Grant Agreement No.	101070931
Start date of Project	1 September 2022
Duration of the Project	48 months
Deliverable name	**D1.3 CMOS interface for ~1024 piezoelectric transducers**
Partner Leader	TUD
Dissemination Level	SEN

Status	Final
Version	V1.0
Submission Date	29-02-2024

Author(s)	Tiago Costa (TUD)
Co-author(s)	

European Innovation Council

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

Executive Summary

The ability to perform brain stimulation with high-spatial resolution anywhere in the brain, while remaining minimally invasive, is of vital importance in the development of a new neuromodulation-based therapy for treatment resistant depression, and many other neurological disorders. Focused ultrasound is the optimal modality to achieve the abovementioned properties due to its excellent combination of depth of penetration, spatial resolution and reconfigurability. At the core of a focused ultrasound brain stimulation device, is the electronics that are capable of producing the electronic signals necessary to perform digital beam-steering and focusing: the ability to produce ultrasound waves that are focused in the three-dimensional space, and for which software can be used to adapt the focal spot location, in real-time and in the three-dimensional space. Beyond these properties, the electronics should also be compact such that it enables its deployment above the dura mater and below the skull, using minimally-invasive procedures. In particular, in the context of pre-clinical experiments with rat models of depression, compactness and high-spatial resolution are key, given the limited size of the brain. This deliverable reports on the development and electrical characterization of such electronic chip by exploring high-performance complementar metal-oxide-semiconductor (CMOS) technology, which is able to interface with a two-dimensional array of piezoelectric transducers exceeding 1024 elements with highly reconfigurable waveforms and driving voltages, while minimizing power-consumption.