

1. If we want to send data at a speed of 3000 bps through a channel of bandwidth 1000 Hz, what is the minimum S/N ratio required?
2. What is the maximum bit rate that can be transmitted over a channel with bandwidth of 500 Hz and a signal to noise ratio of 5 dB?
4. Calculate the signaling rate for the following modulation schemes and bit rates:
 - a) 36Kbps, 4-QAM
 - b) 8Kbps, 32-QAM
 - c) 3Kbps, 8-PSK
5. Calculate the bit rate for the following modulation schemes and signaling rates
 - a) 1Kbaud, 32-QAM
 - b) 2Kbaud, BASK
 - c) 5Kbaud, BFSK

Solutions

1)

$$C = W \log_2 (1 + S/N)$$

C = capacity of channel
 B = bandwidth in Hz
 S/N = Signal to noise ratio
 $C/B = 3000/1000 = 3$
 $2^{C/B} = 2^3 = 8 = (1 + S/N)$
 $S/N = 7$

2)

$$C = W \log_2 (1 + S/N)$$

$$S/N \text{ dB} = 5 \text{ dB} = 10 \log (S/N) \Rightarrow S/N = 3.162$$

$$C = 500 \log_2 (1 + 3.162) = 1028.7 \text{ bps}$$

4)

Bit rate = signaling (or baud) rate * bits per baud. Solving for baud rate we get:

a) $36000/2 = 18000$ Bd

b) $8000/5 = 1600$ Bd

c) $3000/3 = 1000$ Bd

5)

Just like problem 4, with the only difference that it is the bit rate that we need to find.

Hence:

a) $1000 * 5 = 5000$ bps

b) $2000 * 1 = 2000$ bps

c) $5000 * 1 = 5000$ bps