iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** VI **Month of publication:** June 2019

DOI: http://doi.org/10.22214/ijraset.2019.6174

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue VI, June 2019- Available at www.ijraset.com

Near-Field Antenna for RFID Applications

Kavya M[1], Dr. Srividya B V[2], Mr. Sandeep Vedagarbham[3], Mr.Pundaraja[4]
[1]Student, M. Tech, Digital Communication and Networking, Telecommunication Engineering, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India
[2]Associate Professor, Department of PG Studies, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India
[3]Chief Technical Officer, [4]Design Engineer, Lambdoid Wireless Communication

Abstract: Radio-frequency identification (RFID) is an advancing technology that enables in detection and recognition of the objects with an identification code which is carried out by an electronic chip which is attached to the tag. RFID technology identifies the objects, collect the information, and analyze the data from the object. The design of RFID system depends mainly on two devices which are RFID reader and the RFID tag, both the system consists of an antenna in it. The Near-field spiral dipole antenna is used as reader antenna, which is designed for ultra high frequency Generation-2 item-level tagging systems. Here the near-field spiral dipole antenna for the RFID applications is designed for the required range of frequency using a tool called CST tool and then the designed antenna is fabricated on a PCB for the required specifications.
Index Terms – RFID, Spiral Dipole Antenna, VSWR, Return loss, CST tool, PCB

I. INTRODUCTION

RFID uses electromagnetic fields, which spontaneously identify and trace the objects based on the tags which are attached to that objects. The RFID tag contains electronically-stored data and it can be a passive tags or active tags. Tag need not be within the line of sight (LOS) to the reader, which is very much required in the barcode system. The reader antenna transmits the EM energy to energize the tags. The reader which converts radio waves to more understandable form of information collected from the tags. The reader antenna should be designed with lower profile and realize attenuations.

The fields which are surrounded an antenna are divided into three principle regions:

1) Reactive near-field region,
2) Radiating near-field (Fresnel region)
3) Far-field (Fraunhofer region)

The RFID systems differ from each other by system based on several factors like usage, frequency band of operating, reading distance, protocol, power transmission to the tag, the procedure for sending data from the tag to the reader, and so on. The basic classification is on the "near-field" and "far-field" RFID, which is classified based on the power transfer in between the reader and the tag. The antenna here is designed to perform as a near field antenna for RFID applications.

II. METHODOLOGY

The proposed methodology is depicted in the below flowchart, here the design of spiral dipole antenna which operates at the frequency band of 865-868 MHz. The design parameters like length, width and thickness are formulated. The orientation, shape and feeding technique of an antenna is designed using CST tool and analyzed with respect to VSWR, return loss and other specifications. Then the designed spiral dipole antenna is fabricated on the PCB and analyzed using vector network analyzer.

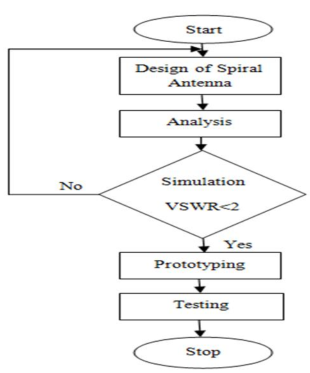


Fig 1: Flow chart of Proposed Methodology

III. SPIRAL DIPOLE ANTENNA DESIGN

Spiral Antenna belongs to the class of frequency independent antennas which will operate over a wide range of frequencies. The antenna proposed has advantages of its easy gain, simple structure, higher space utilization, improved radiation efficiency, pattern control with a small antenna size and which operates at the range of 865-868 MHz. Based on mathematical formulation, the length of outer square of an spiral dipole antenna is around 82.35 mm, width around 105.33 mm with thickness of 1.6 mm. The antenna is designed using CST tool and the results are analyzed. The antenna which is designed is developed on a printed circuit board using FR4 substrate with epsilon value of 4.4 and thickness of 1.6 mm.

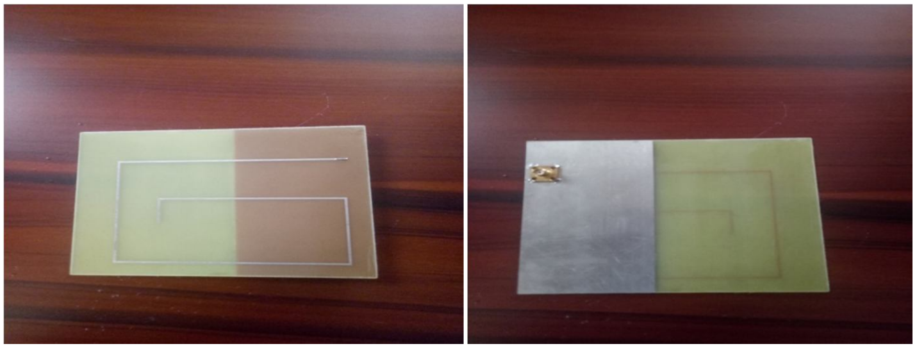


Fig 2: Proposed Near-Field PCB Antenna [Spiral dipole antenna]

