



# Radiofrequency Antenna Array with Electric Dipole and Loop Elements

## Combines Loop and Dipole Elements

A 16-channel transceiver array (16LD) that combines loop and dipole elements maintains both the higher transmit and receive performance of the loop elements at shallower depths and the improved performance of the dipole elements at greater depths. The loop-dipole combination increases channel count and density beyond what can be currently achieved with dipole elements alone while reducing coupling between the two elements. Using this approach, coil arrays with large number of channels (i.e. 8, 16 or more) can be built that have improved transmit and receive B1+ performance. Furthermore, combining dipole and loop elements in a high-field radiofrequency (RF) imaging array can improve transmit and receive performance of MRI, and the antenna arrays can be used in other medical and non-medical electromagnetic heating applications (e.g., RF hyperthermia).

## Improves SNR, SAR and B1+ Transmit

MRI at ultra-high clinical magnetic field strengths (3T) faces a number of challenges: B1+ field inhomogeneities, reduced RF penetration, reduced transmit efficiency, high local specific absorption rates (SAR) and poor image quality. In addition, 3T body coils are particularly challenging to construct. This technology, which combines loop and dipole elements in a 16-channel body imaging array at 7 Tesla, improves SNR, B1+ transmit and SAR efficiencies as compared to two existing state-of-the-art coil arrays. In testing, the 16LD not only maintained high near- and far-field performance of loop and dipole elements, respectively, but it improved both near- and far-field performance compared to existing arrays. Adapting combined loop-dipole arrays for other target anatomies and applications can also further improve performance over existing technologies.

### BENEFITS AND FEATURES:

- Combines loop and dipole elements
- Maintains higher transmit and receive performance of the loop elements at shallower depths as well as improved performance of the dipole elements at greater depths
- Improves SNR, B1+ transmit and SAR efficiencies as well as transmit and receive B1+ performance
- Antenna arrays can be used in other medical and non-medical electromagnetic heating applications

### APPLICATIONS:

## Technology ID

20160153

## Category

Engineering & Physical  
Sciences/MRI & Spectroscopy  
Life Sciences/Diagnostics &  
Imaging  
Life Sciences/Human Health  
Life Sciences/MRI &  
Spectroscopy  
Software & IT/Algorithms  
Software & IT/Image & Signal  
Processing  
Agriculture &  
Veterinary/Veterinary Medicine

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- MRI coil (hardware)
- Body coils for 3T and 7T scanners
- Multi-channel transmit (“high-end”) systems at clinical 3T and pre-clinical 7T field strengths
- Siemens 7 Tesla Magnetom Terra
- Electromagnetic heating for both medical (i.e., hyperthermia and RF ablation applicator) and non-medical applications
- Antenna system for in vivo microwave radiometry
- Bio-electromagnetic applications

**Phase of Development** - Prototype developed

**Researchers**

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[External Link](http://www.med.umn.edu) (www.med.umn.edu)

**Publications**

[A 16-channel combined loop-dipole transceiver array for 7 Tesla body MRI](#)  
*Magnetic Resonance in Medicine*, 2017 Feb;77(2):884-894. doi: 10.1002/mrm.26153. Epub 2016 Feb 17

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