Unique Issues and Features of a Scanning Reflectarray Antenna Based on Ferroelectric Thin Film Phase Shifters

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Evolving high data rate communications systems demand greater attention to subtle aspects of information theory and electromagnetic engineering. As the ratio of signaling bandwidth to carrier frequency decreases, less familiar phenomenon influence system performance. Some interesting effects are expected to appear if the trend toward wide-band scanning phased array antennas and bandwidth-efficient, high-speed modulators continues. Indeed there is a growing demand for efficient, low-cost phased array antennas. The reflectarray is an alternative to directly-radiating phased array antennas and promises higher efficiency at reduced cost. The ferroelectric reflectarray involves phase shifters based on coupled microstrip patterned on $Ba_xSr_{1-x}TiO_3$ films, that are laser ablated onto $LaAlO_3$ substrates. These devices outperform their semiconductor counterparts from X-through and K-band frequencies. There are special issues associated with the implementation of a scanning reflectarray antenna, especially one realized with thin film ferroelectric phase shifters. This paper will discuss these issues which include modulo 2π effects and phase shifter transient effects on bit error rate, scattering from the ground plane, relevance of phase shifter loss and presentation of a novel hybrid ferroelectric/semiconductor phase shifter, and the effect of mild radiation exposure on phase shifter performance.