

Final Term

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Program e : Bs (Telecom)

Subject : Radar and Satellite

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Q<sub>1</sub>. (a) Explain BPSK and QPSK with help of Phase diagram?

(Ans). Binary Phase Shift Keying (BPSK) is a two Phase modulation scheme, Where the 0's and 1's in a binary message are represented by two different Phase states in the Carrier signal:

$\theta = 0^\circ$  for binary 1 and  $\theta = 180^\circ$  for binary 0.

⇒ It is possible to group several bits of information as a symbol.

⇒ When combining N information bits there is the possibility of  $M = 2^N$  states.

⇒ When  $N = 1$ ,  $M = 2$

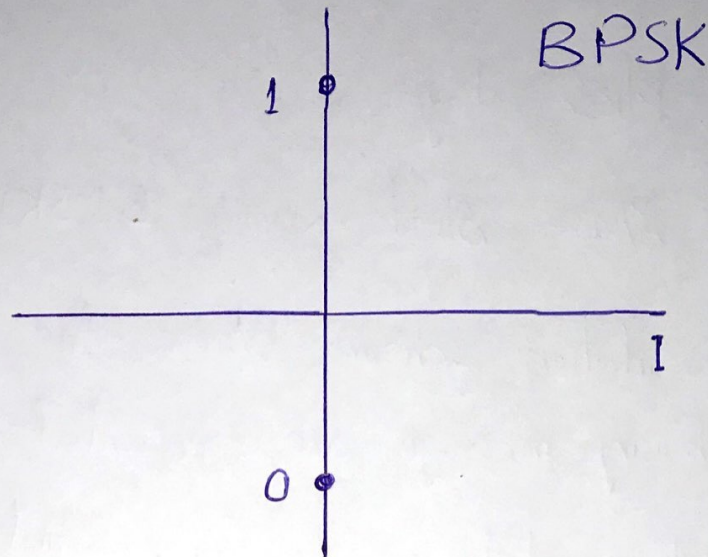
m takes values of 0 and 1

$\phi_m = \pi/2$  and  $3\pi/2$

⇒ Carrier phase is changed by  $180^\circ$  for each bit. This is BPSK.

# BPSK Phase diagram

Pg # 03



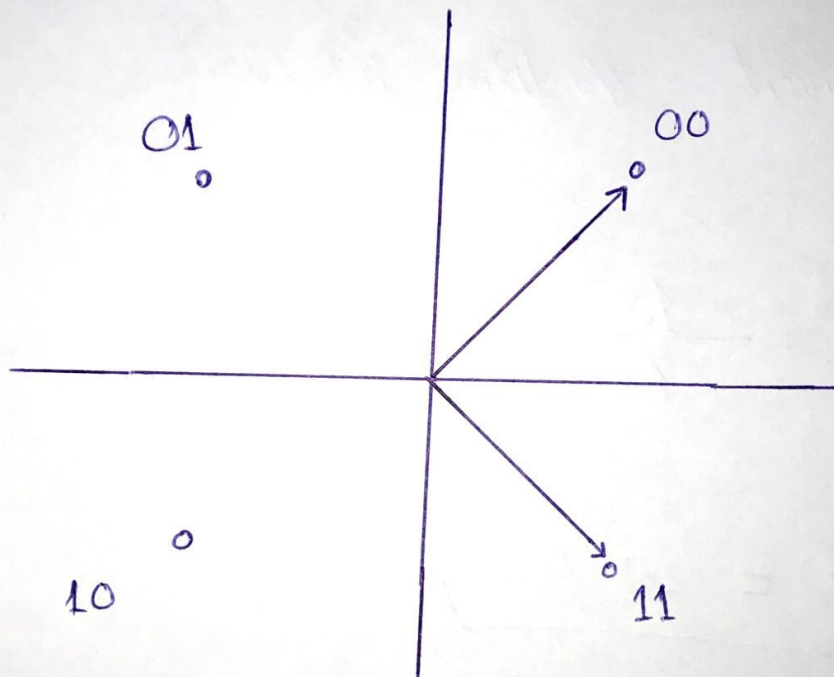
## Quadrature Phase shift keying (QPSK)

Is a form of Phase shift keying in which two bits are modulated at once, selecting one of four possible carrier phase shift ( $0^\circ$ ,  $90^\circ$ ,  $180^\circ$  or  $270^\circ$  degrees).

