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Data Communication CS601 Lecture No 17

Lecture Prepared By

Muhammad Abid Ali

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CS601 Lecture No 17 Topic 79 to 85

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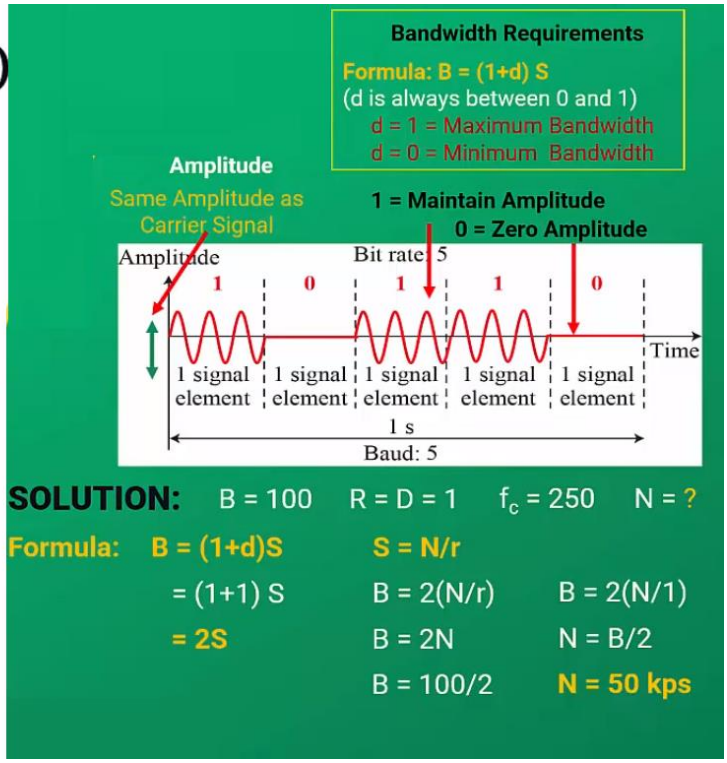
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Amplitude Shift Keying (ASK)

In this technique the amplitude is vary and it vary with the carrier signals as the carrier signal change the amplitude changed.

- This technique is also known as (OOK - On Off Key) or Binary Technique (0's and 1's)
- When Amplitude change than Frequency and Phase remain (Constant).

Example: We have an available bandwidth of 100 kHz which spans from 200 to 300 kHz. What are the carrier frequency and the bit rate if we modulated our data by using ASK with d = 1?



