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Author: Ms. Arya Menon
Manipal Institute of Technology, Manipal University, India, arya.menon@learner.manipal.edu

Mr. Pramath Keny
Manipal Institute of Technology, Manipal University, India, pramathkeny1991@gmail.com
Mr. Gaurav Mohta
Manipal Institute of Technology, Manipal University, India, gauravmohta911@gmail.com

DESIGN OF SMART ANTENNAS FOR NANOSATELLITES

Abstract

Nano-Satellites due to their small size and mass limitations pose a tight constraint to the selection of on-board antennas. Furthermore most of these Nano-Satellites communicate in the band of 144 – 146 MHz in the VHF range and from 434 – 438 MHz in the UHF range. Designing antennas at these frequencies usually makes them larger than the actual Nano-Satellite itself. Typically Nano-Satellites incorporate Monopole or the Dipole Antennas for communication purpose since these antennas can meet the strict design requirements. These antennas are characterized by Omni-Directional radiation pattern having a low directivity and a large Beamwidth; this leads to the antennas being less efficient and also amounts to a large power loss in the communication link. In this paper we propose a Smart Antenna system for a Nano-Satellite consisting of a Monopole based phased array. The radiation pattern of this array can be adjusted depending upon the attitude and orientation of the Nano-satellite using an on-board controller. The radiation pattern can be made highly directional towards the ground station during the downlink operation whereas it can be made Omni-directional when the satellite is unable to maintain its pointing accuracy thus ensuring a reliable communication uplink irrespective of its state of stability. This adjustable radiation pattern of the smart antenna system can be used to overcome the pointing accuracy losses and also will provide sufficient gain to help boost the communication link budget. The design and simulation of the complete Smart Antenna System along with deployment mechanisms will be summarized in the paper.