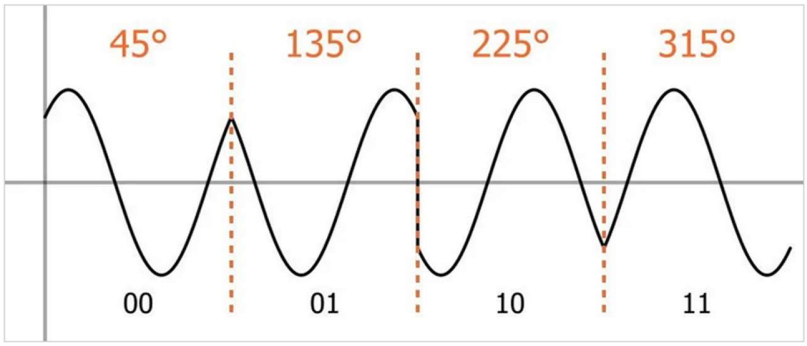
OBJECTIVE

Compare BER (Bit Error Rate) Vs SNR (Signal To Noise Ratio) of Quadrature Phase Shift Keying (QPSK) and Offset Quadrature Phase Shift Keying(OQPSK).

INTRODUCTION

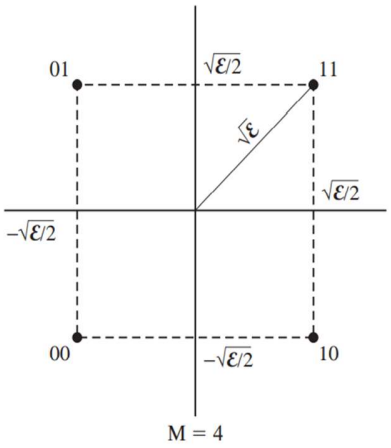
QPSK

Quadrature phase shift keying (QPSK) is a another modulation technique in which we just don't send 0 or 1 but 00,01,10,11 that is two symbols at a time. This two-bits-per-symbol performance is possible because the carrier variations are not limited to two states. In QPSK, the carrier varies in terms of phase, not frequency, and there are four possible phase shifts.

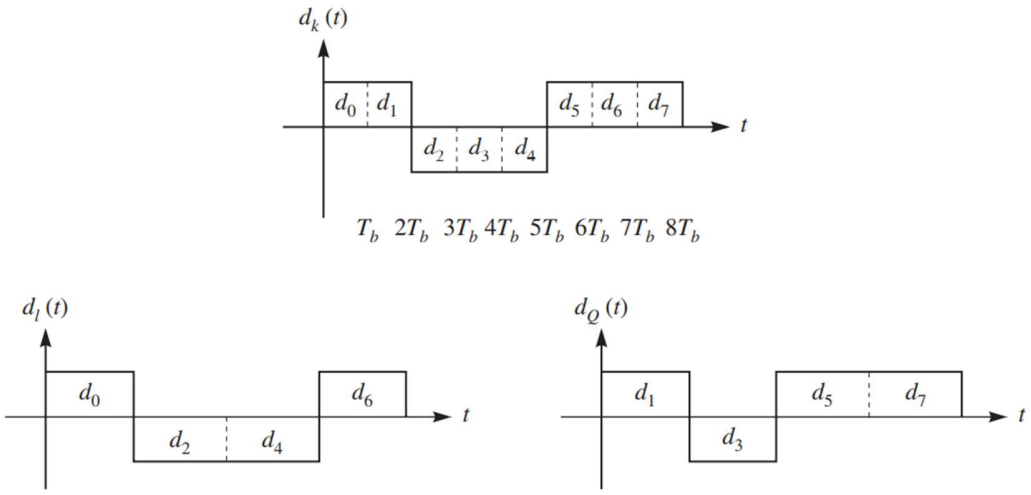


Citation: https://www.allaboutcircuits.com/technical-articles/quadrature-phase-shift-keying-qpsk-modulation/

The waveforms representing the two components of the QPSK signal in phase component and quadrature component hese two waveforms may individually be viewed as examples of a binary PSK signal. Adding them, we get the QPSK waveform.



