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Title:Measurement of dielectric properties for low-loss materials at millimeter wavelengths
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Abstract: We describe here a system for accurate measurement of the dielectric properties of very low-loss materials in the 130 to 170 GHz frequency range. This system utilizes an open resonator with a quality factor ∼ 1 × 106. Resonance curves for this resonator are acquired with a commercial spectrum analyzer equipped with an external millimeter-wave harmonic mixer. The excitation source is a backward-wave oscillator locked to the spectrum analyzer local oscillator via a digital phase-locked loop. This system permits rapid and accurate measurement of resonance curve line widths, permitting determination of loss tangents down to the 10-6 range. Results are reported for silicon carbide (SiC), CVD diamond, sapphire, and quartz.