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5P14 - Performance Analysis of a Compact Pulse Forming Stage and a Microstrip Type Balun for High Power Electromagnetics Applications

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High power microwaves can be used in the field of medical, military and civil applications like cancer treatment, destruction of some explosive devices, food preservation etc. This paper presents the design and experiment results of a high power ultra-wide band source. The system mainly consists of a low inductance Marx Generator, Pulse Forming Stage (PFS), a balun and a linear TEM Horn antenna. The power supply is a coaxial Marx generator composed of 16 stages. In this configuration, the rise time of the output signal can be less than 15 ns with an operating voltage reaching values up to 200 kV with an open circuit configuration. This study especially focused on the design of the PFS which includes a spark gap and a peaking capacitor. A compact and coaxial PFS is designed with 50 Ω characteristic impedance and directly connected to the output of the Marx Generator. Then a linear TEM Horn antenna with a customized microstrip balun is integrated to the output of the PFS. Effects of the system inductance to the rise time of the signal is observed. The PFS, balun and the antenna has been simulated together and the spark gap is simulated as a short circuit. Results of CST simulations like S11 parameters across a broad frequency range 200 MHz to 2 GHz of the system and the radiation patterns of the antenna are shown in this paper. A D-dot probe is used to measure the electric displacement value at the different distances from the antenna and the results are compared with the simulations and good agreement is observed. A capacitor voltage divider is also constructed to determine the output signal of the PFS and preliminary tests show that the system can produce pulses which have the rise time under 1 ns.

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