A HARMONIC SUPPRESSION CIRCULARLY POLARIZED ANTENNA FOR RF AMBIENT ENERGY HARVESTING

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Tajuk Projek	A HARMONIC SUPPRESSION CIRCULARLY POLARIZED ANTENNA FOR RF AMBIENT ENERGY HARWESTING
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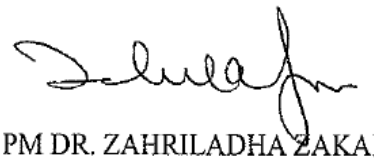
Signature : 

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Extraordinary dedication to my parents

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ABSTRACT

RF energy is right now shown from billions of radio transmitters around the globe, including cell phones, handheld radios, portable base stations, and TV/ radio show stations. The capacity to gather RF energy, from surrounding or devoted sources, empowers wireless charging of low-power gadgets and has coming about advantages to item plan, ease of use, and dependability. Battery-based frameworks can be streamed charged to dispense with battery substitution or develop the working existence of frameworks utilizing expendable batteries. Sans battery gadgets can be intended to work upon interest or when adequate charge is collected. In both cases, these gadgets can be free of connectors, links, and battery access boards, and have flexibility of arrangement and versatility amid charging and utilization. RF energy can be utilized to charge or work an extensive variety of low-power gadgets. At short proximity to a low-control transmitter, this energy can be utilized to stream charge various gadgets including GPS or RLTS following labels, wearable medicinal sensors, and buyer hardware, for example, digital book per users and headsets. At longer range the force can be utilized for battery-based or without battery remote sensors for HVAC control and building robotization, basic checking, and modern control. Contingent upon the force necessities and framework operation, force can be sent persistently, on a booked premise, or on-interest. In substantial scale sensors organizations huge work cost shirking is conceivable by killing the future support endeavours to supplant batteries.

ABSTRAK

Tenaga RF sedang disiarkan dari berbilion pemancar radio di seluruh dunia, termasuk telefon bimbit, radio semburan mandi pegang tangan, stesen pangkalan mudah alih dan stesen siaran televisyen / radio. Keupayaan untuk menuai tenaga RF, daripada sumber ambien atau khusus, membolehkan pengecasan wayarles peranti kuasa rendah dan mempunyai akibat faedah kepada reka bentuk produk, kebolehgunaan, dan kebolehpercayaan. Sistem berasaskan bateri boleh menitis tanggungjawab untuk menghapuskan penggantian bateri atau memanjangkan hayat operasi sistem menggunakan bateri pakai buang. Peranti bateri bebas boleh direka untuk beroperasi atas permintaan atau apabila bayaran yang mencukupi terkumpul. Dalam kedua-dua kes, alat-alat ini boleh bebas daripada penyambung, kabel, dan panel akses bateri, dan mempunyai kebebasan penempatan dan mobiliti semasa pengecasan dan penggunaan. Tenaga RF boleh digunakan untuk mengenakan atau mengendalikan pelbagai peranti kuasa rendah. Pada jarak dekat dengan pemancar berkuasa rendah, tenaga ini boleh digunakan untuk meleleh caj beberapa peranti termasuk GPS atau RLTS menjejaki tag, sensor perubatan boleh pakai, dan elektronik pengguna seperti e-book pembaca dan alat dengar. Pada pelbagai lagi kuasa boleh digunakan untuk sensor jauh berasaskan bateri atau bateri bebas untuk HVAC kawalan dan automasi bangunan, pemantauan struktur, dan kawalan industri. Bergantung kepada keperluan kuasa dan sistem operasi, kuasa boleh dihantar secara berterusan, secara berkala, atau atas permintaan. Dalam sensor berskala besar pergerakan ketara mengelakkan kos buruh adalah mungkin dengan menghapuskan usaha penyelenggaraan pada masa hadapan untuk menggantikan bateri.

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LIST OF ABBREVIATION

UTeM	-	Universiti Teknikal Malaysia Melaka
PSM	-	Projek Sarjana Muda
FYP	-	Final Year Project
CST	-	Computer and Simulation Technology
ISM	-	Industrial, Scientific and Medical
ECG	-	Electrocardiogram
FCC	-	Federal Communications Commission
RF	-	Radio Frequency
ETSI	-	European Telecommunications Standards Institute
VSWR	-	Voltage Standing Wave Ratio
HPBW	-	Half Power Beam Width
E-Field	-	Electrical Field
D	-	Directivity
MHz	-	Mega Hertz
GHz	-	Giga Hertz
kHz	-	Kilo Hertz
mW	-	Mili Watt
kg	-	Kilogram
g	-	Gram

dB	-	Decibels
dBi	-	Decibels per Intensity

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The background of the project is briefly explained. The objectives for this project also being introduce. RF energy harvesting is the process of capturing the RF ambient energy wasted surrounded us to power a low power devices or extend the batteries life or using it as the power source permanently.

