Title: Circularly Polarized Microstrip Ferrite Phase-shifter with Uneven Excitation.

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ABSTRACT:

Satellite and mobile communications depend on phased array antennas, where ferrite phase shifters are widely used to electronically steer the antenna beams or nulls in the desired direction without physically re-positioning the antenna. However, due to the requirement of large number of phase shifters, the related cost, size and integration process plays an important role in the design of micro/millimeter wave array antennas.

Recently, microstrip ferrite phase shifters received renewed interested due to its low cost, lightweight and compact size. To achieve maximum phase shift per unit length of the device, interaction between the propagating microwave signal and the ferrite substrate needs to be maximized. This can be realized by introducing circularly polarized microwave signal, which interacts strongly or weakly with the biased ferrite substrate depending on the direction of propagation in relation to the externally applied biasing field. Although various techniques are used in the literature[1,2] to overcome the difficulty of generating circularly polarized waves in a planar structure, they involve complicated geometry and higher insertion loss.

In this paper, three parallel microstrip lines on a ferrite substrate are excited with linearly polarized microwave signals, having uneven magnitude and a progressive phase of 90°, as shown in figure 1(a, b). Note that the propagating signal (*in z axis*) underneath

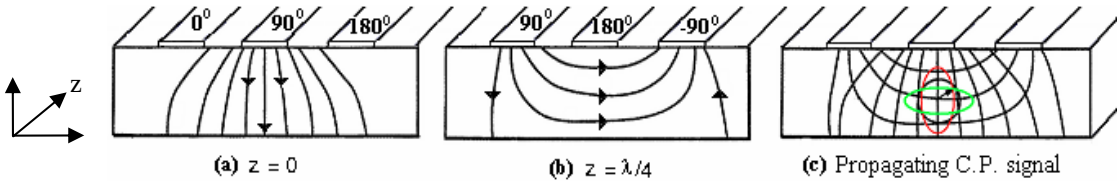

Figure 1: Circularly polarized microwave signal within a ferrite microstrip structure.

the central microstrip line will be circularly polarized, as shown in 1(c). A novel three way uneven power divider/combiner is used as feed networks to avoid the generation of elliptically polarized signal. The affect of longitudinally and transversely applied biasing field on the insertion phase and insertion loss of the device is observed. The simulated results are compared with that of the equivalent single line microstrip ferrite phase shifter. The resonance region of the ferrite material is carefully excluded to avoid losses.

Reference:

[1] D.E. Oates et al, "Superconductor Ferrite Phase shifter and Circulators", IEEE Trans on Applied Superconductivity, Vol. 7, No.2, June 1997, pp. 2347-2350.

[2] R.K. Sorensen et al, "Low cost Nonplanar Microstrip-line Ferrite Phase Shifter Utilizing Circular Polarization", IEEE MWCL, Vol. 14, No.1, Jan. 2004, pp. 25-27.

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