



**CIRCULARLY POLARIZED MIMO ARRAY
ANTENNA FOR 5.8 GHZ POINT-TO-POINT
COMMUNICATION**

by

MOHD KHAIRUL AZHAR BIN NAYAN

(1330810962)

**A thesis submitted
In fulfillment of the requirements for the degree of
Master of Science in Communication Engineering**

**SCHOOL OF COMPUTER AND COMMUNICATION
ENGINEERING
UNIVERSITI MALAYSIA PERLIS**

2016

UNIVERSITI MALAYSIA PERLIS

DECLARATION OF THESIS

Author's full name : MOHD KHAIRUL AZHAR BIN NAYAN
Date of birth : 26 JULY 1988
Title : CIRCULARLY POLARIZED MIMO ARRAY ANTENNA FOR
5.8 GHZ POINT-TO-POINT COMMUNICATION
Academic Session : 2013/2014

I hereby declare that the thesis becomes the property of Universiti Malaysia Perlis (UniMAP) and to be placed at the library of UniMAP. This thesis is classified as :

- CONFIDENTIAL** (Contains confidential information under the Official Secret Act 1972)*
- RESTRICTED** (Contains restricted information as specified by the organization where research was done)*
- OPEN ACCESS** I agree that my thesis is to be made immediately available as hard copy or on-line open access (full text)

I, the author, give permission to the UniMAP to reproduce this thesis in whole or in part for the purpose of research or academic exchange only (except during a period of _____ years, if so requested above).

Certified by:

SIGNATURE

880726-02-5177

(NEW IC NO. / PASSPORT NO.)

Date : _____

SIGNATURE OF SUPERVISOR

ASSOC. PROF. IR. DR. MOHD FAIZAL JAMLOS

NAME OF SUPERVISOR

Date : _____

NOTES : * If the thesis is CONFIDENTIAL or RESTRICTED, please attach with the letter from the organization with period and reasons for confidentiality or restriction.

Specially dedicated to my beloved wife, parents, brothers, sisters and friends

©This item is protected by original copyright

ACKNOWLEDGEMENT

Alhamdulillah, in the name of Allah, Most Graceful, Most Merciful. With His permission, I have completed this master of science research work. Without it, I would not have been able to come this far. In finishing this project, I was in contact with many people, researchers, academicians, and practitioners. They have contributed towards my understanding and thoughts.

First of all, I want to give my special thanks to my parent and my beloved family for giving me life and growth me up and also encouragement to pursue my studies in master by research. In particular, I am also very thankful to Assoc. Prof. Ir. Dr Faizal Jamlos for giving me advice, encouragement, guidance and critics and also not to forget to all my fellow of Advanced Communication Engineering Centre (ACE) friends for their helps. Without their continued support and encouragement, this project would not have been then same as presented here.

My fellow friend should also be recognized for their support. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. Last but not least, I am truly grateful for having such a supportive family members. Thanks you all for your kindness and may Allah bless everyone.

TABLE OF CONTENTS

	PAGE
DECLARATIONS OF THESIS	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENT	v
ABSTRAK	x
ABSTRACT	xi
LIST OF FIGURES	xii
LIST OF TABLES	xvi
LIST OF SYMBOLS	xviii
LIST OF ABBREVIATIONS	xix
CHAPTER 1: INTRODUCTION	
1.1 Introduction	1
1.2 Problem Statement	3
1.3 Thesis Objective	5
1.4 Scope of Work	6
1.5 List of Contribution	6
1.6 Thesis Outline	6
CHAPTER 2: LITERATURE RIVIEW	
2.1 Introduction	8
2.2 Microstrip Patch Antenna	9

