Compact Implantable Antenna for Leadless Cardiac Pacemaker System

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Motivation

- Reduced complications in implantation
- Improved patient monitoring
- Patient comfort

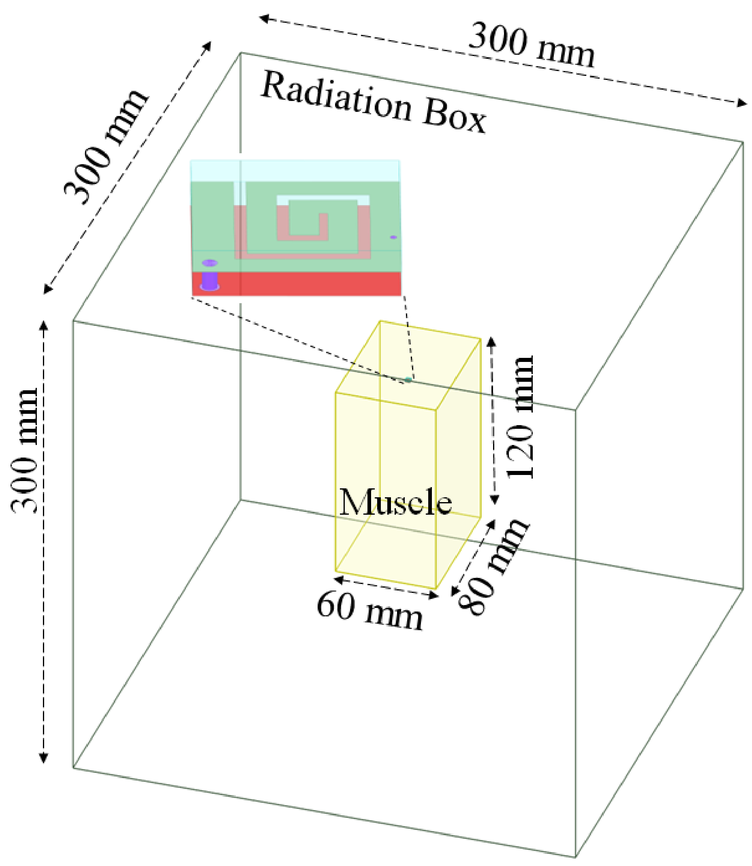
Objectives

- **Enhanced Bandwidth**: improve the bandwidth of the system for greater data rates and for tolerance to detuning in implantation
- **Compact Size**: miniaturise the design to fit in a leadless pacemaker
- **2.4GHz ISM Band**: operate in Bluetooth low energy to communicated with patient smartphones

Contribution

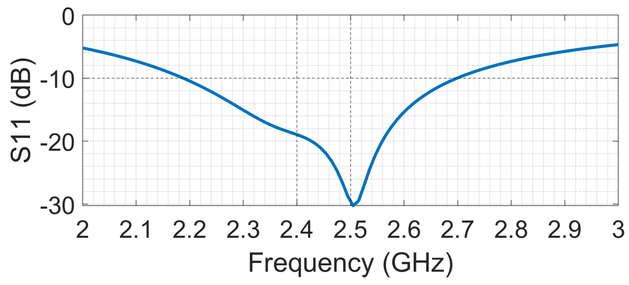
- **Implementing a shorting pin for improved bandwidth and miniaturisation.**
- **Achieveing a miniaturised 3 X 3 X 0.71 mm footprint**

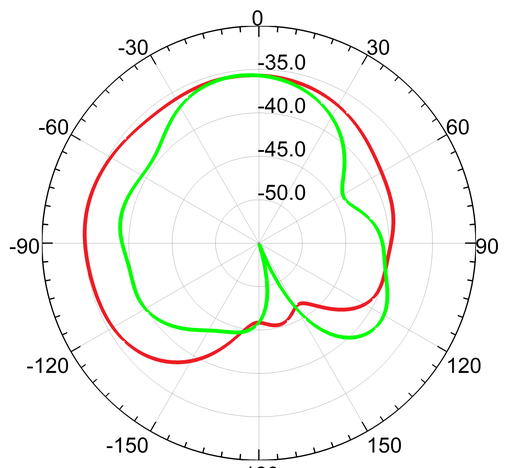
Simulation Setup



Simulation in a homogeneous heart phantom.

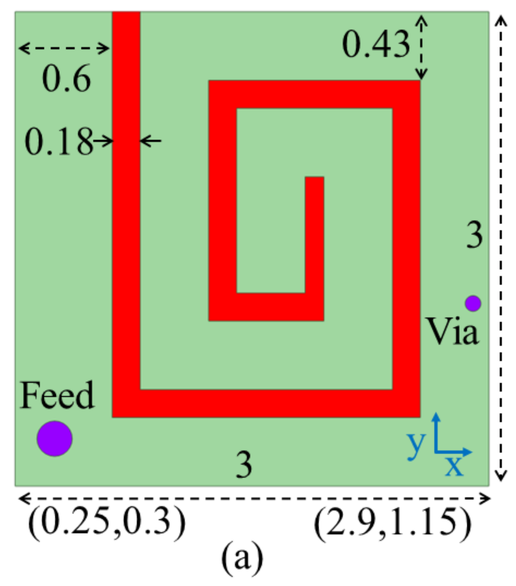
S-11 and Radiation Pattern (dBi)



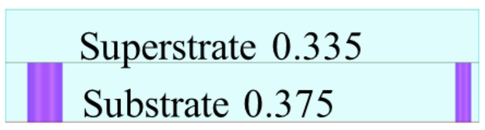


A 20.0% fractional bandwidth is achieved with a high enough simulated gain across the 2.4GHz band to achieve communication with patient smartphones.

