Department of Electronics and Communication Engineering
Maharaja Agrasen Institute of Technology

<u>Guidelines for Preparation of Final Summer Internship Report (5th semester)</u>

The guidelines prescribed in here are intended to be followed by B.Tech (ECE) students of MAIT for preparing their preparing final **Internship Report**. The report should contain the following items in the sequence as prescribed:

- Cover Page
- Declaration (as per the format attached)
- Certificate from the Company (as per the format attached)
- Certificate from the Institute (as per the format attached)
- Acknowledgement
    - Sections of the acknowledgement should express gratitude to the faculty supervisor(s), Company Supervisor (if any), Institute, Principal, HOD and TnP Coordinator(s).
    - Gratitude towards the mentor, peers, family members, friends, etc. may also be added if you wish to include.
- Abstract (1 page only)
- Table of Contents (Drawing of Table is strictly prohibited)
- List of Figures (Drawing of Table is strictly prohibited)
- List of Tables (Drawing of Table is strictly prohibited)
- Chapters (as per format attached)
- Bibliography
- Appendix

General Format Guidelines:

- Paper size: A4 (Single Side Printing)
- Margins: Left- 1.5”, Right- 1.0”, Top- 1.0”, Bottom- 1.0” (Normal Setting)
- Chapters Name: Bold- 16 points, Font- Times New Roman, Left Aligned
- Main Heading: Bold- 14 points, Font- Times New Roman, Left Aligned
- Sub Headings: Italics- 12 points, Font- Times New Roman, Left Aligned
- Main Body: Normal- 12 points, Font- Times New Roman, Justified
- Line spacing: 1.5
- Footer: Normal- 10 Points, Times New Roman- Left Aligned (NAME OF THE DEPARTMENT) Footer should not be present on Cover Page
- Page Numbers in Footer: Normal-10 Points, Times New Roman- Right Aligned, Roman Page number till Table of Contents. No Page number should be marked on the Cover page. The page numbers should be in numerals from Starting from Chapter 1.
- Figure Numbers: Normal- 10 points, Font- Times New Roman, Centre Aligned, Below the figure (Figure itself should be center aligned too). Figure must be cited if required.
- Table Numbers: Normal- 10 points, Font- Times New Roman, Centre Aligned, Above the table (Table itself should be center aligned too). Table must be cited if required.
- References: IEEE Format
- Report Binding & Page Limit: Hard Bound (Golden Engraved Print on **BLUE** Binding) with minimum 40 pages. Hard Bound Report’s side must be printed with “REPORT TITLE (2021-25)”

(A typical Specimen of Cover Page & Title Page)

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TITLE OF SUMMER INTERN REPORT

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A SUMMER INTERN REPORT

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Submitted by

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NAME OF THE CANDIDATE(S)

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Roll No

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in partial fulfillment of Summer Internship for the award of the degree of

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BACHELOR OF TECHNOLOGY

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MAIT LOGO

Maharaja Agrasen Institute of Technology

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Sample

MICROWAVE SINTERING AND PROCESSING OF NOVEL MATERIALS

A SUMMER TRAINING REPORT

Submitted by

SUNNY KUMAR

Enrollment Number: XXXXXXXXXXXX

Electronics and Communication Engineering

Under the supervision of

Dr. XXXXXXXXX (name of external Guide)

Scientist „A/B/C/‟

Mobile and Communication Lab

Delhi Research and rehabilation centre (DRRC)

Delhi House, New Delhi

MAHARAJA AGRASEN INSTITUTE OF TECHNOLOGY

ROHINI, NEW DELHI

Maharaja Agrasen Institute of Technology (14 size bold)

To Whom It May Concern

I, **XXXXXX SHARMA**, Enrollment No. xxxxxxx**2812**, a student of **Bachelors of Technology (ECE), a class of 2012-16, Maharaja Agrasen Institute of Technology, Delhi** hereby declare that the Summer Training project report entitled **"xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxoustic cell"** is an original work and the same has not been submitted to any other Institute for the award of any other degree.