2.2.1	Introduction	9
2.2.2	Dielectric Substrate	10
2.2.3	Ground	10
2.2.4	Feeding Technique	11
2.2.4.1	Coaxial Feeding	11
2.2.4.2	Microstrip Feeding	12
2.2.4.3	Proximity Coupled Feeding	14
2.2.4.4	Aperture Coupled Feeding	14
2.2.5	Array Structure	15
2.3	Polarization of Antenna	17
2.3.1	Types of polarization	18
2.3.1.2	Axial Ratio	20
2.3.1.3	Polarization Diversity and Isolation	21
2.3.2	Circular Polarization Microstrip Antenna	21
2.3.3	Single-Feed Circularly Polarized Microstrip Antenna	22
2.3.4	Patch Antenna with Varies Shape Slots	23
2.3.4.1	Cross slot	23
2.3.4.2	Truncated Edges Patches	25
2.3.4.3	Annular Ring	26
2.3.5	Dual-Feed Circularly Polarized Microstrip Antenna	27
2.3.6	Dual Orthogonal Circularly Polarized Patch	28
2.3.6.1	Quadrature Hybrid Power Divider	28
2.3.6.2	Wilkinson Power Divider	30
2.3.6.3	T-Junction Power Divider	30
2.4	Multiple Input Multiple Output (MIMO)	32

2.4.1	Introduction	32
2.4.2	Correlation Coefficient	33
2.4.3	Diversity Gain	34
2.5	Summary	34

CHAPTER 3 : RESEARCH METHODOLOGY

3.1	Introduction	35
3.2	Flow Chart	35
3.3	Antenna Design Specification	38
3.4	Antenna Design and Configuration	39
3.4.1	Rectangular Truncated Circularly Polarized Antenna (RTCPA)	39
3.4.2	Rectangular Truncated Circularly Polarized Array Antenna (RTCPAA)	42
3.4.3	Rectangular Truncated Circularly Polarized MIMO Array Antenna (RTCPMAA)	45
3.4.4	90° Phase Shift Dual-Coupled Circularly Polarized Antenna (90°PSDCCPA)	47
3.4.5	90° Phase Shift Dual-Coupled Circularly Polarized Array Antenna (90°PSDCCPAA)	50
3.4.6	90° Phase Shift Dual-Coupled Circularly Polarized MIMO Array Antenna (90°PSDCCPMAA)	52
3.4.7	90° Phase Shift Triple-Coupled Circularly Polarized Antenna (90°PSTCCPA)	54
3.4.8	90° Phase Shift Triple-Coupled Circularly Polarized Array Antenna (90°PSTCCPAA)	55
3.4.9	90° Phase Shift Triple-Coupled Circularly Polarized MIMO Array	

Antenna (90°PSTCCPMAA)	57
3.5 Fabrication Process	60
3.5.1 Printing Antenna Layout	60
3.5.2 Dry Film Lamination	61
3.5.3 Ultra Violet (UV) Exposure	61
3.5.4 Developer Process	62
3.5.5 Copper Etching	62
3.5.6 Photo Resist Developer	63
3.5.7 Fabricated Antenna	63
3.5.8 Solder SMA Connector and Switching Component	63
3.6 Antenna Measurement Setup	64
3.7 Summary	64
CHAPTER 4: RESULTS AND DISCUSSION	
4.1 Introduction	65
4.2 Antenna Simulation and Measurement Result	66
4.2.1 Rectangular Truncated Circularly Polarized Antenna (RTCPA)	66
4.2.2 Rectangular Truncated Circularly Polarized Array Antenna (RTCPAA)	68
4.2.3 Rectangular Truncated Circularly Polarized MIMO Array Antenna (RTCPMAA)	69
4.2.4 Phase Shift 90° Dual-Coupled Circularly Polarized Antenna (90°PSDCCPA)	74
4.2.5 Phase Shift 90° Dual-Coupled Circularly Polarized Array Antenna (90°PSDCCPA)	75
4.2.6 Phase Shift 90° Dual-Coupled Circularly Polarized MIMO Array	

