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Course: Radar and satellite

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Program: Bs (Telecom)

(Q1)
(a) Explain BPSK and QPSK with help of Phase diagram?

(Ans) Binary Phase Shift Keying (BPSK)

BPSK is two phase modulation scheme where the 0's and 1's in a binary message are depresented by two different Phase state in the carrier signal $\theta = 0$ for binary 1 and 180° for binary 0.

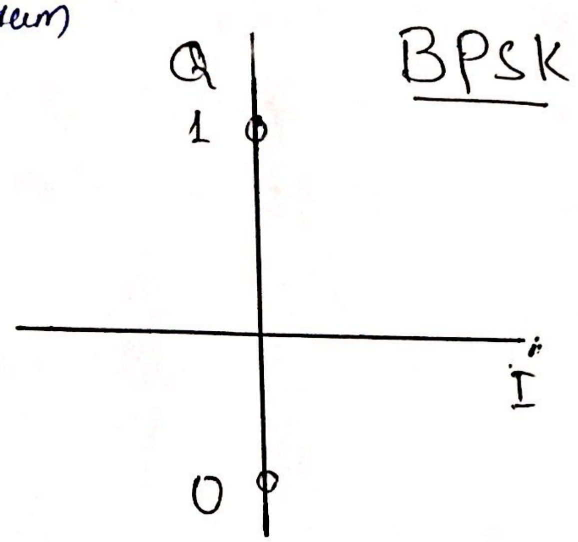
→ It is possible to group several bits of information as a symbol

→ When combining N information bits there is possible of $M = 2^N$ states

→ When $N = 1$, $M = 2$
m takes values of 0 and 1.
$\varphi_m = \pi/2$ and $3\pi/2$.

→ Carrier phase is changed by 180° for each bit. This is BPSK

Phase Diagram



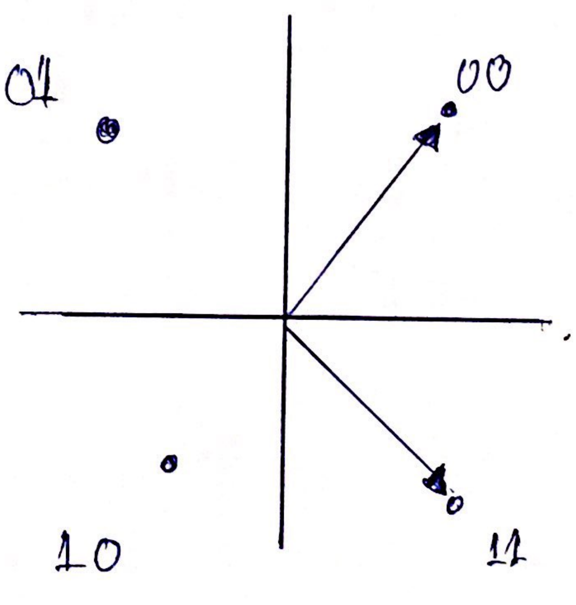
* Quadrature Phase Shift Keying

QPSK is form of Phase keying in which two bits are modulated at once, selecting one of four possible carrier shift (0, 90, 180 or 270 degree)

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

-> This is known as QPSK (Q is for Quadrature.

-> In general when M baseband bit are combined to give M carrier states, such a scheme is known as M-ary PSK.



QPSK

Q1
(b) What is 40 dbm in W?

