
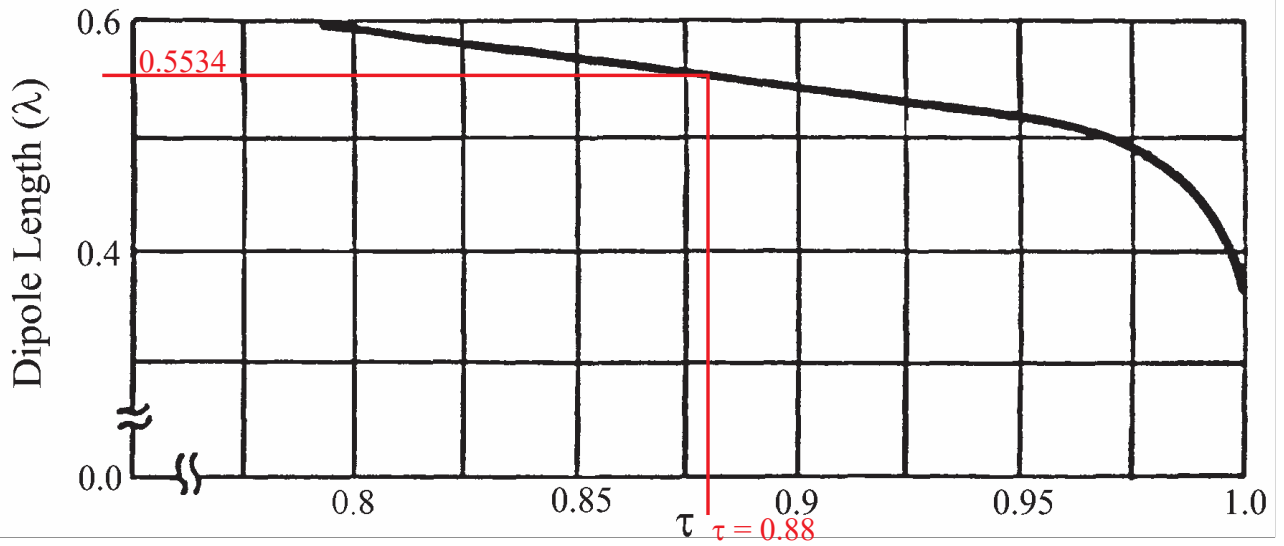
$$\lambda_{\max} = \frac{c}{f_{\text{low}}} = \frac{2.998 \cdot 10^8}{470 \cdot 10^6} = 0.63787234 \text{ m} \Rightarrow \underline{\lambda_{\max} = 63.787 \text{ cm}}$$

Using top fig. on next page & τ , $l_1 = 0.5534\lambda_{\max} = 0.5534(63.787234) \Rightarrow \underline{l_1 = 35.30 \text{ cm}}$

$$\lambda_{\min} = \frac{c}{f_{\text{high}}} = \frac{2.998 \cdot 10^8}{608 \cdot 10^6} = 0.493092 \text{ m} \Rightarrow \underline{\lambda_{\min} = 49.309 \text{ cm}}$$

From fig. on bottom of next page w/ τ & σ — $l_N = 0.287\lambda_{\min} = 0.287(49.309) \Rightarrow \underline{l_N = 14.152 \text{ cm}}$

$$R_1 = \frac{l_1}{2} \cot(\alpha) = \frac{35.3}{2} \cot(10.4915^\circ) \Rightarrow \underline{R_1 = 95.3096 \text{ cm}}$$



$\sigma = \underline{0.162}$ $\tau = \underline{0.88}$ $\alpha = \underline{10.4915^\circ}$ $\lambda_{\max} = \underline{63.787 \text{ cm}}$

$\lambda_{\min} = \underline{49.309 \text{ cm}}$ $l_1 = \underline{35.30 \text{ cm}}$ $R_1 = \underline{95.310 \text{ cm}}$ $l_N = \underline{14.152 \text{ cm}}$