Antenna (90°PSDCCPMAA)	77
4.2.7 Phase Shift 90° Triple-Coupled Circularly Polarized Antenna (90°PSTCCPA)	81
4.2.8 Phase Shift 90° Triple-Coupled Circularly Polarized Array Antenna (90°PSTCCPAA)	83
4.2.9 Phase Shift 90° Triple-Coupled Circularly Polarized MIMO Array Antenna (90°PSTCCPMAA)	85
4.3 Overall Performance of Three Designed MIMO Antenna	89
4.4 Summary	92
CHAPTER 5 : CONCLUSION AND FUTURE WORK	
5.1 Conclusion	93
5.2 Future Work	95
REFFERENCES	96
APENDIXES A	102
APENDIXES B.	103

POLARASI BULATAN MIMO ARRAY ANTENNA UNTUK 5.8 GHZ TITIK KE TITIK KOMUNIKASI

ABSTRAK

Tiga rekabentuk yang berbeza dan konsep pengeluaran sirkular terpolarisasi pelbagai masuk pelbagai keluaran (CP-MIMO) antena untuk komunikasi point-to-point telah dibentangkan dalam tesis ini. Seluruh antena dibangunkan oleh unsur-unsur MIMO dua liang yang setiap reka bentuk yang digunakan elemen memancar yang berbeza. Semua reka bentuk yang menggambarkan gabungan tiga kaedah, termasuk sistem MIMO, reka bentuk dan konfigurasi CP array ke satu antena. Gabungan tiga teknik di dalam satu antena adalah sangat mencabar dan banyak kajian telah dibuat untuk menyelesaikan rekabentuk ini. Ketiga-tiga reka bentuk menggunakan tatarajah yang sama yang mempunyai empat elemen radiasi, tetapi masing-masing mempunyai reka bentuk yang berbeza. Rekabentuk pertama dibangunkan dari empat bentuk persegi dipotong di penjuru petak dan diukir di Taconic TLY-5 substrat dengan 2.2 dan 1.575 mm pemalar dielektrik dan ketebalan masing-masing. Sementara itu, rekabentuk kedua dan ketiga adalah berdasarkan kepada bentuk elemen pemancar bulat dan diukir pada FR4 dengan pemalar dielektrik 4.7 dan 1.6 ketebalan substrat. Rekabentuk pertama yang direka menggunakan kaedah yang mudah untuk menghasilkan kemampuan CP yang telah menghasilkan 2.24 dB paksi catuan, rekabentuk kedua dan ketiga adalah lebih kompleks yang digunakan 90 ° peralihan secara berperingkat untuk menghasilkan 1.9 dB dan 1.94 dB nisbah paksi. Konvergensi kemampuan CP dalam jenis antena MIMO berjaya diwujudkan dengan dua susunan empat pekeliling-bersegmen pelbagai patch unsur radiasi. Selain itu, frekuensi salunan antena 5.8 GHz sesuai untuk point-to-point sistem tulang belakang komunikasi. Semua pengukuran pekali ruang dan refleksi anechoic bersetuju juga dengan keputusan penyelakuan. Gabungan MIMO antena dengan ciri-ciri polarisasi pekeliling akan bertambah banyak keuntungan dari pemancar untuk mencapai kinerja batu terakhir pada masa yang sama mengelakkan isyarat dilemahkan penting di bawah keadaan atmosfera yang buruk. Gabungan dua liang antena akan meningkatkan keuntungan sebanyak pemancar untuk mencapai kinerja batu terakhir pada masa yang sama mengelakkan isyarat dilemahkan penting di bawah keadaan atmosfera yang buruk. Kertas kerja ini memberi tumpuan lebih pada sistem MIMO yang digunakan dalam aplikasi 5.8 GHz.

