OAM Generation Using an Experimental 8-Element Circular Array

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ABSTRACT

Radio communications based on antennas radiating Orbital Angular Momentum (OAM) modes has attracted much attention recently as it potentially provides a means to transmit multiple signals simultaneously at the same frequency to increase channel capacity and improve spectrum efficiency. OAM was first demonstrated (both conceptually and experimentally) in the optical regime. Research into OAM at radio wavelengths has largely been theoretical with very few example of experimental OAM radio antennas reported in the open literature. Some of the antennas suggested for generating radio frequency OAM modes include a discrete staircase non-focusing phase reflector, a helicoidal parabolic antenna, a circular phased array antenna and a time-switched array antenna. In this contribution, we will present details of an experimental circular phased array antenna designed to generate both positive and negative OAM modes at X-band.

The array consists of 8 microstrip patch antennas arranged in a circular configuration. A schematic of the array is shown in Fig 1a .In this example, the feed structure of the array is designed to provide the required progressive phase shift to generate the OAM +1 mode. The array was designed and optimised using CST Mircowave Studio and a theoretical prediction of the phase of the OAM radiated mode is shown in Fig 1b. The experimental array antenna was fabricated from a 1.6mm thick FR4 substrate and is shown in Fig 2. The OAM antenna was measured in the anechoic chamber with a NSI far-field system incorporating an Agilent HP8720 VNA. The measured -10 dB working bandwidth of the array antenna covers from 10.2 GHz to 10.7 GHz. Full measurement data will be presented at the conference.

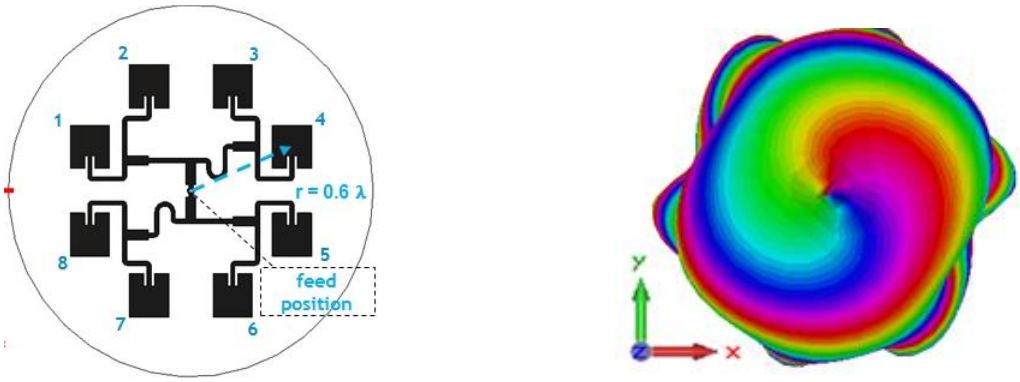

Figure 1. a) 8 element OAM array antenna and b) simulated radiation pattern (phase)

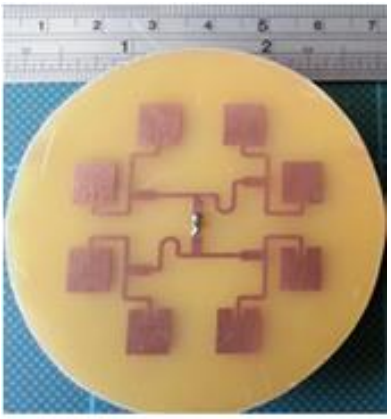

Figure 2. Experimental 8 element OAM antenna array