

DESIGN AND ANALYSES OF TRANSMISSION LINES FOR THE 110 GHz ECH UPGRADE TO 6MW FOR DIII-D*

H.J. Grunloh, C.B. Baxi, E. Chin, M. Condon, J.L. Doane, C.P. Moeller, and R.C. O'Neill

General Atomics, P.O. Box 85608, San Diego, California 92186-5608

During the summer of 1999 the installation of three new Electron Cyclotron Heating (ECH) transmission lines will begin as part of the 110 GHz ECH Upgrade to 6 MW project for DIII-D. An important step in the development of the transmission line design was the selection of the waveguide size. To make this selection, analyses were conducted to characterize the thermal and radio frequency (rf) loss performance of the key corrugated waveguide components subject to 1 MW, long pulse (10 s, 1% duty cycle) operation. Other factors that were analyzed included vacuum conductance and pumping speed, ease of installation, space considerations, and overall cost. The two candidate transmission line sizes were 2.50 in. and 1.25 in. inner diameter.

An overview of the design and layout of the proposed transmission lines for the DIII-D ECH upgrade project is presented. Details and results are reviewed of the vacuum conductance analysis of the overall transmission line, the rf loss analyses and tests on corrugated waveguide and miter bends, and the thermal analyses of the mirrors in the corrugated waveguide switch and the power monitor miter bend. Finally, a discussion is presented which weighs the results of these analyses with the experience gained through the installation and operation of the existing three 1 MW ECH systems at DIII-D and concludes with the selection of 1.25 in. inner diameter waveguide and components for the upgrade project.

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H.J. Grunloh
General Atomics
P.O. Box 85608
San Diego, CA 92186-5608
(619) 455-3294
FAX (619) 455-2838
e-mail: grunloh@gav.gat.com

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