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High Power Soliton Generation Using Hybrid Nonlinear Transmission lines

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Nonlinear Transmission lines (NLTLs) have been studied for high power RF generation with good prospects of applications in pulsed radar systems, disruption of communications in battlefield, etc. Usually, NLTLs employ barium titanate (BT) ceramic-based capacitors or ferrite bead inductor as nonlinear elements, denominated as capacitive or inductive lines, respectively. On the other hand, a configuration that employs both nonlinear elements (LC), known as hybrid line, is an excellent method for exciting soliton oscillations more easily than inductive or capacitive lines. Other interesting aspect is that numerous publications on NLTL with only one linear component [1] are easily found in the literature compared to just a few on hybrid [2]. In this work, a 30-section hybrid NLTL built using both L & C of great nonlinearity (2.2 nF BT ceramic capacitors and 10 μH ferrite bead inductors) will be described. It will be shown that soliton generation packets have been obtained on the middle line section with a frequency of the order 33.0 MHz, peak power of 13.0 kW and voltage modulation depth (VMD) of around 700 V. Finally, it will be demonstrated that by using a proper design, hybrid lumped NLTLs may be suitable to achieve RF above 100 -200 MHz.
[1] L.P. Silva Neto, J.O. Rossi, J.J. Barroso, "High power RF generation using nonlinear transmission lines using commercial ceramic capacitors as nonlinear elements, in Proc. 2015 IEEE Pulsed Power Conf., Austin, 2015, pp. 1-5.
[2] N.S. Kuek, A.C. Liew, E. Schamiloglu, and J.O. Rossi, "RF pulse generator based on a nonlinear hybrid line" IEEE Trans. Plasma Sci., vol. 42, no. 10, pp. 3268-3273, Oct. 2014.

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