

## EE 302 PS 14 - SOLUTIONS

### **Chapter 14**

Questions: 7, 17, 21, 34, 39

Problems: None

Critical Thinking: None

**Additional Problems: 1, 2**

#### **Question 7**

“Hertz antenna”, “half-wave dipole”, or “doublet.”  $\ell = \lambda/2$ .

#### **Question 17**

Antenna gain is an apparent increase in signals strength over the signal from an isotropic point source or a dipole. Gain comes not from amplification, but from the antenna’s ability to focus energy in a beam.

#### **Question 21**

ERP (effective radiated power) is the apparent power radiated by a directional antenna. It is the product of the input power to the antenna and the antenna’s gain.

#### **Question 34**

Driven element; reflector; director

#### **Question 39**

Front-to-back ratio is the ratio of power radiated in the forward direction to the power radiated in the opposite direction.

#### **Additional Problem 1**

1.a.

$$f = 850 \text{ MHz} \longrightarrow \lambda = \frac{c}{f} = \frac{3 \times 10^8 \text{ m/s}}{850 \times 10^6 \text{ Hz}} = 0.3529 \text{ m}$$

$$f = 1900 \text{ MHz} \longrightarrow \lambda = \frac{c}{f} = \frac{3 \times 10^8 \text{ m/s}}{1900 \times 10^6 \text{ Hz}} = 0.1579 \text{ m}$$

1.b. See Table 1.

TABLE 1. Additional Problem 1.b. Antenna lengths for half-wave and quarter-wave antennae of given frequencies.

Frequency (MHz)	$\lambda/2$ (cm)	$\lambda/4$ (cm)
850	17.65	8.82
1900	7.89	3.94

1.c. Choose an antenna that is close to being both  $\lambda/2$  for 1900 MHz and  $\lambda/4$  for 850 MHz. **8.5 cm** may be a good compromise between the two frequencies.

### **Additional Problem 2**

The radiation pattern hits -3 dB at about  $8^\circ$  and at  $352^\circ$ . The beamwidth is the angular separation between the -3-dB points. Based on this reading of the plot the, beamwidth is  $16^\circ$ .

Front power is 0 dB. Back power is -24 dB. Front-to-back ratio can be calculated as follows:

$$F/R = P_{f,\text{dB}} - P_{b,\text{dB}} = 0 - (-24) = 24 \text{ dB}$$