possible mapping of qpsk



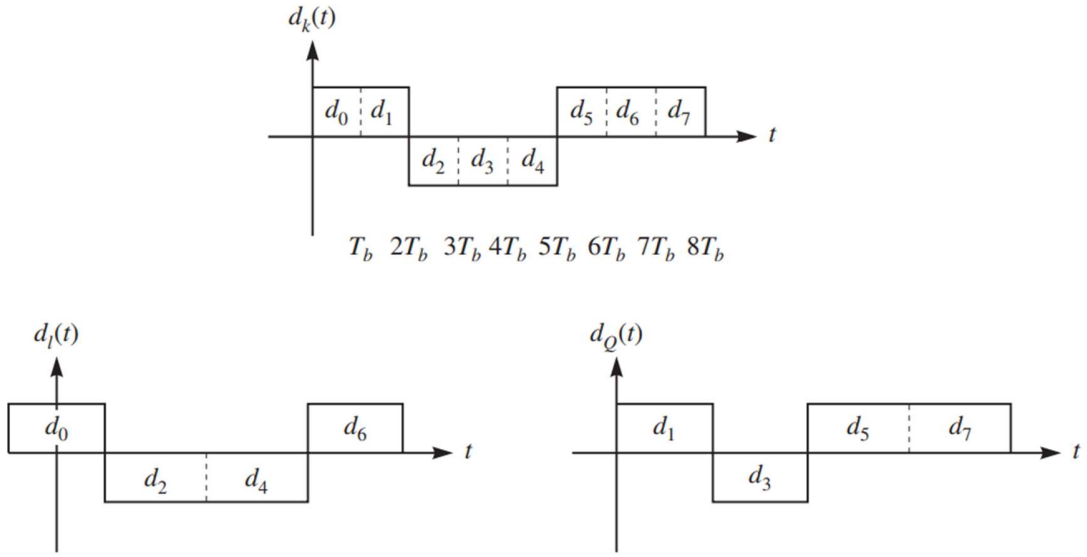
In phase and quadrature component of QPSK

citation: Digital_Communications,_5th_Edition_John_G_Proakis,_Masoud_Salehi

OQPSK

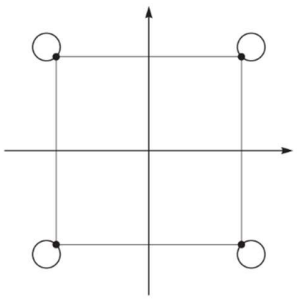
Prior to detection, the QPSK signal is filtered during transmission. In particular, the 180° and 90° shifts in carrier phase can cause changes in the carrier amplitude (i.e., envelope of the QPSK signal) during transmission over the channel, leading to more symbol mistakes when the receiver detects the signal.

To mitigate this shortcoming of QPSK, we need to reduce the extent of its amplitude fluctuations. To this end, we may use offset QPSK. In this variant of QPSK, the bit stream responsible for generating the quadrature component is delayed (i.e., offset) by half a symbol interval with respect to the bit stream responsible for generating the in-phase component.



