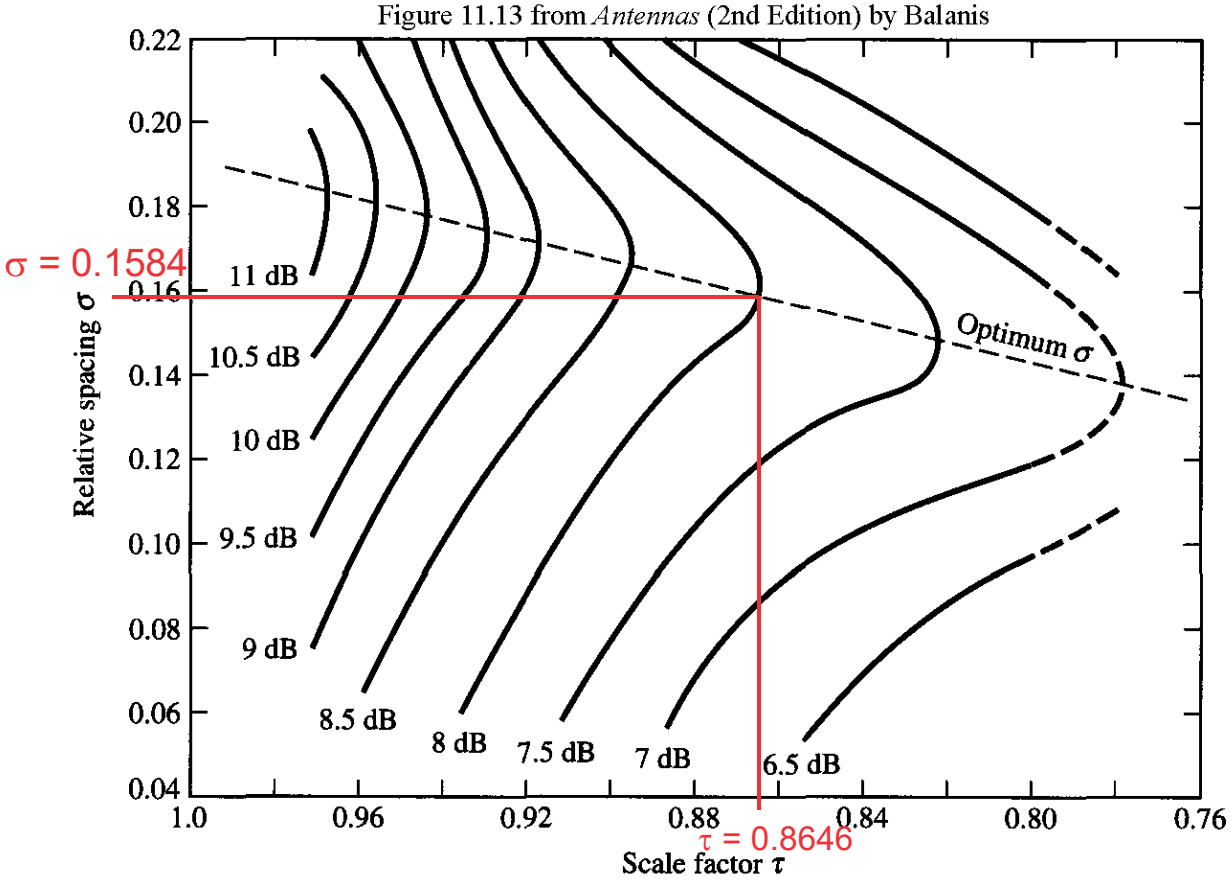
EE 483/583 Antennas for Wireless Communications Quiz #7 (Spring 2026)

Name KEY

For an optimum LPDA with a desired directivity of 8 dBi and frequency range of 470-692 MHz, 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) and location R_1 (cm) of longest LPDA element, and estimated length of shortest element l_N (cm). Assume c = 2.998 × 10^8 m/s in calculations. For extra credit, find l_1 and R_1 in 'uj (Klingon units).

