Design and Operation of First- and Second-Harmonic Coaxial Gyroklystrons for Advanced Accelerator Applications*, M. CASTLE, J. CHENG, V.L. GRANATSTEIN, B. HOGAN, W. LAWSON, M. REISER, X. XU, University of Maryland - At the University of Maryland, we have designed, constructed, and tested a number of gyroklystron and gyrotwystron tubes which are being evaluated as potential drivers for linear colliders and other advanced accelerator applications [1]. With a 440 kV, 160-260 A beam, we were able to produce about 30 MW of peak power in 1 microsecond pulses near 10 GHz and 20 GHz with first- and second-harmonic circular tubes, respectively. The peak efficiencies were near 30% and the large-signal gains were 25-35 dB for two- and three-cavity tubes. We have recently begun experiments on coaxial tubes which are expected to produce peak powers in excess of 100 MW in X- and Ku-Band. The voltage has been increased somewhat compared to the previous system, but the principal increase in power comes from a larger beam current. This increase is achieved by enlarging the average beam radius and subsequently the tube cross-sectional dimensions. Preliminary results have indicated peak powers in excess of 80 MW at 8.57 GHz in a three-cavity first-harmonic tube with reasonable gain and efficiency. In this paper we will detail the results of this experiment and discuss designs and preliminary results of a second-harmonic device designed to give comparable results at 17.14 GHz.

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[1] V.L. Granatstein and W. Lawson, "Gyro-Ampifiers as Candidate RF Drivers for TeV Linear Colliders" IEEE Trans. on Plasma Science, vol. 24, pp. 648-665 (1996).