PEER-TO-PEER LOCKING OF MAGNETRONS: ANALYSIS AND EXPERIMENT

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The viability of coherent power combination of multiple high-efficiency, moderate power magnetrons requires a thorough understanding of frequency and phase control. Injection locking of conventional magnetrons, and other types of oscillators, employing a master-to-slave configuration has been studied theoretically and experimentally [1,2]. This paper focuses on the peer-to-peer locking between two conventional magnetrons, where the general condition for locking was recently derived [3]. This condition reduces to Adler's classical locking condition (master-slave) if the coupling is one way. Dependent on the degree of coupling, the frequency of oscillation when locking occurs was found to not necessarily lie between the two magnetrons' free running frequencies. Likewise, when the locking condition was violated, the beat of the spectrum was not necessarily found to be equal to the difference between the free running frequencies. These features of peer-to-peer locking were observed in our experiments on the peer-to-peer locking of two 1-kW magnetrons [4]. The stability (accessibility) and temporal evolution of the two possible states, together with phase measurements, will be reported. Viability of peer-to-peer locking in the presence of a frequency chirp is also being studied.

[1]P. Pengvanich *et al.,* J. Appl. Phys. **98**, 114903 (2005).
[2]V. B. Neculaes, Ph.D. Dissertation, U. Michigan, Ann Arbor, MI (2005).
[3]P. Pengvanich *et al.,* Phys. Plasmas **15**, 103104 (2008).
[4]E. Cruz *et al*., Appl. Phys. Lett. **95**, 191503 (2009).

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