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Date:

Place:

XXXXXX **SHARMA**

Enrollment No: xxxxxxx2812

Electronics and Communication Engineering

7E456

ACKNOWLEDGEMENT (14 size bold)

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First and foremost, I wish to express my profound gratitude to XXXXXXXXXXXX, Director, Delhi reseachXXXXXX….. Centre, DRRC and Ms xxxxxxxxx, Addl. Director, HRD, XXXXXX for giving me the opportunity to carry out my project at DRRC . I find great pleasure to express my unfeigned thanks to our group head Dr. XXXXXX. Sharma, Sc'F', Biological and ARM Unit, DRRC ,for his invaluable guidance, support and useful suggestions at every stage of this project work.

No words can express my deep sense of gratitude to Mr. XXXXXXXX, Sc _D', without whom this project would not have turned up this way. My heartfelt thanks to him for his immense help and support, useful discussions and valuable recommendations throughout the course of my project work.

I wish to thank my respected faculty and my lab mates for their support.

Last but not the least I thank the almighty for enlightening me with his blessings.

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Students name

Enrollment Number: xxxxxxx812

5E456/E5

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Every chapter will follow the same way.

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ABOUT THE COMPANY (DRRC) (14 size bold)

LOGO of company (Optional)

Delhi Research and rehabilation centre (DRRC) works under Department is dedicatedly working towards enhancing self-reliance in xxxxxxxe Systems and undertakes design & development leading to production of world class weapon systems and equipment in accordance with the expressed needs and the qualitative requirements laid down by the three services.

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ABSTRACT (14 size bold)

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Today, lasers are widely used for various civilian and military applications. Interferometers are basic optical tools used to precisely measure wavelength, distance, index of refraction and temporal coherence of optical beams. In the experiment performed, the coherence of Helium - Neon laser is analyzed using a Michelson Interferometer. The complete experiment was conducted by placing the optics on a vibrational isolation table. The Fringe Contrast was observed by varying the path difference in one of the arms. As expected, the fringe contrast was maximum when there was no path difference. However, the contrast decreased monotonically before fading away. The optimum coherence length was measured as the difference between the two arms.

The second experiment that has been conducted is the design of a pre amplifier circuit in order to observe the resonant frequency response of a Photo acoustic cell based microphone. Photo acoustic Spectroscopy is a useful technique for probing the optical properties of a variety of materials, including explosives that are a major threat to humanity, in the present scenario.

A brief introduction of the various hardware components like laser source, Michelson Interferometer, Photoacoustic cell etc along with phenomena such as Interference and Coherence is given in subsequent chapters. Description of the detailed experimental set- up used, observation and the results are presented in a summarized way in the given report.

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TABLE OF CONTENTS (14 size)

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Sample of the body

CHAPTER 1

INTRODUCTI

ON

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1.1 INTRODUCTION font size 14 …… font size 12

Always use times new roman…no other scripts are permitted. In recent years various types of flat profile printed antennas have been developed such as Microstrip antenna (MSA), strip line, slot antenna, cavity backed printed antenna and printed dipole antenna. When the characteristics of these antenna types are compared, the micro strip antenna is found to be more advantageous.

In this communication, an asymmetric-microstrip antenna is investigated and studied using four unequal small integrated circular-patches for wide-angle CP radiation and GNSS applications. Four unequal circular-patches integrated onto a square microstrip radiator corners contribute towards wideangle CP radiation [1].

In this work Design, Fabrication and Testing of linear polarized co-axial fed microstrip rectangular patch antenna for aerospace applications is presented. Microstrip antennas have several advantages compared to conventional microwave antennas and therefore have many applications over the broad frequency range from 100MHz to 50GHz.

This is the citation you are putting as per your writing of the body of your report. This citation must be there in reference section at the end

1.2 Definition of Antenna

An antenna (or aerial) is a transducer designed to transmit or receive electromagnetic waves. In other words, antennas convert electromagnetic waves into electrical currents and vice-versa. They are used with waves in the radio part of the electromagnetic spectrum, that is, radio waves, and are a necessary part of all radio equipment [2]. Antenna has many uses : communication, radar, telemetry, navigation etc.

