

2.4. NETWORK DEPLOYMENT

2.4.1.

Radio antennas are usually designed to make the diameter equal to the wavelength. If their dimension goes from 1 cm to 5 m , what is the frequency range?

$$f\lambda = c \Rightarrow f = \frac{c}{\lambda}$$

$$\lambda = 1 \text{ cm} \Rightarrow f = \frac{3 \cdot 10^8 \frac{\text{m}}{\text{s}}}{0.01 \text{ m}} = 30 \text{ GHz}$$

$$\lambda = 5 \text{ m} \Rightarrow f = \frac{3 \cdot 10^8 \frac{\text{m}}{\text{s}}}{5 \text{ m}} = \boxed{60 \text{ MHz}}$$

$$\boxed{60 \text{ MHz to } 30 \text{ GHz}}$$

2.4.2.

A telephone company with 1M users connects every phone with the central station by a copper twisted pair, of mean length 10 km, 1 mm diameter, 9 g/cm^3 density and 5.76 \$/kg price. What is the economic value of this infrastructure?

$$\text{price} = 10^6 \text{ users} \cdot \frac{2 \cdot 10 \text{ km}}{\text{user}} \cdot \frac{\pi \cdot \left(\frac{1 \cdot 10^{-3}}{2}\right)^2 \text{ m}^2 \cdot 1 \text{ m}}{\text{m}} \cdot \frac{9 \text{ g}}{\text{cm}^3} \cdot 5.76 \frac{\$}{\text{kg}} = \boxed{8143.008 \text{ M \$}}$$