Sol:-

Formula

$$P(\text{watt}) = \frac{10^{\frac{P(\text{dbm})}{10}}}{1000} \text{ watt}$$

Now convert 40 dbm into watt

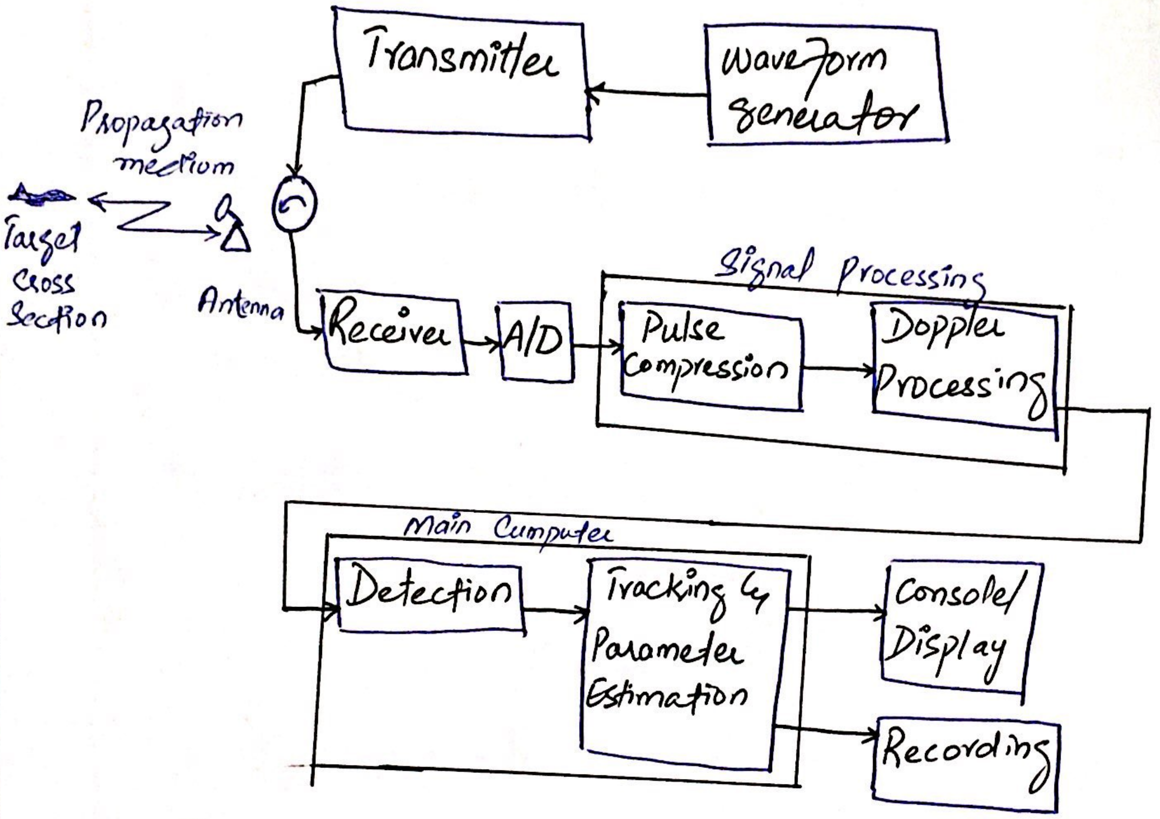
$$P(\text{watt}) = \frac{10^{\frac{40}{10}}}{1000} = \frac{10000}{1000}$$

$$\boxed{P(\text{watt}) = 10 \text{ watt}}$$

Q2

(a) Draw and explain Radar Block Diagram?

Radar Block Diagram:



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

Q2) (b) Name and Explain the typ of block Coding and polarization Used in mobile satellite communication

(Ans) Name and explain the type of block coding

*) Hamming codes
-> Minimum distance of 3

* BCH
-> Most Powerful of all codes.

* Reed-solomon (RS)
-> Used to correcting bursty errors in mobile satellite communication

* Golary M.
-> Minimum distance of 7.

