

# QR-Code based Chipless RFID System

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**Abstract**—A chipless RFID system is designed that uses QR-code as patch antenna for the RFID Tag. This provides more secure and unique communication.

**Index Terms**—RFID, QR-code, patch antenna, resonator, microstrip transmission line

## I. INTRODUCTION

The purpose of this project is to merge two existing technologies of QR-Codes and RFID, to get more secure and unique identification. The designed tag would be readable by both QR Code readers and RFID readers. QR Code has been proved as an antenna which resonates at a frequency depending on its structure. Conventionally, chipless RFID tags are coded with 1 or 0. Instead, a QR resonator will have unique resonating frequency for each design. This project is an implementation of paper [1].



Fig. 1: Block Diagram

## II. THEORY AND IMPLEMENTATION

This project involves designing and using a patch antenna as a resonator circuit. The shape of a patch is defined as a QR-code of a single alphabet letter, like C, D, F, etc. The point of contact at the QR code affects the resonant frequency. Different QR resonators are designed and tested for S21 parameters. A monopole UWB antenna is designed and used as RFID Tag Antenna. A Log Periodic Dipole Antenna is designed and used as RFID Reader Antenna.

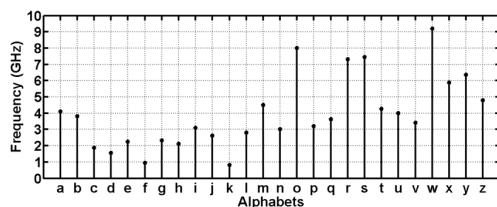


Fig. 2: Expected QR Resonator Frequencies

## III. CIRCUIT LAYOUT

The circuit layout for the three boards is designed using Autodesk Eagle.

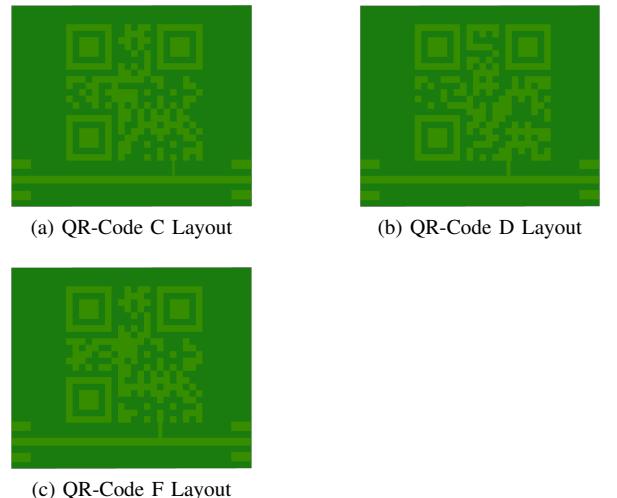


Fig. 3: QR Resonator Circuit Layout

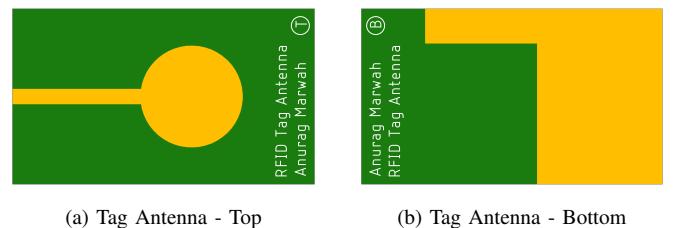


Fig. 4: Tag Antenna Circuit Layout

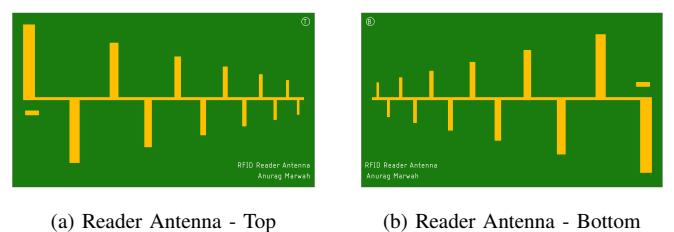
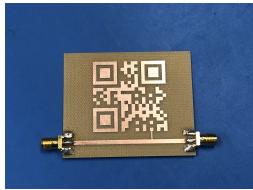


Fig. 5: Reader Antenna Circuit Layout

#### IV. CIRCUIT BOARDS AND MEASUREMENTS

Fig. 6-8 show the QR Resonator circuits and their respective S21 parameters. Fig. 9-10 show the circuits and S11 parameters of the tag antenna and reader antenna respectively.



(a) Circuit Board

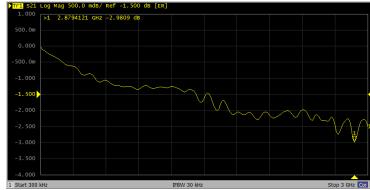
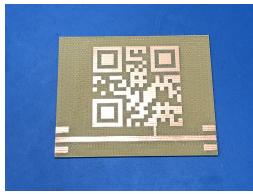


