

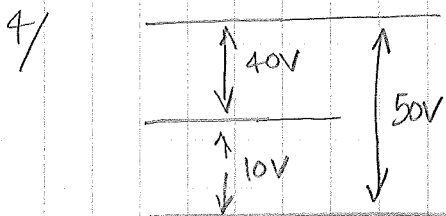
ELEX 3525 Assignment 1

1, (a) data rate = $480 \times 240 \times 30 \times 8 = 27.648 \text{ Mb/s}$

(b) throughput unaffected = 27.648 Mb/s

2/ e.g. 1234 = $0x4D2 = 0000 \ 0100 \ 1101 \ 0010$

3/ e.g. CASA = $0x43 \ 0x41 \ 0x53 \ 0x41$ 4 bytes in UTF-8
(all are < 127)



$$V_+ = 50V$$
$$V_- = 10V$$

$$V_{DIFF} = V_+ - V_- = 50 - 10 = 40V$$

$$V_{CM} = \frac{V_+ + V_-}{2} = \frac{50 + 10}{2} = 30V$$

5/ prep delay = 330 ns
distance = 100 m

$$d = 2 \text{ mm}$$
$$D = 5 \text{ mm}$$

$$v = \text{velocity} = \frac{100 \text{ m}}{330 \times 10^{-9}} \approx 3 \times 10^8 \text{ m/s}$$

$$VF = \frac{v}{c} = \frac{3 \times 10^8}{3 \times 10^8} = 1 \rightarrow \text{air dielectric (or vacuum)}$$

$$VF = \frac{1}{\sqrt{\epsilon_r}} = 1 \therefore \epsilon_r = 1$$

for coax:

$$Z_0 = \frac{138}{\sqrt{\epsilon_r}} \log_{10} \left(\frac{D}{d} \right) = 138 \log_{10} \left(\frac{5}{2} \right) \approx 55 \Omega$$

6/ $PL = \frac{1 \mu\text{W}}{500 \text{ kW}} = \frac{1 \times 10^{-6}}{5 \times 10^5} = 0.2 \times 10^{-11}$

6/

$$P_R = P_T G_T G_R \left(\frac{\lambda}{4\pi d} \right)^2$$

$$P_T = 500 \times 10^3 \text{ (500 kW)}$$

$$P_R = 1 \times 10^{-6} \text{ (1 μW)}$$

$$G_T = 15 \text{ dB} = 10^{1.5} \approx 31.6$$

$$G_R = 0 \text{ dB} = 10^0 = 1$$

$$f = 200 \times 10^6$$

$$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{200 \times 10^6} = 1.5 \text{ m}$$

d = ?

$$d = \left[\frac{P_R}{P_T G_T G_R} \cdot \frac{4\pi}{\lambda} \right]^{-1} = \left[\frac{1 \times 10^{-6}}{5 \times 10^5 \cdot 31.6 \cdot 1} \cdot \frac{4\pi}{1.5} \right]^{-1}$$

$$= \left(2.5 \times 10^{-7} \cdot 8.4 \right)^{-1} = 476 \text{ km.}$$