Abstracts

Dual-frequency electric-magnetic-electric microstrip leaky-mode antenna of a single fan beam

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This paper presents a dual-frequency electric-magnetic-electric (EME) microstrip exhibiting two leaky-wave regions of similar radiation characteristics like the microstrip EH/sub 1/ mode. The EME microstrip incorporates a photonic bandgap (PBG) structure, which is a two-dimensional array consisting of unit cell made of coupled coils connected by a via. The PBG structure employed in the EME prototype conducts at dc and shows the first stopband between 8.8-12.4 GHz, thus rendering the so-called magnetic surface. The EME microstrip is essentially made by substituting the PBG cells for the metal strip of a conventional microstrip. The finite-element method (FEM) analyses of the PBG structure show that the first and second modes are TM-like and TEM-like, respectively. The latter is leaky between 12.4-12.9 GHz and is found to be responsible for the second leaky region of the EME microstrip. The dispersion characteristics of the EME microstrip are obtained by two theoretical methods, namely, the matrix-pencil method and the FEM. Both show excellent agreement in the two leaky regions. Furthermore, the measured far-field radiation patterns of the two leaky regions also validate the dispersion curves. The first leaky region is of EH/sub 1/ type and between 5.05-5.45 GHz. The second leaky region radiates a frequency-scanning fan beam between 11.95-13.0 GHz, similar to those of the EH/sub 1/ mode. Detailed modal current analyses show even and odd symmetry along longitudinal and transverse plane of EME microstrip, respectively, further confirming the two leaky regions behave like the well-known EH/sub 1/ leaky mode. The proposed EME microstrip enriches the modal characteristics of the conventional, uniform microstrip and is thus a manifestation of application of PBG structure for new guiding device.

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