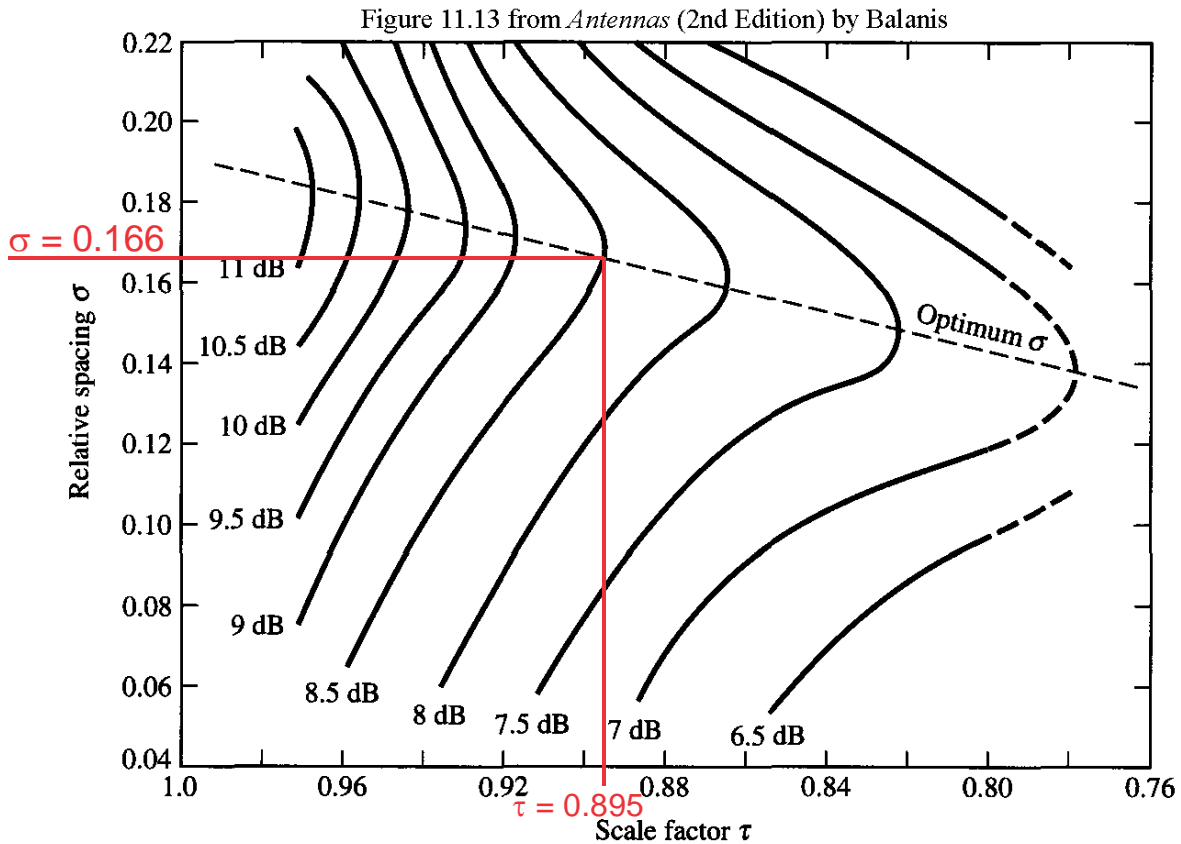


# EE 483/583 Antennas for Wireless Communications Quiz #5 (Spring 2017)

Name KEY

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

For an optimum LPDA with a desired directivity of 8.5 dBi and frequency range of 174-216 MHz (CH 7-13), find the relative spacing  $\sigma$ , scale factor  $\tau$ , apex half-angle  $\alpha$  (degrees), longest  $\lambda_{\max}$  and shortest  $\lambda_{\min}$  wavelengths (in cm), length  $l_1$  (cm) and location  $R_1$  (cm) of longest LPDA element, and estimated length of shortest element  $l_N$  (cm). Show work on given figures. Assume  $c = 2.998 \times 10^8$  m/s in calculations.



$$\alpha = \tan^{-1} \left( \frac{1-\tau}{4\sigma} \right) = \tan^{-1} \left( \frac{1-0.895}{4(0.166)} \right) \Rightarrow \alpha = 8.98592^\circ$$

$$\lambda_{\max} = \frac{c}{f_{\text{low}}} = \frac{2.998 \cdot 10^8}{174 \cdot 10^6} = 1.7229885 \text{ m} \Rightarrow \lambda_{\max} = 172.299 \text{ cm}$$

$$l_1 = 0.5457 \lambda_{\max} = 0.5457(172.299) \Rightarrow l_1 = 94.02 \text{ cm} \text{ using fig. on top of next page \& } \tau$$

$$\lambda_{\min} = \frac{c}{f_{\text{high}}} = \frac{2.998 \cdot 10^8}{216 \cdot 10^6} = 1.38796 \text{ m} \Rightarrow \lambda_{\min} = 138.796 \text{ cm}$$

$$l_N = 0.3042 \lambda_{\min} = 0.3042(138.8) \Rightarrow l_N = 42.22 \text{ cm} \text{ using fig. on bottom of next page w/ } \tau \text{ \& } \sigma$$

$$R_1 = \frac{l_1}{2} \cot(\alpha) = \frac{94.02}{2} \cot(8.986^\circ) \Rightarrow R_1 = 297.28 \text{ cm}$$

$$\sigma = \underline{0.166} \quad \tau = \underline{0.895} \quad \alpha = \underline{8.986^\circ} \quad \lambda_{\max} = \underline{172.299 \text{ cm}}$$

$$\lambda_{\min} = \underline{138.796 \text{ cm}} \quad l_1 = \underline{94.02 \text{ cm}} \quad R_1 = \underline{297.28 \text{ cm}} \quad l_N = \underline{42.22 \text{ cm}}$$

