

# Design Modifications for a Small, Affordable Low Intensity Focused Ultrasound Device

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## ABSTRACT

Depression is a prevalent and serious medical illness, and while there are antidepressant drugs to mitigate depressive symptoms, 10 - 30% of patients either do not respond or develop a tolerance to these medications. Literature supports that there is an interrelation between the inflammatory response and treatment-resistant depression. A promising method to tackle depressive symptoms is to block the inflammatory signaling pathway with vagus nerve stimulation (VNS), reducing pro-inflammatory cytokine levels. Although electrical VNS devices exist, they are invasive, expensive, and have side effects including voice alteration, dyspnea, and cough. Low intensity focused ultrasound (LIFU) is a promising method that can stimulate a desired region noninvasively and without long term negative side effects. Nonetheless, the existing LIFU devices can be expensive, cumbersome, and large. The Center of Implantable Devices designed a prototype called the SonicNode that incorporates a transducer, matching network, and an amplifier into a 50 mm x 57 mm x 76 mm package. We modified the transducer head and created an intensity map of the focal region to demonstrate the improved performance of the device. The SonicNode and LIFU technology can be employed for long term, noninvasive treatment of a variety of neurological disorders.

## KEYWORDS

Focused ultrasound, device design, low intensity, fabrication