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3) $C = B \log_2(1 + SNR)$, $SNR = \frac{S}{N} = \frac{37 \times 10^{-3}}{19 \times 10^{-6}} = 1947{,}36$

$C = 30 \times 10^{+6} \cdot \log_2(1 + 1947{,}36)$

$= 30 \times 10^{6} \cdot 10{,}928$

$= 327{,}8415 \times 10^{6} \cong 327{,}841 \text{ MHz}$

4)

0	36	72	108	180	216	252
x	x	x	x	x	x	x
x	x	x	x	x	x	
x			x	x	x	
x			x	x	x	
			x	x	x	
				x		
$\left(\frac{4}{25}\right)$	$\left(\frac{2}{25}\right)$	2	(5)	(6)	(5)	(1)

252: min

$$Entropy = -\sum_i \log_2(p_i) \cdot p_i$$

$$= -\left[\frac{4}{25} \cdot \log_2\left(\frac{4}{25}\right) + \frac{2}{25} \cdot \log_2\left(\frac{2}{25}\right) \times 2 + \frac{5}{25} \log_2\left(\frac{5}{25}\right) \times 2 + \frac{6}{25} \log_2\left(\frac{6}{25}\right) + \frac{1}{25} \cdot \log_2\left(\frac{1}{25}\right)\right]$$

$= 2{,}61469$

min bits : Ent x cell $= 2{,}61469 \times 25$

$\boxed{= 65{,}36725}$

6) $\frac{E_b}{N_0} \cdot \frac{R_b}{B} = \frac{S}{N}$, $\frac{R_b}{B} = \frac{\log_2 M}{1+r} = \frac{3}{1} = 3$

$\frac{E_b}{N_0} = 11 \text{ dB} = 12{,}5892 \Rightarrow \frac{S}{N} = 12{,}5892 \times 3 = 37{,}7677$

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8) $P_r = P_t + G_r + G_t - P_L$

$P_L = 20 \log\left(\frac{4\pi d}{\lambda}\right) = 81{,}384$, $P_t = 10 \log 1 = 0\,dB = 30\,dBm$

$\Rightarrow P_r = 0 + 4 + 4 - 81{,}384 = -73{,}384\,dB$

$\boxed{= -43{,}384\,dBm}$

9) $\frac{E_b}{N_o} \cdot \frac{R_o}{B} = \frac{S}{N}$, $\frac{R_o}{B} = \frac{\log_2 M}{1+r} = \frac{5}{1{,}3} = 3{,}8461$

$24\,dB \rightarrow 251{,}188 \cdot 3{,}8461 = 966{,}107$

$10 \log (966{,}107) = \underline{29.8502\,dB}$

1) $N = kTB$, $N = 10\log k + 10\log T + 10\log B$,

$= -228{,}6 + 24{,}47 + 69{,}03$

$= -135{,}1\,dB = -105{,}1\,dBm$

10)

	0 1 1 0 0 1 0	1
e	1 0 1 1 0 1 0	0
h	0 0 0 1 1 0 0	0
b	0 1 0 0 0 1 1	1
4	0 1 0 0 0 0 1	0
5	1 0 1 0 1 0 0	1
6	1 1 0 1 1 0 0	0
e	1 1 0 0 1 0 1	0
	0 1 1 1 0 1 1	1

$\Big\}$ ehb456e

7) At 250 MHz ; Attenuation = 33 dB/100m , Next = 39,3 dB

33 dB   100 m

39,3 dB   x m

$\Rightarrow x = \frac{39{,}3 \cdot 100}{33} = 119{,}09\,m$

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(5) $52 \text{ byte} = 52 \times 8 = 416 \text{ bits}$

$44 \text{kbs} = 44 \times 10^3 \text{ bits}$

$\frac{44 \times 10^3}{416} = 105{,}76 \cong 106$ pockets

$\Rightarrow \frac{106 \times 416}{4{,}7 \times 10^6} = 9{,}382 \text{ ms} + \underbrace{3 \text{ms}}_{\text{pro. delay}} = \underline{12{,}382 \text{ms}}$

(2) Each slot has 200kHz bandwith

$R = B \cdot \frac{\log_2 M}{1+r}$, and QPSK is used

$\Rightarrow R = 200 \text{kHz} \cdot \frac{\log_2 4}{1} = 400 \text{kb/s}$

$\Rightarrow$ In 10s, 4000 kb could be downloaded

500kB /8 time div = 62,5