

Compact Multi-Layer Wilkinson Power Divider for Wideband Phased Arrays

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Over the past several decades, phased arrays have become an important component in communications and national defense. Their applications include RADAR, satellite communications, radio telescopes, broadcasting, and amateur radio. Many of these wideband phased array designs are large and require ample space for phase shifters and feed networks comprised of traveling wave components. Dr. Ben Munk changed the array design paradigm when he proposed a tightly coupled array (TCA). The TCA is much more compact by having less than quarter wavelength element spacing compared to conventional arrays and yields a wider bandwidth. For this application, a TCA is designed for airborne communications and the limited space and weight restrictions called for a compact feed network with phase shifters. The feed network ensures each properly weighted element receives the same signal phase. This feed network contributes to beam formation, side lobe level, signal combining or splitting, gain, efficiency, operating range, and many other system level requirements. For this mobile TCA phase array, weight and space are a factor, therefore a compact multi-layer wideband Wilkinson combiner is designed. A problem for multi-layer microwave circuits encompasses engineering the multi-layer transition for striplines. Stripline with embedded resistors are selected over conventional microstrip and surface mount resistors to produce a low profile and light weight Wilkinson divider to interface with the compact TCA and adds EMI and EMC signal protection. This presentation will discuss the design, fabrication, and performance of a wideband compact multi-layer Wilkinson power divider designed for phased arrays. Designing the Wilkinson divider with multi-layer transitions will be discussed. Measured and simulated results will be provided.