UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF METAL MOUNTABLE RFID TAG ANTENNA IN ULTRA HIGH FREQUENCY RANGE

NAJWA BINTI MOHD FAUDZI

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

March 2015

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledge as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Najwa binti Mohd Faudzi
Student I. D. No.	:	2012680754
Programme	:	Master of Science (EE780)
Faculty	:	Electrical Engineering
Thesis Title	:	Development of Metal Mountable RFID Tag Antenna in Ultra High Frequency Range
Signature of Student	:	.....
Date	:	March 2015

ABSTRACT

In recent years, Radio Frequency Identification (RFID) technology is highly demanded in various applications, requiring a rapid development in the RFID technology. The performance of the RFID system mainly depends on the RFID tag, as the tag will be attached on the items or objects that need to be identified. The research described in this thesis focuses on the development of the tag antenna designs to meet the requirements of certain applications which are small size and insensitive to metal object. In this project, three designs of UHF-RFID tag antenna were proposed; namely a compact dipole tag antenna, metal mountable meander feed line tag antenna and metal mountable ladder feed line tag antenna. The Design 1 tag antenna has obtained a size reduction of 70% from the straight half wavelength dipole antenna through the implementation of two miniaturization methods, which are meandering and capacitive tip-loading. However, high sensitivity of the tag to the metal objects attached leads to the formation of the Design 2 tag antenna, which included a ground plane in the antenna structure. The Design 2 tag antenna was then improved to the Design 3 tag antenna, which has smaller size and better reading range, through the implementation of capacitive tip-loading structure and ladder feed line respectively. In order to easily match the impedance of the antenna with the chip, a T-matching technique has been inserted in all three tag antenna designs. The simulation process was carried out using CST Studio Suite software, while the measurement of S_{11}, antenna impedance and reading range was done using fabricated jig, Image method, Vector Network Analyzer and RFID reader. From measurement, the Design 1 tag antenna has achieved the longest reading range in free air with the value of 9.6 m, but failed to be detected when attached on metal object. In contrast, Design 2 and Design 3 tag antennas can be detected in both conditions with the read range value of 2.2 m and 2.3 m in free air, while on metal object the read range is 2.0 m and 2.2 m respectively.

TABLE OF CONTENTS