1.2 BACKGROUND STUDY

Radio frequency energy is discharged by sources that create high electromagnetic fields, for example, TV signals, remote radio systems and cell towers, however through utilizing a force creating circuit connected to a getting radio wire this free streaming energy can be caught and changed over into usable DC voltage [1]. Most regularly utilized as an application for radio frequency ID labels in which the detecting gadget remotely sends a radio frequency to a reaping gadget which supplies simply enough energy to send back recognizable proof data particular to the thing of hobby. The circuit frameworks which get the recognized radio frequency from the reception apparatus are made on a small amount of a micro meter scale yet can change over the spread electromagnetic waves to low voltage DC power at separations up to 100 meters. The primary innovative headway that has permitted these gathering gadgets to produce adequate force is through the improvement of recipients which can sense wide scopes of frequencies, not simply

constrained to TV UHF signs, while catching the most elevated amassing of created waves.

1.3 OBJECTIVES

There are two main objectives that need to be achieved in this project, they are:

a) To design a harmonic suppression circularly polarized patch antenna for RF energy harvesting system

b) To validate the performance of the simulated and the measured result for the propose antenna

1.4 PROBLEM STATEMENT

Nowadays, our mother earth are now facing the world energy crisis. Currently, coal is one of the main sources of fuel to produce electricity. In future, this source of fuel is predicted to be reduced. Energy harvesting is the process of gathering energy around that device and using it to either extend the batteries life of that device or power that device completely [1]. A small amount of power cannot power our home or car, but those small amount of power can power a sensor in our car. Energy harvesters provide a very small amount of power for low-energy electronics. While the input fuel to some large-scale generation costs money, the energy source for energy harvesters is present as ambient background and is free. For example, temperature gradients exist from the operation of a combustion engine and in urban areas, there is a large amount of electromagnetic energy in the environment because of radio and television broadcasting [1].

There are a lot of scientist that are now doing the research on this energy harvesting technologies but a few problems occur such that the amount of the RF energy capture from this system is very low. This affects the system to be no efficiency. Thus, the problem of capturing the energy is related to the fact that the antenna use is lack of efficiency. There are a few factors that contribute in solving this problem. One of them is the polarization of the antenna and the frequency range used.

1.5 SCOPE OF THE PROJECT

In this project the scope of the study is only focus on the RF energy. The design and the analysis of the proposed antenna will be covered in this project. The antenna will be design in the frequency range of 2.4GHz. The research study on journal will focus on a few criteria listed below:

1. Circularly polarized
2. Patch antenna
3. Frequency = 2.4Ghz
4. Harmonic suppression

In order to design the antenna, all the parameter needed is listed in literature review part to find the suitable value or properties that can be used in order to have a greater efficiency antenna [1]. To simulate the design antenna the software of CST Studio Suite is used. As mention in objective part, the antenna design is the circularly polarized patch antenna. After the simulation is success, the implement of the prototype will be started.

1.6 THESIS OUTLINE

This thesis is divided into five chapters. Chapter 1 describes the objectives and the background of the propose project. In the Chapter 2, presents the previous work and gives motivation for the work performed in this thesis. Also, the approach taken and the mathematical tools used in the analysis are explained. Chapter 3, describes the methodology used in the design of the project. Next, is Chapter 4 that presents results and achievement of the project. This chapter also discussed the significance of the results obtained. Chapter 5 which is the last chapter, summarizes the main conclusions of this thesis and presents an outlook for future work.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

For this chapter, a detail background study of this project is stated in the literature review. A lot of the basic element in designing the antenna is been discussed in this chapter. All the parameter that is essential for this project is listed. There are about 30 journals has been reviewed based on the consideration of this criteria:

1. Circularly polarized
2. Patch antenna
3. Frequency = 2.4GHz
4. Harmonic suppression

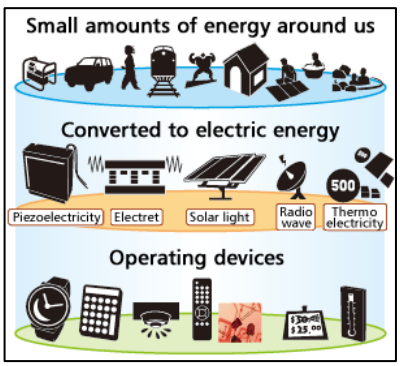

Figure 2.1: Energy Harvesting Poster [1]

2.2 REVIEW ON THE PAST JOURNAL

The table below show the summary of all the journal and article that has been review.

Table 2.1: Review on Journal findings

No.	Parameter used	Methods	Application
1	2.4 GHz ε_r =2.2 h =4mm Rl =-16dB	Designed using H-shaped slot.	Design and Implementation of Dual-Band Square Patch Antenna for Wireless LAN of 2.4GHz and 5.7GHz
2.	2.4 GHz ε_r = 4.2-4.8 h = 1.6mm Rl =-28dB	A reflector is placed behind the antenna to increase its gain.	Design And Optimization Of Printed Dipole Antenna For Wireless Sensor Communication At 2.4GHz
3.	2.4 GHz ε_r =2.55 h = - Rl = -30dB	Using two Radio Frequency Micro-electromechanical system.	An approach for 2.4GHz wide range beam scanning leaky-wave antenna design