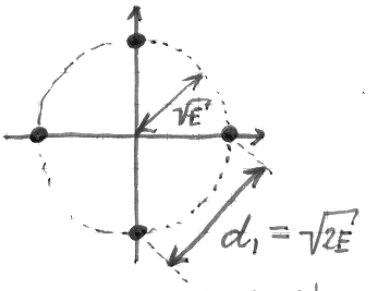
TSKS01 Digital Communication

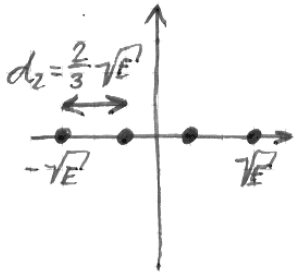
Solutions to Selected Problems from Tutorial 6

Mikael Olofsson, mikael@isy.liu.se

5.2 4-PSK:



4-ASK:



These calculations are based on exact expressions. We could just as well have used the nearest neighbour approximation.

4-PSK:

$$P_{e,1} = 2Q\left(\frac{d_1}{\sqrt{2N_0}}\right) - Q^2\left(\frac{d_1}{\sqrt{2N_0}}\right) = 2Q\left(\sqrt{15}\right) - Q^2\left(\sqrt{15}\right)$$
$$\approx 2 \cdot 5.4418 \cdot 10^{-5} - \left(5.4418 \cdot 10^{-5}\right)^2 \approx 1.09 \cdot 10^{-4}$$

4-ASK:

$$P_{e,2} = \frac{6}{4} Q\left(\frac{d_2}{\sqrt{2N_0}}\right) = \frac{3}{2} Q\left(\sqrt{\frac{10}{3}}\right) \approx 5.04 \cdot 10^{-2}$$

5.10 The situation is the same as in problem 26 with $\alpha = \phi$. The distance $d' = d \cdot \cos\phi$ is what determines the error probability.

$$d' = d \cdot \cos(\phi) = 2 \cdot \sqrt{E} \cdot \cos(\phi)$$

The resulting error probability:

$$P_e = Q\left(\frac{d'}{\sqrt{2N_0}}\right) = Q\left(\sqrt{\frac{E}{N_0}} \cdot \cos(\phi)\right)$$