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This work systematically evaluates two different switching matrices, dubbed herein as EMech and Correlator. One is based on ad-hoc electromechanical switches, the other on off-the-shelf solid-state ones [1]. These matrices interface a 2-port Vector Network Analyzer (VNA) and a 22-antenna array of a low-complexity portable microwave imaging (pMWI) system for brain monitoring [2], falling into to the category of multistatic system with switching network [3]. Hence, a whole 22×22 scattering matrix is sequentially filled by 2×2 segments.

Specifically, the assessment focuses on the switching performance and its extension to the overall system imaging-based monitoring capabilities. Thus, switching time, dynamic range, and repeatability analyses are considered, looking into the best trade-off of setting parameters to perform a real-time operation. The system is then experimentally tested by monitoring a mimicked brain hemorrhagic situation as in [2].

EMech and Correlator have comparable isolation and attenuation. For the former, the isolation is about 85 dB, and the attenuation is equal or lower than 2 dB. Meanwhile, for the latter, the isolation and attenuation are 90 and 4 dB, respectively. Regarding timing, the analysis concentrates on the switching time, the time it takes to change from one state to another, being 45 ms for EMech and having a 3x improvement in the case of Correlator. Besides, the Correlator substantially enhances the portability and compactness of the pMWI scanner, reducing the weight and dimensions.

The system keeps its imaging capabilities to track and localize the stroke progression with both studied switching matrices, reaffirming its potential as a frontline diagnostic and management tool. Imaging-based monitoring of a stroke evolution is illustrated in Fig. 1, changing from a 20 ml stroke to a 40 ml one, reporting the retrieved normalized dielectric contrast from two experiments using the EMech and the Correlator, respectively.

In conclusion, the integration of the Correlator represents a transformative step in the evolution of the pMWI system for stroke monitoring, offering versatility, efficiency, and potential for future advancements in pre-hospital and bedside applications.

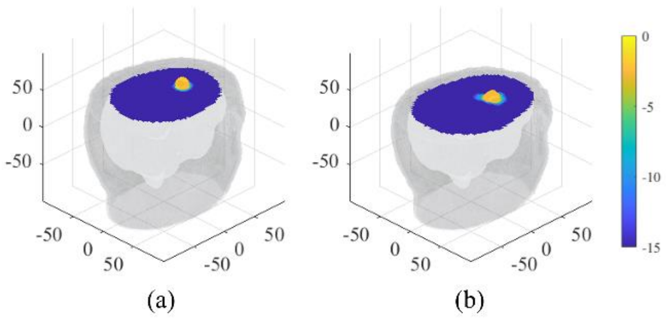

Figure 1. Transverse views extracted from 3-D reconstructions of the normalized dielectric contrast in dB. (a) EMech, (b) Correlator.

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