Foldable Tightly Coupled Dipole Array (TCDA) With Integrated Planar Feed Using LET Joints

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Compact and deployable wideband antennas can facilitate several emerging technologies such as small satellites, unmanned aerial vehicles, and autonomous vehicles. Specifically, wideband antennas allow the same radio to establish multiple wireless links thereby enabling compact and multifunctional wireless systems with reduced power and cost. A wideband antenna for such applications is the Tightly Coupled Dipole Array (TCDA). TCDAs are comprised of elements which are capacitively coupled to cancel the reactance from ground plane. As such, they maintain a stable, and mostly real input impedance across a very wide bandwidth. While TCDAs can achieve large bandwidths, conventional TCDAs occupy a large volume and typically employ a complex feeding system. Achieving ease of packaging and portability can facilitate its integration within small sattelites.

While TCDAs are broadband, designing a wideband feed is crucial. Using an integrated Marchand balun feed is a popular choice that serves as an impedance transformer to achieve greater than 10:1 bandwidth. Other balun types such as the Klopfenstein balun or exponentially tapered balun can provide bandwidth up to 46:1 with VSWR<3. But this is done at the cost of increased profile height and design complexity impeding packaging.

In this paper a foldable dual polarized TCDA is proposed that can be packed in a reduced volume with higher packing ratio. The TCDA is fed by a planar microstrip feedline that extends to the dipole arms. A magnetic choke is also added to suppress common modes. With this design a bandwidth of 5:1 (0.42 GHz-2.10 GHz) is achieved with VSWR <3 with scanning down to 45˚ in both E and H planes. The TCDA is simulated on a Miura pattern, where the spacing between the adjacent array elements is $0.52\lambda_{High}$ (λ_{High} wavelength at 2.10 GHz). The overall profile height of the array is 50 mm ($\lambda_{Low}/14$, where λ_{Low} is the wavelength at 0.42 GHz). To maintain the impedance match during scanning, a superstrate layer consisting of periodic square metallic patches is incorporated. The focus of this paper is to demonstrate the folding design of the TCDA so that it can have a high packing ratio. Simulations and folding mechanism details will be shown at the conference.