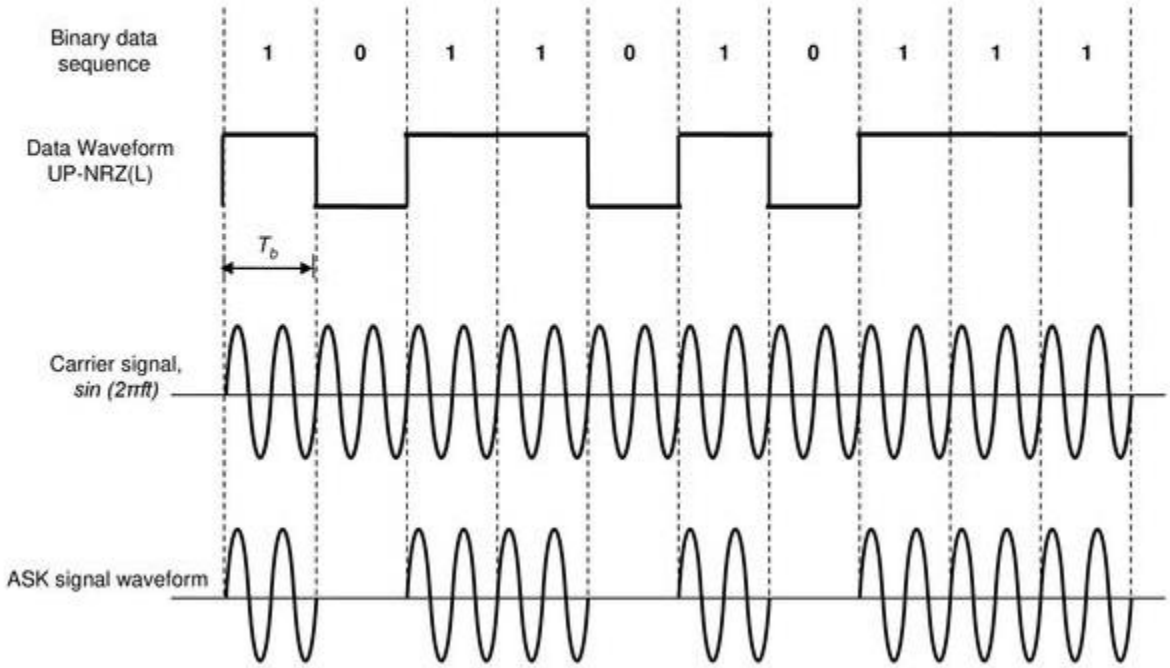
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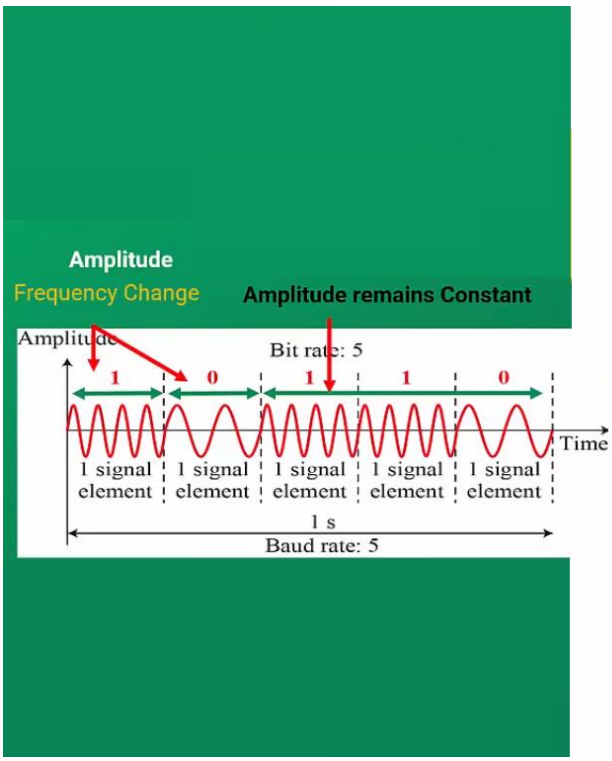
3.1.1 Amplitude Shift Keying (ASK)



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Frequency Shift Keying (FSK)

In this technique in which the frequency vary (change) but the Amplitude and Phase remain constant.

- Formula: $B = (1+d)\,S + 2\,\Delta f$

Example: We have an available bandwidth of 100 kHz which spans from 200 to 300 kHz. What should be the carrier frequency and the bit rate if we modulated our data by using FSK with d = 1?

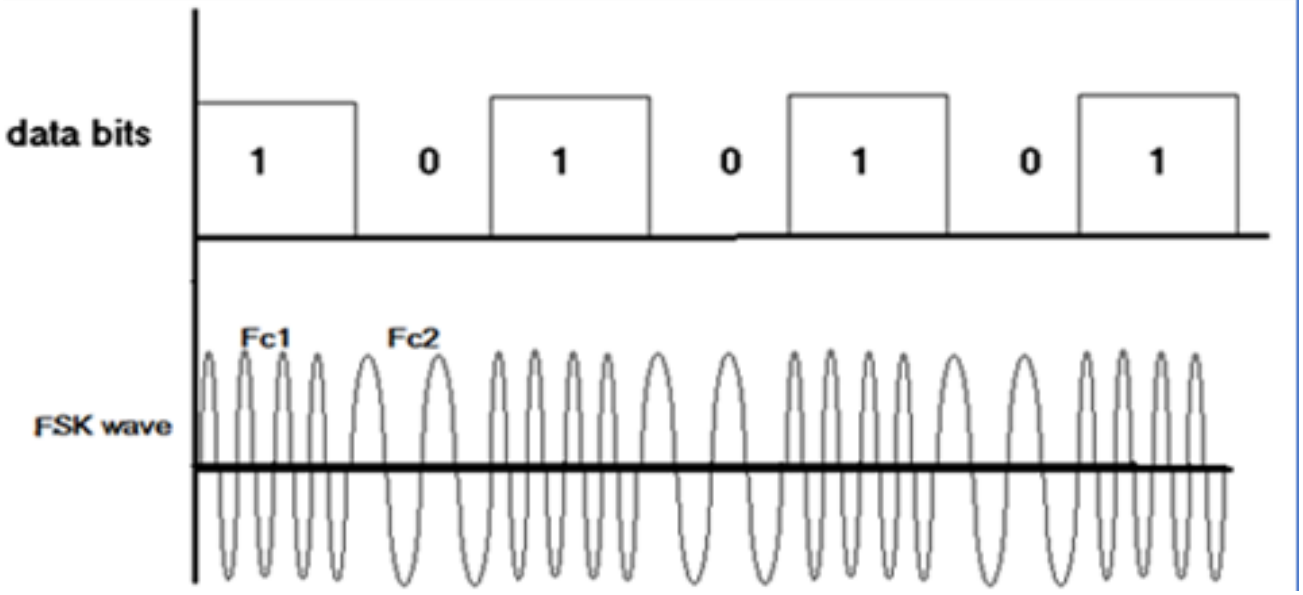
SOLUTION: B = 100 R = D = 1 Δf = 50 N = ?

