Ultra-wideband TCDA-IB with substrate loading for Dual Polarization

Dimitrios Papantonis*, Markus H. Novak, John L. Volakis
ElectroScience Laboratory, Electrical and Computer Engineering Dept.
The Ohio State University, Columbus, OH, 43212.

Tightly coupled dipole arrays (TCDA) are lately of high interest due to their ability to synthesize wide-band, low-profile and wide-scan performance. Our interest focuses on dual-polarized TCDA for efficient bandwidth exploitation through separate orthogonal channels allowing for polarization diversity. Key challenges are high isolation and low cross-polarization levels between orthogonal ports.

So far, a great number of papers have been published and much effort has been devoted to dual polarized arrays. In order to integrate multiple bands in a single aperture, while maintaining low reflection and high polarization purity, several trade-offs must be considered. For instance, some designs demonstrate high performance with wide bandwidths but lack in size and compactness, whereas others concentrate on price and simplicity, thus, restricting their capabilities.

In this paper we present an expanded version of the TCDA- Integrated Balun (IB) (W. Moulder, IEEE Transactions on Ant. and Prop., 60, 4166-4172, 2012), an ultra-wideband, dual-polarized array with substrate loading and superstrate enhancement. The substrate loading eliminates resonances at frequencies where the ground-plane distance becomes half-wavelength, and doubles the bandwidth. A co-designed dielectric superstrate serves to enhance the radiation efficiency. The inter-element capacitance is critical to cancel the ground-plane inductance and is developed via dipole overlap. Both the radiators and the feed infrastructure (a folded Marchand Balun) are implemented on printed circuit boards, which offer a low cost solution. Our main effort focuses on maximizing the bandwidth and the scanning angle, while maintaining practical VSWR levels and reasonable efficiency.

In the meeting we will present a design which accomplishes a 13:1 infinite array bandwidth while maintaining above 70% efficiency at broadside. Full-wave simulation results are verified through measurement of an 8x8 prototype.