In phase and quadrature component of oqpsk

citation: Digital_Communications,_5th_Edition_John_G_Proakis



Phase transition diagram for OQPSK signaling

METHOD

MATLAB CODE

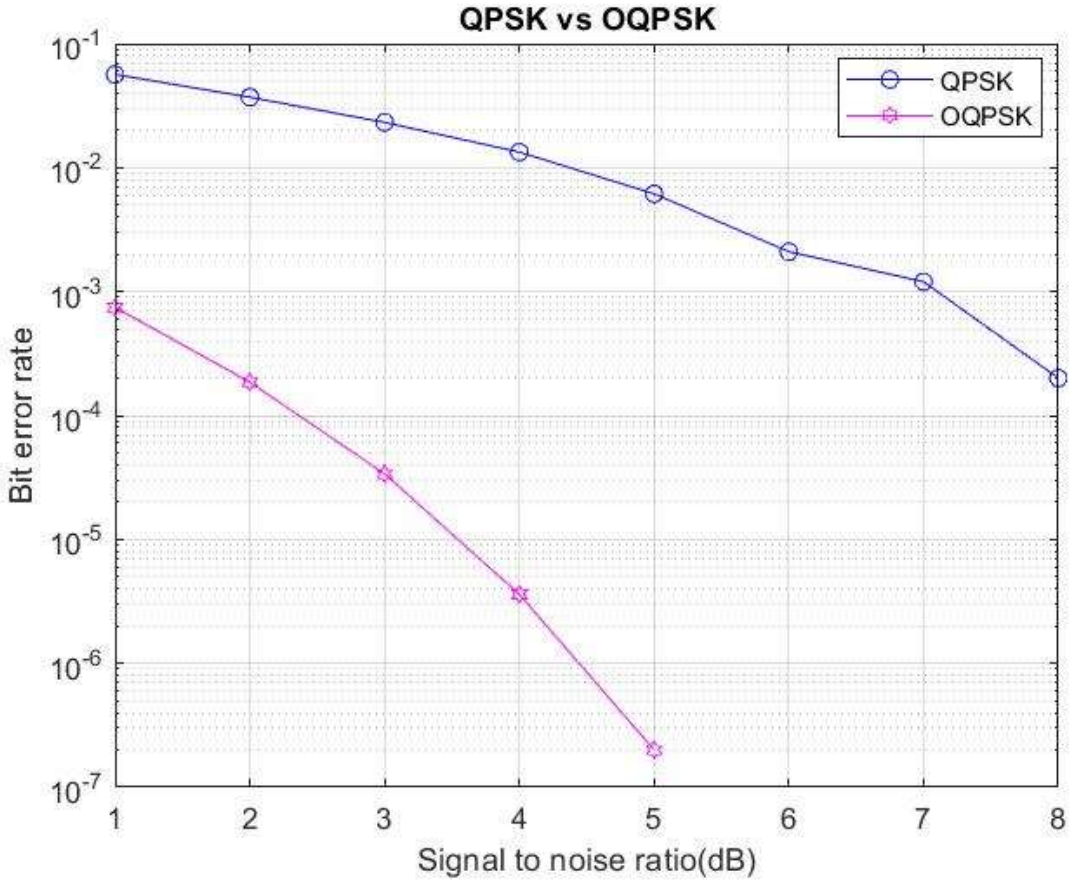
QPSK vs OQPSK

```
clear all;
close all;
for snrdb=1:1:30
    N = 10000;                  % Number of samples
    data = randi([0 3],N,1);          % Random signal
   % s1 = (pskmod(data,Bits));     % BPSK Modulated signal
(desired/output)
     qpskModulator = comm.QPSKModulator;
     s1 = qpskModulator(data);
     s1=(s1')*sqrt(2);
     si=sign(real(s1));
    sq=sign(imag(s1));
    w=awgn(s1,snrdb);
    r1=w;
    si_=sign(real(r1));
    sq_=sign(imag(r1));
    ber1=(length(find(si~=si_)))/N;
    ber2=(length(find(sq~=sq_)))/N;
    ber(snrdb)=mean([ber1 ber2]);
end

      oqpskmod = comm.OQPSKModulator('BitInput',true);
      oqpskdemod = comm.OQPSKDemodulator('BitOutput',true);
       N = 10000;
       txData = randi([0 1],N,1);
       i=1;
for snrdb=1:1:30
  channel =
comm.AWGNChannel('EbNo',snrdb,'BitsPerSymbol',2);
  errorRate = comm.ErrorRate('ReceiveDelay',2);
    for counter = 1:500
        txData = randi([0 1],N,1);
        modSig = oqpskmod(txData);
        rxSig = channel(modSig);
        rxData = oqpskdemod(rxSig);
        errorStats = errorRate(txData,rxData);
```

```
    end
    ober(i) = errorStats(1);
    i=i+1;
end
semilogy(1:1:snrdb ,ber,'-bo',1:1:snrdb ,ober,'-mh')
title('QPSK vs OQPSK');
xlabel('Signal to noise ratio(dB)');
ylabel('Bit error rate');
grid on;
hg=legend('QPSK','OQPSK','Location','Best');
```

RESULT



DISCUSSION

The offset QPSK and QPSK has similar type of graph between the Bit error rate vs signal to noise ratio graph. The performance of OQPSK is better than QPSK as the BER of QPSK is much smaller than BER of OQPSK. And also the graph of BER vs SNR of OQPSK is falling more rapidly.