$B = (1+d)S + 2\Delta f$	100 = 2S + 50
B = (1+1) S +50	100 - 50 = 2S
B = 2S + 50	2S = 50
100 = 2S + 50	S = 25 kHz

Activate Windows
Go to Settings to activate Windows.

N = 25 kHz
Because Data Rate = 1

FSK Modulation and Demodulation



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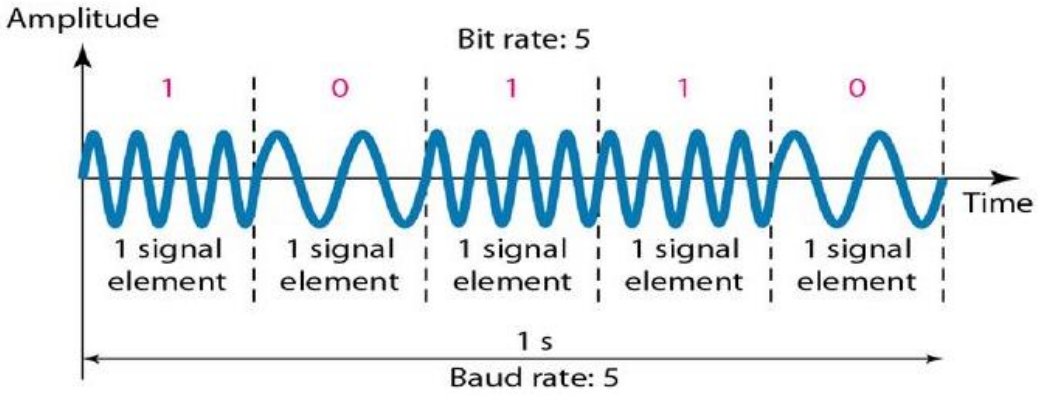
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FSK (Frequency Shift Keying)

- The frequency of the carrier signal is varied to represent binary 1 or 0.
- Both peak amplitude and phase remain constant while the frequency changes.
- The frequency of the signal during each bit duration is constant, and its value depends on the bit (0 or 1).



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Phase Shift Keying (PSK)

In this technique in which the Phase vary (change, but the Amplitude and Frequency remain constant. PSK is relatively common than ASK or FSK

Example: Find the bandwidth for a signal transmitting at 12 Mbps for QPSK. The value of d = 0.

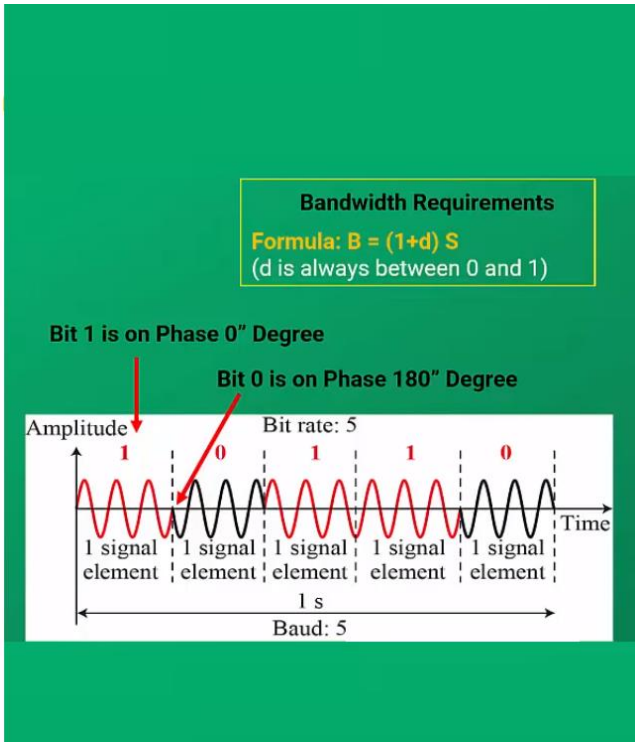
SOLUTION:

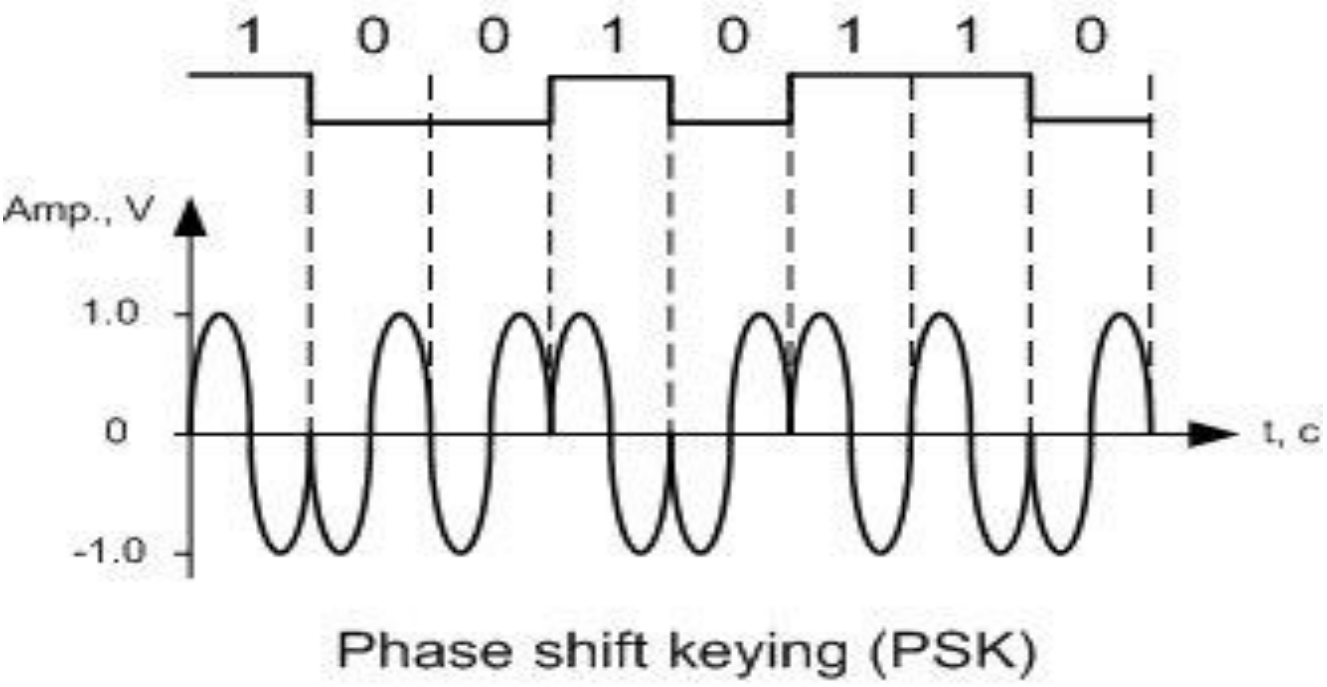
N = 12Mbps R = 2 = 1 S = ?

S = N/r

= 12/2

S = 6 Mbps





Phase shift keying (PSK)

