A Wideband Differentially Fed Tightly Coupled Dipole Array

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Low profile wideband antennas and arrays are key components for high data rate communications systems and software defined radios (SDRs). For these systems, an ultra-wideband (UWB) array replaces several narrowband antennas to achieve orders of magnitude reduction in power, cost, and space. Wideband systems also enable increased spectral efficiency, Multiple-Input-Multiple-Output (MIMO), and simultaneous transmit and receive (STAR) capabilities. Additionally, such arrays must operate across a wide angle scanning range for comprehensive spatial coverage.

Within the context of antenna arrays and their feed networks, differential Radio Frequency (RF) front-ends provide for much greater immunity to ground noise and distortion by suppressing external interference. Recent advancements in differential RF front-ends offer high dynamic range, high input linearity, and low noise in the transceiver chain. However, a major bottleneck with differential systems is the presence of a common mode when operating across a very large bandwidth. The major challenge in the design of a full differential radios is the reduction of common mode currents present at the aperture, and the inevitable mutual coupling between the ports that feed the aperture. If not addressed properly, these issues greatly reduce the impedance bandwidth of the balanced antenna structure.

In this paper, we present a novel ultra-wideband differential antenna array based on the well-established UWB Tightly Coupled Dipole Array (TCDA) concept. A specific differential TCDA (D-TCDA) array design is proposed for UHF-S band (*viz.* 0.4-3.4 GHz) with emphasis on dual-linear polarization and wide-angle scanning. This novel differential signal path implies high dynamic range and input linearity, as well as low noise in the transceiver chain across the entire frequency range. Array simulations are verified with measured results of an 8×8 prototype in a volume of 384mm×384mm×57mm. The array achieves 8.5:1 bandwidth for VSWR < 3 at broadside with scanning down to 45° from boresight in both E and H planes. The measured array gain achieved a near-theoretical gain across the entire operating bandwidth noted above. Measurements with comparison to simulations will be presented at the conference.