IV. RESULTS AND DISCUSSIONS

The "Voltage Standing Wave Ratio" (VSWR) is one of the important parameter, which is used to measure how well the antenna impedance is matched to the radio or transmission line it is connected. The lower the VSWR is the better the antenna is matched and large amount of power is delivered. The value of VSWR ranges from 1 to ∞, but VSWR value less than 2 is considered to be best for most of the antenna applications. The figure 3 depicts that the value of VSWR is less than 2 for the entire range of frequency band of 865-868 MHz.

$$\text{VSWR} = \frac{1+|\Gamma|}{1-|\Gamma|}$$

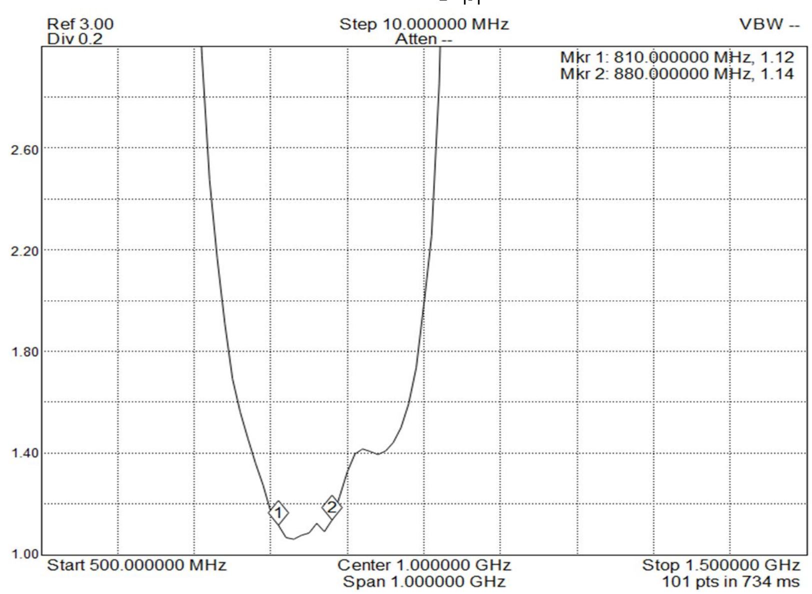


Fig 3: VSWR of Spiral Antenna

Return Loss (RL) is another specification of interest for an antenna design which is denoted in decibels (dB). Basically the return loss should be less than -10 dB for the antenna design. Here in the fabricated antenna the return loss obtained is also less than -10 dB, which is shown in the figure 4 below. The figure 5 and 6 shows the directivity and gain plot of an antenna designed.

