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FREE SPACE OPTICAL COMMUNICATIONS : A NEW SOLUTION FOR VERY HIGH-SPEED
FEEDER LINKS OF VHTS

Abstract

In recent years, we assisted to the development of the Very High Throughput Satellites (VHTS) whose ambition is to provide very high-speed Internet access to millions of terminals over vast coverage. Throughput targets are in the hundreds of gigabit per second and should exceed the terabit for future generations of satellites. These systems should achieve these impressive performances, on the user side, thanks to massive multi-beam coverage and extended frequency reuse of the Ka-band. Difficulty comes as to size the feeder link of these satellites, i.e. the link connecting the satellite to terrestrial fiber optic networks (Internet backbones). The use of Q/V frequency bands, beyond the Ka-band, addresses this problem. However, it requires a large frequency reuse factor and thus the commissioning of many feeder stations. With the next VHTS in the terabit class, a new solution is welcome to improve the deployment of feeder station networks. This paper proposes a new solution for feeder links of the next generation of VHTS. Free-space optical communications have reached sufficient technical maturity to provide a viable and cost-effective alternative to the radio-frequency feeder station networks. It becomes possible to feed a VHTS with a single optical ground station. Unfortunately, the optical links are blocked by clouds. It is so necessary to implement a site diversity network of a dozen stations to achieve an acceptable availability level. Despite this setback, this technology should provide a cost-effective and performing feeder ground segment. The paper presents the architecture of the optical feeder ground segment, its benefits and drawbacks, and it illustrates the deployment of the solution in an European case study.