Abstracts

Oscillator Priming and Preoscillation Noise in a Gyrotron

A.H. McCurdy and C.M. Armstrong. "Oscillator Priming and Preoscillation Noise in a Gyrotron." 1988 Transactions on Microwave Theory and Techniques 36.5 (May 1988 [T-MTT] (Special Issue Commemorating the Centennial of Heinrich Hertz)): 891-901.

Phase control is achieved in a pulsed gyrotron oscillator both by applying an external priming signal directly to the oscillator and by applying the signal to a prebunching cavity. A pulse-to-pulse phase jitter of <2.5° is achieved in the gyrotron at drive-to-oscillator power ratios of -36.6 dB (drive signal-to-noise power ratio of 36 dB) in the direct injection case and -71 dB (drive signal-to-noise power ratio of 22 dB) in the prebunched case. A lumped element theory is compared to the experimental results. The theoretical description seems valid when the drive frequency is within about 5 MHz of that of the oscillator. Preoscillation noise in the gyrotron is ~1.0 µW, larger than expected from either shot noise or thermal noise but in the vicinity of spontaneous cyclotron emission. Convective RF noise growth is investigated. No evidence of the electrostatic cyclotron instability is seen. All growth observed can be attributed to the gyroklystron amplification mechanism. However the noise growth per unit length is not as large as that of a narrow-band drive signal. Thus a prebuncing system is advantageous for achieving control over the oscillation buildup in a pulsed gyrotron.

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