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Compact Marx Generator and High Power Microwave System

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This paper presents the electrical and mechanical hardware considerations of a compact, 160 J modular pulse forming network (PFN) based Marx generator used to drive a high-power microwave (HPM) source with a time variant load at a PRF of 100 Hz. The modular Marx generator is designed to produce an open-circuit output voltage of 600 kV from a 50 kV capacitor charger using twelve stages. Each stage of the Marx is constructed from a PFN created with five, 2.1 nF, high voltage capacitors in parallel. Each Marx module was machined out of acetyl copolymer or Delrin to provide optimal strength, rigidity, and a dielectric constant that closely matches transformer oil. These Marx modules include air supply lines that are machined directly into each block of Delrin allowing airlines to connect to each module chamber rather than every spark gap. The spark gaps are comprised of two electrode inserts placed into the sealed pressure vessel contained within the Marx modules.

After the Marx erects, the energy is delivered to the Virtual Cathode Oscillator where high power microwaves are created within a rectangular cavity resonator. The cavity resonator features several actuators and bellows to change the A-K gap distance, cavity height, and virtual cathode distance from the cavity back wall. The primary benefit of this design is that the vircator can operate in resonance conditions at multiple discrete frequencies. The entire system is controlled with a laptop based program. From this interface the user can control multiple settings including the aforementioned cavity conditions, repetition rate, charging voltage, and burst length.

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