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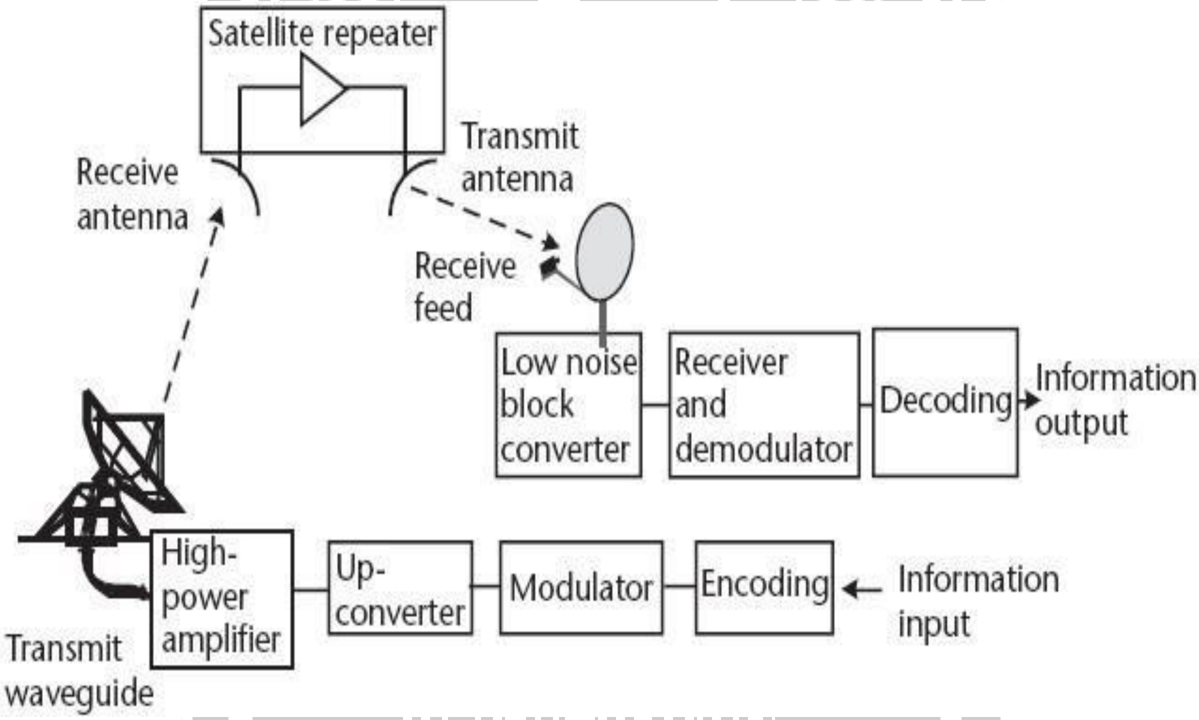
3.5 Link Design with and without frequency reuse

- Intra –orbital links :connect consecutive satellites on the same orbits
- Inter –orbital links :connect two satellites on the different orbits



