

## Dual Mode Phased Array Antenna using Silicon RFICs based Integrated Beamforming Network

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A dual mode ( $TM_{11}$  and  $TM_{21}$ )  $2 \times 4$  phased array antenna at Ku-band is proposed using silicon RFICs based integrated beamforming network. The Anokiwave RFICs (AWMF-0117) provide flat panel integration of the beamforming network with the antenna aperture and has features of 6 bit variable amplitude and phase shift control. The radiating element is a dual mode concentric ring patch and is capable of pattern reconfiguration between broadside and conical patterns. We can excite both modes in the phased array antenna ( $TM_{11}$  and  $TM_{21}$ ) with proper amplitude and phase values so that we can suppress any grating lobes present in the beam steering array performance. These are attractive traits in a crowded electromagnetic environment for a variety of reasons.

The proposed phased array antenna will be using inter-element spacing of  $1.25\lambda$  in order to create sufficient space for the beamforming network layer so that all the RF components and Anokiwave RFICs can be placed. In this case,  $\lambda$  is free space wavelength at 14.5 GHz. This inter-element spacing selection creates a challenge for grating lobe free beamforming for the dominant mode ( $TM_{11}$ ) patch based phased array radiation performance. To suppress any grating lobes in the dominant mode array, we can use beam steered patterns of the  $TM_{21}$  mode patch based phased array with proper amplitude and phase excitations. Therefore, this work will involve designing a dual mode flat panel phased array antenna with integrated beamforming network and an appropriate beamforming algorithm to perform mode combination with proper amplitude and phase control. Figure below shows a layout of the proposed phased array and beamforming network layers. The phased array will be built and tested in the Antenna and Microwave Lab (AML) at San Diego State University for both impedance and radiation performance parameters.

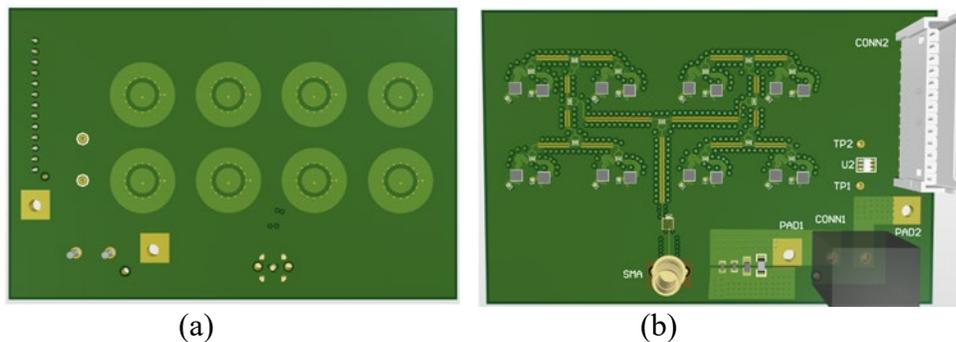


Figure: (a) Proposed  $2 \times 4$  dual mode microstrip phased array antenna aperture and (b) Beamforming network layer with RFICs.