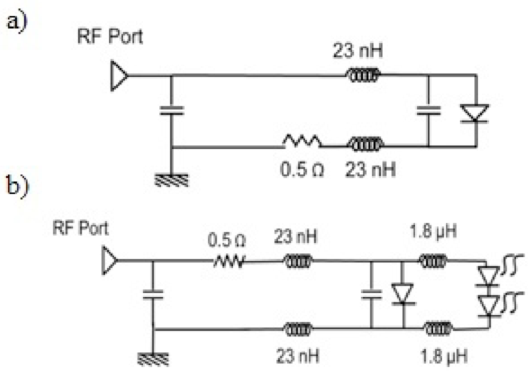


Fig.2: Equivalent circuit of endoluminal coils constituted of rectangular single loop coil (5.1 mm width ; 47 mm length) a) of the reference coil and b) the optical decoupled coil. Two 1.8 μH inductors separate photodiodes from the rest of the coil.

Results: SNR profiles presented in Fig. 3 show that the SNR at 2 mm distance from the tube for the reference coil is about 301, while it is about 262 for opticaly decoupled probe.Fig. 4a) and 4c) show image uniformity with a standard decoupling and coupling effect on image with a non-decoupled coil, respectively. Fig. 4b) shows that optical decoupling is still not perfect.

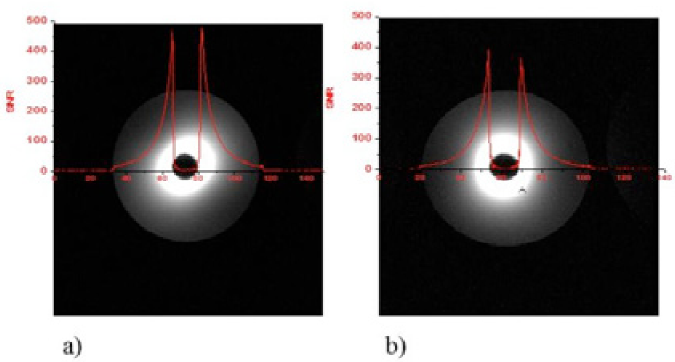


Fig.3: Images obtained with endoluminal coil using a gradient echo sequence with a) galvanic decoupling and b) optical decoupling. Red curve represent the SNR profiles along an horizontal line centered with the coil.

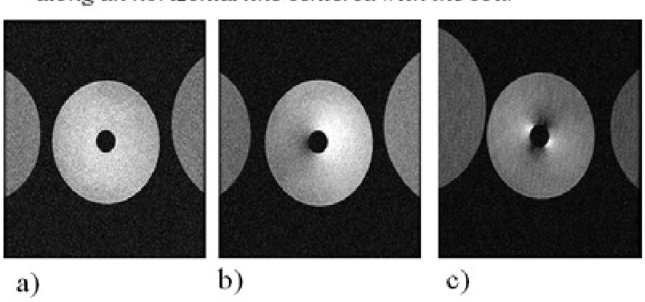


Fig. 4: Images obtained with 'Body' coil using a fast spin echo sequence with a) the reference coil, b)the optical decoupled coil and c) coupled coil inserted in the water tank.

Discussion/Conclusion: The proof of concept of this decoupling circuit was demonstrated. However, the circuit need to be improved in order to compete with usual decoupling circuit. In particular, special care should be taken in the optical conversion and transmission of the bias signal that could explain performance differences.

References:

[1] J. Yuan et al., IEEE Transactions on Medical Imaging, 2008; Vol.27, pp. 1432-1438.

[2] C. Armenean et al., Magnetic Resonance in Medicine 2004; Vol.52, pp.1200–1206.