Figure 1.1 shows the output from a coherent source (e.g. an oscillator) is directed out into free space using an antenna. The signal source is linked to the antenna by some kind of waveguide (microwave guide, light fibre, etc).

The antenna acts as a sort of transformer. It takes the electromagnetic field pattern, moving along the guide and transforms it into some other pattern, which is radiated out into free space.

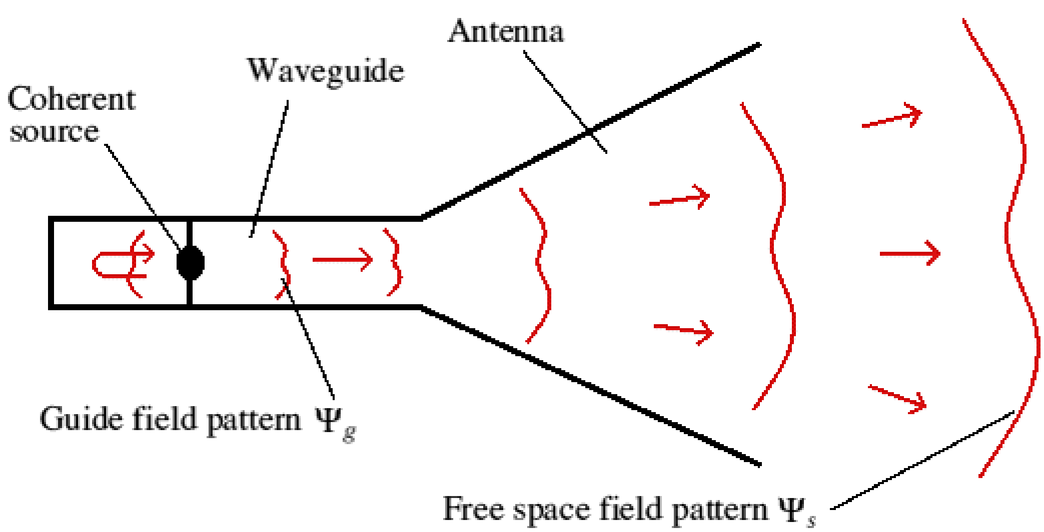

Figure 1.1 Schematic of an antenna system

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Using this simple picture we can establish two basic properties of any antenna:

- Firstly, the antenna doesn't itself generate any power. So, unless the antenna is imperfect and dissipates some power, the total powers carried by the guide and free space fields must be the same. (In reality, all practical antennas tend to be slightly resistive so some power is normally lost, but for now we can assume any loss is small enough to ignore.)

- Secondly, the antenna is a *reciprocal* device — i.e it behaves in the same way irrespective of which way we pass signal power through it. This reciprocal behaviour is a useful feature of a coherent antenna. It means that, in principle, the only real difference between a ‗transmitting‘ and a ‗receiving‘ antenna is the direction we've chosen to pass signals through it.

Theoretically one of the simplest types of antenna is a Hertzian Dipole of the kind illustrated in figure 1.2.

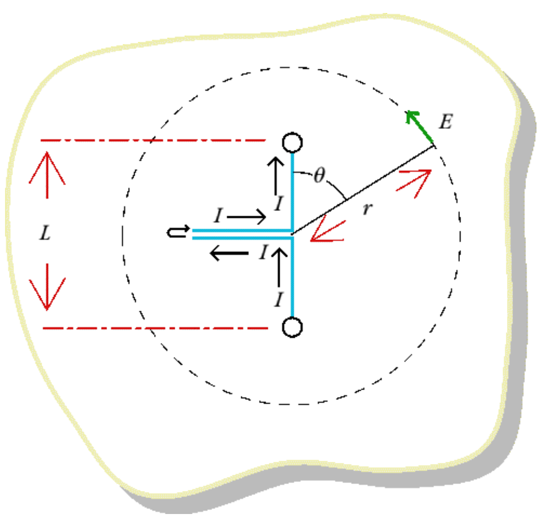

Figure 1.2 Hertzian Dipole Antenna

The dipole consists of a straight piece of wire of length L with a small break at its centre. A pair of wires are then used to connect the break to a generator which can produce a current.