CIRCULARLY POLARIZED MIMO ARRAY ANTENNA FOR 5.8 GHZ POINT-TO-POINT COMMUNICATION

ABSTRACT

Three different design of circularly polarized multiple input multiple output (CP-MIMO) antenna for point-to-point communication is proposed in this thesis. All design involves with combination of three type of technique which are MIMO, CP and array in single antenna. The first design is constructed from four truncated patch etched on Taconic TLY-5 substrate with 2.2 and 1.575 mm of dielectric constant and thickness respectively. Meanwhile, second and third design is based on circular shape radiating element and fabricate on FR4 with 4.7 dielectric constant and 1.6 substrate thickness. Rectangular truncated circular polarized antenna (RTCPA) was designed using a simple technique to produce CP capability 2.24 dB axial ratio, while 90° phased shifted dual and tripled coupled CP-MIMO used 90° phased shifting element to produce 1.9 dB and 1.94 dB axial ratio. Convergence of CP capability within the MIMO array antenna is successfully realized by two arrays of four circular-segmented patch array radiating element. Apart from that, the antenna resonant frequency of 5.8 GHz is suitable for point-to-point backbone communication system. All anechoic chamber's and reflection coefficient measurements agrees well with the simulation result. The combination of MIMO array antenna with circular polarization characteristics will multiply the gain of transmitter to achieve a last mile performance while simultaneously avoiding significant attenuated signals under adverse atmospheric conditions. The combination of two-port array antenna will enhance the gain of transmitter to achieve a last mile performance while simultaneously avoiding significant attenuated signals under adverse atmospheric conditions (bad weather). This thesis focuses more on MIMO system that are used in 5.8 GHz point-to-point communication.

LIST OF FIGURES

NO		PAGE
1.1	MIMO System.	2
2.1	Microstrip Antenna.	10
2.2	Coaxial Feeding.	11
2.3	Direct Microstrip Feed Line.	12
2.4	Inset Microstrip Feed Line.	13
2.5	Gap-Coupled Microstrip Feed Line.	13
2.6	Proximity Coupled Microstrip Feeding.	14
2.7	Aperture Coupled Microstrip Feed.	15
2.8	Layout of Linear Polarized.	16
2.9	Layout of The Transmission Line Feeding Technique.	16
2.10	2×2 Array Geometry.	17
2.11	Ellipse Polarization.	19
2.12	Type of Polarization.	19
2.13	Classification of the Different Polarizations With Respect to Type and Sense.	20
2.14	Single Fed Patches	22
2.15	Circular Patch with Cross Slot.	24
2.16	Circular patch with cross slot in the patch and ground plane.	24
2.17	Truncated corner square microstrip antenna with 2 slits.	25
2.18	Truncated edges elliptical antenna.	25
2.19	Truncated edges circular microstrip antenna.	26

2.20	Annular ring with inner strip line.	26
2.21	Example for dual fed CP patches.	27
2.22	Dual fed CP patches.	27
2.23	Typical Configurations of Dual-Orthogonal CP Microstrip Antennas.	28
2.24	Schematic Diagrams of Power Divider.	29
3.1	Overall Flow Chart of the Entire Project.	36
3.2	Antenna flow from Single Antenna to MIMO Antenna	37
3.3	Geometry of RTCPA.	41
3.4	Geometry of RTCPAA.	42
3.5	Optimized Corporate Feeding Network.	44
3.6	The Geometry of RTCPMAA.	45
3.7	Distance between Two Array Elements.	46
3.8	The Fabricated RTCPMAA.	46
3.9	Geometry of 90°PSDCCPA.	48
3.10	Geometry of 90°PSDCCPAA.	50
3.11	The 90°PSDCCPAA Configuration.	51
3.12	Simulated 90°PSDCCPMAA Geometry.	52
3.13	Center-To-Center Spacing (CCS).	53
3.14	Fabricated 90°PSDCCPMAA.	53
3.15	The Structure of 90°PSTCCPA.	54
3.16	Simulated Geometry of 90°PSTCCPAA.	56
3.17	The 90°PSTCCPAA Radiating and Array Structure.	56
3.18	Simulated Geometry of 90°PSTCCPMAA.	58
3.19	Center-To-Center Spacing (CCS)	58
3.20	The Fabricated 90°PSTCCPMAA.	59

