## A Wideband 8x8 Butler Matrix featuring compact branch-line hybrid couplers for AWS and PCS 1900 MHz Beamforming Nextworks

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## Abstract

This paper describes the design and implementation process of a wideband 8x8 Butler Matrix for beamforming networks in the AWS and PCS 1900 MHZ bands. In order to obtain a system able to operate in the frequency range of 1710 MHz to 2155 MHz, compact wideband branch-line hybrids, Schiffman phase shifters, parallel Schiffman phase shifters and no crossovers were used to implement the wideband 8x8 Butler Matrix. The final operation range for the 8x8 Butler Matrix is 1.65 GHz to 2.2 GHz and 2.3 GHz to 2.6 GHz with amplitude around 10 dB±0.75 dB and maximum phase imbalance of  $\pm 7.5^{\circ}$  for the output port signals. Finally, an 8-element linear array of printed Quasi-Yagi antennas was introduced in the system to verify the beamforming functionality of the 8x8 Butler Matrix. Measured radiation patterns show that the 8x8 Butler Matrix is able to provide adequate phase difference and uniform amplitude to the antenna array in order to function as a beamforming network over the frequency range of interest.