Abstracts

Combination dielectric resonator, power combiner, and antenna

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A rectangular dielectric resonator housed in a cutoff parallel-plate waveguide is used both as a radiating element and microwave power combiner. The resonator is excited by using tuned electrically short monopole antennas to induce a longitudinal electric operating mode. The resonator is then used in conjunction with free-running oscillators in order to provide, via mutual injection locking, stable in-phase power combining. Furthermore, the resonator is arranged such that one of its faces radiates a portion of the power-combined signal. Since the resonator is housed in a cutoff waveguide, the cross-polarization radiation from the antenna is suppressed. It was found that, for a single element, a gain in the azimuthal plane of 5 dB could be achieved and, for a two-element array, a gain of 7 dB was obtained with better than -25-dB cross polarization for each case. The oscillator power-combining efficiency for a single-element antenna (two oscillators) was 91%, and the spatial power-combining efficiency for a two-element antenna array, (four oscillators) was found to be 90%. In addition, it is shown that the presence of the dielectric inserts in conjunction with coupled oscillator dynamics provides moderate overall oscillator phase noise improvement.

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