3.21	Fabrication Process Flow Chart.	60
3.22	Dry Film Lamination.	61
3.23	UV exposure machine.	62
3.24	Etching Machine.	62
3.25	Soldering Process.	63
3.26	Antenna Measurement Setup.	64
4.1	Performance of RTCPA.	66
4.2	Radiation Pattern of RTCPA.	67
4.3	Performance of RTCPAA.	68
4.4	Radiation Pattern of RTCPAA.	69
4.5	Simulated and Measured RTCPMAA Reflection Coefficient.	70
4.6	RTCPMAA Simulated and Measured.	70
4.7	Simulated and Measured Antenna's Performance.	71
4.8	RTCPMAA Radiation Pattern.	71
4.9	RTCPMAA's Radiation Pattern.	72
4.10	RTCPMAA's Performance.	72
4.11	Surface current distribution of the RTCPMAA.	73
4.12	Performance of 90°PSTCCPA	74
4.13	Radiation Pattern of 90°PSDCCPA	75
4.14	Performance of 90°PSTCCPAA.	76
4.15	Radiation Pattern of 90°PSDCCPAA.	76
4.16	Simulated and Measured Reflection Coefficient of 90°PSDCCPMAA.	77
4.17	Parameters with Varying CCS.	78
4.18	Simulated and Measured Antenna's Performance.	79

4.19	Radiation Pattern of 90°PSDCCPMAA.	79
4.20	90°PSDCCPMAA's Radiation Pattern.	80
4.21	90°PSDCCPMAA Performance.	80
4.22	Surface Current Distribution (Contour) of 90°PSDCCPMAA.	81
4.23	Performance of 90°PSTCCPA.	82
4.24	Radiation Pattern of 90°PSTCCPA.	83
4.25	Performance of 90°PSTCCPAA.	83
4.26	Radiation Pattern of 90°PSDCCPAA.	84
4.27	Simulated and Measured Reflection Coefficient of 90°PSTCCPMAA.	85
4.28	Parametric Studies of CCS.	86
4.29	90°PSTCCPMAA Characteristic.	87
4.30	Simulated and Measured Radiation Pattern.	87
4.31	90°PSDCCPMAA's Radiation Pattern.	88
4.32	90°PSTCCPMAA Performance.	88
4.33	Three Designed Antenna's Simulated Reflection Coefficient.	89
4.34	Three Designed Antenna's Measured Reflection Coefficient.	90
4.35	Simulated Antenna Performance.	91
4.36	Measured Antenna Performance.	92

LIST OF TABLES

NO		PAGE
2.1	Microstrip Patch Antenna	9
2.2	General Characteristics of Power Divider Networks	31
3.1	Design Specifications	38
3.2	Optimized Antenna Dimension	41
3.3	Optimized RTCPAA Dimension	44
3.4	Optimized Parameter of RTCPMAA	47
3.5	90°PSDCCPA Dimension	49
3.6	The 90°PSDCCPAA Dimension	51
3.7	The 90°PSDCCPMAA Dimension	53
3.8	90°PSTCCPA Dimension	55
3.9	The 90°PSTCCPAA Dimension	57
3.10	The 90°PSTCCPMAA Dimension	59
4.1	RTCPA Results at 5.8 GHz	67
4.2	RTCPAA Results at 5.8 GHz	68
4.3	RTCPMAA Results at 5.8 GHz	73
4.4	90°PSDCCPA Results at 5.8 GHz	74
4.5	90°PSDCCPAA Results at 5.8 GHz.	76
4.6	Proposed Antenna Characteristics at 5.8 GHz.	81
4.7	90°PSTCCPA Results at 5.8 GHz.	82

4.8	90°PSTCCPAA Results at 5.8 GHz.	84
4.9	90°PSTCCPMAA Characteristics at 5.8 GHz.	89
4.10	Comparison Simulated S-Parameter Three Designed Antennas.	90
4.11	Comparison Measured S-Parameter Three Designed Antennas.	91

