UNIVERSITY GRANTS COMMISSION

BAHADUR SHAH ZAFAR MARG

NEW DELHI – 110 002

EXECUTIVE SUMMARY OF UGC MINOR RESEARCH PROJECT

1. NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR

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2. NAME AND ADDRESS OF THE INSTITUTION

Prajyoti Niketan College, Pudukad, Thrissur, 680301

3. UGC APPROVAL NO. AND DATE

No.F.MRP/12th Plan/14-15/KLCA056 dated 10/12/2014.
1669-MRP/14-15/KLCA056/UGC-SWRO dated 04/02/2015.

4. DATE OF IMPLEMENTATION 01-01-2015

5. TENURE OF THE PROJECT 2 Years

6. TOTAL GRANT ALLOCATED Rs. 3,49,500/-

7. TOTAL GRANT RECEIVED Rs. 3,14,500/-

8. FINAL EXPENDITURE Rs 3,80,688/-

9. TITLE OF THE PROJECT

Design and Implementation of Multi-band RFID Tag Antennas with Enhanced Bandwidth

10. OBJECTIVES OF THE PROJECT:

1. To design and develop multi-band RFID tag antennas for Universal deployment of RFID technology.
2. To improve the bandwidth of the RFID tag antennas; so that the effect of detuning on read range can be minimized.

11. WHETHER OBJECTIVES WERE ACHIEVED: Yes

12. ACHIEVEMENTS FROM THE PROJECT:

1. A dual band antenna for ISM/RFID application is designed, developed and result published in an IEEE journal.
2. A triple band antenna for RFID application is designed, developed and result published in a Scopus Indexed journal.
3. A broadband miniaturized UHF RFID tag is designed, developed and published its findings in Science Citation Indexed (SCI) journal.
4. Another three broadband UHF RFID tag antennas are designed and developed.
5. The key parameters for bandwidth enhancement are identified.

13. SUMMARY OF THE FINDINGS:

Project Summary and Conclusion

The project report presents the design and development of two novel multiband RFID antennas. First one is a modified bow-tie shaped dual band antenna developed for RFID/ ISM applications. The second one is a triple band antenna for RFID applications, which is also derived from conventional bow- tie antennas.

The report also explains a broadband miniaturized UHF RFID dipole tag with tapered meandered arms which is suitable for the universal deployment of RFID tags on small objects. The design and development of three broadband RFID tag antennas and their important design parameters are also presented in the report. The simulation and design of the RFID tag antennas are performed by using CST Microwave Studio software. The commercially available RFID Reader, STA IR0507E with an EIRP of 4W (sensitivity o -80dBm) is used in this

project work for identification and read range measurements of the tag. The RFID chip Alien's Higgs-3 of impedance 27-j201Ω at 915MHz (-18dBm sensitivity) is also used in this work.

1. **A Modified Dual Band Printed Bow-Tie Antenna for RFID Applications**

A modified bow-tie dipole antenna fed by a 50 Ω coaxial cable is proposed for dual band operations. By symmetrically cutting the lateral sides of the conventional bow-tie dipole antenna results in two operating frequencies at 915 MHz and 2.45 GHz. The main attraction of this novel antenna is improved band width with a considerable antenna size reduction for dual band operation particularly in RFID bands. A theoretical model of the proposed antenna has been developed to perform analysis using CST microwave studio. In addition, an experimental verification has been carried out and both the simulated and experimental result shows good agreement with each other.

2. **Triple band printed modified bow-tie antenna for RFID reader/ISM applications**

A modified bow-tie antenna, which finds potential use in radio frequency identification / industrial, scientific and medical (RFID/ISM) applications, is proposed. Triple band operation is facilitated by applying trapezoidal truncations on both arms of the bow-tie antenna. The major attractive feature of the proposed antenna is its improved bandwidth for triple band operation particularly in different RFID bands. A considerable size reduction of the patch area is also achieved for the proposed structure. The simulated results for the radiation characteristics are in good agreement with the measured results.

3. **A Broadband Miniaturized UHF RFID Dipole Tag Antenna with Tapered Meandered Arms**

A novel miniaturized UHF RFID tag antenna (26.4**x**24**x**1.6 mm^3) for broadband operation over the UHF RFID band with good read range characteristics is proposed. The tag consists of a T- matched dipole antenna with tapered meandered arms whose ends are folded to one side and an RFID chip is connected to the terminals of the antenna. The resonant frequency can be tuned by varying the gap between the folded arms so that maximum read range can be achieved in the required territory's allotted band, without affecting its overall size. The measured read range variations for the proposed tag with maximum read range at 915 MHz is also presented.

14. CONTRIBUTION TO THE SOCIETY:

The major challenges in RFID are read range, lack of universal standardization, bandwidth issues and poor multiband operations. This project work deals with these areas and finds successful solutions for the problems. Since RFID is an emerging technology, the important findings of this project work definitely helpful to the development of the technology and hence help to the society.

15. PUBLICATIONS OUT OF THE PROJECT:

International Journals

1. **Jibish Mathew**, Manju Abraham, Aju John KK and Thomaskutty Mathew, "A Modified Bow-Tie Antenna for Dual Band RFID Applications", IEEE international conference on Intelligent Systems and Control(ISCO) 2015, Coimbatore, India.
2. **Jibish Mathew**, Manju Abraham and Thomaskutty Mathew, "Triple band printed modified bow-tie antenna for RFID reader/ISM applications", Procedia Computer Science, 93, Page 48-52, 2016(SCOPUS Indexed).
3. **Jibish Mathew**, Manju Abraham and Thomaskutty Mathew, "A Broadband Miniaturized UHF RFID Dipole Tag Antenna with Tapered Meandered Arms", Microwave and Optical Technology Letters, Willey Publications. (SCI).

International Conferences

1. **Jibish Mathew**, "A Modified Bow-Tie Antenna for Dual Band RFID Reader Applications", IEEE international conference on Intelligent Systems and Control(ISCO) 2015, Coimbatore, India

Dr. Jibish Mathew
(Principal Investigator)

Dr. Shaijan Paul
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