EXPERIMENTS ON ANTENNA IMPEDANCE AND WHISTLER PROPAGATION IN THE SPACE PHYSICS SIMULATION CHAMBER AT NRL*

David D. Blackwell†, David N. Walker‡, George R. Gatling, Christopher S. Compton‡, Erik M. Tejero‡§ and William E. Amatucci

U.S. Naval Research Laboratory, Plasma Physics Division Washington, DC

As part of the widespread scientific effort being applied the the problem of radiation belt remediation, the Space Physics Simulation Chamber group at the Naval Research Laboratory has been actively engaged in experiments on whistler wave generation and propagation in a magnetized plasma. Two of the major experimental efforts are measurements of antenna impedance and near field radiation patterns, and propagation characteristics of whistlers. Antenna impedances for electrically short and long antennas were obtained from the reflection coefficient Γ obtained using a network analyzer; radiated signal variation over frequency and position were measured using balanced loop B-dot probes. Among the results presented will be effects of antenna biasing, contamination, magnetic field strength, antenna size, plasma profile, and signal power. The experiments were performed in the Space Physics Simulation Chamber at NRL. The chamber is 2-m diameter, 5-m long vacuum vessel surrounded by five 3-m diameter water-cooled magnet coils capable of producing a uniform magnetic field of up to 250 Guass. The plasma is created in a pressure of $p \approx 10^{-4}$ Torr Argon with a 1-square-meter array of glowing, biased tungsten filaments. The electron density can be set over a very broad range ($10^6 < n < 10^{12}\text{cm}^{-3}$) while typical electron and ion temperatures are typically $T_e \approx 0.5$ eV and $T_i \approx 0.05$ eV.

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†Electronic mail: david.blackwell@nrl.navy.mil

‡SFA, Inc., Landover, Maryland 20785

§Auburn University, Auburn, Alabama 36849