



**Satellite Communications**  
**By Engr. Abdul Rehman Chishti**

1

## Satellites

- \* Satellite is an object that moves around a larger object.
- \* Earth is a satellite because it moves around the sun.
- \* The moon is a satellite because it moves around Earth.
- \* Earth and the moon are called "natural" satellites
- \* The term "satellite" is typically used to describe a useful object placed in orbit purposely to perform some specific mission or task

2

## Orbit

- \* When satellite is launched it is placed in orbit around the earth.
- \* The earth's gravity holds the satellite in certain path and the path a satellite follows is an **orbit**

3

## Cont'd

- \* Communications antennae, radio receivers and transmitters enable the satellite to communicate with one or more ground stations, called command centers.
- \* Messages sent to the satellite from a ground station are "uplinked"
- \* Messages transmitted from the satellite to Earth are "downlinked."

4

## Components

- \* Satellite communication has two main components
  - \* Satellite
  - \* Ground(Earth Station)
  
- \* Satellite
  - \* Also known as space unit has 3 separate units
    - \* Fuel System
    - \* Satellite and telemetry Control
    - \* Transponders

5

## Satellite view



6

## Fuel System

### \* Fuel System

- \* Many satellites are battery-powered, taking advantage of the ultimate battery recharger, the sun. Silvery solar panels are prominent features on many satellites. Other satellites have fuel cells that convert chemical energy to electrical energy, while a few rely on nuclear energy

7

## Telemetry

### \* Telemetry (tele : far, metron :measure)

- \* Automatic measurement and transmission of data or information by such means as wire or microwaves from source to receiver
- \* (in terms of wireless only) it states: telemetry is the wireless transmission and reception of measured quantities for the purpose of remotely monitoring environmental conditions or equipment parameters
- \* Satellites transmit the data by telemetry
- \* Parameters include: temperature, altitude, fuel, battery etc

8

## Cont'd (Telemetry)

- \* Used in:
  - \* Controllers of Missiles
  - \* Torpedoes
  - \* Space crafts
  - \* Satellites

9

## Transponders

- \* **Transponders**
  - \* An automatic electronic monitoring or control device that receives cross examines amplifies and retransmit the arriving signal.
  - \* Reception and retransmission is done by transponder
  - \* Generally single transponder is capable of handling approx. 5000 simultaneous voice + data channels
  - \* Normally satellite has 32 transponders

10

\* **Earth Station**

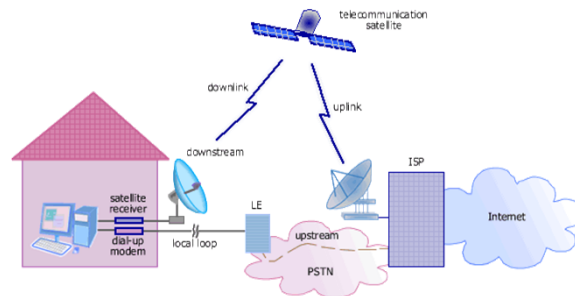
- \* The earth-based communications station providing the communication link to a communications satellite.

\*



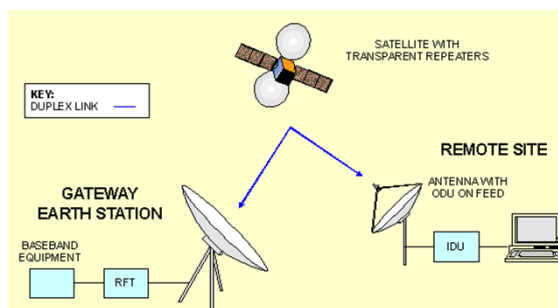
11

## Example of Satellite Communication



12

## Example



13

## TYPES OF ORBITS

- \* GEO (Geo-Stationary Earth Orbit/ Geo Synchronous Earth Orbit)
- \* MEO (Medium Earth Orbit)
- \* LEO (Low Earth Orbit)

14

## Orbit



15

## GEO

- \* GEO satellites takes 24 hours to cover the earth
- \* Distance of almost 36000Km to the Earth
- \* Contains: TV/Radio Broadcast Satellites
- \* Weather Satellites
- \* Backbone for the telephone Networks

16



## MEO

- \* Distance of 5000-12000km
- \* Most common use for the MEO satellites is navigation
- \* Communication satellites that covers the north & south poles are also put in MEO
- \* GPS(Global Positioning System) realized by Department of Defense (DOD) runs with 24 satellites circles the earth twice a day

17

## LEO

- \* Distance 500-1500km
- \* Cellular/ internet communication
- \* Minimum propagation delay and lower power transmitter/receiver
- \* Need many satellites to cover the whole earth
- \* Handover between satellites increases

18

## Summary

ORBIT TYPE	LEO	MEO	GEO
Altitude (Km)	500-1500	5000-12000	36,000
Satellite Needed for Global Coverage	40 +	10-15	3-4
Delay (seconds)	0.05	0.10	0.25
Hand overs	Frequent	Infrequent	Never
Satellite Life time (Years)	3-7	10-15	10-15
Broadcast TV	No	No	Yes

19

## Applications of Satellite Communications

- \* Weather forecast Satellites
- \* Radio/TV Broadcast Satellites
- \* Military satellites
- \* Satellite for Navigation (GPS- Guide from place to place)
- \* Ships, Aircrafts uses satellites for navigation

20

## Frequency Bands

- \* **Ku Band** The Ku band is a portion of the electromagnetic spectrum in the microwave range of frequencies ranging from 11.7 to 12.7GHz. (downlink frequencies) 14 to 14.5GHz (uplink frequencies).
- \* **Ka band** Ka band uplink uses frequencies between 27.5GHz and 31GHz and the downlink uses frequencies between 18.3 and 18.8GHz and between 19.7 and 20.2GHz.
- \* **C Band** is the original frequency allocation for communications satellites.
  - \* C-Band uses 3.7-4.2GHz for downlink and 5.925-6.425GHz for uplink.
  - \* The lower frequencies used by C Band perform better under adverse weather conditions than the Ku band or Ka band frequencies.