

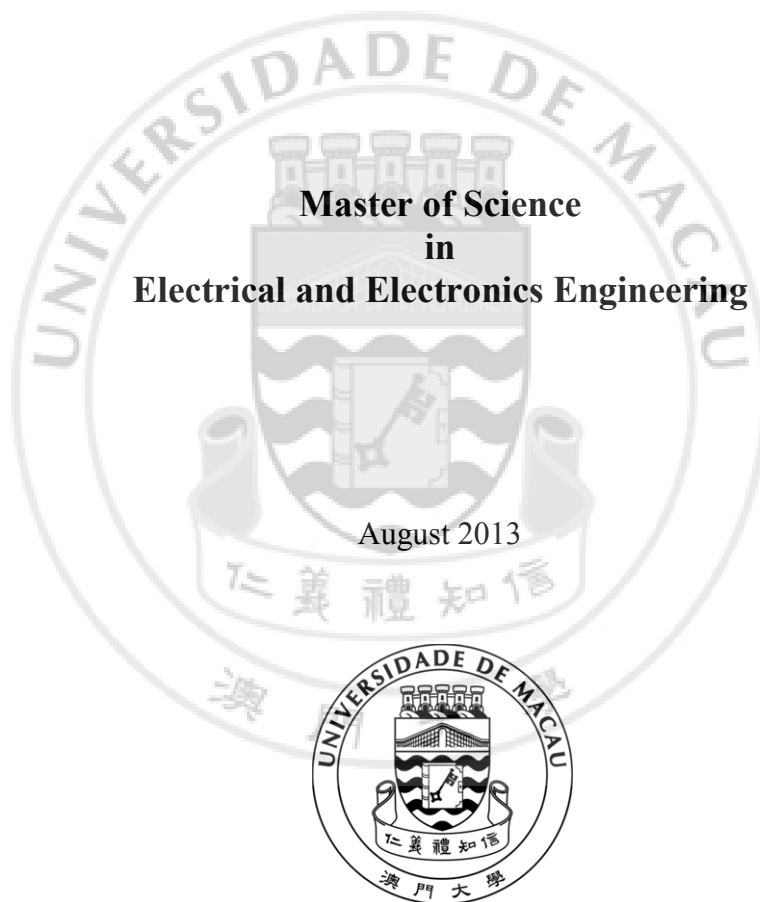
**DESIGN OF A MOBILE RFID READER
SYSTEM WITH CLOSELY PLACED ARRAY
AND ITS APPLICATION TO SEGWAY
VEHICLE**

by

Ou Bin Kai

**Master of Science
in
Electrical and Electronics Engineering**

August 2013



**Faculty of Science and Technology
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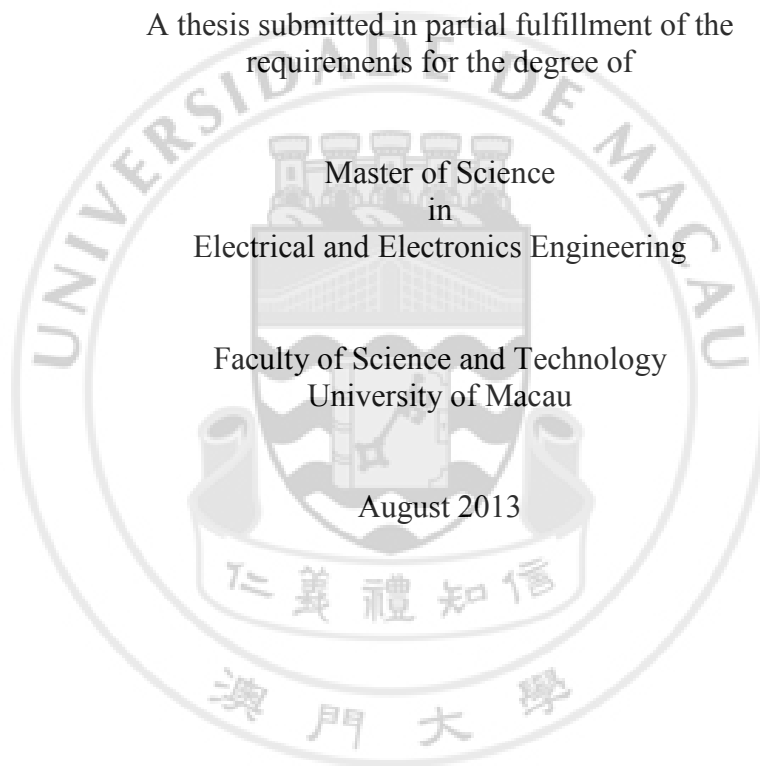
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A thesis submitted in partial fulfillment of the
requirements for the degree of

Master of Science
in
Electrical and Electronics Engineering

Faculty of Science and Technology
University of Macau

August 2013



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Date _____

ABSTRACT

The radio frequency identification (RFID) technology with contactless object identification is essential for a wide range of industrial applications, including manufacturing, logistic, retail, warehouse and so forth. Amongst different operating frequencies, ultra-high frequency (UHF) RFID operated from 920 MHz to 925 MHz is attractive and it is still in growing of importance. Using backscattering communication, the read/write function between the object and the reader is realized in relatively long distance.

