MINIATURE KLYSTRON FOR CUBESATS

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ABSTRACT

We report the results of a 3-year study to build very small 35 GHz, 32-watt klystrons for use in a cloud-imaging radar and deployed on a 1U (10 cm x 10 cm x 10 cm) CubeSat. Three klystrons and four beam testers were constructed. One device achieved 22 watts of saturated output power. DC beam transmission was 99%. The constructed technology is highly unconventional, but has been successfully implemented on other devices [1][2]. It employed glass-rod fastening of electron gun, anode, focusing and RF stack, and a four-stage depressed collector, all suspended inside a glass envelope; reminiscent of cathode ray tube production. This construction provides a drastic reduction in size, along with lower cost. It lends itself to automated production. Other innovations were the use of a scandia-doped tungsten impregnated cathode only 1.2 mm diameter and dissipating only 0.6 watt. The paper will show performance data and discuss the novel construction features.

CubeSat technology allows inexpensive access to space. Constellations of CubeSats flying in formation are contemplated for synthetic aperture radar imaging of earth features [3]. CubeSats numbering in the thousands are now planned for earth-wide internet service [4]. Both radar and broadcasting will require amplifiers at 35 GHz having substantial output power. Vacuum electron devices, such as klystrons and traveling wave tubes, are much more efficient than solid state power amplifiers. Moreover, they are 35 times more efficient at radiating heat.

References

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