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SOFTWARE-DEFINED CONSTELLATION OF SMALL LEO SATELLITES OF THE W-BAND WIRELESS NETWORK: REALITY AND FUTURE PROSPECTS.

Abstract

This article describes a software-defined constellation of low-orbit W-band RAN satellites, which was studied and developed by the authors. The increase in the frequency band to the W-band, E-band is due to the fact that frequency allocations in S X Ka Ku bands get increasingly crowded and difficult to obtain. In the W-band, we can ensure the miniaturization of technology, as well as wider ranges and higher amount of transmitted data rate. The designed constellation consists of small spacecraft - cubesats / nanosats. We can observe a trend towards an increase in the number of low orbit satellite constellations in recent years. These constellations are characterized by a decrease in the size of satellites, an increase in the depth of digital processing (routing, transport layer). In addition, the miniaturization of satellites makes outer space safer and reduces the number of new debris objects. Mini satellites are completely destroyed when they re-enter the Earth's atmosphere; the small cross-sections of the satellites make them much less vulnerable to collisions. This makes the LEO constellations more attractive than their larger counterparts. Orbital parameters will be considered, duration of contact with ground stations and visibility conditions on the surface will be determined. Distributed satellite systems are being used to achieve improved temporal and spatial resolution of observations, as well as higher response speed, reliability, and smoother descent in the event of errors. Satellite networks with global coverage, not limited by geographical restrictions, have attracted the interest of the scientific community and industry. Next-generation satellite networks differ from previous satellite networks in that they have built-in processing, low-cost tracking antennas, and inter-satellite communications. This work is exploratory in nature and answers the question of what solutions can be applied in the coming years. The theoretical limits on network throughput with limited size and available energy will be explored and described. Several methods will be proposed for increasing the payload and expanding the network for inter-satellite and subscriber communications, digital signal processing and protocol stack, as well as the satellite subsystem. The current state and further prospects for the development of this technology are described. The purpose of the designed constellation is to

provide higher data return, provide autonomous airborne navigation with less dependence on ground tracking data and significantly reduce the total operating costs of future research missions.