Power Generation via Traveling Domains

Improved methods and circuits for generating millimeter-wave oscillations

Researchers at Georgia Tech have developed improved methods and circuits for generating millimeter-wave oscillations. Generating millimeter-wave oscillations involves providing a semiconductor device comprising of at least two terminals and a polar heterojunction formed from two semiconductor materials. A voltage bias is applied to at least two terminals of the device in which the voltage enhances a two-dimensional electron gas (2DEG) layer at the polar heterojunction and produces a sharply-peaked but spatially-localized electric field within the 2DEG with a large longitudinal component. The longitudinal component of the electric field serves as a nucleation site for a plurality of propagating dipole domains observable as a plurality of self-sustaining millimeter-wave oscillations.

Summary Bullets

- Improved methods and circuits for generating millimeter-wave oscillations
- High-speed microwave data links

Solution Advantages

- Improved methods and circuits for generating millimeter-wave oscillations
- High-speed microwave data links

Potential Commercial Applications

- Target tracking and imaging
- All-weather radiometry
- Remote sensing

Background and More Information

Presently known oscillators for generating millimeter-wave signals, are ill-suited for several of these potential applications. Gunn diodes, although theorized for microwave through terahertz signal generation, are subject to severe tradeoffs between frequency and output power. In the case of the emerging families of wide bandgap compound semiconductor materials, the very doping levels which would be required for a Gunn diode to function also likely degrade electron velocity to the point of precluding Gunn oscillations in the first place. Moreover, travelling wave tubes, the devices most commonly used to generate millimeter waves at room

temperature, have significant drawbacks including large size, high cost, and relative fragility. As a result, they too have significant shortcomings when it comes to implementing them in all of the potential applications available to millimeter-wave signals. As a result, there remains a need for improved methods and systems for generating millimeter-wave oscillations.

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