VSAT

VSAT is the acronym of Very Small Aperture Terminal, the term ‘Very Small’ coming from relatively small sized antenna mounted on walls, roof tops or ground. VSAT is capable of sending audio, video, data at very high speed via satellite and thus can be at a far off place or unconnected to a terrestrial switching centre. In India, there are more than 45000 VSATs, nearly 75 percent of them are in commercial sector and rest for captive use. The size of the antenna in VSAT varies (0.55-1.8 m) with the frequency band of use. While a C-band (3-7 GHz) VSAT terminal requires larger diameter antenna, the Ku band (10-18 GHz) antenna is smaller and Ka band (18-31 GHz) antenna the smallest. However, at higher frequency range the signal quality is affected by presence of moisture in atmosphere or rainfall. Hence, in Asian countries like India where more rainfalls are expected C-band VSAT is more popular. The present trend is to move towards higher frequency that requires smaller dish as well as due to availability of spectrum. The home consumer service is dominated by Ku band terminals. The possible applications of VSATs are in areas such as (i) Telephony (ii) Banking (iii) Distance education (iv) Telemedicine (v) Video conferencing (vi) Media (vii) Virtual Private Network (VPN) etc.

Fig. 1 shows an arrangement where communication is taking place via VSAT that has three distinct components, (i) satellite (ii) a central hub and (iii) virtually unlimited number of VSAT earth stations at different locations but within the foot print of the communicating satellite. The satellite used for VSAT communications are in geosynchronous orbits so that VSAT antennas are stationary. In certain systems satellites in inclined orbits (usually ageing satellites offering services at cheaper rate) can be used for VSAT communication where the earth station antenna needs to slowly track the satellite. The hub uses a larger sized antenna (4.5-11 m) and controls the network through a Network Management Server (NMS). NMS allows network operator view, modify configuration information to individual VSAT and monitor, control all components of the network. Such a configuration is known as ‘Star’ network and is most popular for VSAT network for its easy operability. The one major drawback of star network is higher propagation delay. The signal travels from source terminal VSAT to hub via satellite (one hop) and then again from hub to destination terminal through satellite (second hop). Since, GEO satellites are at very high altitude (approx. 36000 km) two hops require approx. 500 ms delay which is not good real-time traffic like voice communication.