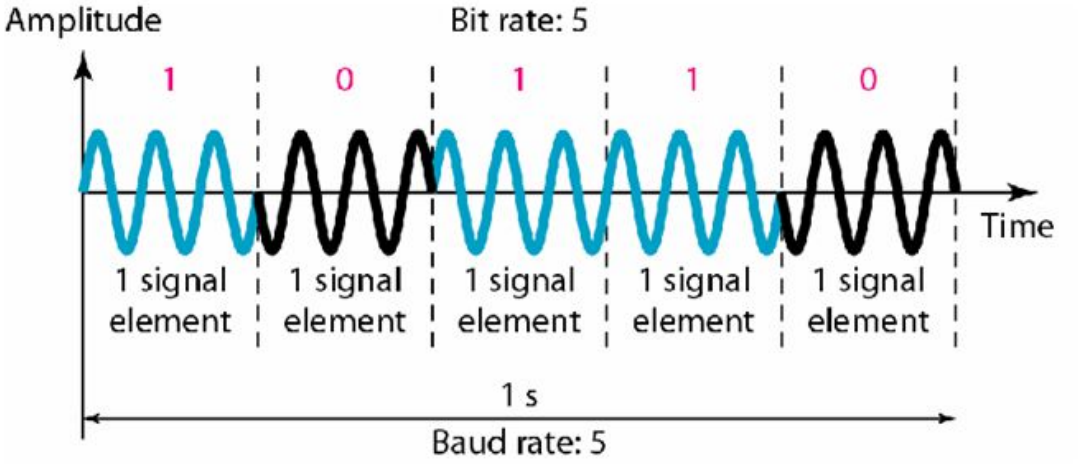
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Phase Shift Keying (PSK)

- In PSK, the phase of the carrier is shifted to represent data.
- Two-Level PSK(Binary PSK) - BPSK
  - Uses two phases (0 and 180°) to represent the two binary digits.
  - The resulting transmitted signal for one bit time is:



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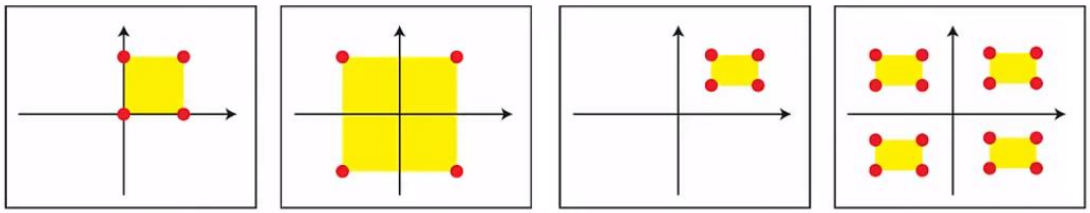
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(QAM)
Quadrature Amplitude Modulation

We have studies about ASK, FSK, and PSK. In these three techniques the **PSK is most effective** technique.

We have **combine two ASK and PSK** to make more effective that become QAM. It has **four variation**.



a. 4-QAM b. 4-QAM c. 4-QAM d. 16-QAM

Bandwidth Requirements:

The QAM require Bandwidth as ASK and PSK requires.

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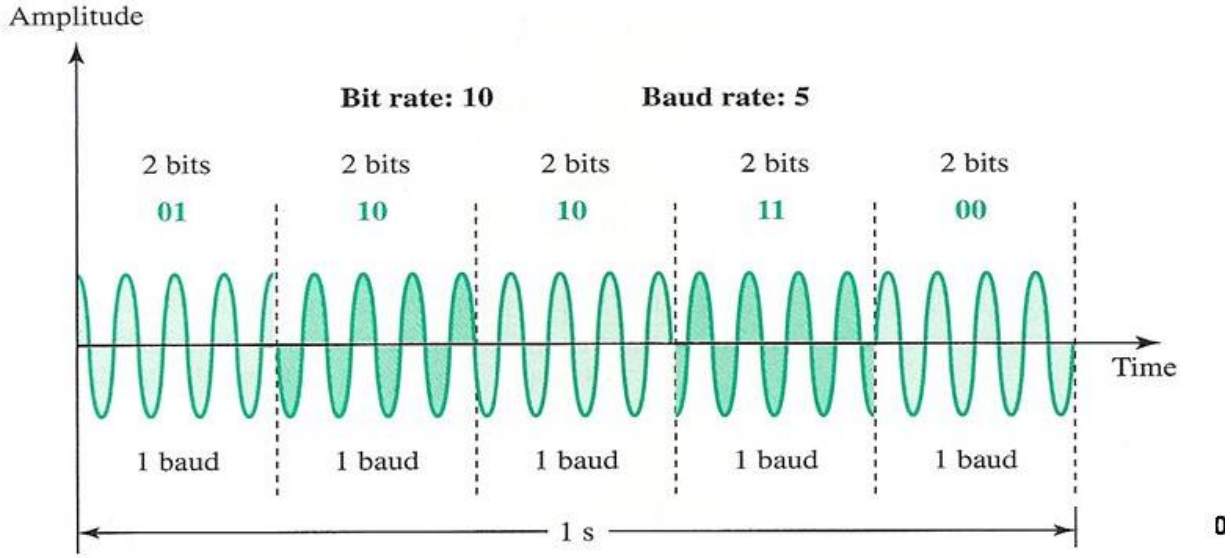
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Quadrature PSK (QPSK)