©This item is protected by original copyright

LIST OF SYMBOLS

θ	Theta
Γ	Reflection Coefficient
Π	Phi
Ω	Ohm
η	Efficiency
ϵ	Permittivity
Δ	Loss Tangent

©This item is protected by original copyright

LIST OF ABBREVIATIONS

CAD	Computer Aided Design
CST	Computer Simulation Technology
dB	Decibel
dBm	Decibel of Measured power referenced to 1 mille watt.(mW)
GHz	Giga Hertz
GPS	Global Positioning System
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ISM	Industrial, Scientific and Medical
mm	Millimeter
PAN	Personal Area Network
PCPTF	Pure Copper Polyester Taffeta Fabric
RF	Radio Frequency
SAR	Specific Absorption Rate
SNR	Signal Noise Ratio
VSWR	Voltage Standing Wave Ratio
WBAN	Wireless Body Area Network
WLAN	Wireless Local Area Network
MIMO	Multiple Input Multiple Output
CP	Circular Polarized

ARMSA

Annular-Ring Microstrip Antenna

CST

Computer Simulation Technology

©This item is protected by original copyright

CHAPTER 1

INTRODUCTION

1.1 Introduction

In Malaysia, point-to-point wireless local area network (WLAN) is functioning in the upper Unlicensed National Information Infrastructure (UNII) band of 5.725 to 5.875 GHz. A point-to-point wireless communication usually fails to distribute the threshold signal strength of -71 dBm. It also fails to stabilize the data rates in severe climate conditions (R. A. Saed & S. Khatun, 2005). Failing to comply such meshold leads to the slow internet connection or even disconnected. A high efficiency, gain, and circular polarized (CP) microstrip patch antenna will provide an appropriate solution to avoid major signal attenuation during such conditions (William H. Hayt & Jr. John A. Buck, 2001; M. Rahmani et al., 2009). Instead of CP antenna, two-port MIMO techniques to increase channel capacity for higher data rate and better link stability of a system. Consequently, convergence between CP technique, array antenna configuration and MIMO antenna techniques are studied to deliver effective trustworthy point-to-point communication. One simple technique that has been widely used among researcher to produce CP is by using a single feed CP microstrip antenna (Wen Shyang Chen, Chun Kun & Kin Lu Wong, 1998). By using only single feed, the antenna should have two modes and necessity excited with equal amplitude and 90° out of phase. Usually, a basic microstrip patch antenna produces a linear polarization. However, in

order to obtain a CP feature, there must be some techniques applied in the patch design. For example, in order to divide the field into two orthogonal modes with equal magnitude and 90° phase shift the perturbation segments are necessary. Thus, producing a circular polarization.

In this thesis, a circularly polarized two port array antenna is designed using the truncated edge patch and 90° phase shifted technique basically construct based on the inner and outer ring model (William H. Hayt & Jr. John A. Buck, 2001; Tso-Wei Li, Cheng-Liang Lai & Jwo-Shiun Sun, 2005; Mohamed A. Abdelaal & Hussien Hamed Mahmoud Ghouz, 2014). Instead of rectangular truncated edge patch and external polarizer, dual-coupled and triple-coupled 90° phased shifter has been designed as internal polarizer to each circle-segmented element to generate CP signals. Such design acts like shunt inductors and leads the E-field component function in 90° phase difference.

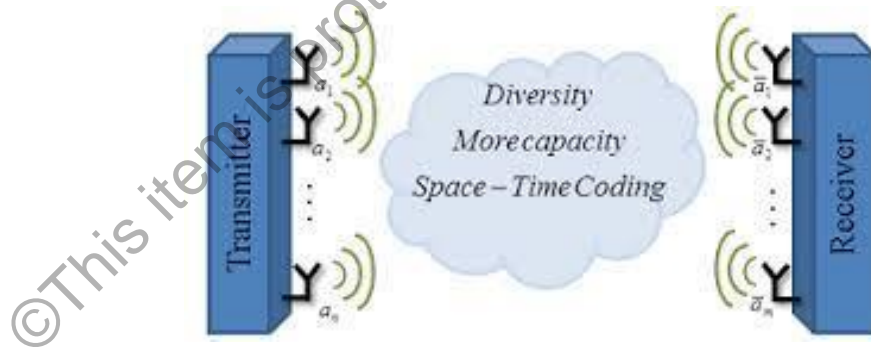


Figure 1.1: MIMO System [Claude Oestgates & Bruno Clerckx, 2007].

