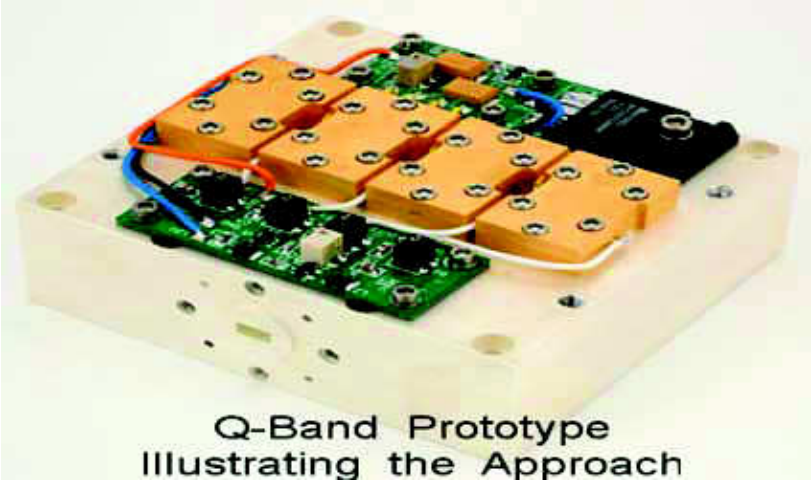
HIGH-EFFICIENCY, Ka-BAND SOLID-STATE POWER AMPLIFIER (SSPA) UTILIZING GALLIUM NITRIDE (GaN) TECHNOLOGY

QuinStar Technology, Inc.

2014 Phase I
01.03-9656



Identification and Significance of Innovation

- Future NASA robotic and manned space exploration missions require high-efficiency (60%) SSPAs, operating at Ka-band, for high-data-rate, long-range space communications
- Employing state-of-the-art GaN MMIC technology to fabricate a high-efficiency SSPA operating at Ka-band frequencies (31.5 to 34 GHz)
- GaN devices are operating in a Class F switching mode for highest efficiencies; simulations with commercial foundry models show that it is possible to realize power-added efficiency (PAE) levels above 60%
- Employing a high-efficiency (95%) four-way planar combiner to achieve 20 W output power

Expected technology readiness level (TRL) range at the end of contract

- 1 to 3

Technical Objectives

- Develop a GaN-based, high-efficiency SSPA operating at Ka-band frequencies (31.5 to 34 GHz) for high-data-rate, long-range space communications.
- Reach 20 W output power and 60% power-added efficiency.
- Conduct a SSPA architecture study to examine the tradeoffs between power and efficiency.
- Evaluate and select a GaN foundry partner for Phase II.
- Perform switching-mode simulations of the high-efficiency GaN monolithic microwave integrated circuit (MMIC) amplifier.
- Design, simulate, and lay out the GaN MMIC.
- Design and simulate the four-way, high-efficiency combiner network.
- Submit Phase I final report.

NASA Applications

- Robotic and manned space exploration missions requiring high-efficiency SSPAs, operating at Ka-band, for high-data-rate, long-range space communications
- Ka-band radar sensors for a wide variety of Earth science applications

Non-NASA Applications

- Department of Defense (DoD) applications include SATCOM for the Army in the 29.5 to 31 GHz band and military radar applications unmanned aerial vehicles (UAVs) and airborne in the 33 to 38 GHz band
- SATCOM terminals
- Airborne terminals for commercial airlines
- Weather and environmental monitoring radars
- Aircraft landing systems