- The term "quadrature" implies that there are four possible phases (4-PSK) which the carrier can have at a given time.
- The pair of bits represented by each phase is called **dibit**.
- The rate of change (baud) in this signal determines the signal bandwidth.
- BUT the throughput or bit rate for QPSK is twice the baud rate.



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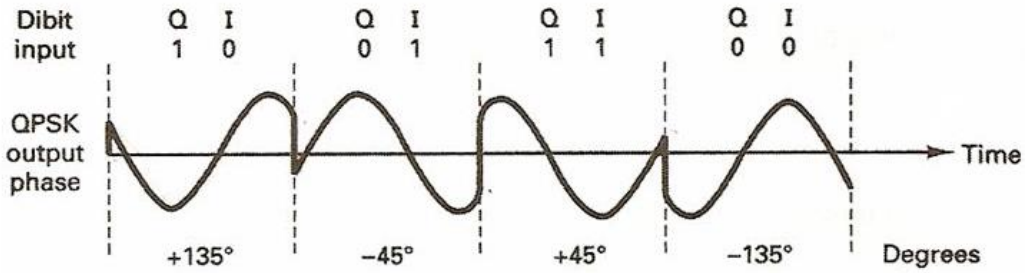
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QPSK = 4-PSK

PSK that uses phase shifts of 90°=π/2 rad ⇒ 4 different signals are generated, each representing 2 bits



Assumption

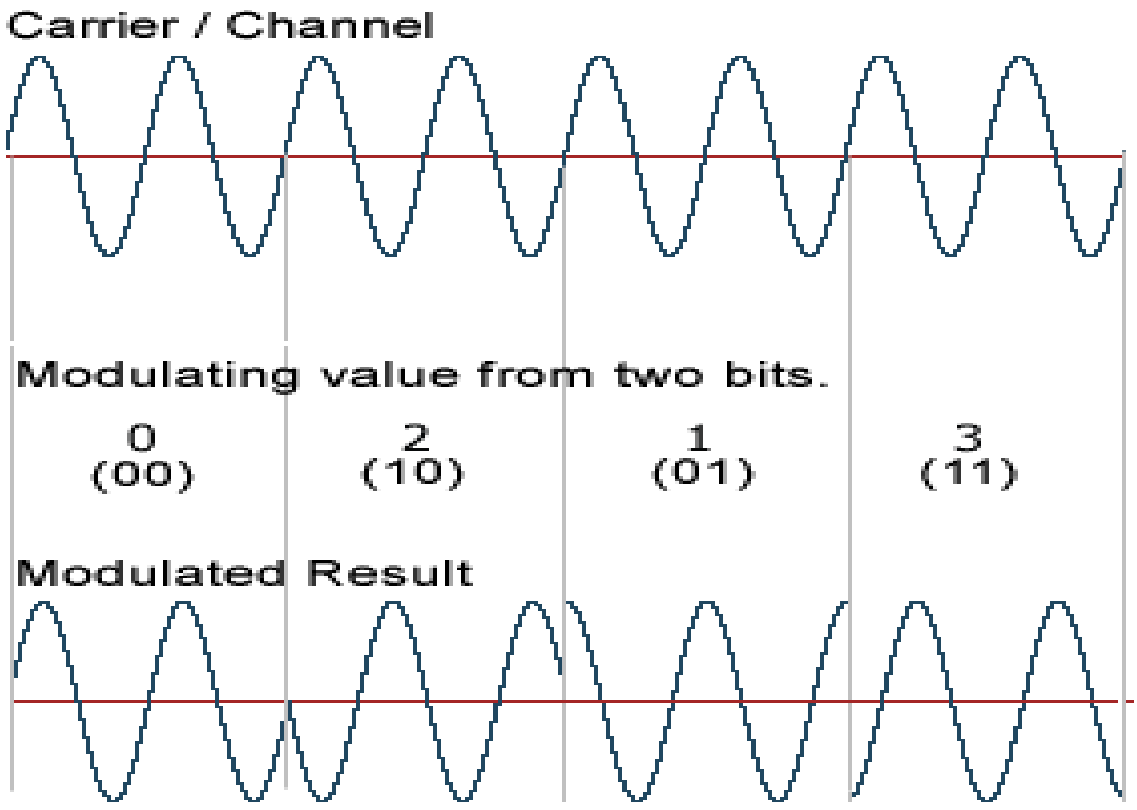
Binary input		QPSK output phase
Q	I	
0	0	−135°
0	1	−45°
1	0	+135°
1	1	+45°

