# Broadband Collinear Arrays

James L. McDonald* [1,2], Farzin Lalezari [2], and Dejan S. Filipovic [1]
(1) Dept. of Electrical and Computer Engineering, University of Colorado, Boulder, CO 80309
(2) FIRST RF Corporation, 4865 Sterling Drive, Boulder, CO 80301

There is an ever increasing need for simple, robust, and multifunctional antennas that provide high gain over a large bandwidth. This is especially true for the next generation of communication systems, such as JTRS. Some of the joint systems operate in UHF and L-Bands and require antennas that can provide gain from +3 to +9 dBi within 225-2500 MHz range. In this paper, we investigate a collinear array topology as candidate for the high gain needs required for JTRS applications.

Conical dipoles and monopoles are integrated in a collinear fashion to provide a high gain broadband response. These antennas have inherently broadband impedance bandwidth, while the radiation pattern can have some significant undulations over the elevation. These pattern modifications are caused by both, element pattern stability, and arraying. In this paper, we expand on a method previously utilized for determining the antenna bandwidth that takes into account the radiation pattern stability over a specified field of view (J.L. McDonald and D.S. Filipovic, *IEEE Trans. Propagat.*, April 2008, 1196-1201). The radiation pattern of an array of resonant half-wave thin dipoles is used as a benchmark with respect to which the bandwidth is computed. The bandwidth of a monocone is increased by merging a cone with a circular cylinder at the position referred to as the junction location. The cone angle and junction location are optimized by using an efficient global optimizer to determine the best geometry for a modified monocone-bicone collinear array. A number of different cost functions for the optimizer are also explored. A full-wave method of moments model is used to study the mutual coupling of the optimal geometries and their effect on antenna performance. Finally, a number of different methods to minimize the coupling effects on the monocone-bicone collinear array are investigated, individually and in combinations. It is shown that the monocone-bicone collinear array arrangement can provide stable pattern and high gain over several octaves of bandwidth.