# Wireless Power Transfer for Biomedical Application


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## Objectives

- *To safely transmit 100 mW power for biomedical application between the transmitter and receiver*
- *To generate magnetic flux in the vicinity of the transmitter which should not exceed 27 µT*

## Methodology

- *Implement analytical equations by MATLAB*
- *Verification by Finite Element Simulation (COMSOL Multiphysics)*
- *Experimental verification by developing a prototype*

## Results

| Reference | Transmitter dimensions | Receiver diameter | Receiver's No. of turns | PDL (mW) | Magnetic Flux Density under safety range |
|---|---|---|---|---|---|
| [1] | 10 x 20 cm | 0.5 cm | 20 | 3.9 | - |
| [2] | 29 x 20 cm | 1.9 cm | 19.5 x 4 | 43 | - |
| [3] | 50 x 60 cm | 4 cm | 2 | 20 | - |
| [4] | 30 x 30 cm | 1.05 cm | 8 | 80 | - |
| [5] | 103 x 90 cm | 2.5 cm | 3 | 20 | - |
| [6] | 8 x 8 cm | 1.2 cm | - | 1.7 | - |
| [7] | 27 x 27 cm | 4.2 cm | 8 | 120 | - |
| This Work | 40 cm (diameter) | 3.86 cm | 9 | 100 | Yes |


- [1] A Smart Cage With Uniform Wireless Power Distribution in 3D for Enabling Long-Term Experiments With Freely Moving Animals, 2009
- [2] Columnar Transmitter based Wireless Power Delivery System for Implantable Device in Freely Moving Animals, 2013
- [3] Towards a Smart Experimental Arena for Long-Term Electrophysiology Experiments, 2012
- [4] A Smart Multicoil Inductively Coupled Array for Wireless Power Transmission, 2014
- [5] A Smart Cage for Behavioral Experiments on Small Freely Behaving Animal Subjects, 2013
- [6] A system for wireless power transfer of micro-systems in-vivo implantable , 2014
- [7] A Smart Cage With Uniform Wireless Power Distribution in 3D for Enabling Long-Term Experiments With Freely Moving Animals, 2015


## Conclusion

- *Based on the result in Fig 7, we can confirm that a Helmholtz coil with a transmitter radius of 20 cm and a separation of 10 cm is the best model for safely transmitting wireless power of 100 mW to the receiver.*
- *It is also one of the first coil configuration study considering the safety limit of magnetic flux density*

