ABSTRACT

Title of Dissertation: OPERATION OF A HIGH-POWER, SECOND HARMONIC, COAXIAL GYROKLYSTRON

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The performance of a succession of three-cavity, second harmonic gyroklystron tubes operating in the Ku-band is reported. An overview of the gyroklystron laboratory and past results is given as a starting point for the present work. Theoretical issues are discussed and a summary of the tools used to help design the system are presented. A detailed description of the experimental system in which the microwave circuits operate is provided. Information about the design of the cavities that make up the circuits and cold-testing results are given. The functional operation of the amplifier with these tubes is subsequently given. No amplification was observed in the first tube since the electron gun produces much lower beam currents than the nominal design point. The second tube was redesigned for these lower current values. After re-installing the emitter, output powers of nearly 28 MW were observed in the TE_{02} mode

at 17.166 GHz for 1.0-1.3 μs, and exhibited gains of 23 dB with 13% efficiency. Nominal designs for this were to produce 80 MW of power. Various reasons for not achieving this amount are discussed, including nonuniformity of the electron beam, limitations of alpha, and limited firing time to produce optimal results.