Homework 5

Chapter 5 Questions

5.3) The difference between NRZ-L and NRZI is that Non-return to Zero-Level (NRZ-L) is the used to generate or read digital data, using terminals. NRZI maintains a constant voltage pulse for the bit duration of time. The data is encoded as the presence or absence of a signal.

5.4) 1) Pseudo ternary Schemes: the binary 0 represents positive or negative level, alternating for zeros and ones

2) Bipolar - Am: the binary 0 is a no line signal and binary 1 is positive or negative level, alternating

5.5) Biphase encoding techniques requires that at least one transition per bit time.

Two Techniques: 1) There is a transition at the middle of each bit period. The midpoint transition represents a 1, and a high to low transition represents a 0.

2) IN differential, the mid bit transition is used only to provide clocking. The encoding of a 0 is represented by the presence of a transition at the beginning of a bit period and a 1 is represented by the absence of a transition at the beginning of a bit period.

Chapter 5 Problems

4.15) 0.1 W @ 2 GHz

a) $G = \frac{7A}{\lambda^2}$ $\quad A = \pi r^2 \Rightarrow \pi\left(\frac{1.2}{2}\right)^2$

$\lambda = \frac{c}{f} = \frac{3\times10^8}{2\times10^9}$

$G = \frac{7\times\pi\times(0.6)^2\times(2\times10^9)^2}{(3\times10^8)^2} = 351.85$

$G_{dB} = 10\log_{10}(351.85) = 25.46\text{dB}$

b) effective radial power

$0.1\text{w} \times 351.85\text{w}$

$= 35.185\text{w}$

c) $L_{dB} = 20\log\left(\frac{4\pi f d}{c}\right) - 10\log(G_r) - 10\log(G_t)$

$= 20\log(4\pi) + 20\log(f) + 20\log(d) - 20\log(c) - 10\log(G_r) - 10\log(G_t)$

$= 20\log(12.57) + 20\log(2\times10^9) + 20\log(24\times10^3) - 20\log(3\times10^8) - 10\log(351.85) - 10\log(351.85)$

$= 21.99 + 186.02 + 87.60 - 169.54 - 25.46 - 25.46$

$295.61 \quad - 220.47$

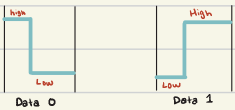
$= 71.54\text{dB}$

$\text{dBm} = 10\log\left(\frac{0.1}{0.001}\right)$

$\text{dBm} = 20$

$20 - 71.54 = -51.54\text{dBm}$

5.7)



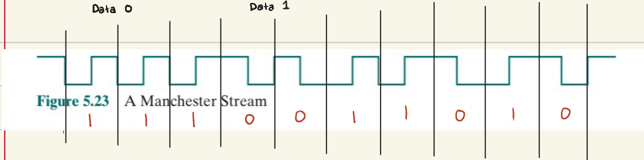
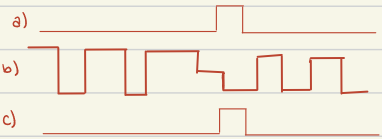


Figure 5.23 A Manchester Stream

1110011010

1 1 1 1 1 0 1 1 1 1 1

5.8)



NRZ-L

Bipolar - AMI

Pseddoternary

5.9)

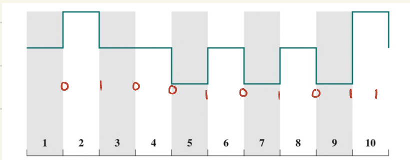
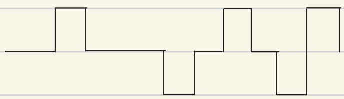


Figure 5.24 A Received Bipolar-AMI Waveform



Homework 5

1)

100 mbps wireless network

1.5m & 0.5m $A_c = 0.81A$

d = 500m 40 mHz @ 5GHz

T = 295.15°K

a) $N_0 = KTB$

$N = (1.38\times10^{-23})(295.15)(40\times10^{6})$

$N = 1.63\times10^{-13}\,W$

b) 80%

$SNR_{dB} = 10\log_{10}\frac{\text{signal power}}{\text{noise power}}$

$C = B\cdot\log_2(1+SNR)$

$0.8 = 40\times10^{6}\,Hz\cdot\log_2(1+SNR)$

$SNR = 1.39\times10^{-8}$

$1.39\times10^{-8} = 10\log_{10}\frac{P_s}{1.63\times10^{-13}\,W}$

$P_s = 2.266\times10^{-22}\,W$

c) $L_{dB} = -20\log\lambda + 20\log(d) + 21.98dB$

$= -20\log(1) + 20\log(500) + 21.98$

$0 + 53.98 + 21.98$

$L_{dB} = 75.96dB$

d) $G = \frac{4\pi A_e}{\lambda^2} = 4\pi\cdot0.81$

$G = 10.18$

e) $\frac{P_t}{P_r} = \frac{(4\pi d)^2}{\lambda^2} \Rightarrow \frac{(4\pi\cdot500)^2}{1^2} = 39{,}478{,}417.6$

$P_{dBm} = 10\log_{10}\left(1000\cdot\frac{P_t}{P_r}\right)$

$P_{dBm} = 115.96dBm$

2)