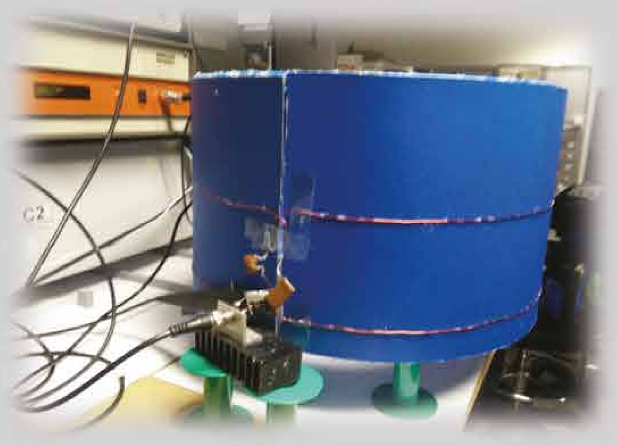

Fig 1: Transmitter

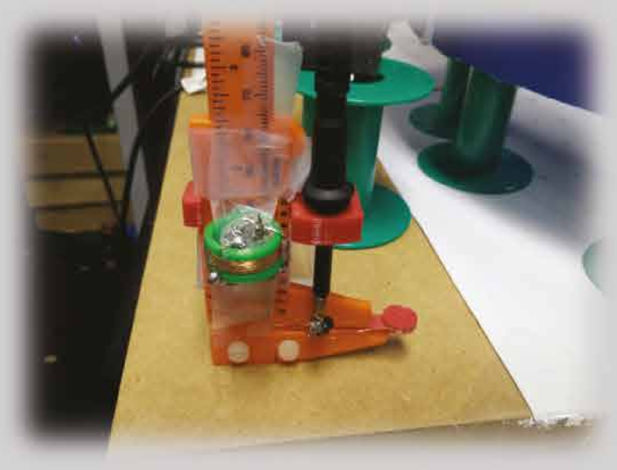

Fig 2: Receiver

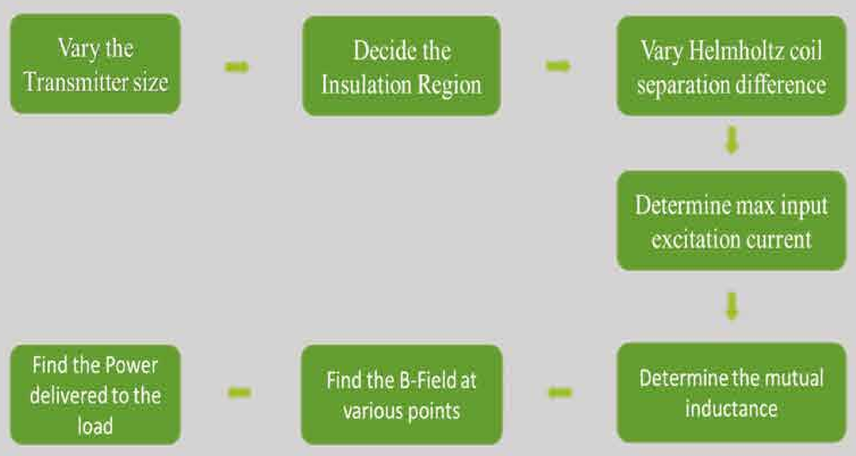


Fig 3: Flowchart showing design and optimization

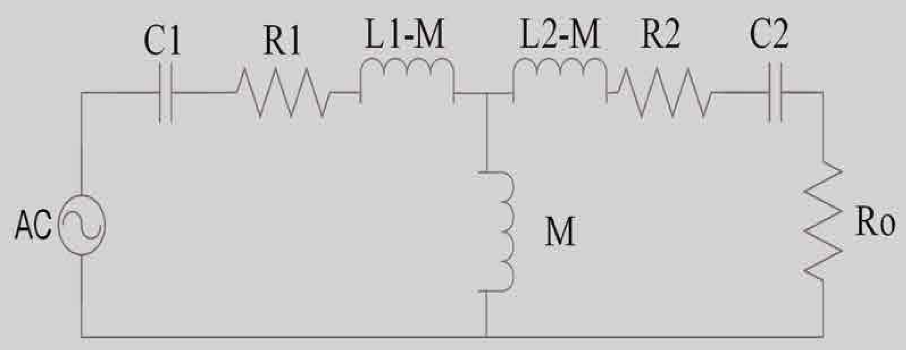


Fig 4: Circuit Diagram

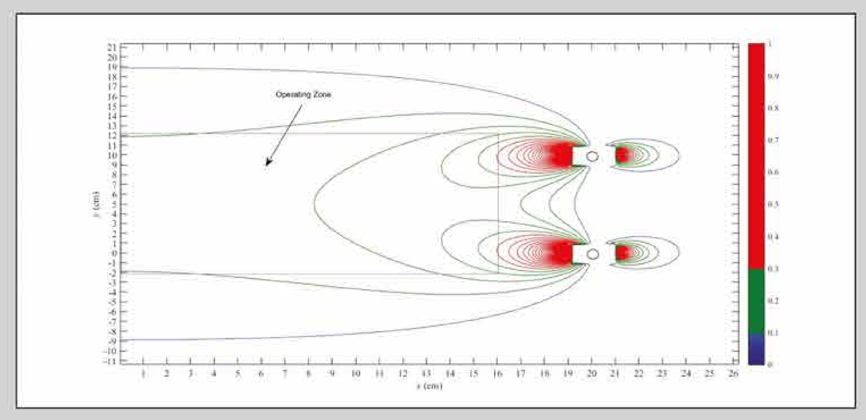

Fig 5: Power distribution (MATLAB)

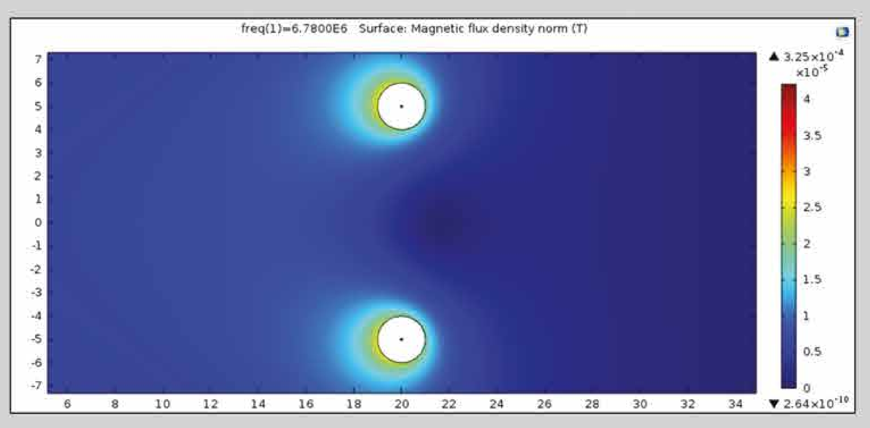

Fig 6: Magnetic flux distribution (COMSOL)

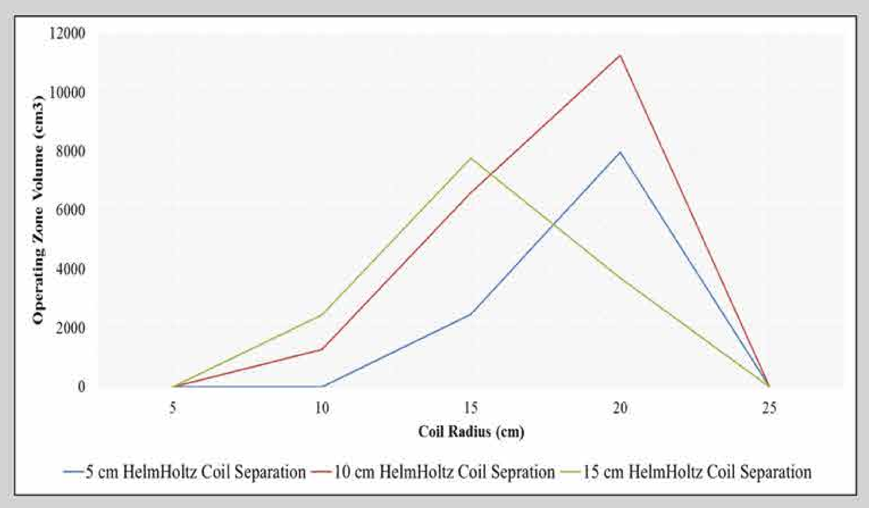


Fig 7: Operating zone volume for different configurations