

Solutions

1.

- 83 dB attenuation at 600 kHz.

 \Rightarrow - 3 dB " " 60 Hz.

$$\Rightarrow 3 \text{ dB BW} = 2 \times 60 = 120 \text{ Hz}$$

$$\begin{aligned} \Rightarrow Q \text{ factor} &= \frac{400 \times 10^6}{120} \\ &= \frac{10}{3} \times 10^6 \end{aligned}$$

2.

$$\begin{aligned} \text{a. } \text{IP}_3 &= P_{in} + \frac{\Delta P}{2} = P_{in} + \frac{P_{out}(f_2) - P_{out}(2f_2 - f_1)}{2} \\ &= -40 + \frac{30}{2} = -25 \text{ dBm} \end{aligned}$$

$$\text{b. At point X, interference strength} = -20 + 60 = 40 \text{ dBm.}$$

$$\text{Since } \text{IP}_3 \geq P_{in}$$

$$\Rightarrow \text{IP}_3 > 40 \text{ dBm.}$$

3.

The constellation points are -

$$\begin{aligned} &b_{2n} \left(1 + \frac{\epsilon}{2}\right) \cos \frac{\theta}{2} - b_{2n+1} \left(1 + \frac{\epsilon}{2}\right) \sin \left(\frac{\theta}{2}\right) \\ &- b_{2n} \left(1 - \frac{\epsilon}{2}\right) \sin \frac{\theta}{2} + b_{2n+1} \left(1 - \frac{\epsilon}{2}\right) \cos \left(\frac{\theta}{2}\right) \end{aligned}$$

which leads to the points

$$\begin{aligned} &\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right), \left(-\frac{1}{2} + \frac{\sqrt{3}}{2}\right), \left(\frac{\sqrt{3}}{2} + \frac{1}{2}\right), \left(-\frac{1}{2} - \frac{\sqrt{3}}{2}\right) \\ &\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right), \left(\frac{1}{2} + \frac{\sqrt{3}}{2}\right), \left(-\frac{\sqrt{3}}{2} + \frac{1}{2}\right), \left(\frac{1}{2} - \frac{\sqrt{3}}{2}\right) \end{aligned}$$