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High power, high frequency tetrode development with revitalization supply chain

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Tetrode-based amplifiers are well-established, and now have a revitalized supply chain after their demise looked imminent. High power tetrodes have been shown to have a greater power density and frequency range than solid state amplification, making them a robust choice for future accelerators and fusion devices. Recently, the MIT PSFC spearheaded an effort to source new pyrolytic graphite grids, to re-establish the supply chain for the Communication and Power Industries (CPI) high power 4CM2500KG tetrode. This allows Vacuum Electron Device (VED) amplification methods to be seriously considered for the next generation accelerators [2].

Development and experimental validation [1] of a 120 MHz, 2.5 MW tetrode is described. The tetrode Final Power Amplifier (FPA) was excited with both a (1) tetrode-based Driver, and (2) Solid-State-Amplifier (SSA), utilizing a cavity power system, and protective circuitry developed at DTI. The experimental electrical schematic, setup, and measured results of the Driver and FPA output power, gain, bandwidth, efficiency, and frequency range are discussed and differences in performance between Driver- and SSA-excitation of the FPA are shown.

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Footnotes

REFERENCES

1. Adams J.M., Ageladarakis P., Alper B., Altmann H., Amasov U., Arshad S. et al., ICRF results in D-T plasmas in JET and TFTR and implications for ITER (Plasma Physics and Controlled Fusion, 1998). 40, A87-A103.
2. Mohamed M., Ridzon J., Garcia I., Quinlan, K.E., et al., High Frequency, High Power ICRF Source for Fusion Plasmas (24th Topical Conference on Radio-frequency Power in Plasmas, Sept. 26-28th 2022) Annapolis, MD.

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