

The Performance of the 8.4 MW Modulator/Regulator Power System for the Electron Cyclotron Heating Facility Upgrade at DIII-D*

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The DIII-D National Fusion Facility at General Atomics is completing the upgrade of its Electron Cyclotron Heating (ECH) capability by adding three MW gyrotron systems operating at 110 GHz[1]. An 8.4 MW Modulator/Regulator (M/R) power system has been designed and constructed to support the operation of these gyrotrons [2].

The power system, with a nominal output of -80 kV and 80 A, can supply a pair of gyrotrons with up to 10 second long pulses that may or may not be modulated. A surplus modulator/regulator which used a BBC CKQ200-4 tetrode was acquired from the LLNL MFTF program. In order to meet the performance goals of the program, substantial design modifications were needed to be made on the grid driver amplifier and the closed-loop feedback regulator circuits [3]. Also, a newly designed crowbar switch system, featuring a high speed, thyatron-like triggered gas switch, was implemented [4]. A simplified, PLC and CPLD based control system was also developed.

The modulator/regulator performance to date has been demonstrated as having less than 0.06% peak-to-peak ripple and square wave modulation of 50% amplitude at 2 kHz. The design of the power system and its performance will be presented in this paper.

- [1] W.P. Cary, *et al.*, "The Upgrade of the DIII-D 110 GHz ECH System to 6 MW," Proceedings of the 18th Symposium on Fusion Engineering, Albuquerque, New Mexico (1999).
- [2] S.G.E. Pronko, *et al.*, "8.4 MW Modulator/Regulator Power System for the Electron Cyclotron Heating Facility Upgrade at DIII-D," Proceedings of the 18th Symposium on Fusion Engineering, Albuquerque, New Mexico (1999).
- [3] A. Nerem, *et al.*, "Circuit Modeling and Feedback Controller Development of the 8.4 MW Modulator/Regulator Power System for the Electron Cyclotron Heating Facility Upgrade at DIII-D," to be presented at this conference.
- [4] S.G.E. Pronko, "A New Crowbar System for the Protection of High Power Gridded Tubes and Microwave Devices," to be presented at this conference

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