$$I\{t\} = I_0 \operatorname{Sin}\{2\pi f t\} \quad \textbf{(1.1)}$$

For the sake of simplicity we can assume that L<c/f

This means that we can neglect the time it takes for any current to flow along the dipole. We can therefore assume that the current equals $I\{t\}$ everywhere along the dipole. In reality, of course, the current would have to ―come from and go somewhere‖ at the wire ends since charge can't appear and vanish into/out of nothing. We can imagine two spheres or discs placed at the ends of the wires to act as charge reservoirs. By reference to a suitable book on electromagnetic or antennas we can discover that a wire of length L carrying a uniform current oscillation of amplitude I_0 will radiate an oscillating electric field.

(1.2)

where, r is the radi $E\{t, r, \theta\} = \frac{60\pi L I_0 \operatorname{Sin}\{\theta\} \operatorname{Cos}\{2\pi(ft - r/\lambda)\}}{\lambda r}$ where we wish to determine the electric field; theta is the angle between the dipole wire and the line connecting the point and the centre of the dipole; and lambda is the free space wavelength of the radiation.

1.2 Origin of Antennas font size 14

Communication is the process of transferring information from one entity to another. Communication has existed since the beginning of human beings, but it was not until the 20th century that people began to study the process. At first this was achieved by sound through voice. As the distance of communicating increased, various devices were introduced, such as drums, horns and so forth and for even greater distances visual methods were introduced such as

signal flags and smoke signals in the daytime and fireworks at night. These optical communication devices, of course, utilize the light portion of electromagnetic spectrum. It has only been recently in human history that the electromagnetic spectrum outside the visible region has been employed for communication, through the use of radio.

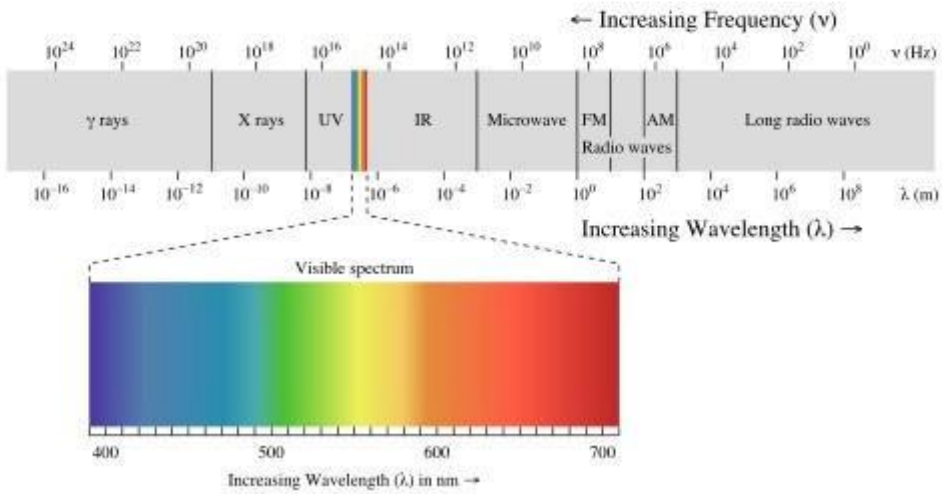

Figure 1.3 Electromagnetic spectrum

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The antenna is an essential component in any radio system which provides a means for radiating or receiving radio waves that is it provides a transition from a guided wave on a transmission line to a free-space wave.

1.3 History of Antenna Technology (14 Size bold)

The theoretical foundations for antennas rest on Maxwell‗s equations. James Clark Maxwell in 1864 presented his results before Royal Society, which showed that light and electromagnetics were one in physical phenomenon and also predicted that light and electromagnetic disturbances both can be explained by waves travelling at the same speed. And in 1886 Heinrich Hertz verified the above and **Always use Font size 12 Times new roman**
discovered that the electrical disturbances could detected with a secondary circuit of proper dimensions for resonance and containing an air gap for sparks to occur.

