

Abstract Submitted
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Microwave In-Phase and Quadrature Detection of E-Beam Generated Air Plasma¹ ROBERT VIDMAR, CHRIS RAMSAYER, University of Nevada, Reno, KENNETH STALDER, Stalder Technologies and Research — Microwave In-phase and Quadrature (I/Q) measurements at 10 GHz are discussed in the context of determining plasma parameters. Plasma generated in laboratory air with a pressure from 1 mTorr to 636 Torr is modeled as collisional plasma. The electron temperature is close to the bulk gas temperature at high pressure or up to a few eV at low pressure. Plasma generation is produced with 10-ms pulses of electrons from a 100-keV 5-mA electron gun, which then propagate through a 12.7- μ m aluminum transmission window into a 400-liter test cell. A differential measurement approach is described that extends the dynamic range of the I/Q magnitude measurement from tens of dB to a small fraction of a dB. Amplification of the phase measurement is used to increase sensitivity. Ultimate sensitivity and filtering of both measurements are discussed in the context of mixer shot noise, Johnson noise, and pulse duration. Representative measurements and the procedure to convert raw data into estimates of electron number density and electron momentum transfer collision rate are discussed.

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