ABSTRACT

Accurate measurements of the emission frequency and bandwidth of a pulsed 140 GHz gyrotron have been made using a harmonic mixer system. This system has been used to measure the bandwidth of individual, 1 μsec pulses of the gyrotron, to determine the dependence of the operating frequency on the cathode voltage and resonator magnetic field, to detect and identify second harmonic radiation, and to study multimode operation. Bandwidths as low as 3 MHz, which is the instrumental limit, have been observed. In addition, frequency pulling has been measured and compared with predictions based on linear and self-consistent nonlinear theory. It was found that linear theory is inadequate for describing the frequency characteristics of a gyrotron operating well above the starting current, while self-consistent nonlinear theory was in reasonable agreement with the experimental results. The small bandwidths and stable operating frequencies that were measured confirm the viability of the gyrotron as a millimeter and submillimeter source for plasma diagnostics.