

Mechanically Actuated Low-Profile Reconfigurable Circularly Polarized Antenna for CubeSats

Michail O. Anastasiadis*, Alexander D. Johnson, Vignesh Manohar,
Satheesh B. Venkatakrisnan, and John L. Volakis
Florida International University, Miami, Florida

The development of compact, low-cost reconfigurable antennas for CubeSats with reduced hardware complexity are important for exoatmospheric applications. Specifically, reconfigurable antennas that can adapt their pattern characteristic and be packable within small CubeSats (typically 1kg weight for a 1U size) are highly valuable.

Conventional reconfigurable antenna apertures employ active tunable components that offer fast reconfiguration, but at the cost of high power consumption. Additionally, complex bias circuitry may be required for optimal performance of these active components. As an alternative, in this paper we propose mechanical actuation that can reconfigure the antenna and avoid biasing networks. When combined with light-weight and low power actuation, the proposed antenna can be more attractive to CubeSat missions that may require dynamic reconfiguration.

The presented antenna is illustrated in Fig.1(a). It consists of a U-slotted patch antenna with unequal arms (no.1 in Fig.1(a)) loaded by superstrates. The patch antenna itself is circularly polarized and operates at 14-14.5 GHz, an allocated frequency band of Fixed Satellite Service. The patch gain is 7.2dB with an axial ratio under 3dB. To switch the band of operation, an actuator is used to move the corresponding superstrate on top of the antenna. If operation at the 12.2-12.7 GHz band (Direct Broadcast Service) is desired, superstrate no.2 is employed. The simulated gain of the antenna at this frequency band is 12.5dB. Similarly, other superstrates are designed to reconfigure the frequency and gain of the antenna as summarized in Table 1. In the presentation, the antenna design details and mechanical reconfiguration will be presented along with measurement results.

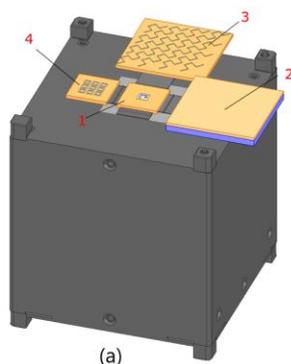


Table 1

Components used	Operating Frequency (GHz)	Polarization	Gain (dBi)
1	14 – 14.5	RHCP	7.2
1&2	12.2-12.7	Linear	12.5
1&2 & 3	12.2-12.7	RHCP	13
1&4	17.2-17.7	RHCP	8

Fig.1 (a) The proposed antenna mounted on a 1U CubeSat. (b) Operation of the antenna at different states.