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QPSK

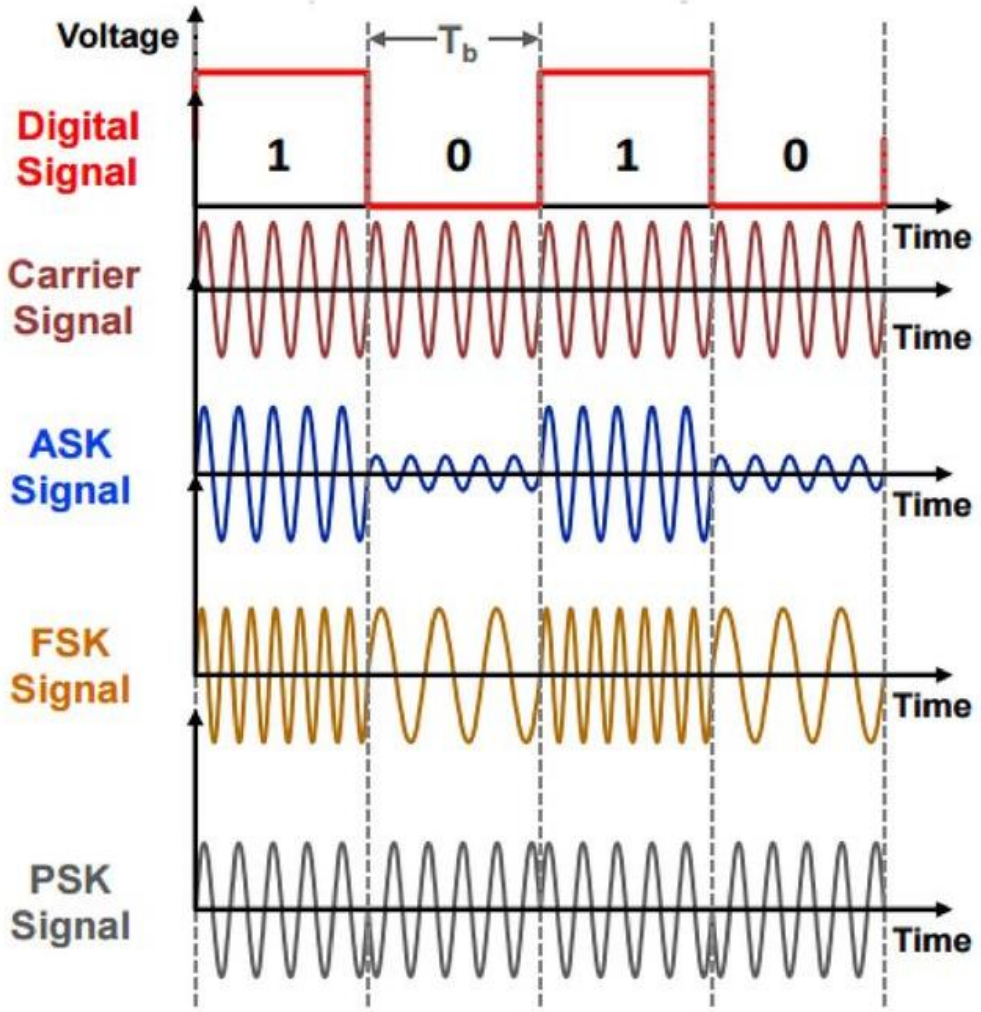


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Comparison between ASK, FSK and PSK



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- Amplitude Shift Keying (ASK):
  - change amplitude with each symbol – frequency constant
  - low bandwidth requirements
  - very susceptible to interference
- Frequency Shift Keying (FSK):
  - change frequency with each symbol
  - needs larger bandwidth
- Phase Shift Keying (PSK):
  - Change phase with each symbol
  - More complex
  - robust against interference

