# Quadrature Phase Shit Keying

## Common

Consider the following **unit energy ( and )** pulses,

Where, , can be identified as an integer number of cycles

Observing that is a phase shifted version of and is a phase shifted version of

Showing the unit energy of and

Calculating the inner-product between the and

Hence, and are orthogonal unit energy pulses. It forms the orthonormal basis of signal space

## Modulation

Consider two bits of information ,

Two symbols and are be modulated with and . Each pulse can carry a single bit of information.

**E.g :-** , the average bit energy

Set of 4 possible signals form the sample space in QPSK with the orthonormal basis functions of and .

Waveforms of QPSK modulated signals,

Considering particular waveforms in signal space,

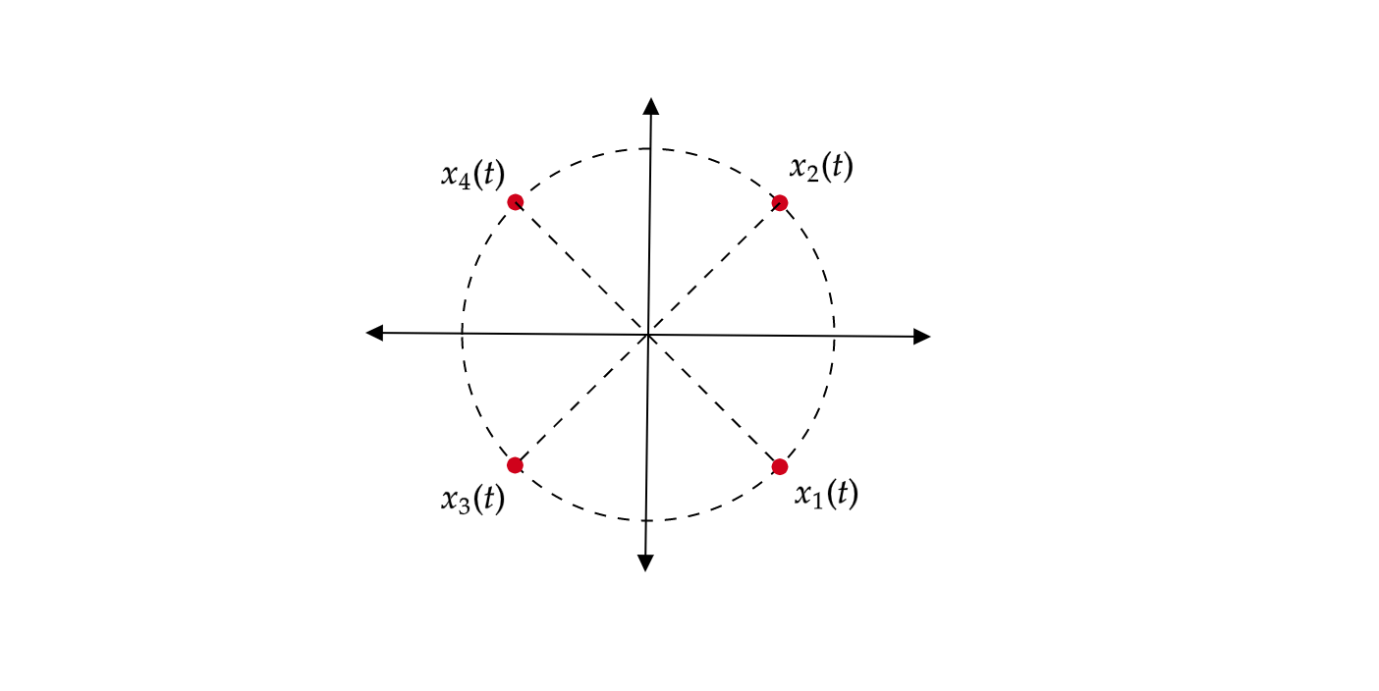
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Phase difference between successive waveforms is , This implies the Quadrature phase shifting in this modulation scheme.



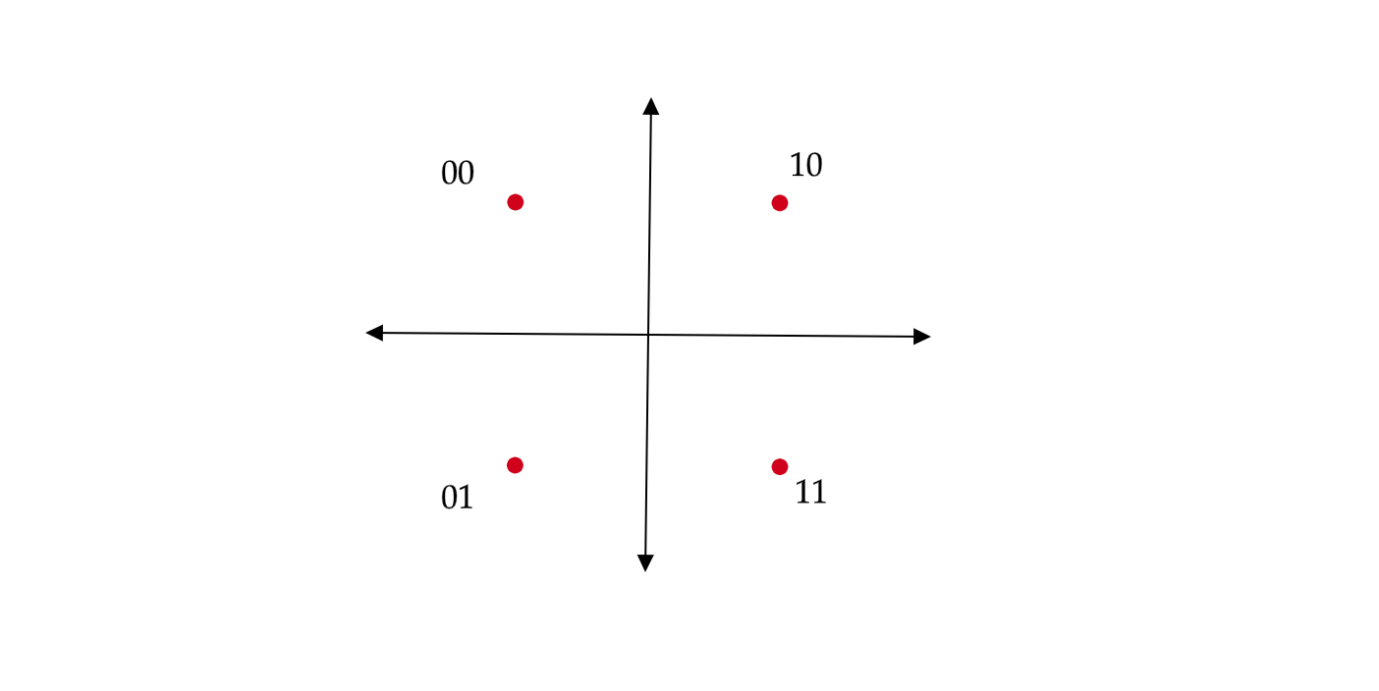


Figure 1: Constellation Diagram for QPSK

## Demodulation

**Logic:**

is matched with to recover , and the is matched with to recover

Required matched filter ,

Assume received signal as and considering AWGN channel

Where, is white Gaussian noise with and , is the power spectral density of the noise.

Applying matched filter to the received signal,

Considering signal component separately,

Substituting ,

Sampling with period , , then , considering the periodicity property,

Considering the same analysis for matched filter ,and both results can be finalized as,