

Electronic Scanning of Antennas

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Electronic scanning of antennas is used in a variety of applications. This is accomplished using Beam Forming Networks (BFNs). One of the widely used BFN is the Butler Matrix. A Butler Matrix is a circuit type Beamformer. Conventional Butler matrices consist of Hybrids and phase shifters. The Butler Matrix is a $N \times N$ passive microwave networks, consisting of 'N' input and 'N' output ports, used to feed an array of 'N' antennas. The above $N \times N$ networks generates a set of 'N' orthogonal beams, which could scan the whole visible region. Since, they are constructed with simple transmission lines, they are inherently narrow band structures.

A novel design of the butler matrix is presented at X band (8 GHz – 12 GHz), which enhances the bandwidth by using broad banding techniques to obtain wider bandwidth performance from the transmission point of view. Problems encountered in designing such networks at high frequencies are addressed. The designs are simulated using a full wave commercial code based on the method of moments. The networks are then fabricated and tested using an Agilent's 8712C Network Analyzer to obtain the S-parameters. Good agreement between the computed and measured results is obtained.