241

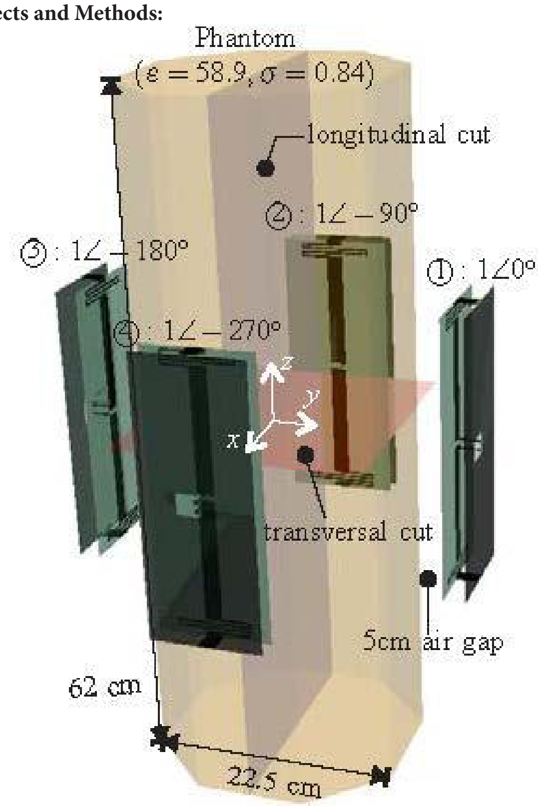
A 4-Channel RF Coil with Large Longitudinal Field-of-View for 7-T MRI

Z. Chen[1,2], A. Rennings[2], K. Solbach[1], D. Erni[2]

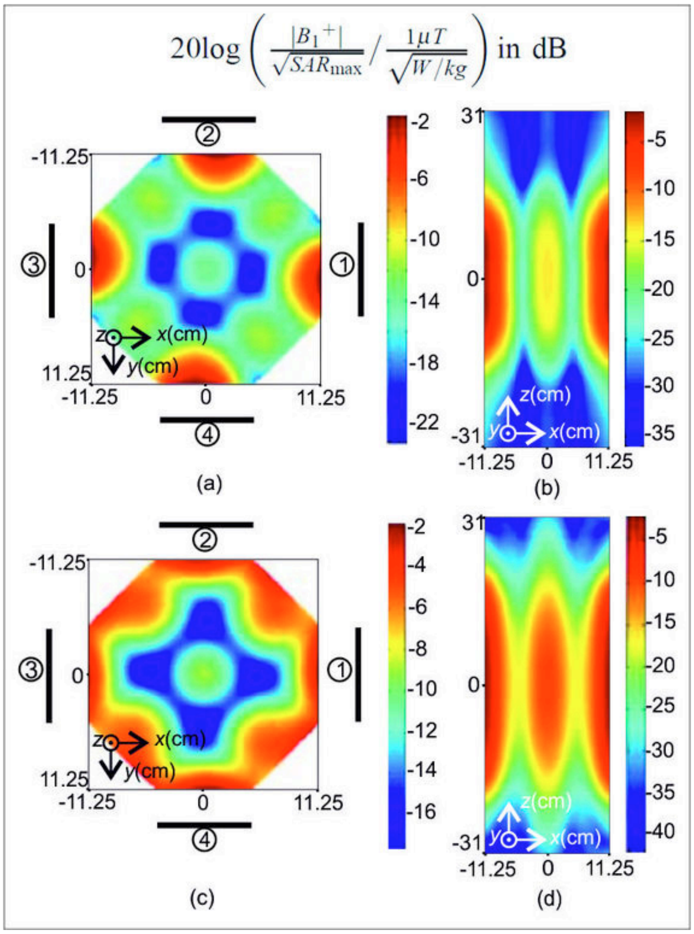
[1]High Frequency Engineering (HFT), University of Duisburg-Essen, Duisburg/GERMANY, [2]General and Theoretical Electrical Engineering (ATE), University of Duisburg-Essen, Duisburg/GERMANY

Purpose/Introduction: Recently multi-channel RF coils based on several longitudinally oriented strip-line elements have been successfully applied in ultra-high field MRI. Among the different utlized dipole approaches [1], [2], the symmetrically fed RF coil element which was terminated by two meanders [2] seems to be one of the most promising candidates. Compared to this well established 25 cm-long element, a novel 41 cm-long coil element with an optimized SAR distribution and a better H-field homogeneity has been presented in [3]. In this study we establish a preliminary 4-channel RF coil for whole-body 7-T MRI with the aforementioned two kinds of elements. We show a qualitative comparison based on numerical simulation and experimental measurement.

