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GAN HPA WITH INTEGRATED SUPPLY MODULATOR FOR SMALLSATS

Abstract

High Power Amplifier is the most critical element within a multifunctional transceiver chip. The need for high linearity and high output power for RF input signals with a high peak-to-peak average power ratio makes the design of high power amplifiers extremely challenging. Drain bias modulation techniques like envelope tracking is used to improve the efficiency of a wideband power amplifier by modulating the drain supply voltage to the envelope of the input RF signal using an envelope amplifier.

The critical element within an envelope amplifier is the high frequency switch-mode power converter. The key enabler for delivering high efficiencies at high switching frequencies within an envelope amplifier is the power switch. The low on-resistance and input capacitance of RF GaN HEMT transistors make them ideal candidates as power switches. The integration of power switches within a high power amplifier would allow the minimization of all circuit parasitics, enabling delivery of high voltage and high currents at an extremely high slew rate to the drain of the high power amplifier.

A modulator integrated X-Band HPA was designed and fabricated in 0.25 μm GaN process. The calculated PAE for the supply modulated HPA at a drain bias of 20 V was over 26% with an output power of 35 dBm. A supply modulator integrated HPA in a 0.25 μm GaN process will enable on chip supply modulation capability, for use with efficiency enhancement techniques like ET, to deliver high efficiency, high power and high linearity in HPAs within smallsats, cubesats with limited power.