

## High temporal and spatial resolution breast MR imaging at 7T; Feasibility Study using 8-to-1 channel Tx-only Array Combined with 8 channel Rx-only Insert

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**Introduction:** In the breast MR imaging, high temporal and spatial resolution is critical to improve the accuracy of diagnosing the changes in breast tissue. Dynamic MR imaging is used for tracking the wash-in/-out patterns and depiction of fine morphologic details of lesion can be observed only in early post-contrast phase (60-120 sec. after the injection). Acquiring breast MR images with high spatial resolution is another prerequisite for assessing the breast disease, since the most commonly used diagnostic criteria for differential diagnosis is based on lesion morphology [1]. Also, it has been reported that the non-uniform B1 field within the breast significantly affects not only the kinetic analysis but also efficacy of fat-suppression [2]. With the advantage of high SNR at 7T, in order to acquire uniform B1 field distribution with high temporal and spatial resolution of breast MR imaging, we have developed the TX only array combined with 8-ch. Rx array insert. Three normal healthy volunteers were examined with T1w-fat suppression to demonstrate the feasibility of breast Tx-only/Rx-only coil system.

**Materials and Methods:** Three normal healthy volunteers (29 - 32 yr.) were involved in this IRB approved study. All imaging was performed on 7T human MR scanner (Siemens Medical System, Erlangen, Germany). Eight – channel Tx only array was constructed based on the Tic-Tack-Toe concept [3] and Eight Rx-only array was constructed in cylinder frame (Fig. 1a-b). 4-port quadrature (right side in Fig.1a) and anti-quadrature (left side in Fig.1a) excitations was utilized through the simple use of different cable lengths, thus there was no need for using B1 shimming and/or full Tx array system (the array is capable of utilizing parallel excitation if needed.). Unilateral breast MR imaging using GRE-sequence with fat-saturation was applied. Scan parameters were; TR/TE=120/3(msec), FA=60, in-plane resolution=0.4x0.4 mm<sup>2</sup>, slice thickness=3mm, Total scan time=22 (sec.).

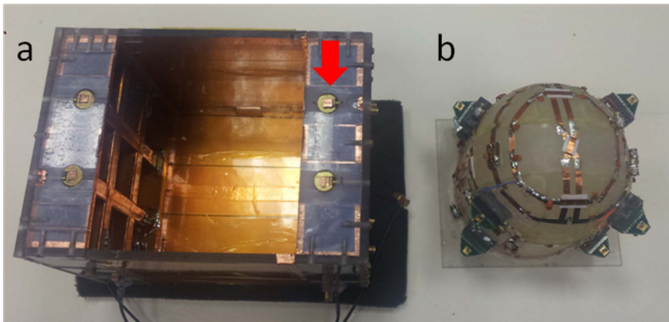


Figure 1. a) Eight Tx only array based on TTT coil design and b) eight Rx only array insert constructed on a cylinder frame. Red arrow indicates the rod which can be pull in/out for fine-tuning and matching.

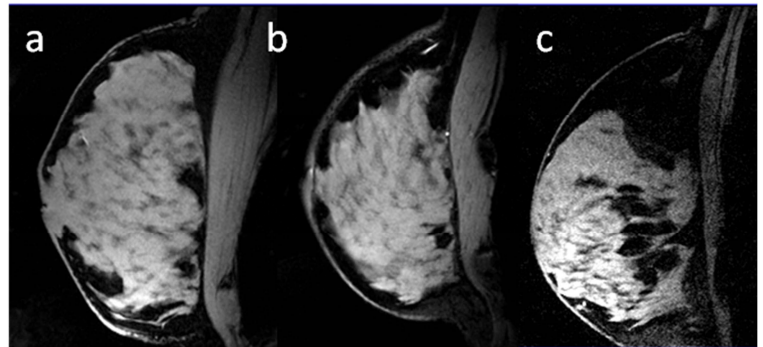


Figure 2. Unilater breast MRI of three volunteers using GRE with fat-saturation a-b) with and c) without Rx only array insert.

**Result and discussions:** T1W breast MR imaging using GRE fat-saturation was successfully acquired using eight Tx only array combined with eight channel Rx only array insert. In-plane res. of 0.4 x 0.4mm<sup>2</sup> had sufficient SNR, as high as two folds when Rx only array was combined. The breast MR imaging at 7T shows potential for detecting small changes in breast tissue. The homogeneity of the B1 field was measured to be 78% across the volume of a phantom with the size of the human breast (data not shown.).

**References:** 1. Kuhl CK et al. Contrast-enhanced MR imaging of the breast at 3.0 and 1.5 T in the same patients: initial experience. *Radiology* 2006;239:666–676. 2. R. Brown et al. Sub-Millimeter Breast Imaging and Relaxivity characterization at 7T. *Proc. Intl. Soc. Mag. Reson. Med.* 19 (2011). 3. T.S. Ibrahim et al. Tic Tac Toe: Highly-Coupled, Load Insensitive Tx/Rx Array and a Quadrature Coil Without Lumped Capacitors. *Proc. Intl. Soc. Mag. Reson. Med.* 16 (2008.)

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