Fig. 6: QR Resonator C



(a) Circuit Board

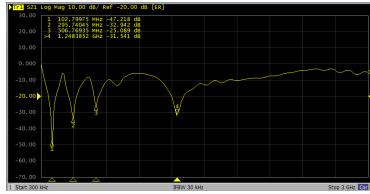


Fig. 7: QR Resonator D



(a) Circuit Board

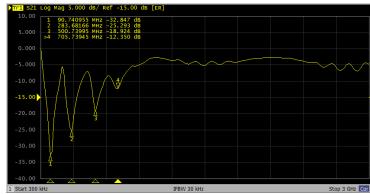


Fig. 8: QR Resonator F



(a) Circuit Board

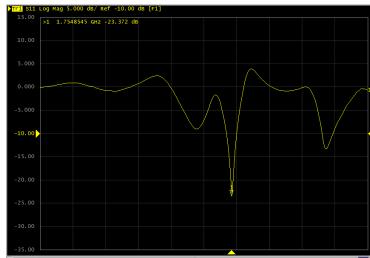
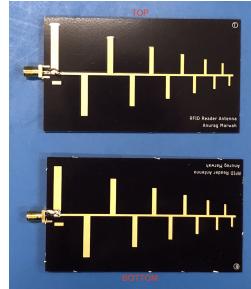


Fig. 9: RFID Tag Circuit

#### V. INTEGRATED SYSTEM

##### A. Experimental Setup

Fig. 11 shows the experimental setup. Keysight E5061B Network Analyzer is used to observe the S21 parameters of the complete RFID system.



(a) Circuit Board

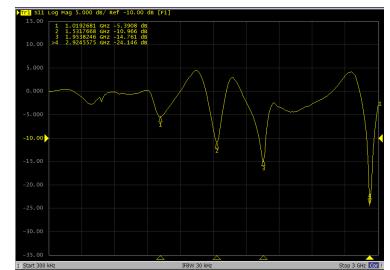


Fig. 10: RFID Reader Circuit

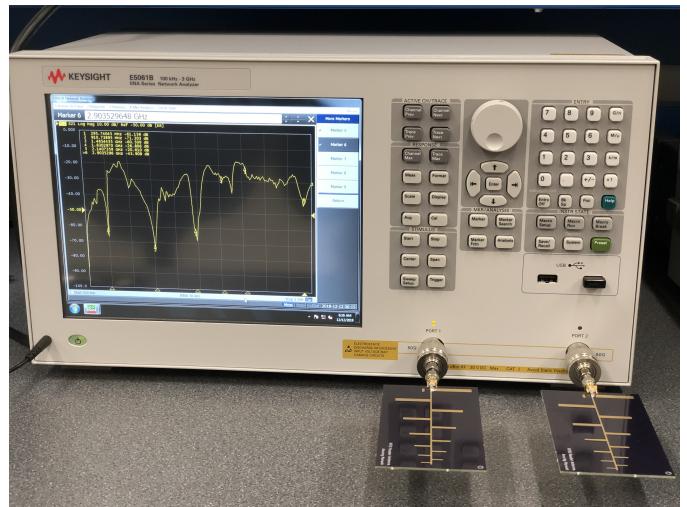
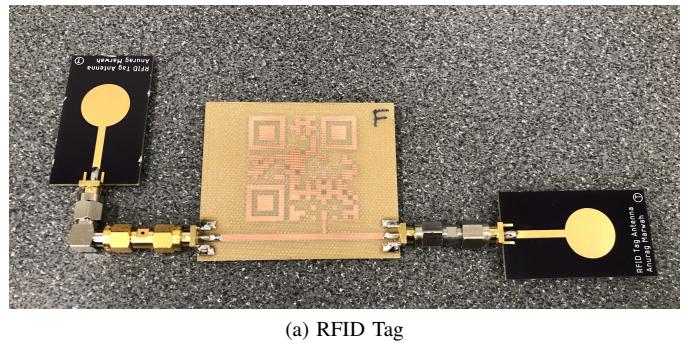


Fig. 11: Experimental Setup

##### B. VNA Readings

Fig. 12 shows the S21 parameters of the complete RFID system for different QR resonators.

#### VI. RESULT AND CONCLUSION

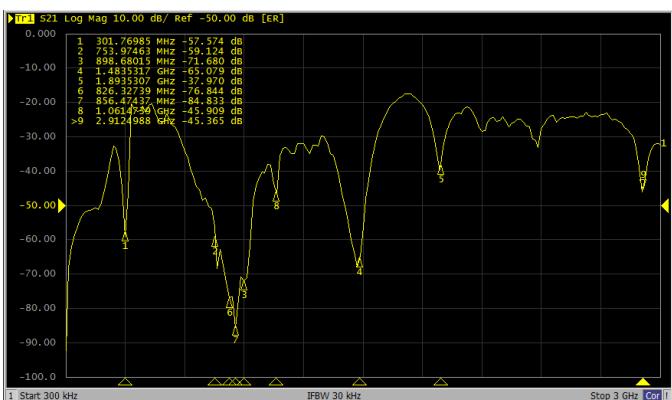
Based on the results of the S21 parameters of the complete RFID system, it is seen that the gain peaks at the resonant frequency of the QR resonators. This indicates that the RFID reader is detecting the tag. Thus, the design is verified.



(a) QR Resonator C



(b) QR Resonator D



(c) QR Resonator F

Fig. 12: S21 Parameters of RFID System

## REFERENCES

- [1] G. S. Vardhan, N. Sivadasan and A. Dutta, "QR-code based chipless RFID system for unique identification," 2016 IEEE International Conference on RFID Technology and Applications (RFID-TA), Foshan, 2016, pp. 35-39.