Figure 11.13 from *Antennas* (2nd Edition) by Balanis



$$\alpha = \tan^{-1}\left(\frac{1-\tau}{4\sigma}\right) = \tan^{-1}\left(\frac{1-0.8646}{4(0.1584)}\right) \quad \Rightarrow \underline{\alpha = 12.0626°}$$

$\lambda_{max} = c/f_{max} = 2.998\times10^8 / 470\times10^6 = 0.63787$ m $\Rightarrow \underline{\lambda_{max} = 63.787 \text{ cm}}$

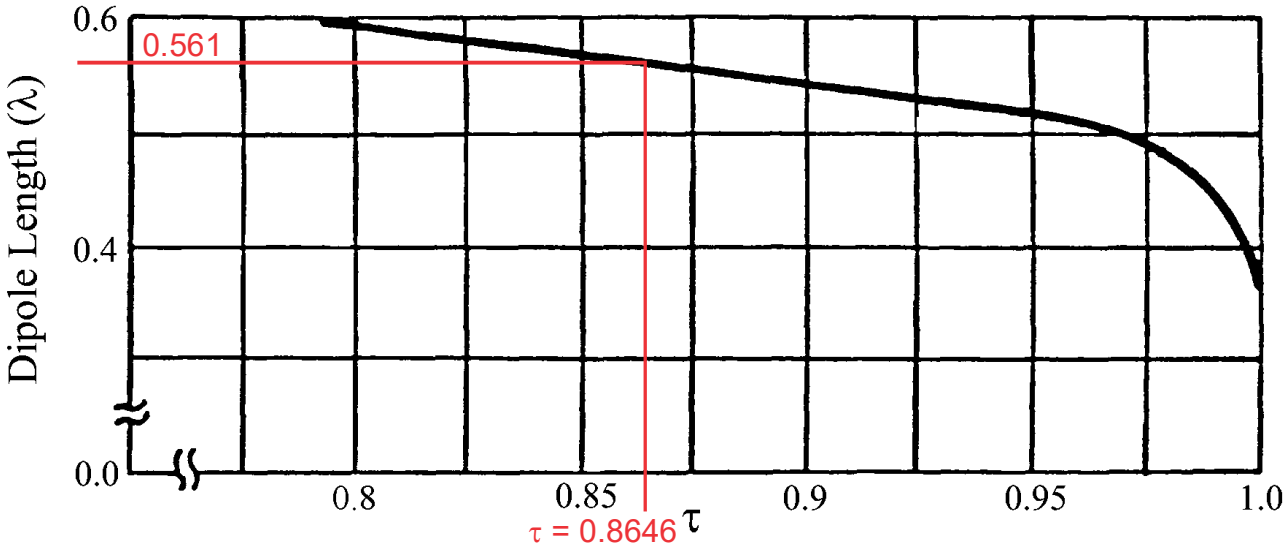
Using figure on top of next page, $l_1 = 0.561\,\lambda_{max} = 0.561(63.787)$ $\Rightarrow \underline{l_1 = 35.785 \text{ cm}}$