$$\text{RL} = -20 \log \left[\frac{VSWR-1}{VSWR+1}\right]$$

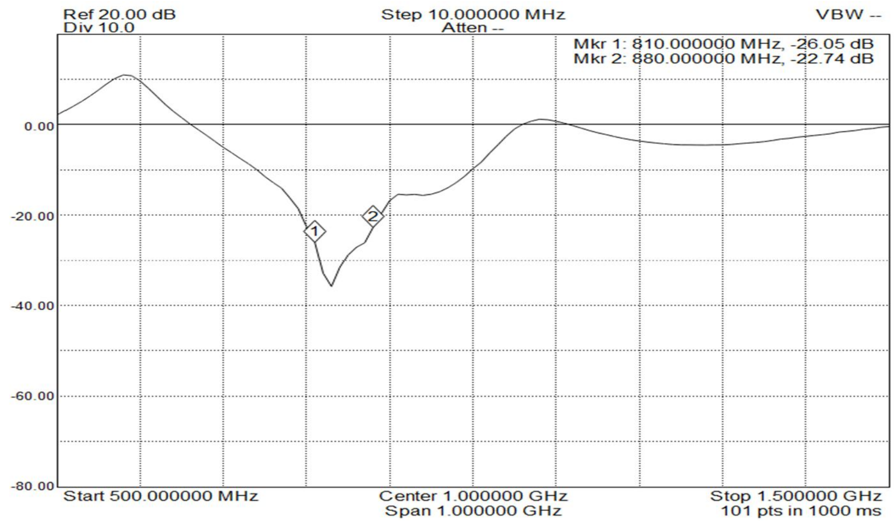


Fig 4: Return loss of spiral antenna

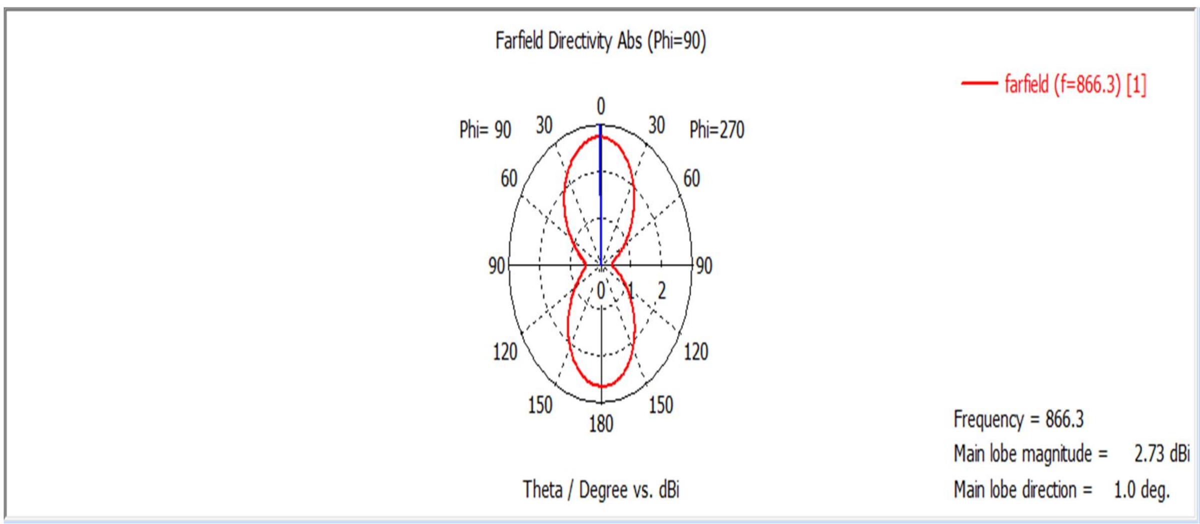


Fig 5: Directivity plot

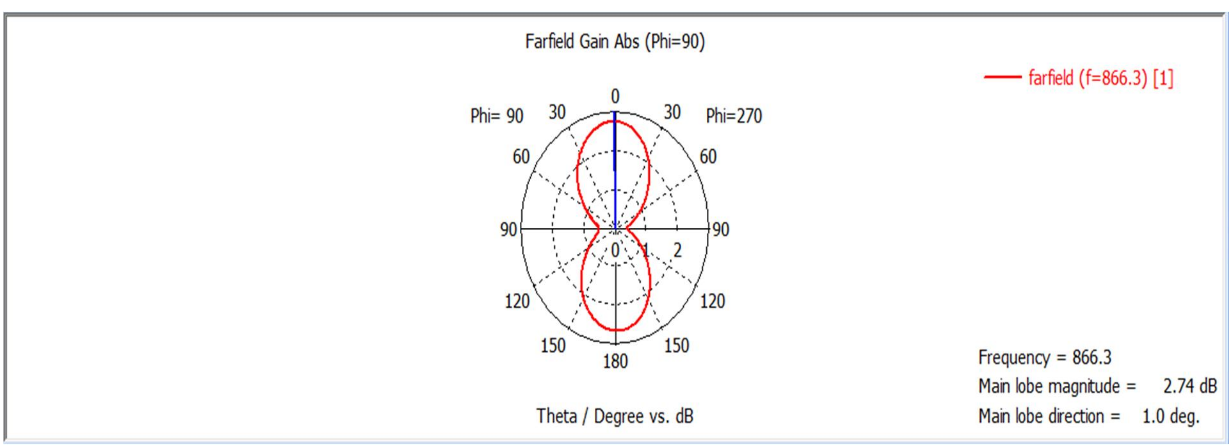


Fig 6: Gain plot

V. CONCLUSION

The near-field spiral dipole antenna for RFID application for the range of 865-868 MHz with VSWR less than 2 and return loss of less than -10 dB is designed using CST tool and it is analyzed. The designed antenna is fabricated on Printed Circuit Board and tested based on required specification.

REFERENCES

[1] Ji Yan, Changrong Liu, Xueguan Liu, Jingjing Li, Huiping Guo, Xinmi Yang, "A Switchable Near-/Far-Field Reader Antenna for UHF RFID Applications", IEEE Antennas and Wireless Propagation Letters, 16 March 2018

[2] Zhi Ning Chen , Xianming Qing, Jin Shi, Yunjia Zeng, "Review of Zero Phase Shift Line Loop Antennas for UHF Near-Field RFID Readers", IEEE Journal of Radio Frequency Identification, Dec. 2017

