

CHAPTER 4: MODULATION TECHNIQUES

Problem 1.

Consider a communication system operating at below bandwidth and using following parameters.

- Let the transmission bandwidth be 1 MHz. Say a rolloff factor of $r = 0.25$ is used. Determine:
 - Achievable rate of data traffic
 - Delay spread that no ISI occurs
- Repeat for following cases:
 - Let OFDM with $N = 16$ equally spaced carriers be used.
 - If 16-QAM is now utilized for the OFDM system.

Problem 2.

Consider a communication system operating at transmission bandwidth of 1MHz, rolloff factor of $r = 0.25$. It is desired to transmit at a 4.8 Mbps data rate, but without inter-symbol interference for delay spreads up to $25 \mu s$. QAM and OFDM are used. Select appropriate modulation technique and number of subcarriers to accommodate the maximum delay spread required above.

Problem 3.

A transmission bandwidth of 2MHz is available. Nyquist rolloff shaping is used in transmitting data.

- Find the bit rates that may be transmitted over this channel using PSK for rolloff factors of 0.2, 0.25, and 0.5.
- Nyquist roll off shaping of 0.25 is used. It is desired to transmit at a rate of 6.4Mbps over this channel. What modulation techniques should be used to support this data rate?

Problem 4.

Successive binary pairs	a_i	b_i
0 0	-1	-1
0 1	-1	+1
1 0	+1	-1
1 1	+1	+1

Choose an input sequence of ten or more binary digits to be applied to a QPSK modulator. Map them to the five appropriate QPSK signal pairs using above Table. Let the carrier frequency be some multiple of $1/T$.

- Sketch the corresponding output QPSK signals.
- Note the times at which π radian and $\pi/2$ radian phase shifts occur. Correlate these with the input bit pairs.