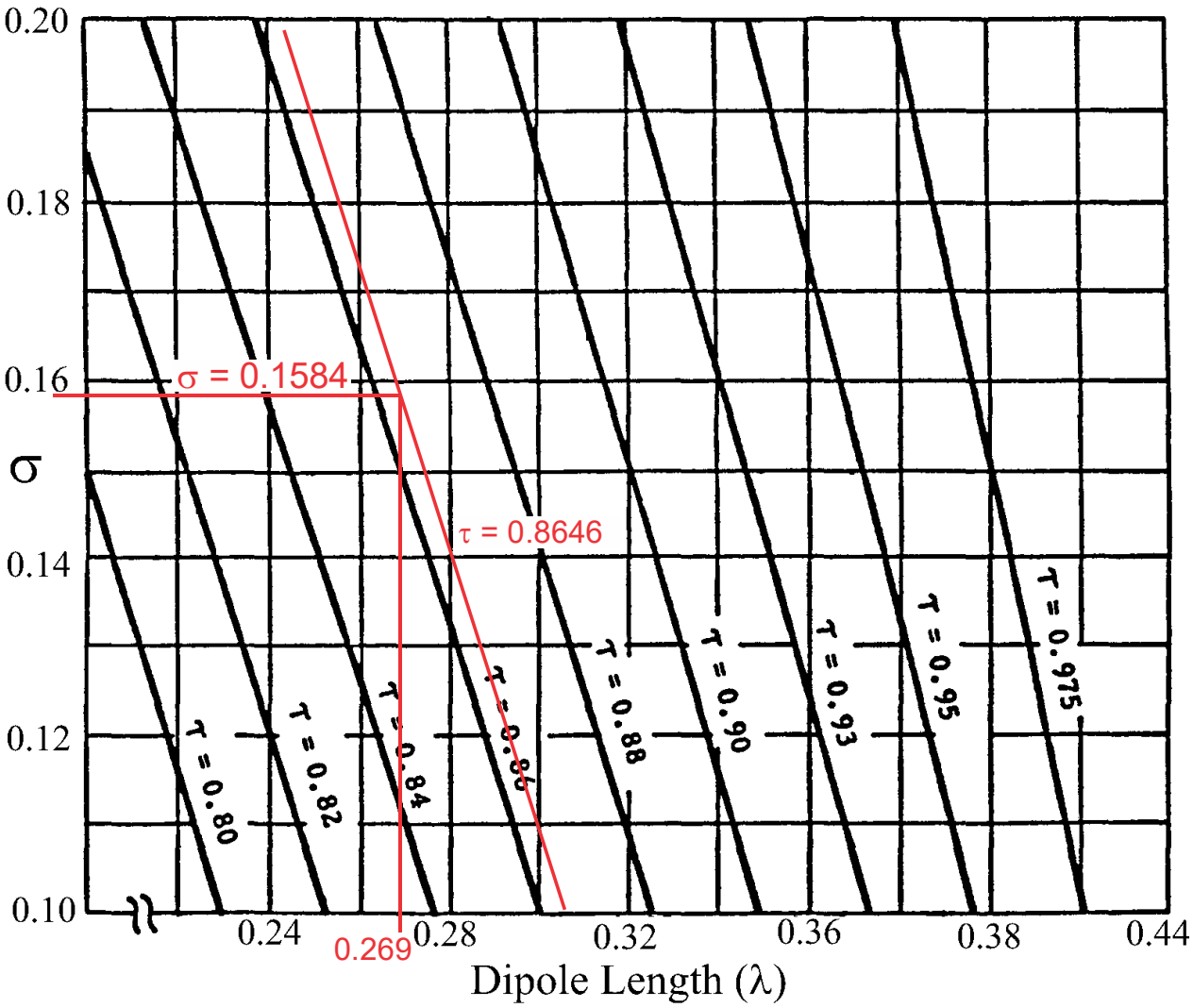
× (1 'uj/34.83 cm) = **1.027 'uj**.

$\lambda_{min} = c/f_{max} = 2.998\times10^8 / 692\times10^6 = 0.433237$ m $\Rightarrow \underline{\lambda_{max} = 43.324 \text{ cm}}$

Using bottom figure (next page) w/ τ & σ, $l_N = 0.269\lambda_{min} = 0.269\,(43.324)$ $\Rightarrow \underline{l_N = 11.654 \text{ cm}}$

$$R_1 = \frac{l_1}{2}\cot(\alpha) = \frac{35.785}{2}\cot(12.0626°) \quad \Rightarrow \underline{R_1 = 83.7267 \text{ cm}} \times (1 \text{ 'uj} / 34.83 \text{ cm}) = \underline{2.404 \text{ 'uj}}$$





σ = **0.1584** τ = **0.8646** α = **12.06°** λ_{max} = **63.787 cm**

λ_{min} = **43.324 cm** l_1 = **35.785 cm** = **1.027 ‘uj** R_1 = **83.727 cm** = **2.404 ‘uj** l_N = **11.654 cm**