

Prob 4.1 | (a) $g(t) = g_{RC}(t)$ $T = \frac{T_s}{4}$

$R_b = 300 \text{ kbps}$

$M = 64$
 $K = 6$

$W_{\text{mainlobe}} = 800 \text{ kHz}?$

Sol From Table 2.1

$$W_{\text{mainlobe}} = \frac{4}{T} = \frac{16}{T_s} = \frac{16}{6 \cdot T_b} = \frac{8}{3} \cdot (300 \text{ kbps})$$

$W_{\text{mainlobe}} = 800 \text{ kHz}$

True.

(b) M-QAM $g(t) = g_{RC}(t)$ $T = 0.25 \text{ ms}$, $T_s = T$

if $M = 16 \rightarrow 64 \Rightarrow P, R_b \rightarrow$ increased by a factor 1.5?

Sol

$M = 16$

(1) $R_b = \frac{K}{T_s} = \frac{4}{T}$

$M = 64$

(2) $R_b = \frac{6}{T}$

$\Rightarrow \frac{R_b^{(2)}}{R_b^{(1)}} = \frac{6}{4} = 1.5$ (True)

(1) $P = \frac{R_b^{(1)}}{W}$

(2) $P = \frac{R_b^{(2)}}{W}$

$\Rightarrow \frac{P^{(2)}}{P^{(1)}} = \frac{R_b^{(2)}}{R_b^{(1)}} = 1.5$ (True)

P# 4.2

QPSK (M=4), $T_s = \frac{T_b}{2}$, $g(t) = g_{rec}(t)$
 $W_{mainlobe} = 100 \text{ kHz}$

(a) $R_b = ?$

From table 2.1, or from the energy spectrum of rectangular pulse, it can be seen that

$$W_{(onesided)} = \frac{1}{T} = \frac{1}{T_s/2} = R_b$$

$$R_b = 50 \text{ kbps}$$

(b) Refer to Figure D.2 at p# 616 for PSD of rectangular pulse.

At $fT = 3$ (150 kHz) relative to the f_c is the peak of mainlobe of another system. Sidelobes within $3 \leq fT \leq 4$ is stronger than -45 dB. Hence the system doesn't satisfy the requirement.

(c) From Raised cosine pulse PSD (Fig. D10 p# 620). Sidelobe within $3 \leq fT \leq 4$ is below -45 dB. Triangular and half cycle sinusoidal doesn't meet the requirement.

bit rates $W = \frac{4}{T} \Rightarrow W_{onesided} = \frac{2}{T} = \frac{2}{T_s/2} = \frac{4}{T_b}$

$$W = 2R_b \Rightarrow R_b = 25 \text{ kbps}$$
 raised cosine

hcs $R_b = \frac{100 \text{ kbps}}{3}$

Triangular $R_b = 25 \text{ kbps}$