

Exercise 8 in SSY135 Wireless Communications

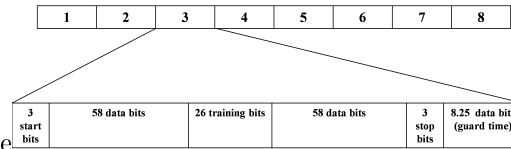
Topic: Multiuser communications

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1. $B = 10$ MHz, $B_{\text{total}} = [(10 + 2)100]$ MHz = 1200 MHz.

2. The TDMA frame:

$$B_{\text{total}} = 25\text{MHz}; R = 270.833 \text{ kbps}$$



(a) GSM frame

(b) Fraction of data bits = $\frac{2(58)}{3+2(58)+26+3+8.25} = 0.7424$.
 \therefore Information rate = $R * 0.7424 = 201.066$ Kbps

(c) Frame duration = $8 \times \text{time slot duration}$
time slot duration = $\frac{2(3)+2(58)+26+3+8.25}{270.833 \times 10^3} = 576.92 \mu\text{s}$.
 \therefore Frame duration = 4.61ms.
Latency = $7 \times \text{time slot duration} = 4.038\text{ms}$

(d) Duration of guard band + stop bits = $\frac{3+8.25}{270.833 \times 10^3} = 41.54 \mu\text{s}$.
 \therefore max delay spread $T_m < 41.54 \mu\text{s}$ for the guard band to be useful.

3. $P_b = Q(\sqrt{2\gamma_b}) = 10^{-6} \Rightarrow \gamma_b = 11.2975$, $N \geq (\gamma_b)^{2/\gamma} \Rightarrow N \geq 11.2975$. Note that $N = i^2 + j^2 + ij$, with i, j are integers. Hence, $N = 12$ with $i = 2$ and $j = 2$. The minimum reuse distance is $D = \sqrt{3N}R = 6R$, where R is the radius of the cell. The user capacity is defined as the total number of active users per cell that the system can support while meeting a common SIR target for all users. $N_c = \frac{B}{B_s N} = 480/12 = 40$.