Modification, Modeling, and Measurement of a Balanced Antipodal Vivaldi for a Multi-Channel Receiver
USNC-URSI National Radio Science Meeting

Seth A. McCormick* [(1)] and William O. Coburn [(2)]
(1) General Technical Services LLC
(2) US Army Research Laboratory, Adelphi, Maryland, 20783
seth.a.mccormick.ctr@mail.mil

The modification, modeling, and measurement of a Balanced Antipodal Vivaldi (BAV) is presented. A BAV published in the literature is modeled to match published results and then modified to best meet the performance requirements for a multi-channel receiver. The design goals were to outperform the current Vivaldi receive antennas over the frequency band of 0.3 to 2.0 GHz while maintaining a total aperture width (multiple elements in cross range) of less than 2.2 m. Also, dual polarization was a requirement with 16 BAVs per polarization. The performance metrics for comparison included VSWR, realized gain, and front-to-back ratio. Careful modeling with the Method of Moments (MoM), Finite Element Method (FEM), and Finite Difference Time Domain (FDTD) provided high confidence in results before prototyping. Comparing simulated results and computational time between methods highlighted advantages of certain computational methods over others. Simulated and measured data comparisons showed excellent agreement and confirmed superior performance over the current receive antennas.

Further modeling explored antenna positioning to predict impacts on performance (primarily pattern perturbations) when in the presence of other elements. To minimize size, the 32 BAV elements were divided into 2 stacked, 16 element rows (8 elements per polarization). The rows are translated horizontally with respect to each other by one half BAV width. FDTD simulations with paired elements (one excited, one terminated) in the various expected combinations showed negligible to minor influence of neighboring elements. The total width of the receive aperture is 2.2 m, achieves the dual-polarization requirement, and out performs the current receive antennas.