QPSK allows the signal to carry twice as much information as ordinary PSK using the same bandwidth.

⇒ This is known as QPSK (Q is for Quadrature)

⇒ In general, when  $N$  baseband bits are combined to give  $M$  carrier states, such a scheme is known as  $M$ -ary PSK.



QPSK

Q<sub>1</sub>. (b). What is 40 dBm in W?

(Ans).

Formula :

$$P(\text{Watt}) = \frac{10^{\frac{P_{\text{dBm}}}{10}}}{1000} \text{ Watt}$$

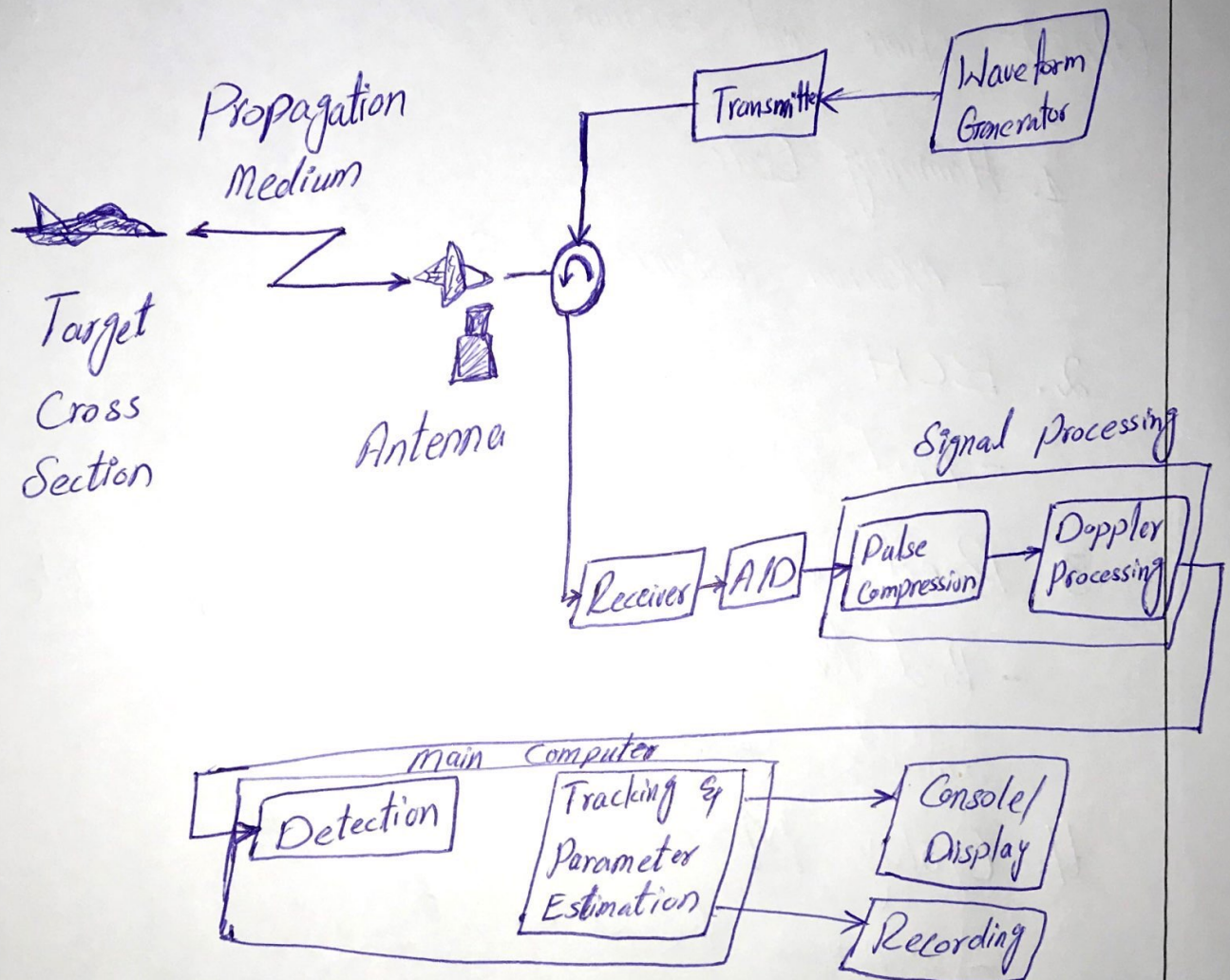
Now Convert 40 dBm into Watt

$$P(\text{Watt}) = \frac{10^{\frac{40}{10}}}{1000} = 10 \text{ Watt}$$

$$P(\text{Watt}) = 10 \text{ Watt}$$

Q<sub>2</sub>. (a). Draw and Explain Radar Block Diagram?

(Ans).



⇒ The basic parts of radar system are illustrated in the simple block diagram of Fig. The radar signal usually a repetitive train of short pulse. Is generated into the transmitter and radiated into the space by the antenna. If the output of the radar receiver is sufficiently large detection of target is said to occur.

