



High Performance Amplifiers for Better Wireless Communication

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WARF: P07047US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a transistor amplifier that will enable high power, high frequency wireless devices on a single chip.

Overview

Cell phones, radar and other wireless communication systems use high power solid-state amplifiers to boost and transmit signals. These amplifiers function in the radiofrequency (RF) and microwave range. They are made of different semiconductor materials and operate either at high power/low frequency (e.g., for cell phones) or low power/high frequency (e.g., for Wi-Fi).

Amplifiers operating at both high power and high frequency are difficult to make because they typically employ a large number of emitter (or gate) 'fingers' to produce power. As more emitter fingers are used to increase power, more heat is generated. The heat dissipates unevenly, creating hotspots that degrade performance. Heat-stabilizing resistors may be incorporated, but they tend to cause delays and cut power output.

A more thermally stable design could lead to breakthroughs like new cell phones that last longer on a single battery charge.

The Invention

UW–Madison researchers have developed a new amplifier design that will enable the production of high power/high frequency wireless devices. In the new design, emitter fingers are arranged such that heat dissipates more smoothly and the device can operate at a uniform low-junction temperature.

More specifically, the emitter fingers are made up of subcells. They are configured in a one- or two-dimensional form having a hollow center layout, where some of the fingers or subcells are left out during design or disconnected during manufacturing. They also may be arranged in arc-shaped rows. Both configurations prevent hotspots from forming and maintain thermal stability at high power.

Applications

- Cell phones, base stations, radars, remote sensing and other wireless communications

Key Benefits

- Provides high power and high frequency
- Reduces circuit complexity
- Less susceptible to manufacturing variations
- Enables new communication frequency bands and broader bandwidth in high power devices
- Improves thermal stability
- Promises to increase the efficiency and battery life of cell phones

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- Can be extended to any type of power device (e.g., BJT or FET) and any type of substrate (e.g., GaAs, InP or other wide bandgap substrate)
- Works with cheaper semiconductor materials
- Particularly suited to SiGe and GaAs applications

Stage of Development

Simulated results on a silicon-based substrate showed that the frequency response of higher power devices can be made to closely match the frequency of their low power counterparts.

Additional Information

For More Information About the Inventors

- [Zhenqiang Ma](#)

Related Technologies

- [WARF reference number P05260US describes a silicon-based bipolar transistor that provides improved power gain and efficiency at high frequencies.](#)
- [WARF reference number P08017US describes an improved high-power transistor amplifier for wireless communications.](#)

Tech Fields

- [Information Technology : Hardware](#)

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846

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