Design of the Satellite System

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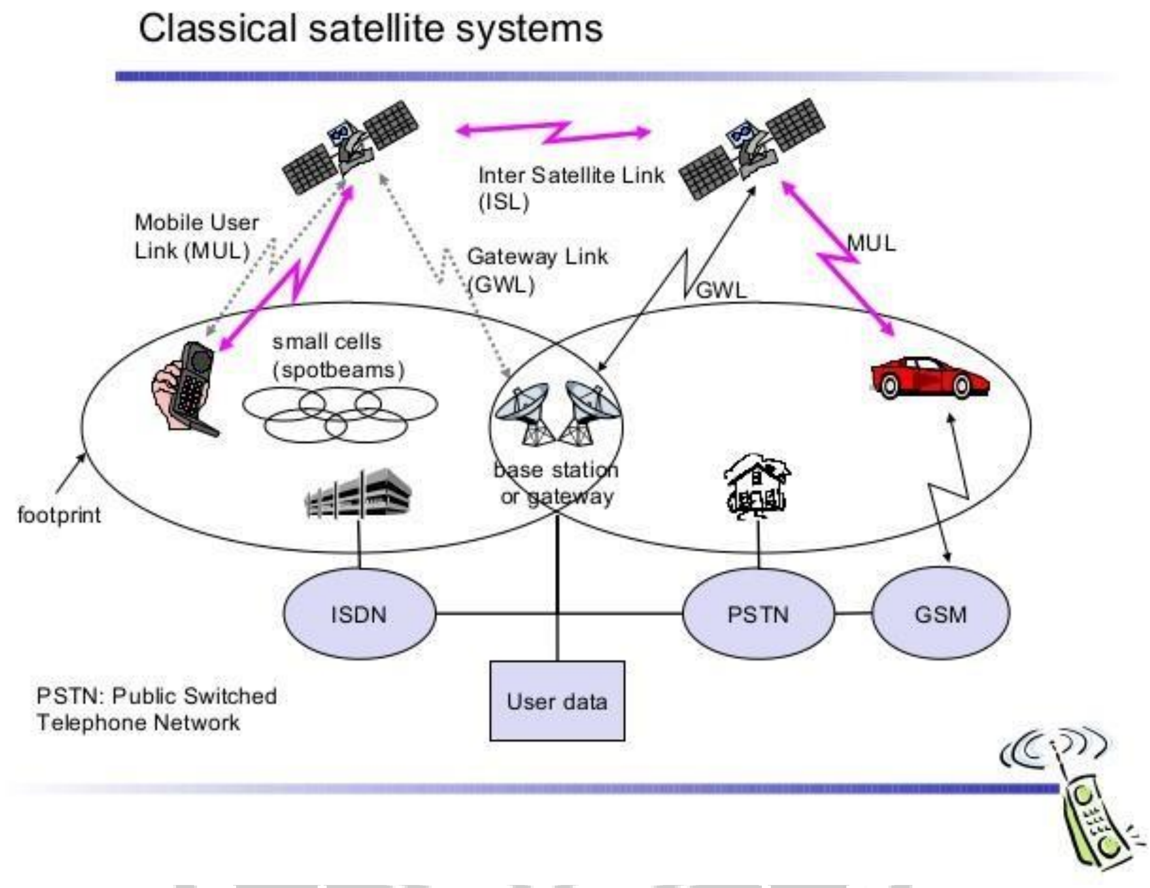

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LNB (LOW NOISE BLOCK DOWN CONVERTER)

- A device mounted in the dish, designed to amplify the satellite signals and convert them from a high frequency to a lower frequency. LNB can be controlled to receive signals with different polarization. The television signa can then be carried by a double-shielded aerial cable to the satellite receiv while retaining their high quality. A universal LNB is the present standard version, which can handle the entire frequency range from 10.7 to 12.75 G and receive signals with both vertical and horizontal polarization.

Demodulator

A satellite receiver circuit which extracts or "demodulates" the "wanted "signals from the received carrier.

Decoder

- A box which, normally together with a viewing card, makes it possible to view encrypted transmissions. If the transmissions are digital, the decoder usually integrated in the receiver.
- recorded video information to be played back using a television receiver tuned to VHF channel 3 or 4.

- **Modulation**

  The process of manipulating the frequency or amplitude of a carrier in relation to an incoming video, voice or data signal.

- **Modulator**

  A device which modulates a carrier. Modulators are found as components in broadcasting transmitters and in satellite transponders. Modulators are also used by CATV companies to place a baseband video television signal onto a desired VHF or UHF

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Atmospheric Layers

A signal traveling between an earth station and a satellite must pass through the earth's atmosphere, including the ionosphere, as shown

Atmospheric Losses

- Losses occur in the earth's atmosphere as a result of energy absorption by the atmospheric gases.

The weather-related losses are referred to as *atmospheric attenuation* and the absorption losses by gases are known as *absorption.* **Atmospheric scintillation:**

This is a fading phenomenon, the fading period being several tens of seconds.

It is caused by differences in the atmospheric refractive index, which in turn results in focusing and defocusing of the radio waves, which follow different ray paths through the atmosphere.

- Fade margin in the link power-budget calculations are used for Atmospheric Scintillation.

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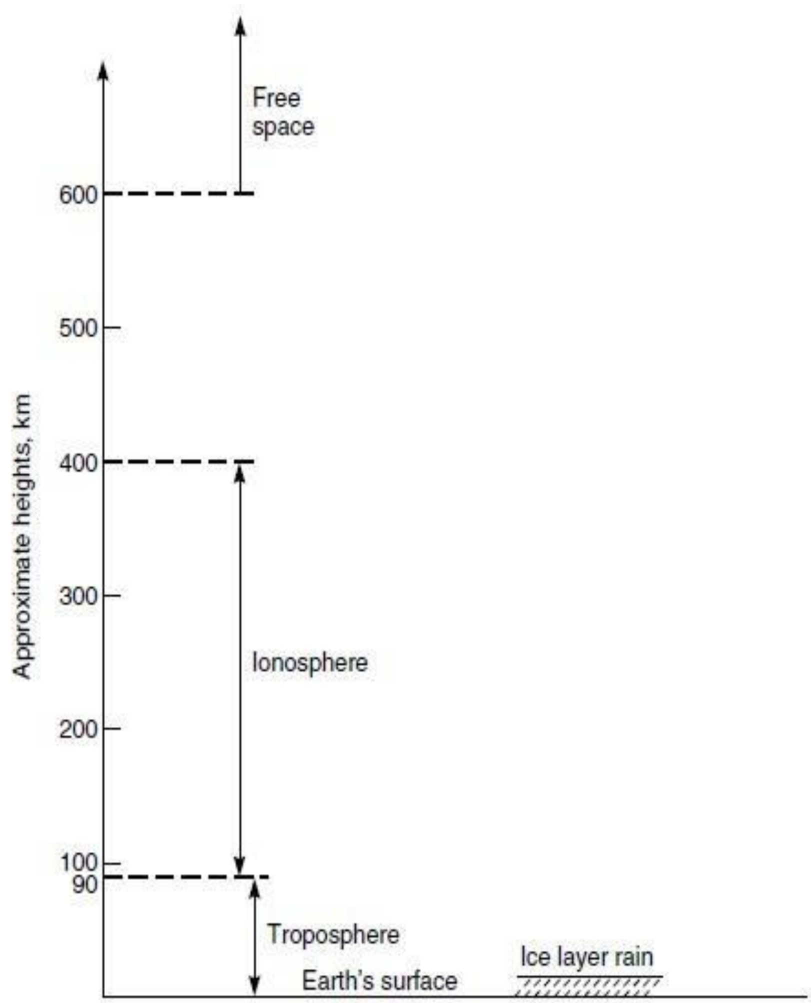

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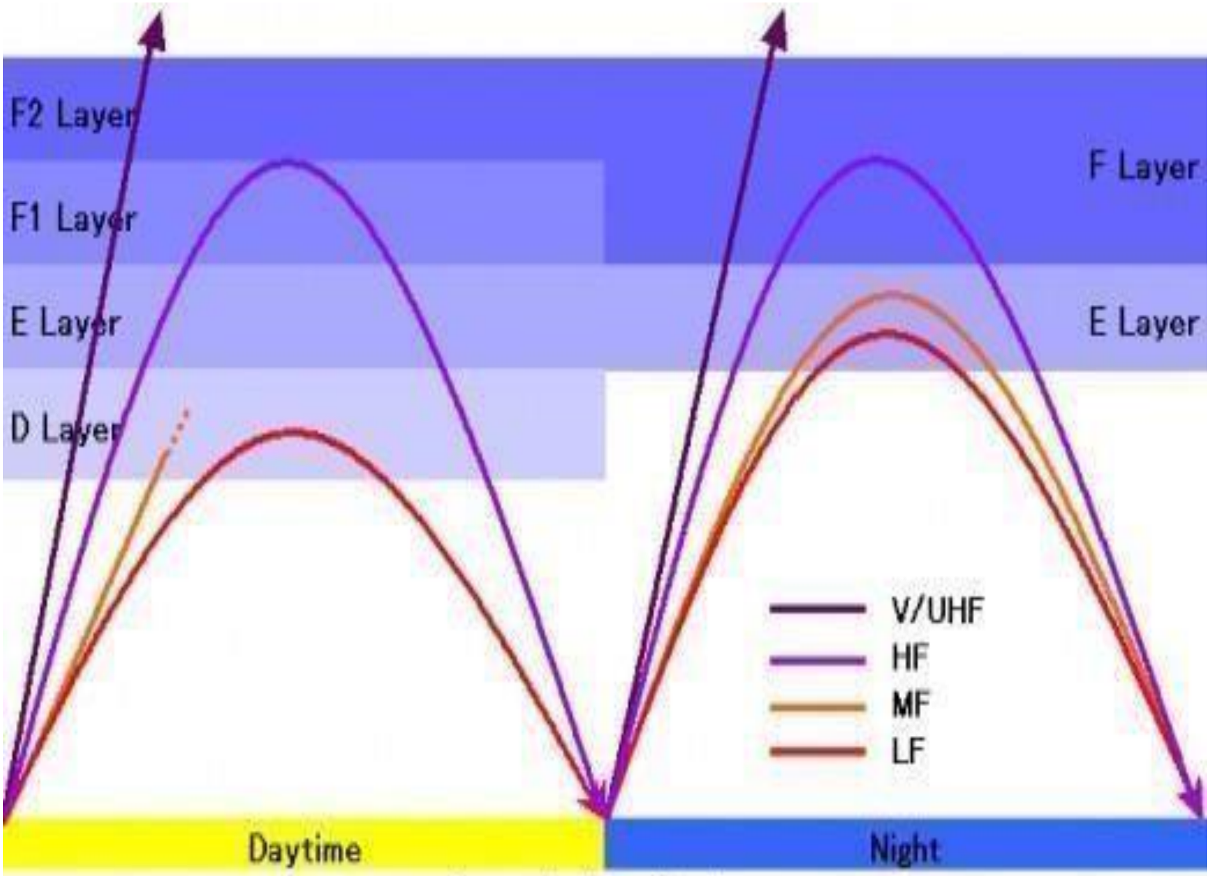

Ionospheric reflection
(under normal condition)

3.6 Ionospheric Effects

- Radio waves traveling between satellites and earth stations must pass through the ionosphere.

- The ionosphere is the upper region of the earth's atmosphere, which has been ionized, mainly by solar radiation. • The free

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electrons in the ionosphere are not uniformly distributed but form in layers, which effect the signal.

Ionospheric Layers

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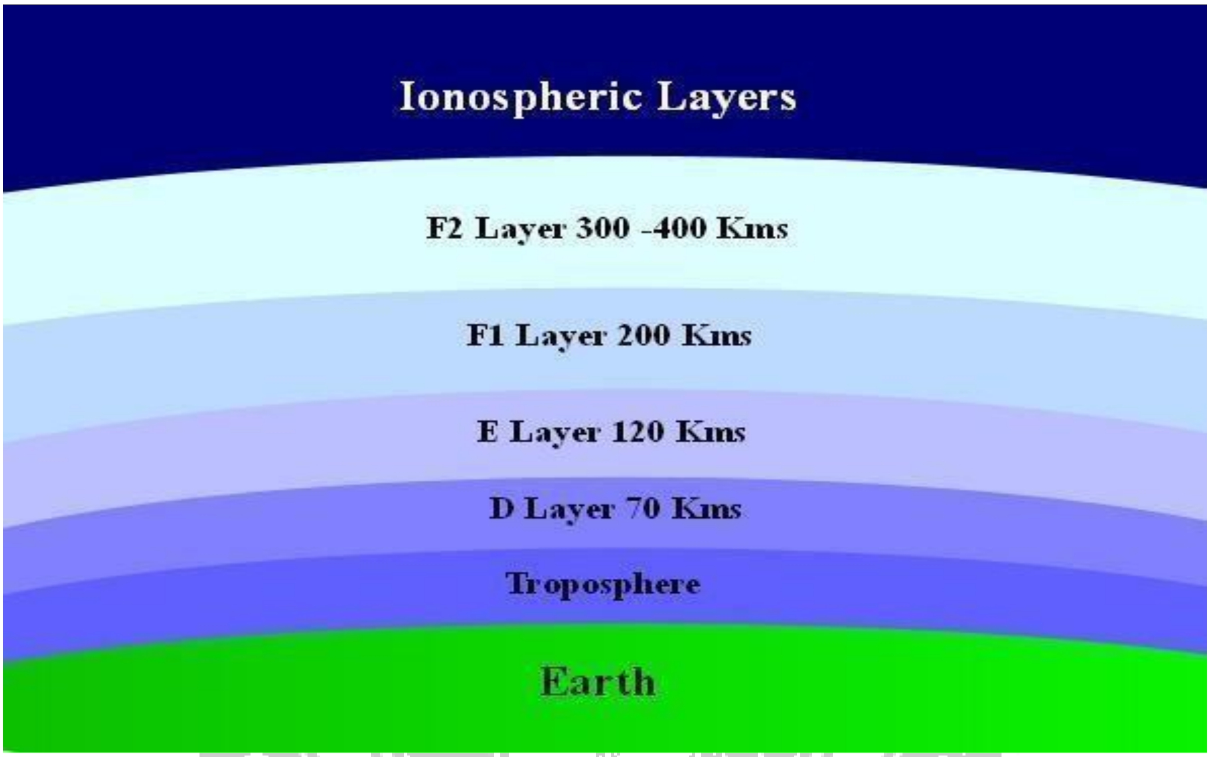

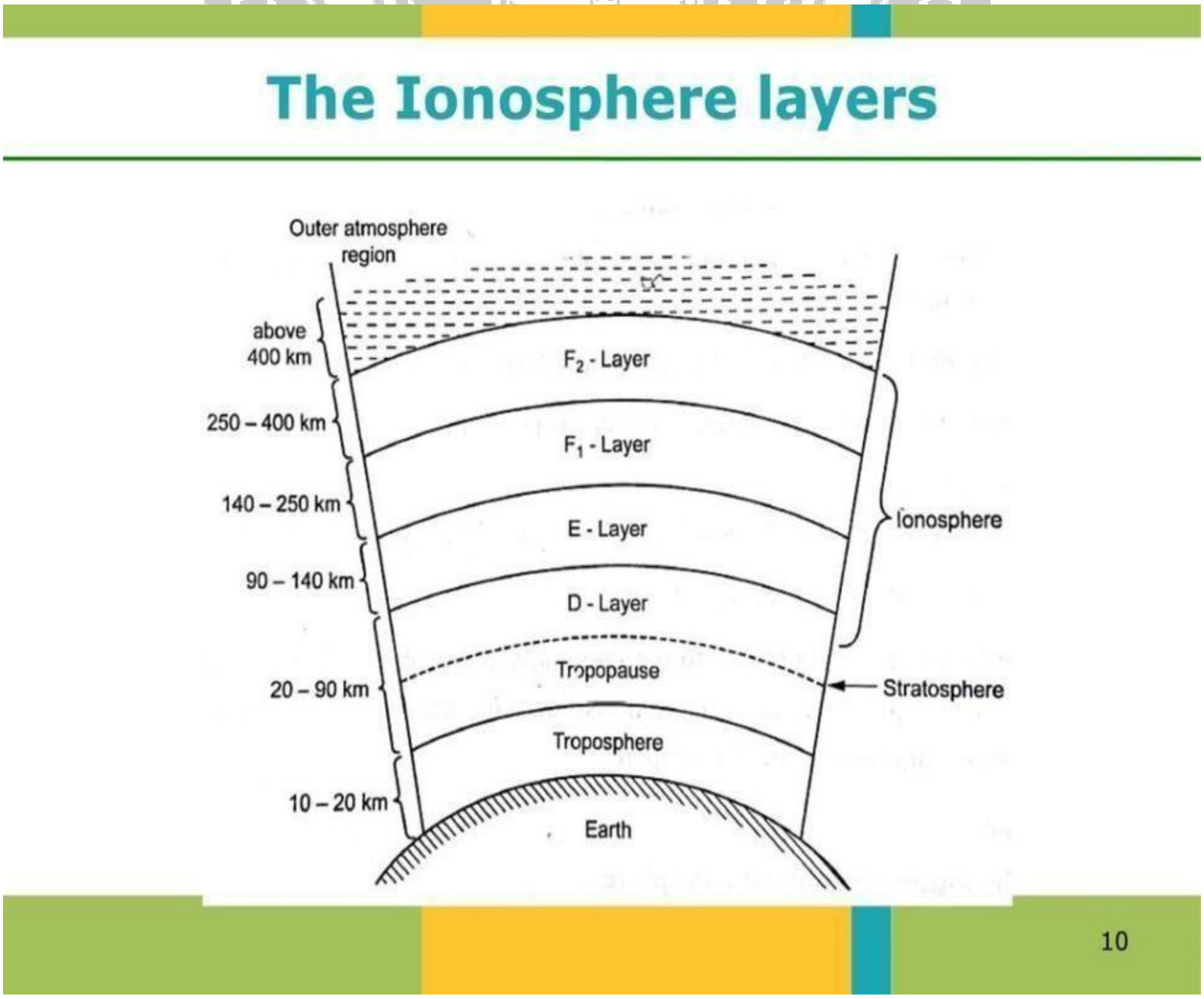

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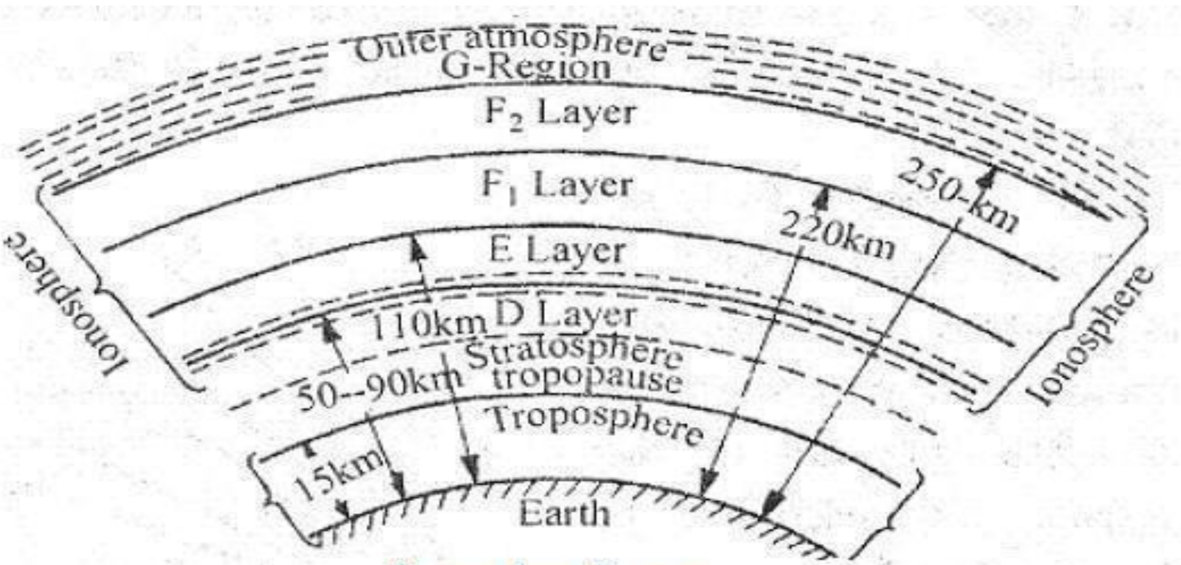
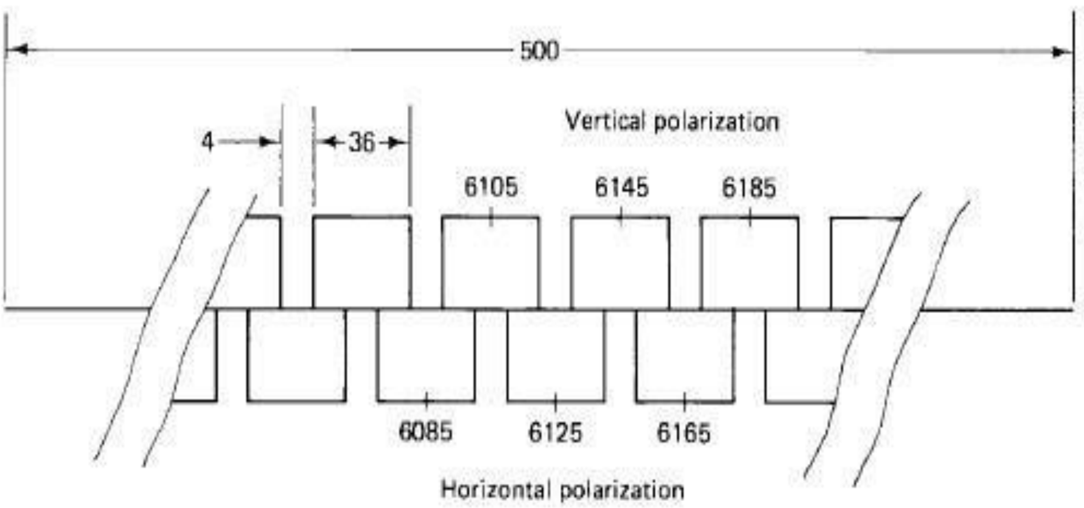


Ionosphere Layers

Link Design With and without Frequency Reuse



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- Frequency reuse is employed to reduce the crosspolarization caused by ionosphere, ice crystals in the upper atmosphere and

- rain, when the wave being transmitted from satellite to earth station.
- Frequency reuse achieved with spot-beam antennas, and these may be combined with polarization reuse to provide an effective bandwidth.

- The bandwidth allocated for C band service is 500 MHz, and this is divided into sub bands, one for each transponder. A typical transponder bandwidth is 36 MHz, and allowing for a 4-MHz guard band between transponders, 12 such transponders can be

- accommodated in the 500-MHz bandwidth. this number can be doubled. Polarization isolation refers to the fact that carriers, which may be on the same frequency but with opposite senses of polarization, can be isolated from one another by receiving

- With antennas linear match polarized carriers can be separated in this way, and with circular polarization, left-hand circular and right-hand circular polarizations can be separated. Because the carriers with opposite senses of polarization may overlap in frequency, this technique is referred to as *frequency reuse*

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RHCP

	1	3	5	. . .	31
Uplink MHz	17324.00	17353.16	17382.32	. . .	17761.40
Downlink MHz	12224.00	12253.16	12282.32	. . .	12661.40

LHCP

	2	4	6	. . .	32
Uplink MHz	17338.58	17367.74	17411.46	. . .	17775.98
Downlink MHz	12238.58	12267.74	12296.50	. . .	12675.98