In wireless communication nowadays, Multiple input multiple output (MIMO) technology has concerned the considered by researchers to explore and analyze its capabilities. Figure 1.1 illustrates the MIMO antenna operating system with include the transmitter and receiver antenna. Significant increases in channel capacity are realized without the requirement of extra bandwidth or transmit power by positioning several

antennas for transmission to attain an array gain and diversity gain, thereby improving the spectral efficiency and reliability. MIMO antenna methods oblige high decoupling amongst antenna ports and a compact size for application in handy devices. MIMO techniques are divided into several methods including single input single output (SISO), single input multiple output (SIMO) and multiple input single output (MISO) according to its application (Claude Oestgates & Bruno Clerckx, 2007). The MIMO system used numerous antennas for both transmitter and receiver. They have dual competency of integrating the SIMO and MISO technologies. They can also significantly increase capacity by using Spatial Multiplexing (SM). The MIMO technology has several advantages over Single-input, Single-output (SISO) technology. The declining is extremely eradicated by spatial diversity. Furthermore, MIMO required small power consumption paralleled to other techniques.

1.2 Problem Statement

Point-to-point communication deliberated as the backbone for the antennas subsequently they are expectable to deliver the wireless transmission amongst those devices. Moreover, presence capable to attain respectable signal to noise ratio and immunity to noise, they should have depicted compact structure, and can be simply fabricated and attached to numerous devices. A certain point-to-point application that's required high performance of the antenna such as high gain, good directivity with a low profile antenna including the lightweight, compact size, low cost and ease of installation are constraints. Based out of those demands, Microstrip antenna is one solution to satisfy all these requirements.

In early 1953, the microstrip antenna has been classified among one of the better technique and has several advantages over conventional microwave antenna, thus

widely used in communication system nowadays (Deschamps & G. A, 1953; James, J. R. & P. S. Hall, 1989). However, from the viewpoint of another researcher that have investigate the microstrip antenna it also claim that microstrip antenna has some weaknesses containing small gain, low efficiency, and weak power handling ability (Kumar, G. & K. P. Ray, 2003). Currently, various techniques have been exposed by investigators to overwhelm the weaknesses of microstrip antenna by consuming an array structure. The array microstrip antenna has been extensively established and used among researcher to enhanced performance of the antenna such as gain, efficiency and beam scanning directivity (D. M. Pozar & D. H. Schaubert, 1995; A. AdyaPramudita, Lydia Sari & V. WindhaMahyastuti, 2012; Ada S. Y. Poon, David H. C. Tse & Robert W. Brodersen, 2006). For point-to-point wireless communication applications, it is necessary that the antenna has a narrow beam width, which is inflexible to accomplish by using a single element antenna. For that array antenna can achieve such goals, where array antenna beam width and side lobes generally depends on the numeral of elements and arrangement among them.

Point-to-point works with limited quality and stability signal strength under adverse at morphemic condition such as humidity, hot and rainy. Moreover, the complex geographical condition leads to the physics propagation issues (e.g scattering, diffraction, reflection of incident waves). Consequently, users experience a show internet connection and even worse losing the connection. It is significant for an antenna to have a better directivity (dBi) while simultaneously mitigating propagation issues and geographical. Circular polarization characteristics within a MIMO array structure is capable to decrease those problems as its wave, radiant energy in both horizontal and vertical planes and all planes in between. CP characteristic also more resistant to signal degradation due to severe weather circumstances throughout the ranges (Luxul, 2011).