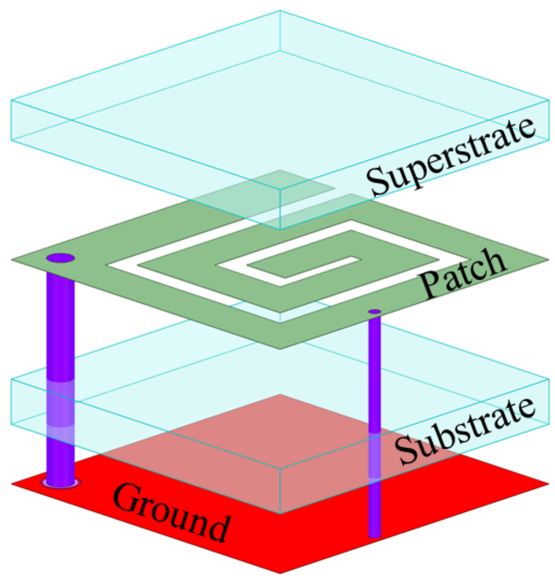
Proposed Antenna Dimensions



(a)

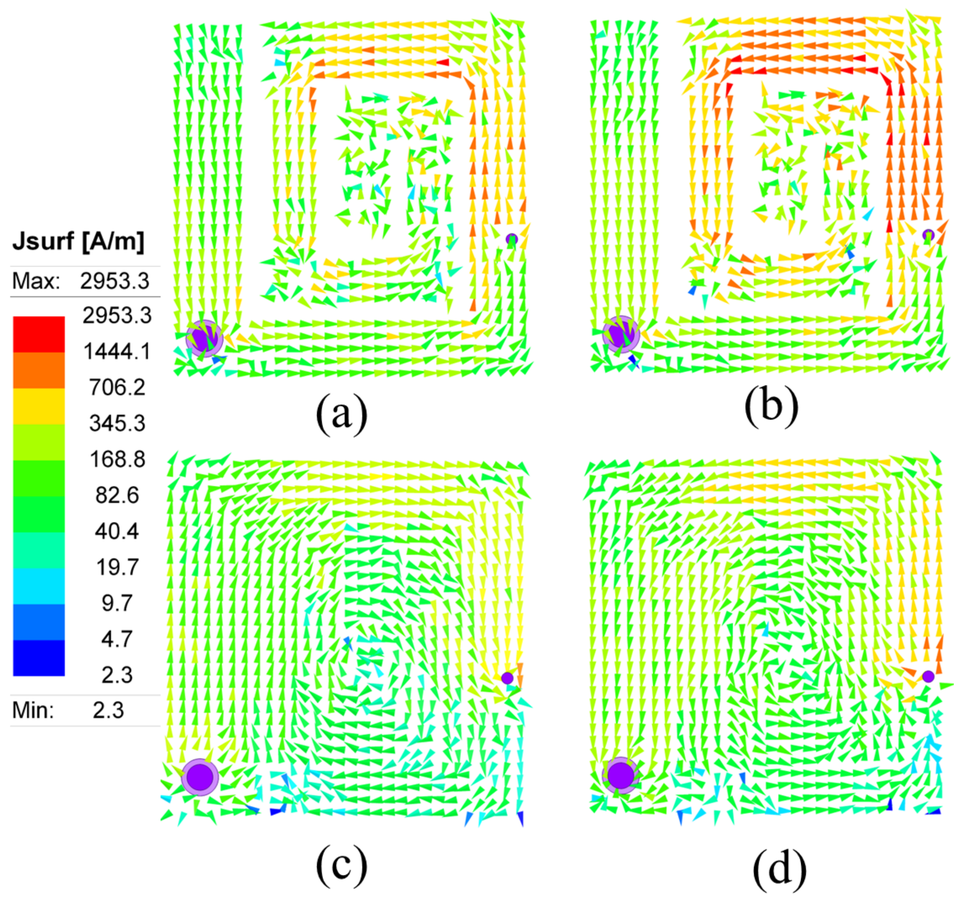


(b)



(c)

Current Distribution



Top and bottom current paths at 2.3 GHz and 2.5 GHz showing alternative paths for lower and higher frequencies

Conclusion

- **The proposed dimensions are close to the smallest in the literature while attaining an improved simulated fractional bandwidth of 20.0%.**
- **Miniaturisation is achieved through a shorting pin and spiral meander pattern.**
- **Fabrication and real world testing is needed to validate the design**

Specific Absorption Rate

The specific Absorption Rate of this design adheres to IEEE C95.1-1999 in multiple different simulation scenarios

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