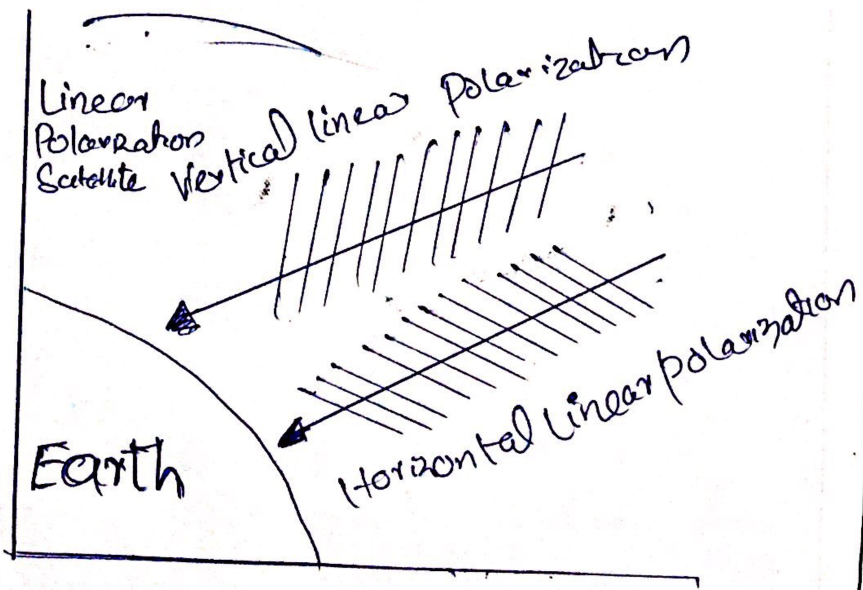
* Code selection is dependent on Channel characteristics.

* Polarization used in Mobile Satellite communication:-

⇒ After noting and horizontal polarization is widly used on Satellite communication.

⇒ This reduce interface between between program on the same frequency band transmitted from adjacent satellite. (one use vertical, the next horizontal, and so on.)

⇒ Allow for reduced angular separation between the satellite.

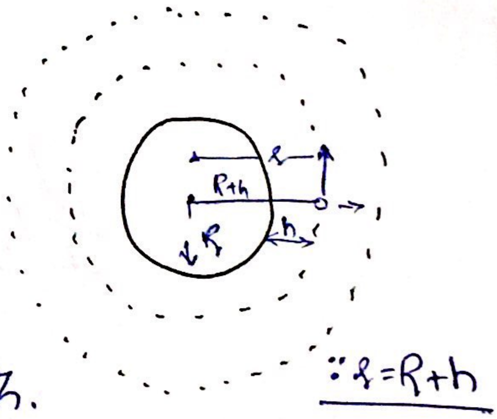


Q3

(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 $g = 9.8 m/s$

R_E = radius of earth.

The value for orbital velocity was found to be 7.92K/s

$$v = R\sqrt{g/_{R+h}}$$

Satellite is close to earth.

$R+h \approx R$

$$V = R\sqrt{g/_R}$$

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

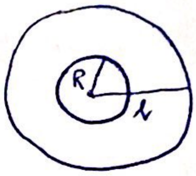
$$\boxed{v = 7.92 \times 10^3 m/s}$$

★ Time Period of Satellite

Time taken by satellite for one complete revolution around earth.

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

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



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

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

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

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

It is independent of mass of satellite
[redacted]

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

Orbital Velocity decrease with increase in orbital radius.

(Q3) If an earth station is required
(b) to generate an EIRP of 50 dBW using an antenna of Gain 50dBi. How much transmission power in watt would be needed?

Sol:-

As We Know That

→ 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)

Now

$$EIRP = P_t G_t \ W$$

$$EIRP = 10\log P_t + 10\log G_t \ dBW$$

$$10\log P_t = EIRP - 10\log G_t$$

$$10\log P_t = 50dBW - 0$$

$$10\log P_t = 50\ dBW$$

$$P_t = 10^{50}$$

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

(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.

