Abstracts

Apparent Frequency Dependence of the Microwave Power Radiated from Gas Discharge Noise Sources (Correspondence)

K.W. Olson. "Apparent Frequency Dependence of the Microwave Power Radiated from Gas Discharge Noise Sources (Correspondence)." 1971 Transactions on Microwave Theory and Techniques 19.9 (Sep. 1971 [T-MTT]): 776-777.

Historically it has been assumed that the microwave power per unit bandwidth radiated from the plasma of typical argon and neon gas discharge noise sources is frequency independent. There are now both a priori basis and experimental evidence for questioning this assumption. For such frequency independence to exist over a frequency range of 100 MHz to 100 GHz the following conditions must be met: (1) /spl planck/omega / kT<<1; (2) proper matching of the discharge to the guide; (3) an appropriate level of absorptivity of the plasma for these frequencies; (4) a Maxwellian electron velocity distribution function; and (5) absence of collective oscillations. The first three conditions are shown to be met. The fourth condition involves the concept of a radiation temperature. Because the appropriate electron velocity distributions are not Maxwellian this radiation temperature does depend somewhat on frequency. This dependence is limited to a small region around the electron-atom collision frequency. For the discharges of concern it is shown that these collision frequencies are 10/sup 9/ to 10/sup 10/s/sup -1/ and therefore contained in the frequency range of interest. The fifth condition relates to the fourth and recently has been shown in theory to be untrue. Finally there is now available experimental evidence which appears to show a small (0.2-0.3 dB) variation of excess noise ratio with frequency on existing tubes. Suggestions for future experiments and interim considerations are made.

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