Microstrip Based MR Birdcage Coil for 1.5 T

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Birdcage is a well-known magnetic resonance (MR) head coil since it was firstly described in 1985 by Hayes et.al. It is widely used due to high signal to noise ratio and a high radiofrequency magnetic field homogeneity that guarantee a large field of view. Microstrip based birdcage coil for 4T is proposed in 2003 [Zhang XL, Ugurbil K, Chen W. A microstrip transmission line volume coil for human head MR imaging at 4 T. J. Magn. Reson 161 (2): 242-251 APR 2003] and gives a very homogenous field. In this work, we analyze and fabricate microstrip based birdcage coil, which can be used as head coil for 1.5 Tesla MR imagers.

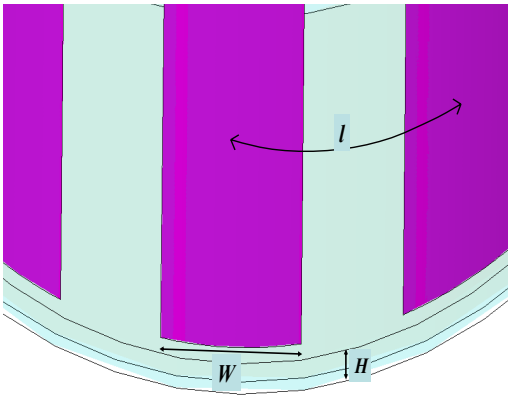

Figure 1

In Figure 1, sectional sketch of a microstrip transmission line (MTL) can be seen: *H* is the distance between the strip conductor and the ground plane, *W* is the width of the strip, the strip-to-strip distance is given by *l*.

Copper is commonly used for strip conductor and the ground plane. For the substrate we use acrylic with relative dielectric constant of 3.4. The geometrical and electrical properties of MTL determine the Q value, which is mainly dictated by radiation losses.

For the birdcage, shown in Figure 2, 12 microstip lines are evenly distributed around the inner surface of a circular substrate. The outer surface is the ground plane. The strips are fed from one end and terminated by an open circuit at the other end. At the feeding end, lumped inductances are used for the tuning purpose. The equivalent circuit of the structure is obtained as a coupled resonant circuit. The resonant frequencies can be found from the strip capacitances and the lumped inductances. It is found that the first resonance is around 67 MHz, which is also found to be consistent with the experimental measurements. The slight differences may be attributed to the mutual inductances ignored in the analysis. This design has a low-pass characteristic. High pass structure can be obtained by short circuiting the strip ends and using lumped capacitances between the strip lines at the feeding end.

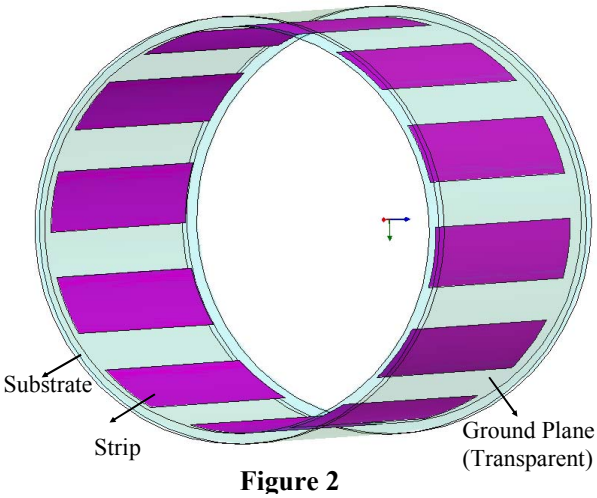

Figure 2

The field structure is less dependent on the loading of the coil then conventional birdcage coil designs. The possible applications and properties of this coil will be discussed during the presentation.