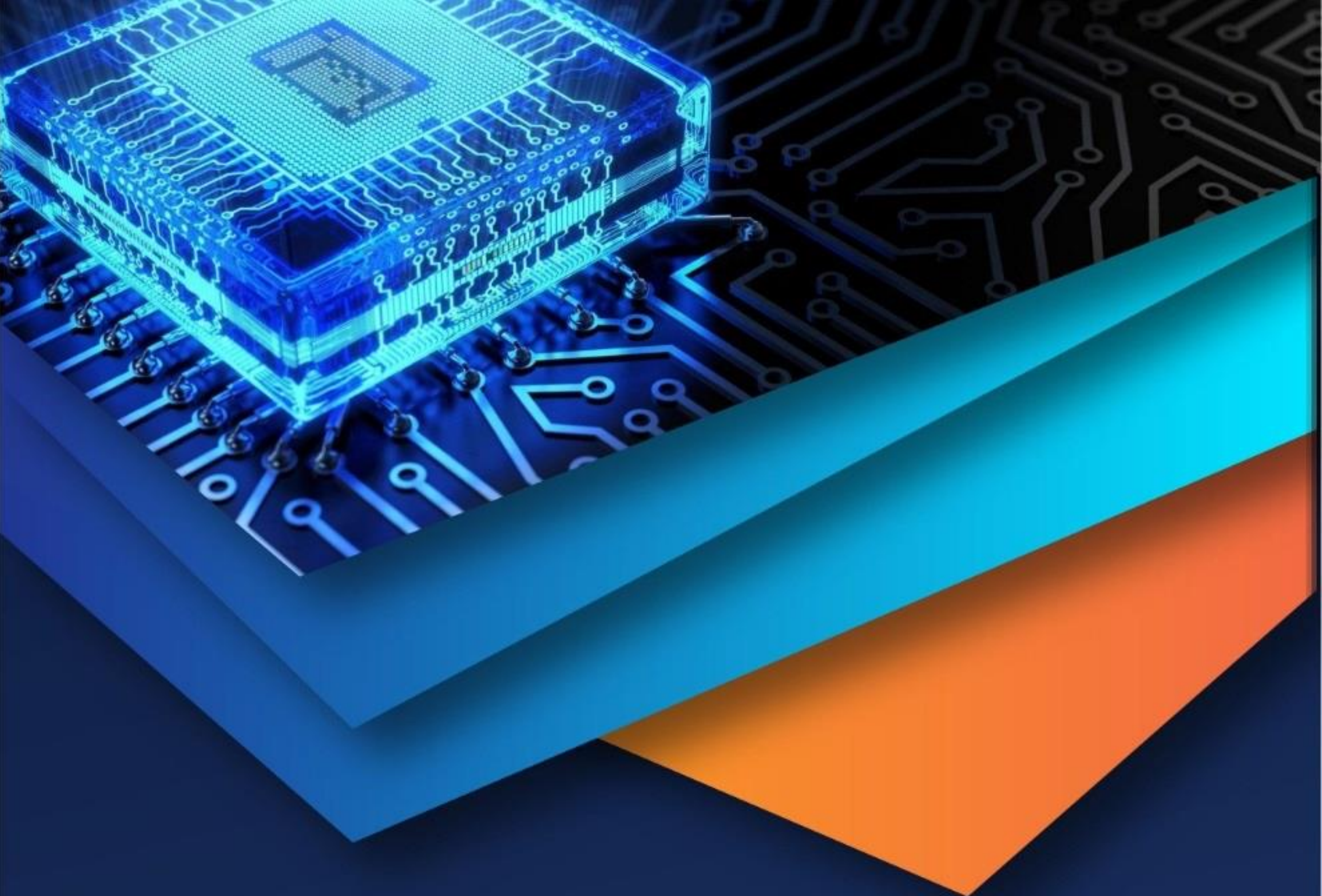
[3] Pavel Nikitin, "Self Reconfigurable RFID Reader Antenna", 2017 IEEE International Conference on RFID (RFID), 2017

[4] M. Dhaouadi, M. Mabrouk, T. P. Vuong, A. C. de Souza, A Ghazel, "UHF tag antenna for near field and far field RFID applications", IEEE, 2014

[5] G. Manzi, "Use of transmission lines as near field antenna in UHF RFID", 2012 IEEE International Conference on RFID-Technologies and Applications (RFID-TA), 2012

[6] Carla R. Medeiros, Jorge R. Costa, Carlos A. Fernandes, "RFID Reader Antennas for Tag Detection in Self-Confined Volumes at UHF", IEEE Antennas and Propagation Magazine, 2011

[7] Yun-liang Liu, Xiao-Zheng Lai, Ze-ming Xie, Xin Wang, "Near-Field RFID Reader Antenna Design", 2010 IEEE International Conference on RFID-Technology and Applications, 2010



10.22214/IJRASET

INDEX COPERNICUS 45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY