Dual-Polarized Series-Fed Frequency Scan Microstrip Array Antenna with High Polarization Purity

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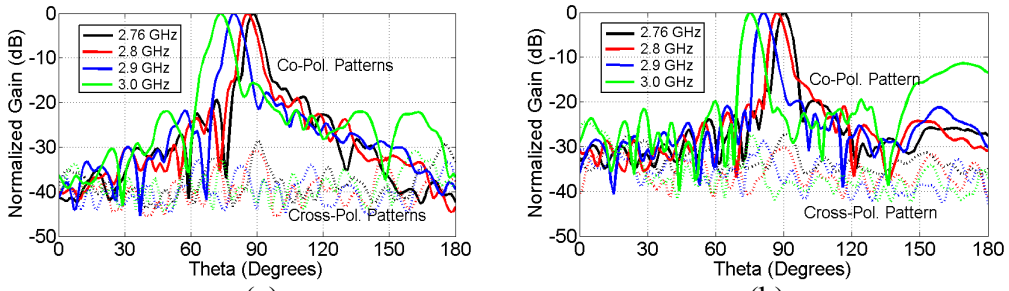
A dual-polarized frequency scanning array with high polarization purity is designed for weather measurements. Frequency scanning array antenna is a series fed phased array antenna, where beam scanning occurs by changing the frequency of the exciter (I. W. Hammer, McGraw-Hill, 1970). Although the design of frequency scanning microstrip array antennas has been considered for many years, dual-polarization capability with high cross-polarization isolation and low sidelobe requirements make the antenna design cumbersome and challenging (Sainati, Artech House, 1996).

In the current design, the multilayer microstrip patch technology is used to achieve high isolation and low cross polarization. The array antenna is operating at the frequency band of 2.7 – 3.0 GHz. The antenna consists of the radiating patches, parasitic patches, two main transmission lines, and two ground planes. The desired power is coupled through the aperture on the ground plane on third layer. The linear patch elements are fed by two series fed terminated to 50 Ω matched loads. The element to element phase shift is controlled by the length of the main transmission lines. The phase shift criterion dictates the distance between the elements. By changing the frequency, the phase shift between the elements is changed and the beam is scanned.

A 20dB Taylor amplitude distribution was applied to a 19-element linear array to obtain low sidelobe levels. The measurement results of the antenna (Figure bellow) show that the desired sidelobe levels and very low cross-polarization patterns are achieved. In addition, a very good isolation between the vertical and horizontal polarizations is attained.



(a) (b)

The Co-Pol and Cross-Pol radiation patterns of the linear array for (a) Horizontal and (b) Vertical Pol. excitations.