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HV Cables for Remotely Located Pulsed Magnetron Applications

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In the majority of applications for e2v's direct-switched solid-state modulators, the modulator is connected to the magnetron with a short length of cable. This colocation of modulator and magnetron imposes very little pulse distortion and yields a high-quality, flat current pulse with good RF fidelity.

Typically, the modulator output cable is not rated for the full operating voltage of the magnetron; voltage breakdown is instead prevented by mechanically ensuring suitable separation of the cable from earthed surfaces. This approach limits modularity and the topological layout of systems.

Some applications demand a more modular approach, where the magnetron is physically separated from the modulator. Applications such as linear accelerator gantries or steerable antennae could benefit from the reduction in mass associated with the remote location of the modulator system, thereby reducing the mechanical demands of their rotating platforms.

To achieve this design flexibility, the practicalities and considerations for transmitting high-power electrical pulse energy over a number of metres, via commercially available cables, need to be determined.

This paper details the considerations for such an HV cable to be able to operate a pulsed magnetron, remote from the modulator source. It reviews the construction of HV cables from adjacent applications, and outlines the electromechanical performance factors that determine suitability for the aforementioned scenarios. Magnetron and modulator performance limiting factors are also identified and discussed. Finally, a time-domain transient analysis is presented, with supporting evidence from experimental test results.

Author: Mr HUTLEY, Joe (e2v)

Co-author: Mr HICKS, Matthew (e2v)

Presenter: Mr HUTLEY, Joe (e2v)

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