

Interactive comment on “ArduiTaM: accurate and inexpensive NMR auto tune and match system” by Mazin Jouda et al.

Anonymous Referee #2

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The authors claim an automatic system for RF tuning and matching through a micro-controller (Arduino) and variable capacitors by mechanical step-motors. This reviewer acknowledges the need to develop automatic system to replace time-consuming manual adjustment. However, some points are not clear and mislead the readers so a minor revision is necessary to improve the quality of this manuscript to be published. Major and minor concerns are listed below.

Major concerns 1. This study is limited in receive coil only. As the authors state in part 2 (why tune and match?), the tuned and matched condition is matter even at receiving side. However, the effect of impedance matching at the transmit side is more important in SNR. There is no any comments about the transmit side, tuning and matching condition with sample. How can the authors verify the condition of the transmit is always

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same during all experiments for this work. Perhaps, dose it relate to #5 in minor concerns? Even very small difference at transmit side (distance between a sample and coil or between transmit and receive coil.) make a huge different results in S-parameters (S11 and S21) that ultimately make different SNR. The authors should explain how to keep the same condition to conduct the comparison of receive only coil among manual, before and after auto tune and match. 2. Tuning and matching, in general, are performed after a sample is loaded. If the shift by loading a sample is negligible, this work has less scientific impact. Also, RF coils that have a little bit wide bandwidth may resolve the loading problems. In this respect, the authors are required supplement additional experiments to prove the necessity of this work. For example, bench test results with a universal tuning and matching before and after a sample loads to show loading effect that should be compensated. Also, the authors can add an image and SNR comparison with a universal tuned and matched coil using a sample without manual and auto correction in figure 9. 3. (Line 7, page2) and (Line 94, page 4): it misleads the readers because VCO may cover the frequency range for 1T to 23T but it is almost impossible to adjust resonating frequency (i.e., Larmor frequency) with capacitors and RF coil element. Otherwise, the authors should provide additional description with practical values (e.g., capacitor values and/or size of resonating structure) that can cover the wide range of NMR system.

Minor concerns 1. Is stepper motor okay for MRI study even if it has strong magnetic property? It may bring safety issues or magnetic field disturbance. 2. (Line 24, page 2): Please add a reference in the bibliography about the commercial system. 3. How can the NMR console receive a signal from ArduiTaM system? Is there an open port in the console or the homebuilt system need an interface module? The details should be described in the manuscript to better understanding because the minimized interface between automatic system and NMR console is important in this application. 4. There are some typo (e.g., line 28, page2) and improper English grammar/expression. The authors need to carefully check it. 5. This reviewer would like to ask to the authors to add the mathematical analysis to explain SNR comparison in Line 158, page 13.

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How only 0.8 dB insertion loss results in lowering 6 dB in SNR in figure 9. 6. Figure 5 missed the unit for the Y-axis.

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