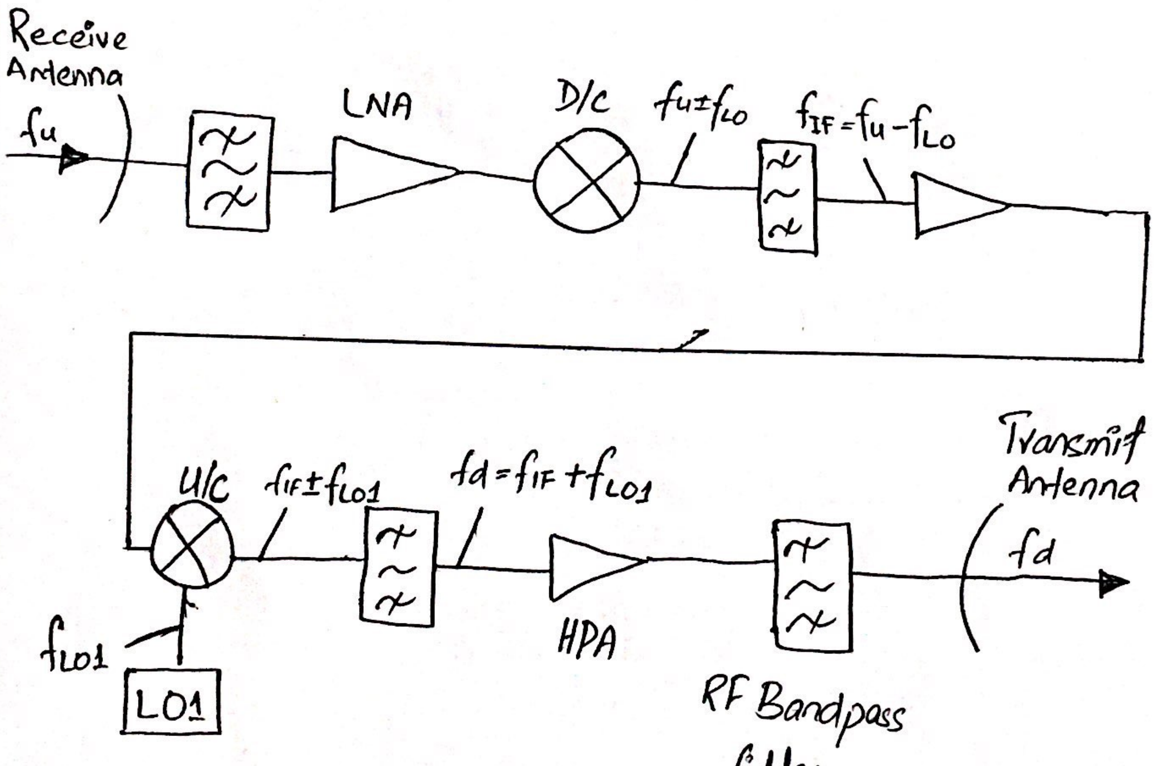
* Double Conversion:-

⇒ Uses and intermediate frequency of lower value than downlink frequency.

⇒ It is used in mobile communication systems satellite 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.
- Convenient for interconnection of Ku-band payload (14/12 GHz) and C-band (6/4 GHz).

