A PROTOTYPE HIGH-VOLTAGE UWB TRANSMITTER

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We describe here the early development of a high-voltage Ultra-Wideband (UWB) transmitter that combines a portable high-gain antenna and a fast-risetime triggered source. The device, which is currently in the early stages of development, integrates a compact triggered wave-erection Marx generator into the center support of a Collapsible Impulse Radiating Antenna (CIRA). The current version of the antenna (TX-1) must be deployed manually; however, a spring mechanism can be added to open the antenna automatically as it emerges from a housing. The Marx generator is a bipolar device with two outputs specifically designed for use on an Impulse Radiating Antenna (IRA).

For this project, we wanted an integrated UWB source and antenna that could be stored in as small a space as possible, and that could be deployed automatically. So a collapsible antenna similar to our CIRA-2 seemed appropriate. However, feeding such an antenna is a particular challenge. Normally an IRA includes a splitter balun that splits the signal from a 50-ohm source into two parallel 100-ohm cables, which are then connected in series at the feed point to drive the 200-ohm antenna. But such an arrangement is not practical in devices operating at high voltage within limited space, so we explored two options for avoiding the balun, a bipolar Marx generator and an unbalanced feed.

The first option for avoiding the balun was a bipolar Marx generator. This is just two identical Marx banks charged with equal and opposite polarities, timed to fire simultaneously, resulting in two equal and opposite outputs. We investigated this by building a prototype Bipolar Marx Generator that could demonstrate the principle. Our measurements showed a jitter of around 100 ps, which was a relatively small fraction of the risetime, so the device performed about as expected.

The second option for avoiding the balun was simply to use a single 50-ohm cable to drive the balanced 200-ohm antenna, resulting in an impedance mismatch, which we hoped would not be too severe. To test the theory, we built a scale model 46 cm (18 in) in diameter. This was a version of the standard IRA-2 without the splitter balun feed, driven with a single 50-ohm cable connected across the feed point. The results show that even with the mismatch at the feed point, the performance of the antenna was only modestly degraded at frequencies below about 12 GHz.

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2. E - Electromagnetic Noise and Interference

3. (a)

4. C - Contributed Paper

5. Should be in in session on High Power Electromagnetics, chaired by IRA Kohlberg