Planar Antennas for Small Satellite

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ABSTRACT

In today's era of wireless communication, there has been increased need of high speed communication to achieve high quality transmission of voice, video or data. Satellite communication is one of the most important modes of wireless communication and has a significant role in the field of global telecommunications. There are approximately 2000 artificial satellites orbiting Earth and enable communication to and from multiple locations across the globe. One of the advanced satellite technologies is 'small satellites' which enables a number of tasks and experiments in space previously considered impossible or impractical. Small satellites came into existence because of the evolved miniaturization technologies. Besides the advantages of small satellite, it is a challenge to provide all necessary components within the physical limitations and restrictions. One of the main concerns for small satellite is to have adequate, efficient and economically viable antenna. Antennas are indispensable components in the design of satellite communication systems. The employment of lower frequency antenna (UHF/VHF) requires large antennas due to their large wavelength. Low speed communication, deployable monopole and 3D antennas are unsuitable for small satellite applications as they increase complexity of operation and the possibility of failure. For modern small satellite communication systems, the antennas must be of low profile, compact size, light weight, low cost, high gain, highly directive and conformable to the architecture of the mounting surface. Planar antennas are one of the primary candidates for such applications, especially because of their lightweight and low profile characteristics but often suffer from intrinsically low gain. Besides, satellite communication often requires circular polarization to alleviate any orientation related issues of the receiving base station antennas. In this talk, I will present two planar antennas, one for S band and another for UHF application for small satellite. The S band antenna consists of four asymmetric V-shaped slits, one at each corner of a rectangular patch, and a parasitic rectangular strip which is properly excited in order to have the maximum gain in the boresight direction and produce circular polarization. The proposed antenna structure has achieved by using the Ramped Convergence Particle Swarm Optimization (RCPSO) algorithm. The antenna has a compact size with design simplicity and its geometry and performances are compatible with any small satellite structure. The proposed s band antenna was also integrated with a small satellite body and

different test has performed such as atomic oxygen test, plasma environment test, microwave test and thermal vacuum test and mechanical stress tests. The second antenna is designed for UHF (437 MHz) applications. The proposed design consists of meander line patches with a partial ground plane with compact size.