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Dual-Tuned Removable Common-Mode Current Trap for MRI

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ABSTRACT

Magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) are preferred methods of gathering information from the body due to their non-invasive approach of obtaining a diagnosis. MRI can obtain spatial mappings from a region of interest, while MRS can obtain metabolic information from different elements. Dual-tuned radiofrequency (RF) coils are able to capture signals produced by both hydrogen atoms and a second atom of interest. Unwanted shield currents occur in these scans, which can cause image distortion, while the high energy dissipated can create harmful heat, which can injure the patient. These shield currents, also known as common-mode currents, need to be suppressed in the RF coils by non-magnetic current traps, or chokes. Typically, chokes are soldered directly onto the coax cables and require precise placement. In this paper, a novel dual-tuned current choke that is not soldered to the cable is presented. The design was manufactured with 3D printing to allow for optimal customization. The current trap attenuates shield currents at the Larmor frequency for hydrogen and phosphorous at 3T, 127.74MHz and 51.72MHz by -17.8 dB and -8.39 dB respectively. This novel device facilitates dual-tuned coil operation by not having to place two current traps for two frequencies, while also being able to relocate the trap to where common-mode currents are highest.

KEYWORDS

MRI, MRS, common-mode current, balun, RF coil, current choke