

140

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Title:A watt-class 1-THz backward-wave oscillator based on sine waveguide

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Abstract:A novel backward wave oscillator was proposed by utilizing a concise sine waveguide slow-wave structure combined with sheet electron beam to operate at terahertz frequency band. First, the design method was described, and the dispersion curve and interaction impedance of the sine waveguide were calculated, then the device oscillation frequency and operating voltage were determined. Next, the circuit transmission losses were learned over the tunable frequency range. Finally, the particle-in-cell simulation method was applied to predict its signal generation performance. The investigation results show that, the backward wave oscillator can produce over 1.9 -W peak power output at the central operating frequency of 1-THz under 27-kV operating voltage and 5-mA beam current. And the interaction efficiency at 1-THz is more than 1.4% with a circuit length of 7.2-mm. It, therefore, will be considered as a promising watt-class terahertz radiation source.

Number of references:27

Inspec controlled terms:backward wave oscillators - circuit tuning - electron beams - radiofrequency oscillators - slow wave structures - terahertz wave devices - waveform generators - waveguides

Uncontrolled terms:backward-wave oscillator - sine waveguide slow-wave structure - electron beam sheet - terahertz frequency band - sine waveguide impedance - circuit transmission loss analysis - tunable frequency range - particle-in-cell simulation method - watt-class terahertz radiation source - central operation frequency - bunch sheet electron beam interaction - frequency 1 THz - voltage 27 kV - current 5 mA

Inspec classification codes:B1230B Oscillators - B2350D Travelling wave tubes - B1310 Waveguides and striplines - B1230G Function generators

Numerical data indexing:frequency 1.0E+12 Hz;voltage 2.7E+04 V;current 5.0E-03 A

Treatment:Practical (PRA)

Discipline:Electrical/Electronic engineering (B)

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