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Development of High Power Burst Pulse Generator for Cancer Treatment and Investigation of Superiority of High Power Burst Pulse as against Single Pulse

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A cancer treatment by an ultra-short pulse high electric field is one of new biological applications. This work focuses on the development of a high power nanosecond pulsed electromagnetic wave generator for the cancer treatment, and effect on a cancer cell by the developed device. We have developed a burst pulse generator that outputs the multiple pulses continuously by a NLTL (Nonlinear Transmission Line) using magnetic switches [1]. The NLTL makes the pulse train by delaying the propagation of the pulse through the magnetic switch of each ladder. The number of pulses in the pulse train can be varied by the number of the units of the magnetic switch. In this study, we have investigated whether applying a burst pulse to the cancer cells is more effective than applying a single pulse to the cancer cells under the same conditions. The condition of the burst pulse is the electric field strength of 80 kV/cm, the frequency of 130 MHz, the repetition rate of 1 pps and the number of LC stages of 5. The condition of the single pulse is also same electric field strength and frequency. However, for same applying power, the number of repetitions is 5 pps. Here, we have used the yeast that is simulated the cancer cell and have used the PI staining method in order to confirm how many the cancer cells dead by applying the pulses. The result has shown applying the burst pulse to the cancer cells is possible to give lethal impact than that of the single pulse.

[1] Keita Yasu, Yasushi Minamitani, Ken Nukaga, "Development of High Power Burst Pulse Generator Based on Magnetic Switch for Bioelectrics,"Proc. of 2016 International Power Modulator and High Voltage Conference, pp. 392-396, (2016)

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