**Selective Wirelessly Adjustable Multiple-Frequency Probe with Automatic Impedance Matching for MR Imaging and Spectroscopy**

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**Introduction**

 We developed a high sensitivity multiple-frequency NMR coil system for spectroscopy and imaging measurements, which consists of a selective wirelessly adjustable multiple-frequency probe (SWAMP) with automatic impedance matching (AIM), using inductive-coupling between remote and local NMR resonators that can be used in various applications requiring multiple-frequency operation. This system can be used 1) to monitor tissue function *in vivo* for a range of nuclei in important biomolecules using remotely implanted coil, and 2) to remotely tune a resonator over a range of frequencies.

**Experimental**

 With previous funding, we designed and built a prototype of the SWAMP and AIM system (1-4) and developed and bench tested a final design and fabricated a fully functioning SWAMP coil with AIM (see Fig. 1, Part A). Here we tested this system in the AMRIS Facility 4.7 T and 11.1 T magnet systems. The SWAMP uses an integrated circuit (IC) implantable microchip fabricated in mainstream complementary-metal-oxide semiconductor (CMOS) technology that incorporates a digitally tunable capacitor array (D-Cap), a clock/data recovery receiver, a microcontroller with register bank and a power management system (not shown).

**Results and Discussion**

 We successfully used the same SWAMP coil and AIM system, with a phantom, to tune and match for H-1 resonance in the 4.7 and 11.1 T magnets (see Fig. 1, Part C), which demonstrates the system capability to tune and match over a broad frequency range.

**Conclusions**

 With this successful result, we have shown that the system is suitable for multiple frequency operation so next we will image with H-1 then measure spectroscopy with C-13, P-31, or F-19 using a suitable phantom, and begin the steps to apply this coil system to animal studies.

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**References**

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A B C

200 MHz (4.7 T)

400 MHz (11.1 T)



Fig. 1: Part A, SWAMP and AIM system; Part B, transmit receive surface coil; Part C, phantom images.