Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Modification to the Nyquest Thermal Noise Equation for Plasma Circuit Elements - a high frequency cut off[1] IGOR ALEXEFF, University of Tennessee, TED ANDERSON, Haleakala R & D, Inc. — The Nyquest Thermal Noise Equation for circuit elements is given as $\frac{2}{\pi}RKT$ where R is the resistance in Ohms, K is Boltzmann's constant (Joules per degree Kelvin) and T is the temperature in degrees Kelvin. When applied to plasma circuit elements such as plasma antennas[2], this equation predicts a large amount of thermal noise, since plasmas are in general much hotter than metal circuit elements. However, this equation is an approximation in that it assumes that the electron collision frequency in the conductor is much higher than the frequency being studied. We have extended this equation as follows $\frac{2RKT}{\pi}(\frac{1}{1+(\frac{2\pi\nu}{\nu_c})^2})$ where ν is the frequency of interest and ν_c is the electron collision rate. Actually in our research in the 2 GHz frequency region, we find that the electron collision rate is much lower than the applied frequency. This results theoretically in a plasma antenna having much less thermal noise than a metal antenna.

[1]Work supported by two Phase 2 SBIR grants from the U S Air Force and the U S Army.

[2]Recent Results for Plasma Antennas, Igor Alexeff, Ted Anderson, Esmaeil Farshi, Naresh Karnam, and Nanditha Reddy Pulsani, Physics of Plasmas 15, 057104-1 (2008).

Igor Alexeff
Unniversity of Tennessee

Date submitted: 18 Jul 2008 Electronic form version 1.4