SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB301-ANALOG AND DIGITAL COMMUNICATION

III YEAR/ V SEMESTER

UNIT 4 – DIGITAL MODULATION TECHNIQUES

TOPIC – QPSK

Quadrature Phase Shift Keying $QPSK$

This is the phase shift keying technique, in which the sine wave carrier takes four phase reversals such as 0°, 90°, 180°, and 270°.

If this kind of techniques are further extended, PSK can be done by eight or sixteen values also, depending upon the requirement.

QUADRATURE PHASE SHIFT KEYING

The **Quadrature Phase Shift Keying** $QPSK$ is a variation of BPSK, and it is

also a Double Side Band Suppressed Carrier $DSBSC$ modulation scheme,

which sends two bits of digital information at a time, called as **bigits**.

Instead of the conversion of digital bits into a series of digital stream, it converts them into bit pairs. This decreases the data bit rate to half, which allows space for the other users.

QPSK MODULATOR

The QPSK Modulator uses a bit-splitter, two multipliers with local oscillator, a 2-bit serial to parallel converter, and a summer circuit. Following is the block diagram for the same.
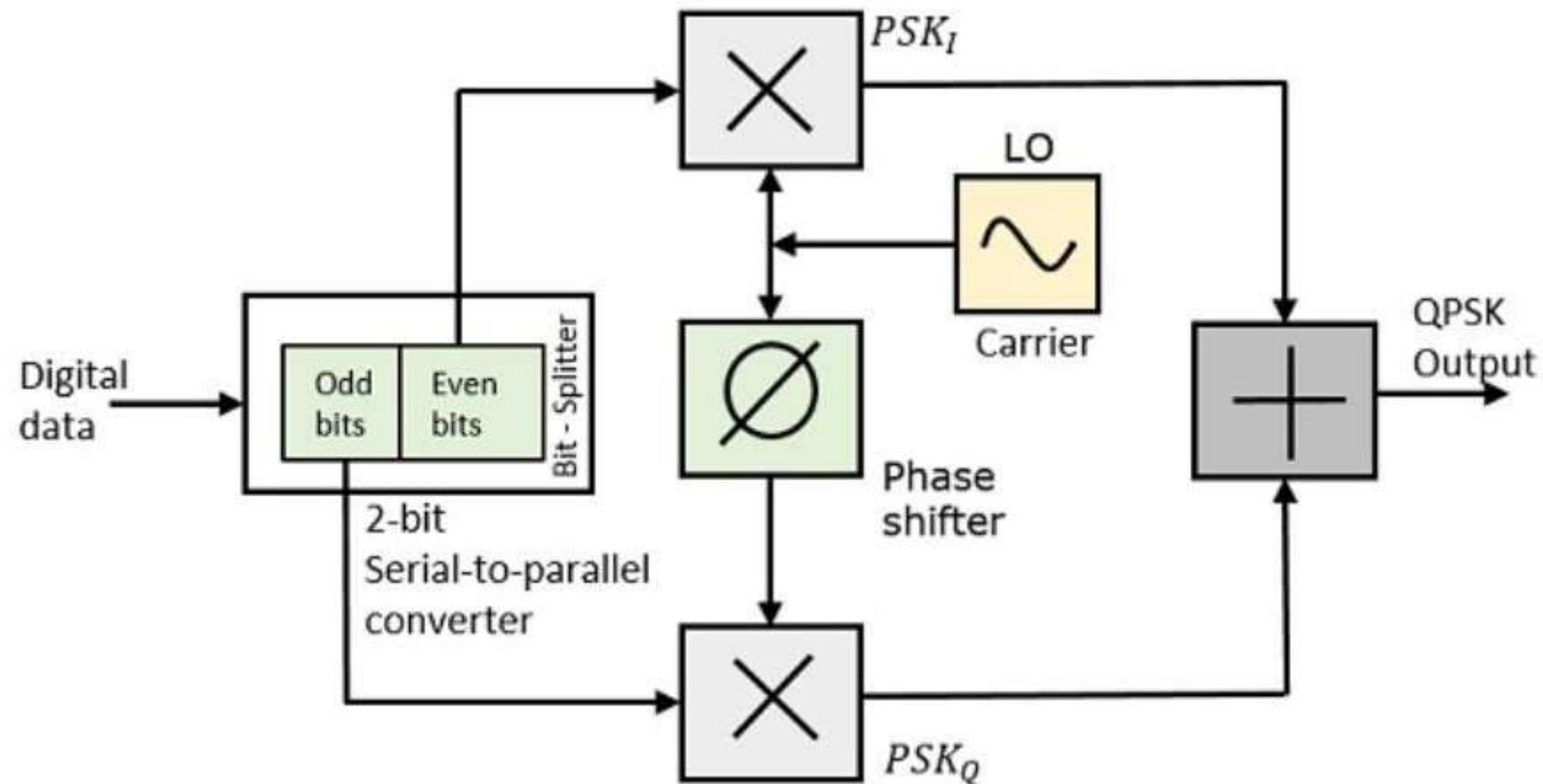
QPSK MODULATOR

