A Microstrip Volume Coil with Easy Access for Wrist Imaging at 7T

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Introduction:

MRI/MRS at ultra high static magnetic field (>4T) has advantages in increased SNR, allowing improved spatial resolution or fast imaging, and also provides better spectral resolution. Due to distributed elements and intrinsic shield, microstrip transmission line coil [1] has some advantages at ultra high filed MRI. In this work, an easy accessed and open microstrip wrist coil was designed and tested at 7T.

Methods:

As shown in Fig. 1, an 8-elment microstrip transmission line (MTL) wrist volume coil was built on a Teflon tube (ε =2.1). It consists of two half-volume pieces. The coil dimensions were 7.5cm long (*L*) by 6.5cm inner diameter. Compared with traditional volume coils, the open MTL wrist coil can fit human wrist very closely because palm doesn't need to go through the MTL coil. This kind of coil structure has particular sensitivity because of better filling factor and close distance between wrist and coil elements. The widths *W* of the strip conductors of the MTL resonant elements were 6.35mm while the substrate thickness *H* or the distance between the strip conductor and the ground plane was 4mm. Fixed capacitors (27pF, ATC, Huntington Station, NY) were terminated at one end of each element. Trim capacitors (Voltronics, Denville, NJ) were terminated at the other end of each element. The coil was driven in linear and matched to 50 ohm. Frequency responses of the coil under unloaded and loaded cases were measured with network analyzer (Agilent E5070B).

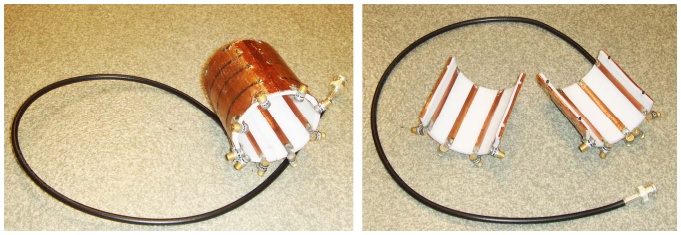

Fig.1 8-element MTL wrist volume coil integrated (left) and split (right)

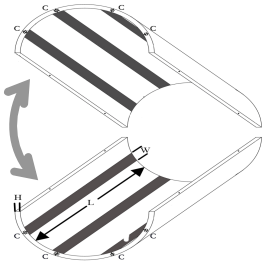

Fig.2 Schematic illustration of two half-volume pieces.

Phantom imaging and in-vivo imaging experiments were performed on a GE 7T MRI system (GE Healthcare, Waukesha, WI) using gradient echo sequence with TE=7.2ms, TR=150ms, Flip angle=30, FOV = 11cmx11cm, slice thickness = 3mm, matrix size = 256x256, NEX=1.

Results and Discussion:

The measured frequency responses (S11) of the unloaded and loaded cases were illustrated in Fig 3. The imaging mode (mode 1) was tuned to 299MHz. Unloaded Q and loaded Q are 288 and 85 respectively. A MR image of cucumber and in-vivo wrist images with in-plane resolution of 430μm x 430μm acquired by the MTL wrist coil were shown in Fig.4. According to bench tests and MRI experiments, the coil performance wasn't lowered by the split ground of the MTL coil. Furthermore, the two half-volume pieces has potential to be half-volume coils, as long as the resonant frequency of the half-volume coil was tuned to right value. In conclusion, an easy-accessed MTL wrist coil was successfully designed and tested for ultra high field MRI.

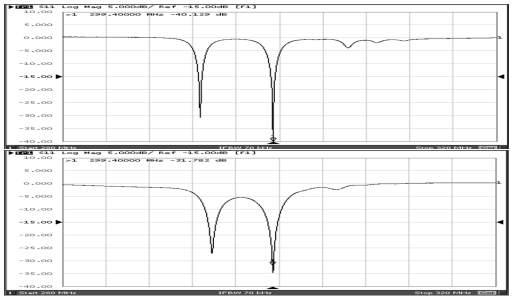

Fig.3 Measured frequency response of the MTL prototype wrist coil when unloaded and loaded

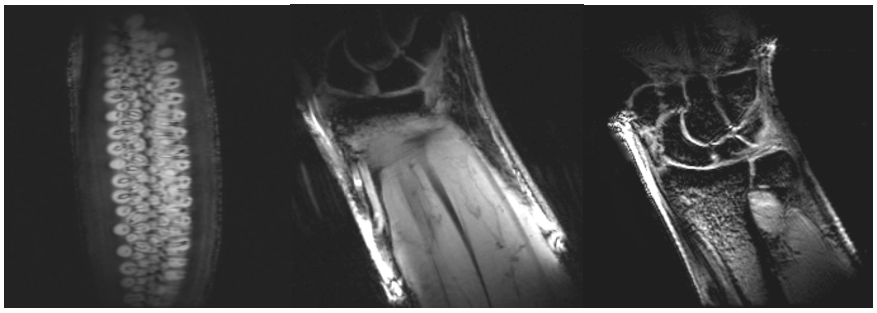

Fig.4 Phantom (cucumber) image and in-vivo wrist images acquired by the MTL wrist coil

Acknowledgement:

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References:

[1] Zhang X, et al, J Magn Reson (2003) 161:242-251;