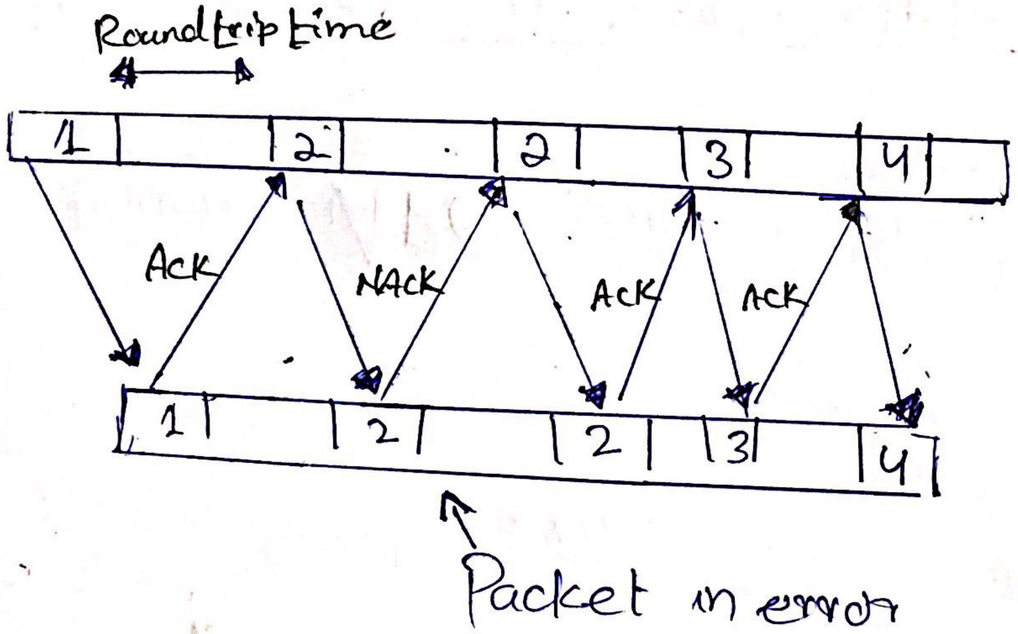
Double conversion - Basic Components.



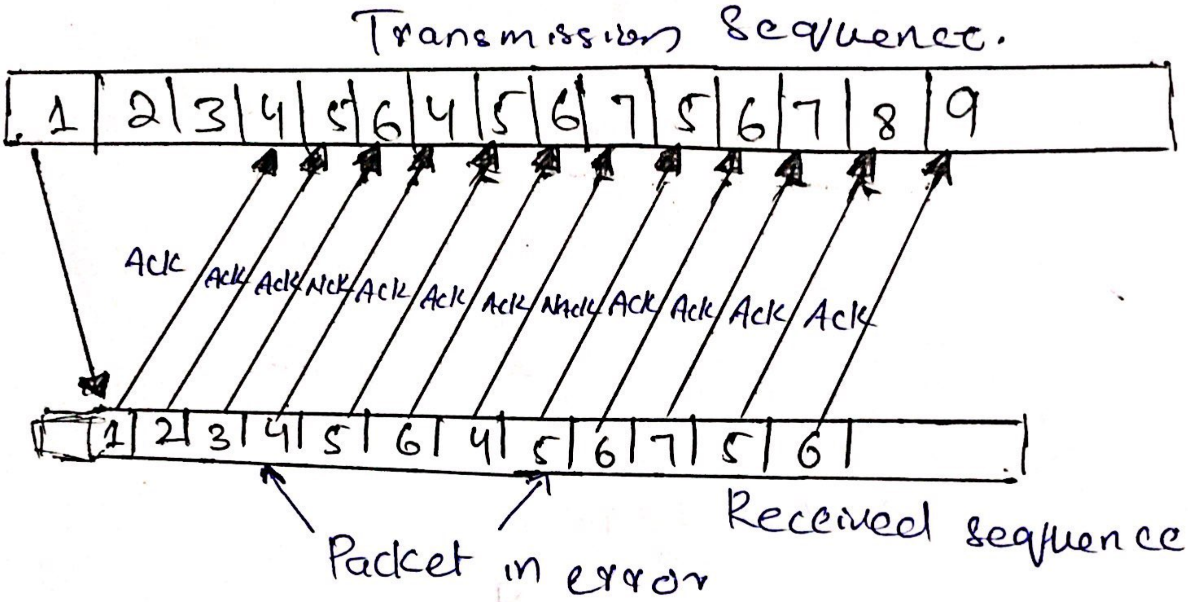
(Q5) Draw diagram to illustrate the applications of the ARQ scheme.

(Ans)
Sol

Stop and wait



* Continuous ARQ with Repeat



* Continuous ARQ with Selected Repeat