Near Field Focused Microstrip Array with a Dolf-Chebyshev Design

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A new concept in designing array antennas to focus the microwave power in the radiation near-field region is presented. A small 4×4 focused array antenna using microstrip patch elements to achieve desired sidelobe levels in the Fresnel region based on Dolph-Chebyshev design is implemented. A quadratic phase taper and Dolph-Chebyshev amplitude distribution were applied to the elements of the array to obtain -20dB SLL and a focal distance of 20 cm. This array is build to verify the concept and measured and computed fields are compared to verify the accuracy of the design. Fig. 1 shows the measured and simulated electric field of the antenna in the axial direction. It is seen that the measured and simulated results are in good agreements. The maximum intensity of the electric field is at $z=6.2cm$ distance while the focal point is at $z=20cm$ distance from the antenna aperture. Moreover, a large 64×64 array antenna by using the prediction of mutual admittance of elements from the small array antenna is presented. For this large array, Dolph-Chebyshev amplitude tapering and various quadratic phase distributions are considered to focus the power at different distances from the antenna aperture and all have -40dB SLLs. As it is shown in Fig. 2 the maximum intensity of the electric field is closer to the antenna aperture than the focal point where all of the rays contribute in phase because of the quadratic phase distribution on the aperture. In addition, it is shown that using this designing method, desired sidelobe levels in the electric field pattern at the maximum intensity plane, close to the axis of the antenna, can be achieved.

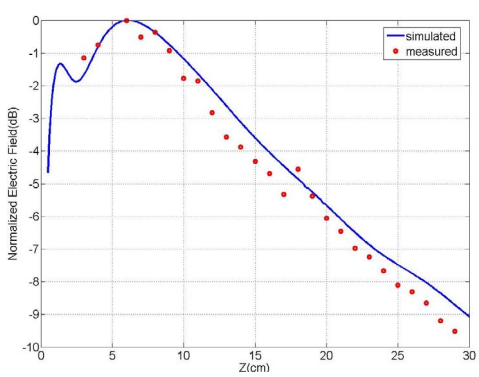

Fig. 1 The simulated and measured normalized electric field intensity of the 4×4 microstrip patch array antenna in

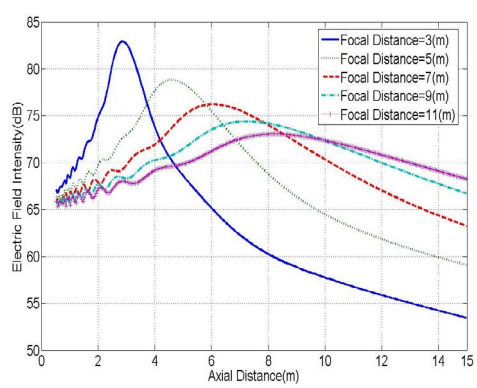

Fig. 2 Electric field intensity of the 64×64 microstrip patch array antenna in the axial distance for different focal