

OPTO-ELECTRONIC CLASS AB MICROWAVE POWER AMPLIFIER USING PHOTOCONDUCTIVE SWITCH TECHNOLOGY

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ABSTRACT

Next generation land-based, mobile, phased-array radar systems for battlefield applications must meet constraints on volume, weight, power consumption, and data processing capability that are currently not available. The most inefficient component in a phased array radar system is the final power amplifier in each transmit-receive (TR) module. More recent final power amplifiers for TR modules have been configured in the Class AB or push-pull mode with a theoretical efficiency of 78.5% and an operational efficiency of only 20% at x-band (8-12.5 GHz) frequency. Note that an efficiency of 10% requires ten times the radiated power to be generated and 90% of the delivered energy to be removed as heat. In this dissertation, we present a new scheme of power amplifier, in particular, an opto-electronic (OE) Class AB push-pull microwave power amplifier. With this amplifier, 50.0 % of circuit efficiency and 2.2 Watts of output power can be achieved at X-band (8-12.5 GHz) by utilizing a novel photoconductive semiconductor switch (PCSS) based on intrinsic GaAs instead of the traditional microwave transistors.