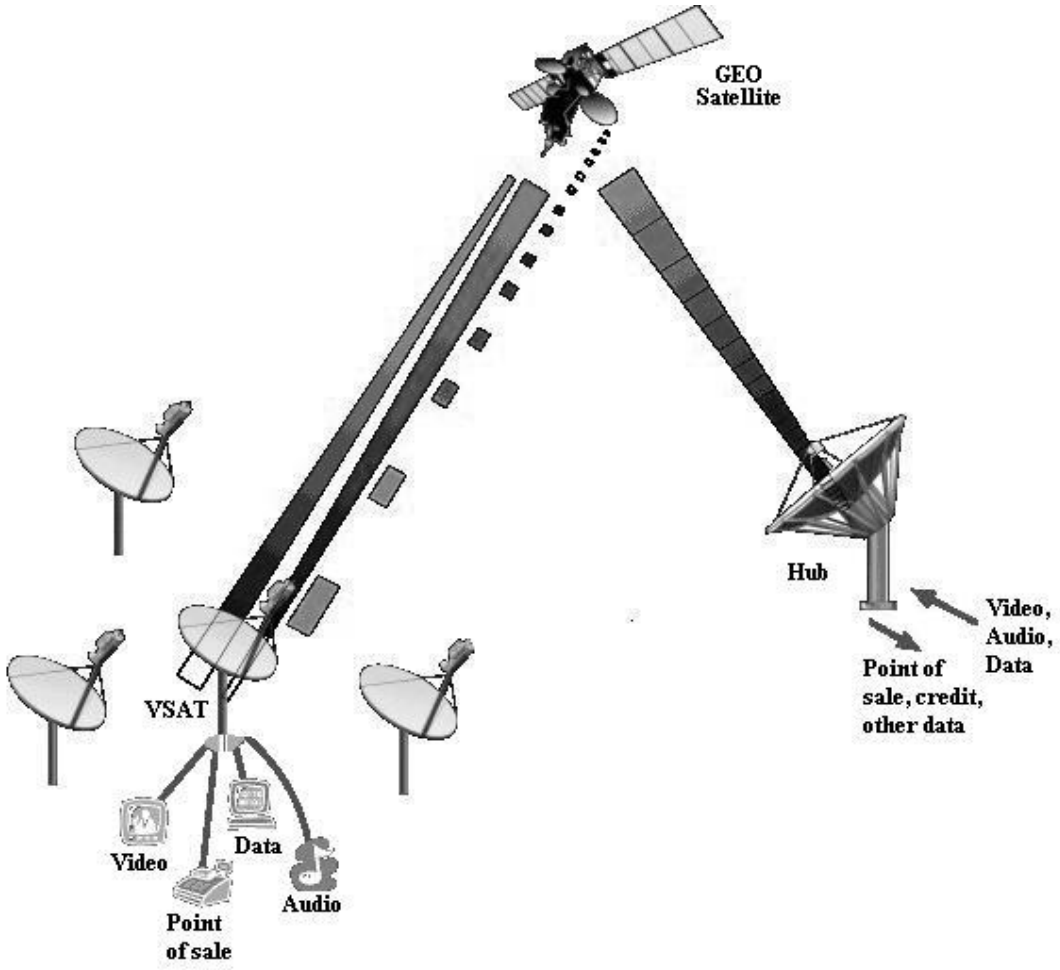

Fig. 1 : A VSAT based communication network

In ‘Mesh’ network one VSAT can communicate to another VSAT directly requiring single hop and lower delay. However, each VSAT requires higher power, higher antenna size, more complex set up and thus costlier than ‘Star’ as there is no centralized large sized antenna in the form of hub to communicate to. There are ‘hybrid’ networks available where a mix of both star and mesh topology are found. In ‘broadcast’ type networks message is only received by more than one VSAT as seen in television, radio broadcasting. Point to point communication involves communication between two stations through dedicated channel. This is costlier but offers higher bandwidth.

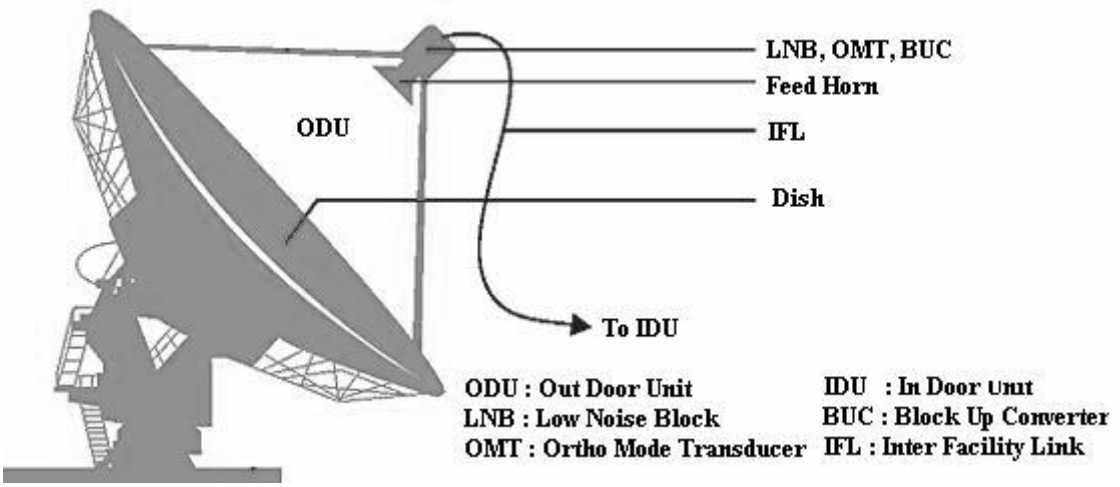

Fig. 2 : A VSAT earth station Out Door Unit.

Fig. 2 shows various components of a VSAT earth station's ODU and full form of various acronyms. The ODU consists of a dish antenna and a receiver-transmit assembly on mechanical mount. The receiver-transmit assembly; also called feed assembly is connected to IDU via IFL. The weak noisy signal coming from satellite is reflected and collected at the focal point of dish antenna by feed horn. The LNB amplifies this signal and down converts its frequency to go to IDU via IFL. In transmission mode, the signal coming from IDU is up converted by BUC to feed to feed horn. The LNB and BUC is separated by OMT and transmit reject filter to avoid mixing or interference of transmit and receive signal. The IDU contains a modulator-demodulator, together called *modem*. The receive-only VSATs do not require any modulator. Note that VSAT should have a clear and unobstructed view of the satellite with which it is communicating.

For efficient use of expensive and finite bandwidth several access schemes are present. In Single Channel Per Carrier (SCPC), VSAT is allocated a dedicated channel and thus is always 'on'. This is expensive but is useful where a guaranteed service is required. In Frequency Division Multiple Access (FDMA), bandwidth is shared and VSAT can transmit and receive only at predetermined frequency. In Demand Assigned Multiple Access (DAMA), a VSAT is allocated a communication channel only when it places a demand. DAMA is usually used together with SCPC or FDMA to improve bandwidth utilization. In Time Division Multiple Access (TDMA), each VSAT communicates in its own time slot and at that time entire bandwidth is available. However, to make this useful the VSAT must have enough information to transmit, also it needs higher power. In hybrid system, the VSAT can use one access scheme for transmission and the other for reception. The Forward Error Correction (FEC) techniques used in VSATs include (i) Convolutional encoding (ii) Reed-Solomon Code (iii) Concatenated Convolutional and Reed-Solomon Code (iv) Turbo Code etc. (Note that, these coding schemes are discussed in details in main text book.)