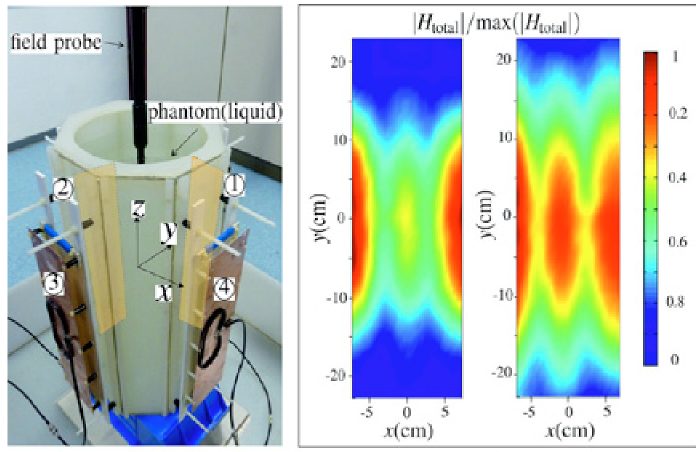
Subjects and Methods:



The strip-line elements are arranged quadripartitely around a octagonal prismatic phantom (ε_r=58.9, σ=0.84 S/m) with a circumradius of 10 cm, as shown in Fig. 1. The top surface of the coil elements is separated 5 cm from the phantom by air. The excitations of the elements 1-4 are set equally in magnitude and with 90° lag to the previous one.
For the preliminary near-field measurement, a 4-channel setup is established in-house, which can be seen in Fig. 3(a). The input power is split into four equal parts with 90° phase-shift with each other via a Bulter matrix. Each part is connected to a power amplifier and supplied to the corresponding coil element.
Results:



The simulation results of the 4-channel RF coil with different elements are shown in Fig. 2. The $|B_1^+|$ patterns on the transversal and longitudinal sections are normalized to $\sqrt{SAR_{max}}$ inside the phantom.
Fig. 3 shows the measured relative magnetic field distribution with the setup depicted in Fig. 3(a). Due to the limitation of the field probe, instead of $|B_1^+|$, the absolute magnetic field in xz-plane is measured.



(a) (b)

Discussion/Conclusion: Our numerical analysis yields a coupling between the adjacent elements below -30dB for both cases. It can be seen that compared to the case with the well-established 25 cm-long element, the 4-channel RF coil with the 41 cm-long element encompassing an eigen-resonant metallic ground plane [3] exhibits a more uniform $|B_1^+|$ distribution in the vicinity of the phantom boundary. Besides this improvement, a larger longitudinal field-of-view(FoV) is achieved due to the longer extent of the element. This is also confirmed by the corresponding measurement results.

References:

[1] Brunner et al, 2007, ISMRM, p.448.
[2] Orzada et al, 2008, ISMRM, p.2979.
[3] Chen et al, 2013, IMS, #1217.

242

A new antenna concept for RF excitation at 9.4T

I. Zivkovic[1], K. Scheffler[1,2]
[1]High Field MRI, Max Planck Institute for Biological Cybernetics, Tuebingen/GERMANY, [2]Center for Integrative Neuroscience, University of Tuebingen, Tuebingen/GERMANY

Purpose/Introduction: By introducing of the higher static magnetic field, B_1^+ field distribution becomes inhomogeneous due to the shorter wavelength in tissue. Different experimental hardware and methods are used in order to reduce B_1^+ field inhomogeneity [1-3]. In this work we present a new antenna concept used for the first time as RF transmit coil at 9.4T. Antenna is used in two configurations which produce complementary B_1^+ field patterns that cover whole head region.
Subjects and Methods: Experiments were performed on a 9.4T MR scanner (Siemens Medical Solutions, Erlangen, Germany). The original antenna is described in [4] and is modified for operation inside of 9.4T scanner. Proposed antenna does not contain any lumped elements or matching circuits and all antenna parts are made of copper.
Antenna's geometry is shown in **Fig. 1**. Antenna consists of an 'empty' rectangular box that has five sides and is placed 2mm above ground plane. Ground plane size is 300x300mm and box size is 210x200x55mm. Two short copper straps connect box sides and ground plane.
Antenna 1 and antenna 2 are used for RF excitation. The difference between them is in position of ground plane connections. Antenna 1 has ground plane connections starting from the midpoint of the box sides while short straps of the antenna 2 are 7mm shifted from the midpoint (**Fig. 1b**).
In measurement setup, antenna was placed at 15cm distance from the phantom's head.

ESMRMB
European Society for Magnetic Resonance in Medicine and Biology

Magnetic Resonance Materials in Physics, Biology and Medicine

magma

Vol 26 / Suppl 1 / October 2013
Electronic only

Book of Abstracts
ESMRMB 2013
30th Annual Scientific Meeting
Toulouse/FR, October 3–5, 2013

Official Journal of the European Society for
Magnetic Resonance in Medicine and Biology

Springer