Abstracts

Whispering gallery modes in a dielectric resonator: characterization at millimeter wavelength

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Applications of whispering-gallery-mode (WGM) dielectric resonators in the millimeter and submillimeter frequency range are discussed. A summary of the main peculiarities of these resonators is given, and a method to obtain approximate analytical expressions of electromagnetic field components is developed. Problems connected with the excitation by far infrared (FIR) laser radiation are examined. The analysis of electromagnetic propagation in different structures drives the best choice for the transmission line (metallic and dielectric waveguides), and the same theoretical analysis allows to face the basic problem of optimizing the matching between transmission-line and WG resonators; the role in this application of dielectric waveguides with variable diameter is discussed. All of the predictions are obtained in a unified theoretical picture. The experimental characterization of a WG resonator at 240 GHz involved the measurement of the effectiveness of the coupling between the transmission line and the resonator, the determination of the merit factor and free spectral range for the different resonance families in different resonators. Accurate measurements were carried out to acquire knowledge of the field distribution in both axial and radial directions; to this purpose, dielectric antennas with high directivity were used to sense the field intensities for different resonance modes. The good agreement between the experimental results and the theoretical predictions is carefully discussed.

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