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5P57 - All solid state ultra-fast turn-on time compact MARX generator

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It will be presented in this work development, production and experimental results of HPM modulator based on Marx topology. In general, drivers for HPS devices based on PFL or capacitor source coupled to the HPM devices by means of high voltage transformer. In our case, due to strong requirement on ultra-fast rise time, common concept was unacceptable, and direct coupling of the source was proposed. To supply high voltage pulse (30kV) having width of about 1 μ S and rise time less than 100nS with output current of 10Amps, Marx topology generator was chosen. In order to keep the design compact (portable application) solid-state switches as well as ceramic capacitors were considered in Marx circuit. All power stage components were chosen through optimization procedure that will be addressed in this paper. Switches of the Marx circuit were implemented by high voltage fast switching MOSFETs. Energy storage capacitors were implemented by high voltage Class2 ceramic capacitors.

A unique gate drive scheme was used to achieve ultra-fast turn on and simultaneous operation of all switches. It will be shown that even in the case of not truly simultaneous switching of the circuit the reliability would not be compromised. This excellence based on avalanche ability of the switches. This ability allows the switch, in the case of late triggering, to absorb some energy before its impedance falls due to gate drive signal.

In order to minimize the size and weight of the generator auxiliary power for the gate circuitry was derived from the hold off voltage of the switch. This allows reducing the complexity of the design by removing the need for floating power supply.

This paper presents design and implementation concepts, experimental results of all solid state Marx generator HPM modulator under development.

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