

Liquid Crystal Based Reconfigurable Reflectarray Antenna Design

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Abstract : This paper presents the design and analysis of Liquid Crystal (LC) based tunable reflectarray antenna with slot embedded patch element configurations within X-band frequency range. The slots are shown to modify the surface current distribution on the patch element of reflectarray which causes the resonant patch element to provide different resonant frequencies depending on the slot dimensions. The simulated results are supported and verified by waveguide scattering parameter measurements of different reflectarray unit cells. Different rectangular slots on patch element have been fabricated and a change in resonant frequency from 10.46GHz to 8.78GHz has been demonstrated as the width of the rectangular slot is varied from 0.2W to 0.6W. The rectangular slot in the center of the patch element has also been utilized for the frequency tunable reflectarray antenna design based on K-15 Nematic LC. For the active reflectarray antenna design, a frequency tunability of 1.2% from 10GHz to 9.88GHz has been demonstrated with a dynamic phase range of 103°; provided by the measured scattering parameter results. Time consumed by liquid crystals for reconfiguration, which is one of the drawback of LC based design, has also been disused in this paper.

Keywords : liquid crystal, tunable reflectarray, frequency tunability, dynamic phase range

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