Abstract

High frequency gyrotron operation in the TE_{611} whispering gallery mode is reported. Powers as high as 112 kW and an efficiency as high as 25.4% have been obtained. In addition to the TE_{611} mode, ten other fundamental modes with frequencies between 133.9 GHz and 216.4 GHz were observed. A quasioptical antenna for whispering gallery modes has been tested for the TE_{611} mode. The combination of this antenna and a reflector produces a well collimated, linearly polarized rf beam suitable for electron cyclotron resonance heating or plasma diagnostics. The experimental conversion efficiency was determined to be 89%, and the cross polarization was down by 25 dB. A new quasioptical transmission line employing this antenna has also been tested with the gyrotron. The absence of mode competition for the TE_{611} mode, as well as the efficient conversion of the output radiation into a linearly polarized Gaussian-like beam, substantiates the arguments for operation in surface modes in high power gyrotrons. The implications of quasioptical antennas for megawatt gyrotron window design are discussed.