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**Development and Test of a Travelling Wave Tube mm-wave Source**[1] MARK FIELD, Teledyne Scientific LLC, TAKUJI KIMURA, JOHN ATKINSON, Communications and Power Industries, DIANA GAMZINA, LARRY BARNETT, JINFENG ZHAO, NEVILLE LUHMANN, University of California, Davis, ZACHARY GRIFFITH, Teledyne Scientific LLC, THOMAS REED, MARK RODWELL, University of California, Santa Barbara — We report on the fabrication and test of a Traveling Wave Tube (TWT) amplifier designed for operation over a 40 GHz bandwidth centered on 220 GHz, and producing 50 W output power. The TWT amplifier uses a slow wave structure with staggered interdigitated vanes within a waveguide [1]. Each vane is 110 micron wide situated inside a 770 micron wide waveguide, and was directly machined into copper using a 100 micron wide end mill. This structure slows radiation down to group velocity of 8.16 x $10^7$ $ms^{-1}$ where the velocity matches the speed of electrons from a 20 keV source. The TWT uses a sheet electron beam of 7:1 aspect ratio and 400 $A/cm^2$ charge density stabilized by a Brillouin flow magnetic field provided by an external permanent magnet. RF vacuum windows were designed and built using brazed diamond windows, providing less than 1 dB insertion loss across the full 40 GHz bandwidth. Solid state preamplifiers have been developed which provide 20 dB gain and 50 mW output power over the full bandwidth to the input of the TWT.

[1] Y-M. Shin & L.R. Barnett, *Appl.Phys. Lett. 2008,* 92 pp. 091501.

[1]DARPA HiFIVE Program, Contract # W911NF-08-C-0050.

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