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Distributed Discharge Limiter Studies for X-band High Power Microwaves[1] DAVID HOLMQUIST, JOHN SCHARER, MATT KIRLEY, B. KUPCZYK, JOHN BOOSKE, University of Wisconsin — We have constructed and carried out measurements to study rapid gas breakdown with high power X-band microwave radiation. The microwave source is a 25 kW, 9.38 GHz magnetron with a 0.8 microsec pulse width. The discharge chamber is a section of WR-650 (L-band) waveguide with Lexan vacuum windows. Pumping, flanging, tubulation and gas flow control allow pressure variation from below 0.1 to 760 torr with a variety of gas species. Microwaves are transmitted into the test chamber from the output of a WR-90 (X-band) waveguide. Using HFSS simulations, the maximum electric field intensity on the chamber's interior side of the vacuum window is indicated to be 4.1 kV/cm, well above the breakdown for many gases. Experiments using 22 kW pulses have demonstrated that rapid plasma discharges can be obtained between 220-250 torr in Ar and Ne. Discharges form with an 18 ns turn-on delay with 7-14 ns rise times dependent on pressure and have sufficient density and extent to attenuate the transmitted power by 28 dB in neon at 240 torr. The high collisionality $\nu \sim 10^{11}$ s^{-1} in these gases at high pressures allows substantial attenuation of the signal at substantial plasma densities $n_e \sim 10^{12}$ cm^{-3}.

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