

Holistic Design And Optimization Of Millimeter-Wave Transmitters With Load-Modulated Balanced Power Amplifiers

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BRIEF DESCRIPTION

A novel mm-wave transmitter architecture that integrates load-modulated balanced power amplifiers (LMBPA) and double quadrature (DQ) up-conversion for enhanced efficiency, image suppression, and antenna resilience.

FULL DESCRIPTION

This invention presents a new RF/mm-wave transmitter design that optimizes load-modulated balanced power amplifiers (LMBPA) with double quadrature (DQ) up-conversion circuits. By significantly reducing the number of passive power splitting and combining networks from nine to four, the architecture is more compact and power efficient. Its balanced structure and advanced phase control techniques enable continuous 0–360-degree phase shifts with less chip area and passive loss, leading to a fully symmetric layout and enhanced operational flexibility.

SUGGESTED USES

- » Next-generation mm-wave communication transceivers for 5G/6G wireless networks.
- » High-performance radar systems requiring compact, efficient mm-wave transmitters.
- » RF front-end modules in satellite and aerospace communication equipment.
- » Advanced phased array antenna systems with enhanced calibration-free operation.
- » Industrial and automotive sensing applications utilizing mm-wave technology.

ADVANTAGES

- » Significant reduction of passive power-splitting/combining circuits, improving compactness and power efficiency.
- » Eliminates the strict quadrature-phase requirement between amplifier paths, enabling greater design flexibility and tolerance to phase mismatches.
- » Continuous 0–360-degree phase control using passive networks with minimal chip area impact.
- » Deep power back-off power-added efficiency (PAE) enhancement surpassing traditional designs by leveraging inverted LMBPA topology.
- » Dual-path image suppression without the need for loop-back I/Q calibration. · Resilience to antenna VSWR variations without load impedance tuning due to balanced architecture.
- » Fully symmetric layout floorplan for easier integration and improved performance stability.

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OTHER INFORMATION

CATEGORIZED AS

- » **Communications**
- » Internet
- » Networking
- » Wireless

RELATED CASES

2025-816-0

PATENT STATUS

Patent Pending

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