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STUDY OF TERABIT/S SATELLITE FOR INDIA

Abstract

With the transformation of the globe into a digital world, the demand for data is increasing tremendously. Requirement for Internet broadband services is growing rapidly in India year by year, being driven by high quality video (4K) streaming and other multimedia applications. The advent of "Digital India" necessitates high speed internet in even remote places of the country. The evolution of mobile technologies to 4G and beyond has witnessed newer applications and a drastic increase in the data speeds. Satellites are best suited to provide broadband services to areas that are unserved or under-served by the terrestrial systems. Hitherto, Geo-HTS were providing Gbps rates. Keeping in view the enormous rise in data requirement, it is time for India to move towards "Terabit/s satellites". Huge bandwidth is required to achieve terabit/s data rate. Conventionally, Ku band is primarily used for Direct to Home systems whereas Ka-band for broadband application. Both cannot meet the bandwidth requirements of a terabit/s satellite. Hence Q/V band is considered as prime option for this study. For a terabit/s satellite, the bandwidth required per user beam will be around 1.5GHz. For a given coverage area, the throughput is a function of the number of beams, spectral efficiency, BW, beam size and frequency re-use factor. A detailed trade-off study is carried out to arrive at an optimal configuration. High throughput can be easily achieved by providing service to a select few places in India as it simplifies the spatial diversity constraint in spot beam technology, enabling more bandwidth per beam. However, here the requirement is to provide pan India coverage, which comes with several design complexities. The required number of beams with 0.3 degrees beam-width are well above 100. Reducing the beam-width increases the number of beams resulting into various challenges especially accommodation of feeds as well as stringent control accuracy. On the other hand, increasing the beam-width results in lesser EIRP at the edges of the beam and would require higher on-board radiated power. This paper deals with the complexities in detail and strike a trade-off between all the above constraints. This paper analyses the data rates achievable for various configurations of bandwidth, number of beams and spectral efficiency. This apart, link budget to meet the requirements is also elaborated. Keeping all aspects in view, an optimal terabit/s satellite configuration is converged along with the future technologies required to make Terabit/s satellite a reality.