At the modulator's input, the message signal's even bits (i.e., 2nd bit, 4th bit, 6th bit, etc.) and odd bits (i.e., 1st bit, 3rd bit, 5th bit, etc.) are separated by the bits splitter and are multiplied with the same carrier to generate odd BPSK (called as **PSK$_I$**) and even BPSK (called as **PSK$_Q$**). The **PSK$_Q$** signal is anyhow phase shifted by 90° before being modulated.
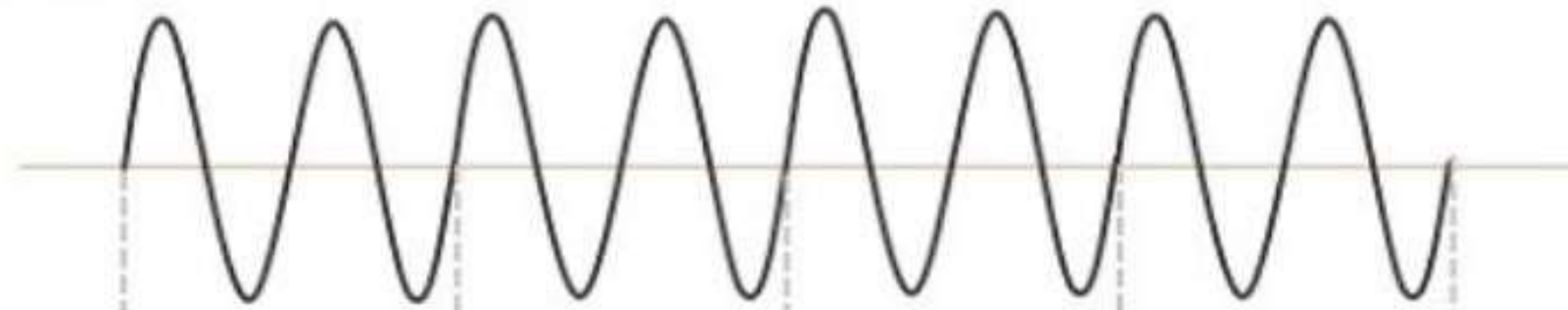
The QPSK waveform for two-bits input is as follows, which shows the modulated result for different instances of binary inputs.
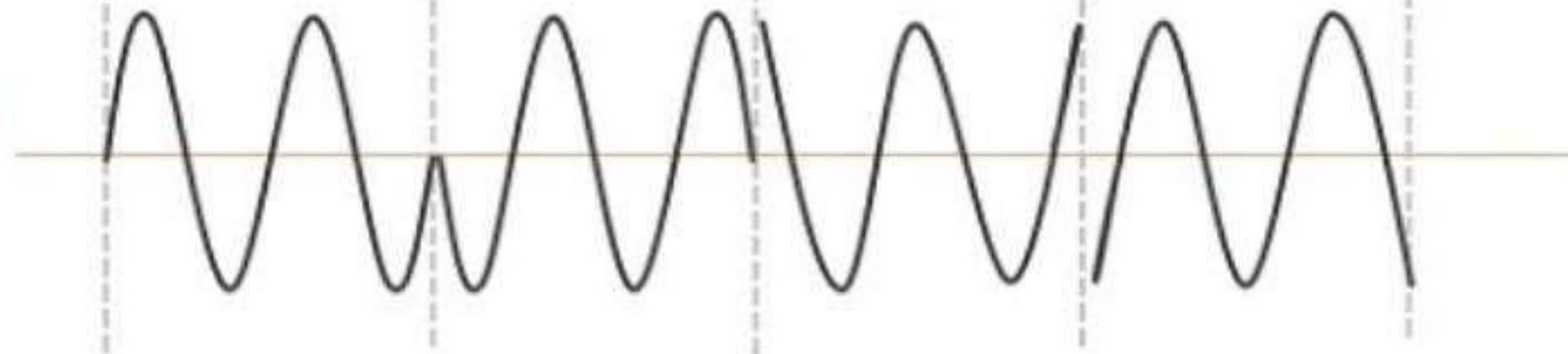
QPSK WAVEFORMS

Carrier / Channel

Modulating value from two bits

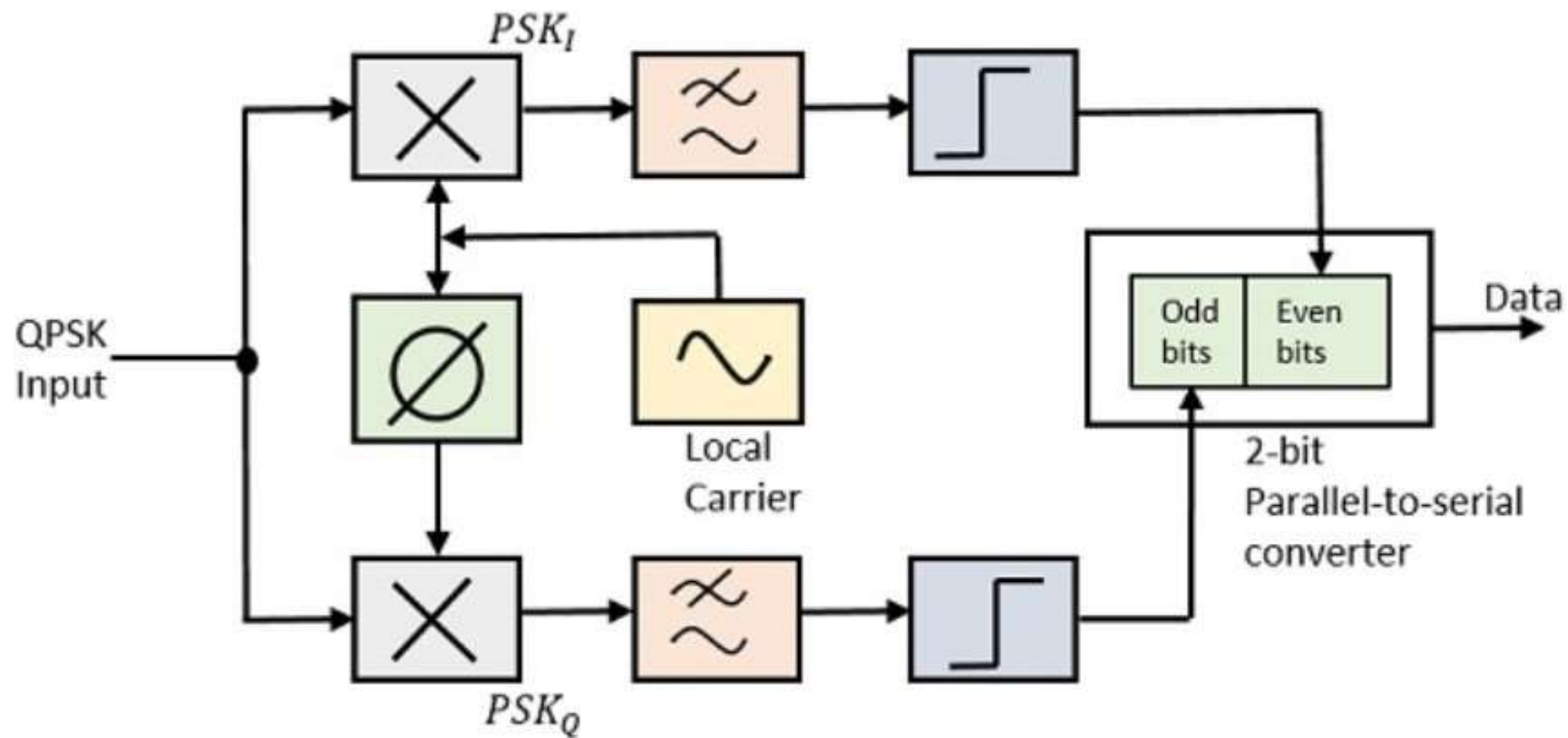| 0 | 2 | 1 | 3 |
| (00) | (10) | (01) | (11) |

Modulated Result

QPSK DEMODULATOR

The QPSK Demodulator uses two product demodulator circuits with local oscillator, two band pass filters, two integrator circuits, and a 2-bit parallel to serial converter. Following is the diagram for the same.

QPSK DEMODULATOR

The two product detectors at the input of demodulator simultaneously demodulate the two BPSK signals. The pair of bits are recovered here from the original data. These signals after processing, are passed to the parallel to serial converter.

QPSK ADVANTAGES

- QPSK provide very good noise immunity

- It provides low error probability

- Bandwidth is twice efficient is compared to BPSK modulation

- For the same BER, the bandwidth required by QPSK is reduced to half as compared to BPSK

- It is more efficient utilization of the available bandwidth of the transmission channel

- Carrier power almost remains constant because of OQPSK amplitude is not much

QPSK DISADVANTAGES

- QPSK is not more power efficient modulation technique compare to other modulation types as more power is required to transmit two bits

- QPSK is more complex compared to BPSK receiver due to four states needed to recover binary data information

QPSK APPLICATIONS

QPSK (Quadrature Phase Shift Keying) scheme is used in various applications in modern

digital communication system; it provides high performance on bandwidth efficiency

and bit error rate. The areas include **wireless communication, mobile**

communication and Satellite Communication.

THANK YOU