PURDUE INNOVATES | Office of Technology Commercialization

High Power Microwave Generator Based on Nonlinear Composites

Compact nonlinear composite device generating portable high-power microwaves for defense and energy.

Researchers at Purdue University have developed a new high-power microwave generator using nonlinear composites. Unlike traditional microwave production, this design is much smaller than typical nonlinear transmission lines (NLTL). The new design uses materials which allow the device to operate as both a pulse forming line and high-power microwave source. As voltage and current move through the lines, permeability and permittivity of the composite change respectively. As waves propagate through the NLTL, oscillations are generated that can be extracted into an antenna or into a load. In testing RF production reached 160 kW with a charging voltage of 17.5 kV at a frequency of 1 GHz. The Lines were also able to produce higher frequency RF during the pulse reaching 2.28 GHz and an output power of almost 1 kW. The material evaluation performed on the composites shows a possibility of reaching voltages over 500 kV. This technology can be implemented in energy transmission and defense applications.

Advantages:

-Light-weight

-Portable

-Improved Charge Transfer Capability

-Higher Efficiency

Potential Applications:

-Electrical Power/Energy Transmission

-Military and Defense

-Biological Treatments/Radiotherapy

Technology ID
2021-FAIR-69397

Category
Aerospace & National Security/Defense, Electronics, & Surveillance Technologies

Authors
Andrew Jonathan Fairbanks
Allen Garner

Further information
Matt Halladay
MRHalladay@prf.org

View online

Technology Validation:

The new light-weight material for NLTLs developed by Purdue researchers has been tested for improved voltage and current output as well as output frequency and efficiency over current NLTL materials.

Recent Publication:

"Nonlinear Permeability Measurements for Nickel Zinc Ferrite and Nickel Zinc Ferrite/Barium Strontium Titanate Composites from 1-4 GHz"

IEEE Transactions on Magnetics

DOI: 10.1109/TMAG.2021.3068820

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2021-03-21, United States

Utility-Gov. Funding, 2022-03-18, United States

Keywords: high power microwave generator,nonlinear transmission line,compact RF power source,portable microwave generator,defense directed energy,energy transmission technology,biological radiotherapy applications,lightweight microwave system,high efficiency RF generation,advanced RF materials