In this thesis, we intend to enhance object detection capability, smart antenna technique is thus studied. The phased array antenna is adopted, which not only extends the coverage by enhancing the antenna gain of the radiating beam, but also provides the beam steering capability to RFID readers. A 4-element Quasi-Yagi antenna array operated at 920 MHz is thus implemented, with flexible phase shift control by software leading to 40° beam steering controllability. Incorporating the developed antenna system with Segway vehicle, a mobile RFID item management platform is demonstrated.

It is well known that the array antenna suffers from the mutual coupling problem when they are closely placed, a simple and systematic decoupling network using parallel coupled-line (PCL) is thus proposed, and three types of PCL structure with open-ended, short-ended with capacitors loaded and inductors loaded are theoretically analyzed. At the center frequency of 920 MHz for UHF RFID, a design example for two closely coupled Quasi-Yagi antennas using open-ended PCL is designed and experimentally characterized, the port isolation has around 15 dB improvement compared with the uncoupled situation in the measurement. Besides, the port decoupling demonstrates a notable improvement of received signal strength indicator (RSSI) for single and multiple tag detections.

ACKNOWLEDGEMENTS

I am greatly indebted to my supervisors, Prof. Tam Kam-Weng and Dr. Ma Shao Dan, for their invaluable instruction and suggestion on my thesis as well as their careful reading of the manuscript, without their help, the completion of this thesis would not be possible. Prof. Tam always encouraging me to explore new thinking, enlarging my view on scientific and engineering aspect. During the preparation of writing thesis, he spent huge effort for reviewing because of my poor writing skills. Besides the knowledge that I learnt, I also appreciated his encouragement and dedication whenever I was exhausted and frustrated.

In addition, I would like to thank Dr. Choi Wai-Wa, Dr. Ting Sio-Weng and Mr. Pedro Cheong for technical support on RF/Microwave simulation software and sharing the experience in microstrip components designs. Specially thanks to Pedro, he always provides assistance to me and helps me to tackle many practical issues with patience, his experiences and ambition are valuable gifts to me. Moreover, thanks for all the members in Wireless Communication Laboratory, including Wen Yao, Hui, Sky and Li for their supports, I really enjoy the days to be with them. Last but not least, I appreciate my family and Grace for their tireless encouragement over past years of my study, which strengthened my persistence to accomplish my thesis.

This work is supported by the University Research Committee of the University of Macau under the Research Project RG058/08-09S/10R/CWW/FST and Science and Technology Development Fund of Macao, Grant No. 034/2008/A2, 020/2009/A, 020/2009/A1 and 042/2011/A2.

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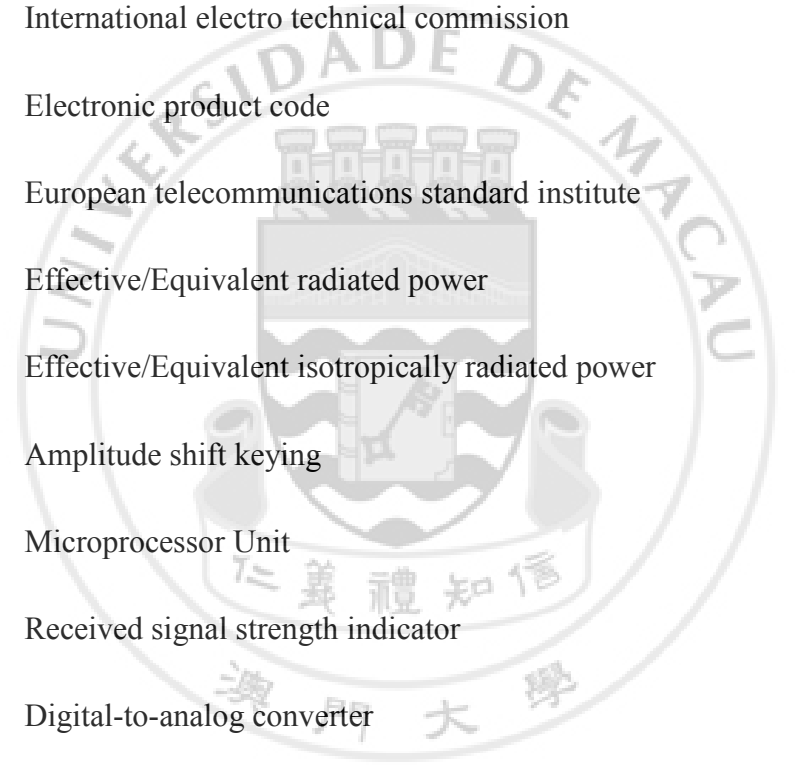
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LIST OF ABBREVIATIONS



RFID	Radio frequency identification
PCL	Parallel coupled-line
ISO	International organization for standardization
IEC	International electro technical commission
EPC	Electronic product code
ETSI	European telecommunications standard institute
ERP	Effective/Equivalent radiated power
EIRP	Effective/Equivalent isotropically radiated power
ASK	Amplitude shift keying
MCU	Microprocessor Unit
RSSI	Received signal strength indicator
DAC	Digital-to-analog converter
CPW	Co-planar waveguide
PIFA	Planar inverted F antenna
SRR	Split ring resonator
DGS	Defected ground structure
SPI	Serial peripheral interface