Q2. (b). Name and explain the type of block coding and polarization used in mobile satellite communication.

(Ans). Name and explain the type of Block Coding:

1. Hamming Codes

- Minimum distance of 3

2. BCH

- Most powerful of all codes

3. Reed - Solomon (RS)

- Used for correcting bursty errors in mobile satellite communication.

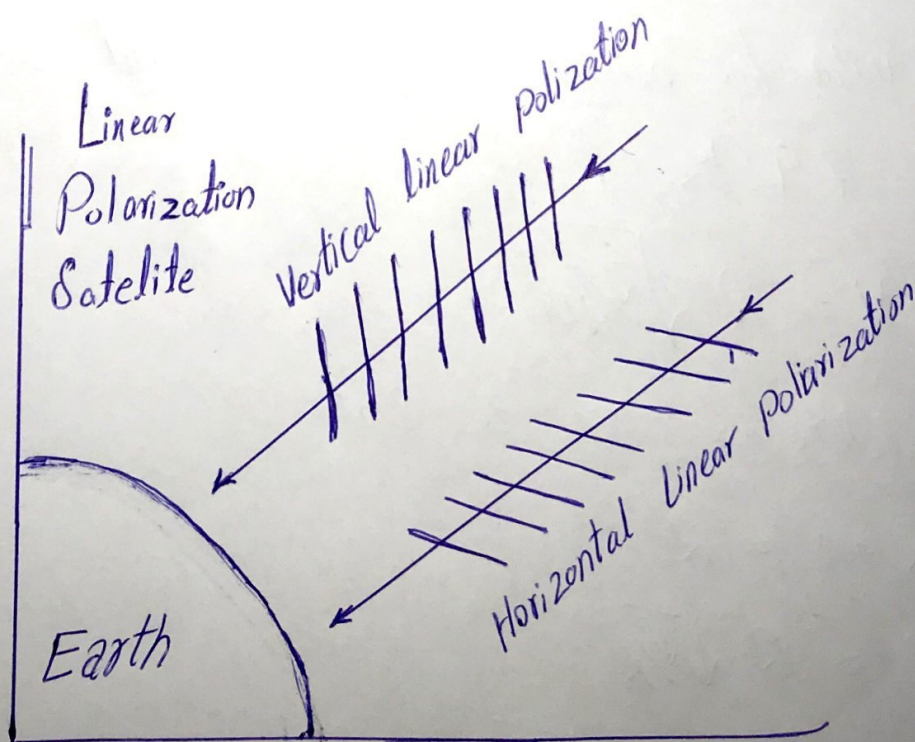
4. Golay M

- Minimum distance of 7

5. Code selection is dependent generally on channel characteristics.

⇒ Polarization used in mobile Satellite Communication:

- Alternating Vertical and horizontal Polarisation is widely used on Satellite Communications.
- This reduces interference between programs on the same frequency band transmitted from adjacent satellite (one uses vertical, the next horizontal, and so on)
- Allows for reduced angular separation between the satellites.





Q<sub>3</sub>. (a).

Find out the orbital speed and time Period of Satellite?

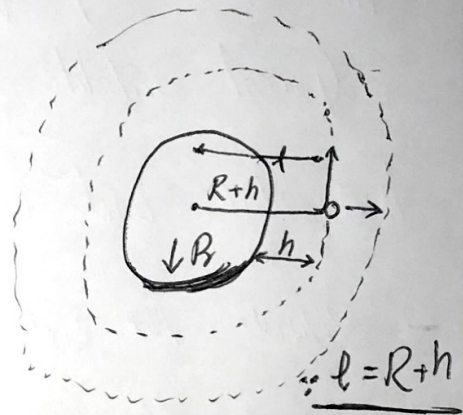
(Ans): Orbital Speed:

It is the minimum speed required to put satellite in given orbit around earth.

$$V = \sqrt{\frac{GM}{r}} = \sqrt{\frac{gR^2}{r}}$$

Where  $g = 9.8 \text{ m/s}^2$

$R_E = \text{radius of earth}$



The value for orbital velocity was found to be  $7.92 \text{ km/s}$

$$V = R \sqrt{\frac{g}{R+h}}$$

Satellite is close to earth.

$$R+h \approx R$$

$$V = R \sqrt{\frac{g}{R}}$$

$$V = \sqrt{g \times R} = \sqrt{gR}$$

$$V = 7.92 \times 10^3 \text{ m/s}$$

Q3 (a).

Pg #10

⇒ Time Period of Satellite

Time ~~Periode~~ taken by Satellite for one complete revolution around earth.

$$T = \frac{\text{Distance travelled in one revolution}}{\text{orbital speed.}}$$

$$T = \frac{2\pi r}{v} = \frac{2\pi r}{R\sqrt{g/r}}$$

$$T = \frac{2\pi r}{R} \sqrt{\frac{r}{g}} = \frac{2\pi}{R} \sqrt{\frac{r^3}{g}}$$

$$T = \frac{2\pi}{R\sqrt{g}} \sqrt{r^3}$$

$$T = \frac{2\pi}{R\sqrt{g}} = \sqrt{(R+h)^3}$$

$$v = R\sqrt{g/r}$$

It is independent of mass of satellite

$$v \propto \frac{1}{\sqrt{r}}$$

orbital velocity decrease with increase in orbital radius.

Q3. (b).

If an earth station is required to generate an EIRP of 50 dBW using an antenna of Gain 30 dB, how much transmission power in watts would be needed?

(Ans) → In Practice, antennas are used to focus and direct transmit power into a particular direction.

→ The EIRP is a combination of power and antenna gain

→ It has units of W (or dBW)

$$\text{Now} - \text{EIRP} = P_t G_t \text{ W}$$

$$- \text{EIRP} = 10 \log P_t + 10 \log G_t \text{ dBW}$$

$$10 \log P_t = \text{EIRP} - 10 \log G_t$$

$$10 \log P_t = 50 \text{ dBW} - 0$$

$$10 \log P_t = 50 \text{ dBW}$$

$$P_t = 10^{50}$$

$$P_t = 1.69897 \text{ dBW}$$

Q4. Explain Double Conversion Transparent Transponder?

(Ans). Transparent Transponders.

- Translate the uplink frequency to a suitable downlink frequency and power.
- Operate irrespective of access and modulation scheme used by system.

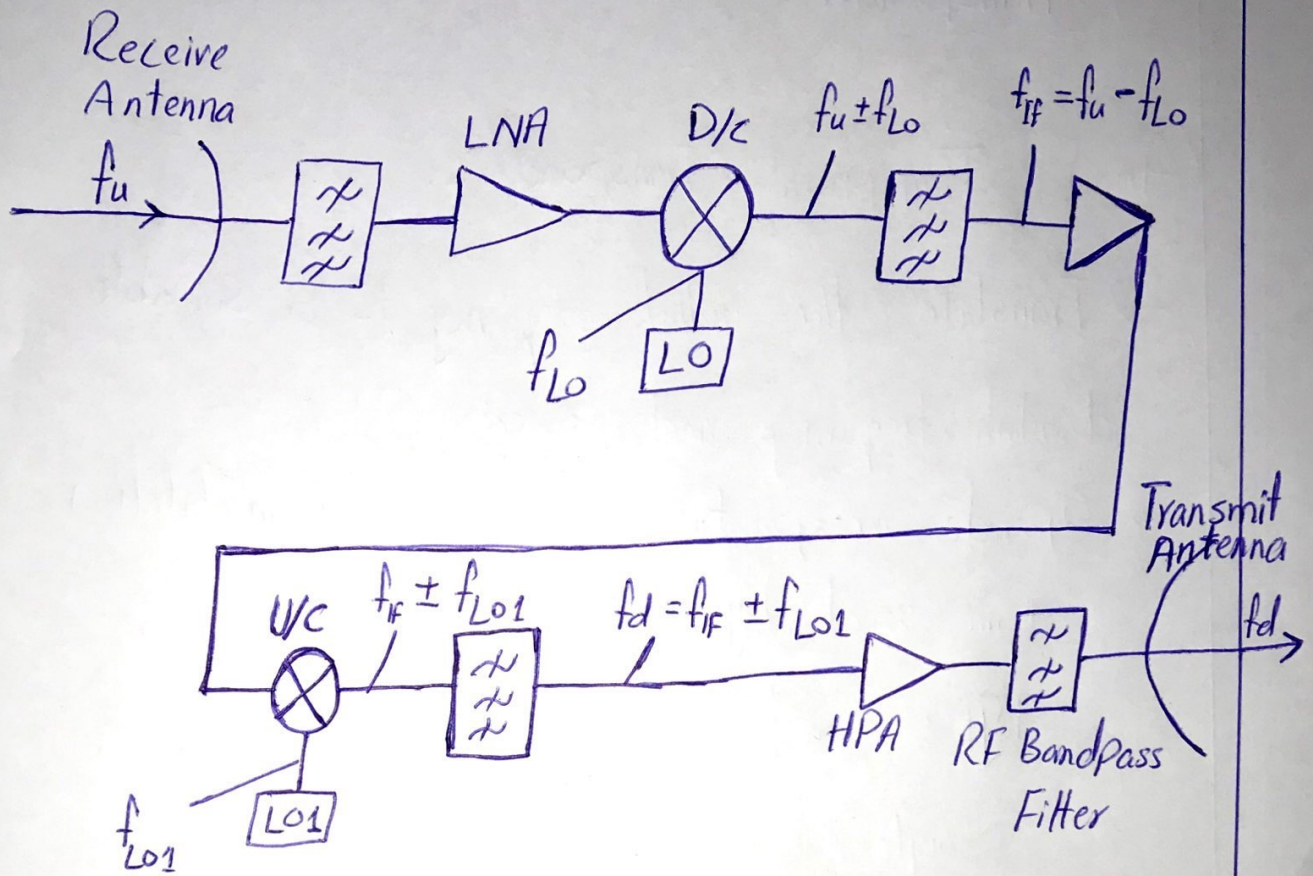
⇒ Types of Transponder:

- Single Conversion
- Double Conversion

→ Double Conversion:

- Uses an intermediate frequency of lower value than downlink frequency.
- It is used in mobile communications systems Satellites to convert from one band to another.
  - ACeS uses L-band (1.6/1.5 GHz) for mobile links and C-band (6/4 GHz) for feeder link.
  - Conversions for interconnections of Ku-band Payload (14/12 GHz) and C-band (6/4 GHz).

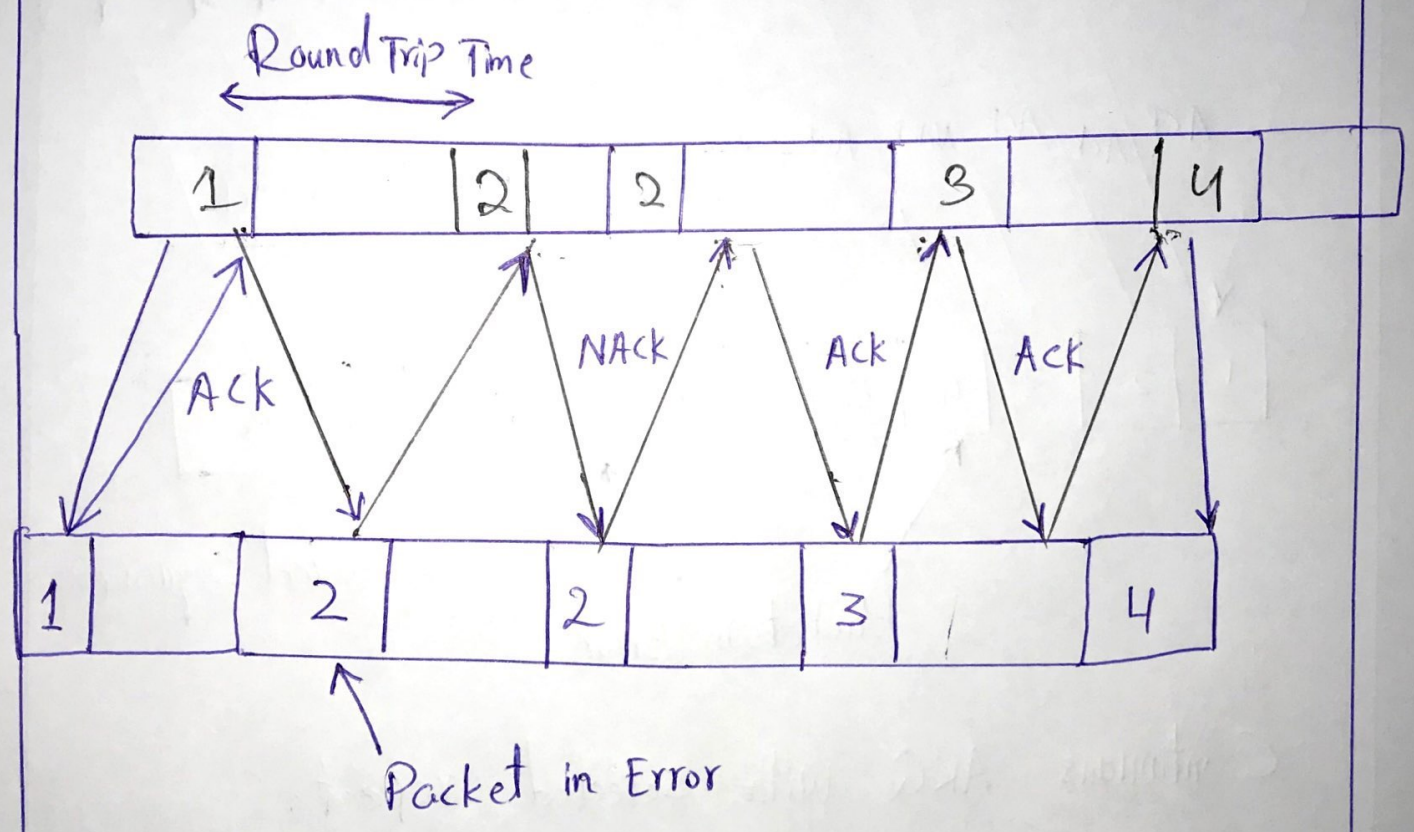
# Double Conversion



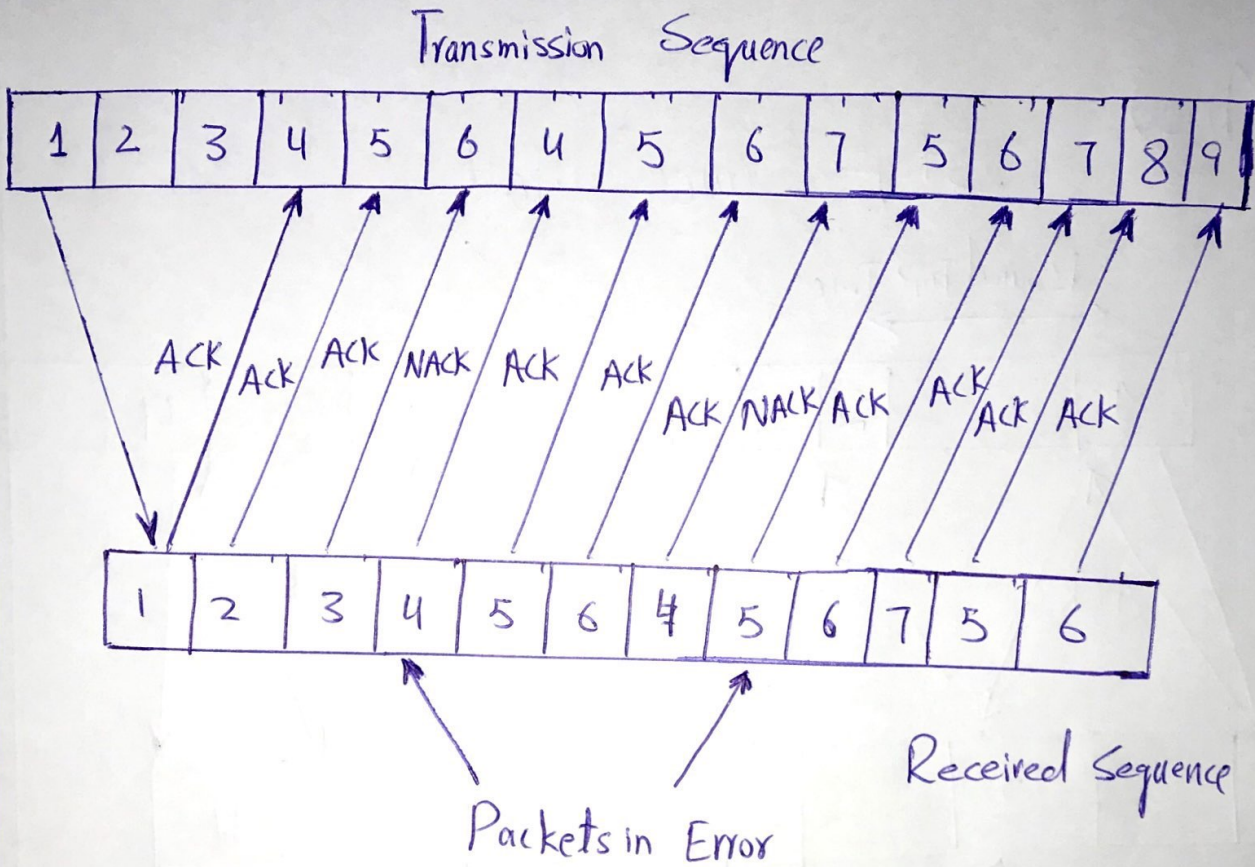
: Double Conversion Transparent Transponder :

Q.5:- Draw a diagram to illustrate the applications of the ARQ schemes?

(Ans). Stop and Wait



### Continuous ARQ with repeat:



### Continuous ARQ with selected repeat:

