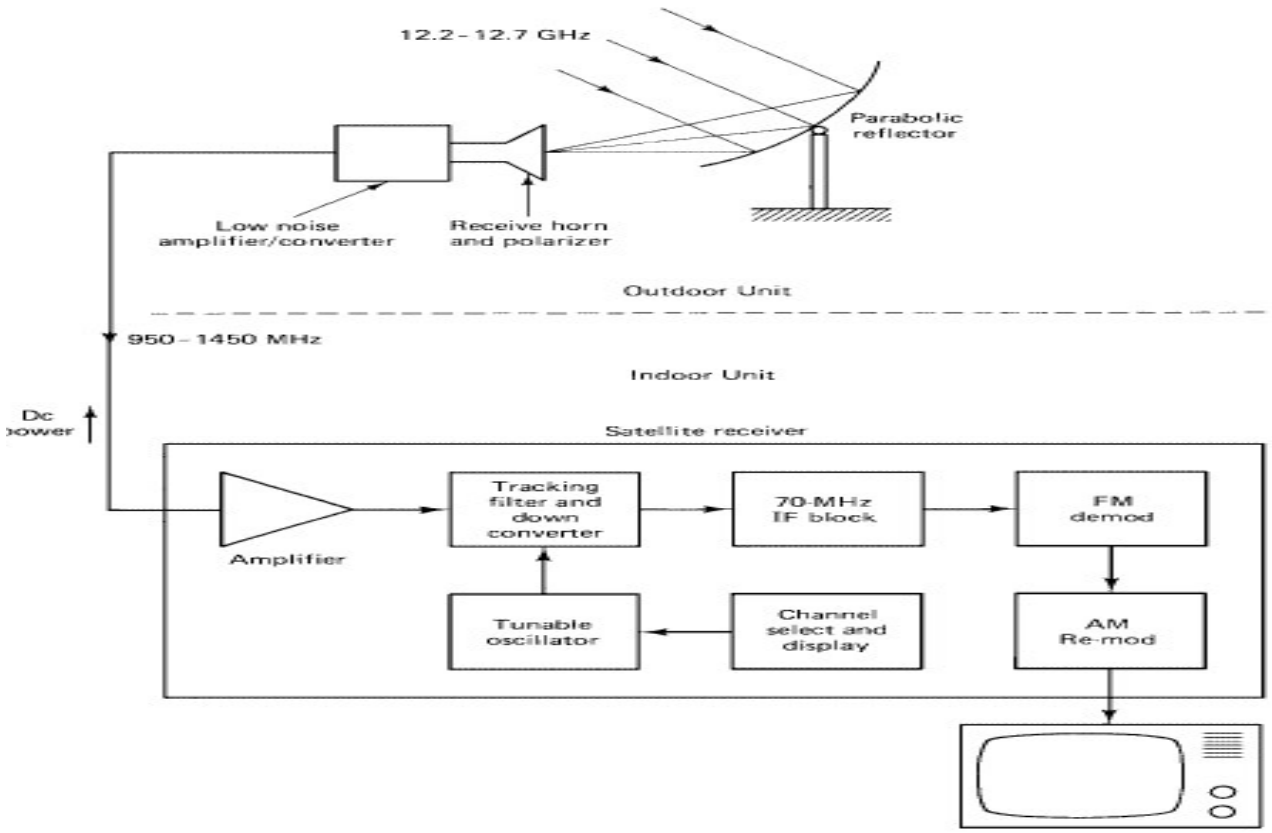
EARTH SEGMENT - I

5.1 Introduction

The earth segment of a satellite communications system consists of the transmit and receive earth stations. The simplest of these are the home TV receive-only (TVRO) systems, and the most complex are the terminal stations used for international communications networks. Also included in the earth segment are those stations which are on ships at sea, and commercial and military land and aeronautical mobile stations.

5.2 Receive-Only Home TV Systems

Planned broadcasting directly to home TV receivers takes place in the Ku (12-GHz) band. This service is known as direct broadcast satellite (DBS) service. There is some variation in the frequency bands assigned to different geographic regions. The comparatively large satellite receiving dishes (about 3-m diameter) which are a familiar sight around many homes are used to receive downlink TV signals at C band (4 GHz). Such downlink signals were never intended for home reception but for network relay to commercial TV outlets (VHF and UHF TV broadcast stations and cable TV "head end" studios). Although the practice of intercepting these signals seems to be well established at present, various technical and commercial and legal factors are combining to deter their direct reception. The major differences between the Ku-band and the C-band receive-only systems lies in the frequency of operation of the outdoor unit and the fact that satellites intended for DBS have much higher EIRP.



5.3The outdoor unit

This consists of a low noise amplifer/converter combination. A parabolic reflector is used along with horn mounted at focus.

The downlink frequency band of 12.2 to 12.7 GHz spans a range of 500 MHz, which accommodates 32 TV/FM channels, each of which is 24 MHz wide. Obviously, some overlap occurs between channels, but these are alternately polarized left-hand circular (LHC) and right-hand circular (RHC) or vertical/horizontal, to reduce interference to acceptable levels. This is referred to as polarization interleaving. A polarizer that may be switched to the desired polarization from the indoor control unit is required at the receiving horn. The receiving horn feeds into a low-noise converter (LNC) or possibly a combination unit consisting of a low-noise amplifier (LNA) followed by a converter. The combination is referred to as an LNB, for low-noise block. The LNB provides gain for the broadband 12-GHz signal and then converts the signal to a lower frequency range so that a low-cost coaxial cable can be used as feeder to the indoor unit. The standard frequency range of this downconverted signal is 950 to 1450 MHz. The coaxial cable, or an auxiliary wire pair, is used to carry dc power to the outdoor unit. Polarization-switching control wires are also required.

The low-noise amplification must be provided at the cable input in order to maintain a satisfactory signal-to-noise ratio. A low-noise amplifier at the indoor end of the cable would be of little use, because it would also amplify the cable thermal noise. Of course, having to mount the LNB outside means that it must be able to operate over a wide range of climatic conditions, and homeowners may have to contend with the added problems of vandalism and theft.

5.4 The indoor unit for analog (FM) TV

The signal fed to the indoor unit is normally a wideband signal covering the range 950 to 1450 MHz. This is amplified and passed to a tracking filter which selects the desired channel. As previously mentioned, polarization interleaving is used, and only half the 32 channels will be present at the input of the indoor unit for any one setting of the antenna polarizer. This eases the job of the tracking filter, since alternate channels are well separated in frequency.
The selected channel is again downconverted, this time from the 950- to 1450-MHz range to a fixed intermediate frequency, usually 70 MHz although other values in the VHF range are also used. The 70-MHz amplifier amplifies the signal up to the levels required for demodulation. A major difference between DBS TV and conventional TV is that with DBS, frequency modulation is used, whereas with conventional TV, amplitude modulation in the form of vestigial single sideband (VSSB) is used. The 70-MHz, frequency-modulated IF carrier therefore must be demodulated, and the baseband information used to generate a VSSB signal which is fed into one of the VHF/UHF channels of a standard TV set.