Video Article

Construction and Testing of a 32 Channel Phased-Array for Magnetic Resonance Brain Imaging

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Abstract

In the last decade, parallel detection of the Magnetic Resonance Imaging (MRI) signal with multiple receive-only surface coils has proven valuable for increasing image sensitivity and acquisition speed. The success of parallel imaging methods has driven the design of MR receive arrays with an increasing number of elements. The high degree of parallelism requires systemized design, construction and testing in order to implement the large number of tuned receive circuits with minimal mutual interaction and has altered the work-flow for how we construct receive arrays. The main aim of this work is to inform MRI researchers about the basic procedures for phased-array construction and describe an optimized protocol for constructing, tuning and decoupling a highly parallel array coil. The goal is to provide a better understanding of the basic experimental RF tools and procedures to facilitate the efficient design and construction of highly parallel MRI receive-arrays. We demonstrate the protocol with the construction of a 32-channel brain array of overlapped circular surface coil elements for pediatric subjects, although the basic principles apply to any array of overlapping loop elements. The video will go through the following steps: i) Describing the layout of the array elements, ii) creating a single loop coil, iii) tuning and active PIN diode detuning circuitry of the single loop, iv) estimating the coil quality factor, v) adjusting the single loop and match circuit to optimize preamplifier decoupling, vi) placing the neighboring elements to allow them to be efficiently constructed and inductively decoupled, vii) assembling the array, viii) decoupling the array elements from one another, ix) tuning and matching the coil elements, and x) performing final bench tests.

Disclosures

No conflicts of interest declared.

