

BROADSONIC: Revolutionizing Partial Discharge Detection in Electrical Systems

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Introduction: Partial discharges within electrical systems pose a serious threat if left undetected. Existing acoustic sensors often struggle with issues related to sensitivity, range, and bandwidth. This white paper introduces BROADSONIC, a groundbreaking solution that employs an optical detection method, ensuring immunity to electromagnetic interference. BROADSONIC's unique technology delivers unparalleled sensitivity over a wide bandwidth, allowing the detection of subtle events at significant distances.

Methodology: To validate the performance of BROADSONIC, a test was conducted using a piezoelectric starter (Optimus 12715 Piezoelectric Fire Starter, Sparky) positioned at a distance of 1 meter from the sensor. The subsequent results were analyzed in both time and frequency domains to assess the system's capabilities comprehensively.

Results: Figure 1(a) illustrates a time domain measurement of the acoustic signature of an electrical discharge generated by the piezoelectric starter. The accompanying frequency domain plot in Fig. 1(b) showcases content reaching up to 1 MHz. The analysis revealed a peak signal-to-noise ratio exceeding 10^3 for the strongest frequency components of the signal.

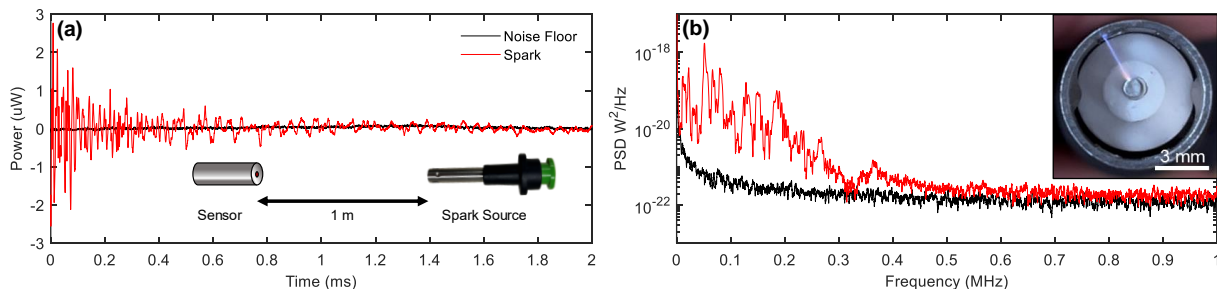


Fig. 1. Listening to a spark. **(a)** A time domain measurement showing the acoustic signature of a keychain igniter. The noise floor is also plotted to show signal strength. A schematic depicting the measurement setup is shown as the inset. **(b)** The same data in frequency space showing content up to roughly 1 MHz. The inset shows an image of an electrical discharge generated from the keychain igniter.

Implications: The outstanding signal-to-noise ratio suggests that BROADSONIC has the capacity to detect the same discharge event at distances significantly greater than 1 meter. This capability holds significant promise for high-voltage distribution applications, particularly in areas such as partial discharge detection in transformers. BROADSONIC's immunity to electromagnetic interference, combined with its extreme sensitivity, positions it as a revolutionary advancement in the field of acoustic sensors for electrical systems.