

A Uniplanar Dual-band Antenna Array Feed Network Employing MTM-EBG Filtering Crossovers

Samuel Clark, Braden P. Smyth, and Ashwin K. Iyer
University of Alberta, Edmonton, AB, Canada

The metamaterial-based electromagnetic bandgap (MTM-EBG) structure is a fully planar, periodically loaded multiconductor transmission line (MTL) structure (S. Barth et al., “A Miniaturized Uniplanar Metamaterial Based EBG for Parallel-Plate Mode Suppression,” *IEEE Transactions on Microwave Theory and Techniques*, Vol. 64, No. 4, 1176-1185, April 2016). The size and location of the bandgap can be easily controlled by varying the reactive loading and/or host-MTL properties of the MTM-EBG unit cells. The MTM-EBG has been extended to two dimensions in order to model the uniplanar compact EBG (UC-EBG) (S. Barth et al., “The MTM-EBG as a Rigorous Multiconductor Model of the UC-EBG and Approaches for Miniaturization,” *IEEE Transactions on Antennas and Propagation*, Vol. 70, No. 4, 2822-2831, April 2022). Similar to the 1D MTM-EBG, the 2D MTM-EBG exhibits a bandgap at certain frequencies but unlike the 1D MTM-EBG, it can possess different bandgaps for the two planar directions of propagation (x and y), as determined by the reactive loading and/or host MTL properties of the unit cells. This property has been exploited to create a frequency-dependent microstrip crossover (S. Clark et al., “Fully Embedded Microstrip Filtering Crossover Using 2D MTM-EBGs,” *2024 IEEE INC-USNC-URSI Radio Science Meeting*). In particular, at a frequency f_1 , propagation is allowed on the x -directed microstrip line while isolated from the y -directed line. At a different frequency f_2 , propagation is allowed on the y -directed microstrip line while isolated from the x -directed line.

In this talk, we present a practical implementation of this microstrip crossover technology for operation at 2.4 and 5.8 GHz using surface mounted reactive elements. Further, we present the design of a crossed antenna feed network employing these 2D MTM-EBG based microstrip nodes. One feed network, feeding a 2×1 microstrip patch antenna array at 2.4 GHz is implemented on the same layer as a separate feed network, feeding a 2×1 microstrip patch antenna array at 5.8 GHz. Because these two feed networks exist on the same layer, there are four nodes where the microstrip lines of the two feed networks cross each other. By implementing 2D MTM-EBG unit cells at these nodes, the two feed networks are effectively isolated from each other. Further, the matching and bandwidth of the crossed feed network at its two operating frequencies is comparable to the single-band feed networks operating at 2.4 GHz and 5.8 GHz individually. This technology can be generalized to larger array feed networks as well as the feed networks for shared aperture arrays.