Guglielmo Marconi built a microwave parabolic cylinder at a wavelength of 25 cm for his original code transmission and worked at longer wavelengths for improved communication range. Marconi is considered as the father of amateur radio. Antenna developments in the early years were limited by

the availability signal generators. About 1920 resonant length antennas were possible after the De Forest triode tube was used to produce continuous wave signals up to
1MHz.

At these higher frequencies antennas could be built with a physical size in resonant region. Just before World War II microwave (about 1 GHz) klystron and magnetron signal generators were developed along with hollow pipe waveguides. These lead to the development o horn antennas, although Jagadish Chandra Bose in India produced the first electromagnetic horn antenna many years earlier. The first commercial microwave radiotelephone system in 1934 was between England and France and operated at 1.8G Hz. During the war an intensive development effort primarily detected toward radar, spawned many modern antenna types, such as large reflectors, lenses and waveguide slot arrays.

1.4 Basics Antenna Characteristics

An antenna is a device that is made to efficiently radiate and receive radiated electromagnetic waves. There are several important antenna characteristics that should be considered when choosing an antenna for application such as Gain, radiation pattern, bandwidth, beam width etc., are as follows:

1.4.1 Radiation Pattern

Practically any antenna cannot radiate energy with same strength uniformly in all directions. The radiation from antenna in any direction is measured in terms of field strength at a point located at a particular distance from antenna. Radiation pattern of an antenna indicates the distribution of energy radiated by the antenna in the free space. In general radiation pattern is a graph which shows the variation of actual field strength of electromagnetic field of all the points equidistant from antenna. The two basic radiation patterns are field strength radiation pattern which is expressed in terms of **field strength** E (in V/m) and **power radiation** pattern expressed in terms of power per unit solid angle.
Field radiation pattern is a 3-dimensional pattern. To achieve this it requires representing the radiation for all angles of Φ and θ which give E-plane (vertical plane) and H-plane (horizontal plane) pattern respectively.

1.4.2 Gain

Antenna gain relates the intensity of an antenna in a given direction to the intensity that would be produced by a hypothetical ideal antenna that radiates equally in all directions (isotropically) and has no losses. Since the radiation intensity from a lossless isotropic antenna equals the power into the antenna divided by a solid angle of 4π steridians, we can write the following equation:

$$\text{Gain} = 4\pi * \text{Radiation Intensity/Antenna Input Power} \qquad \textbf{(1.3)}$$

1.4.3 Directivity

The directive gain of the antenna is the measure of the concentration of radiated power in a particular direction. It may be regarded as the ability of the antenna to direct radiated power in a given direction. It is usually a ratio of radiation intensity in a given direction to the average radiation intensity. Generally $D > 1$,except in the case of an isotropic antenna for which $D = 1$. An antenna with directivity $D >> 1$ is directive antenna.

1.4.4 Polarization

Polarization is the orientation of the electromagnetic waves far from the source. There are several types of polarization that apply to antennas. They are Linear (which comprises vertical and horizontal), oblique, Elliptical (left hand and right hand polarizations), circular (left hand and right hand) polarizations.

1.4.5 VSWR

VSWR is the ratio of the maximum to minimum values of the "standing wave" pattern that is created when signals are reflected on a transmission line. This measurement can be taken using a "slotted line" apparatus that allows the user to measure the field strength in a transmission line at different distances along the line.

The voltage standing wave ratio is a measure of how well a load is impedance-matched to a source. The value of VSWR is always expressed as a ratio with 1 in the denominator (2:1, 3:1, etc.) It is a scalar measurement only (no angle), so although they reflect waves oppositely, a short circuit and an open circuit have the same VSWR value (infinity:1). A perfect impedance match corresponds to a VSWR 1:1, but in practice you will never achieve it. Impedance matching means you will get maximum power transfer from source to load.

1.4.6 Reflection Coefficient and return Loss

Reflection coefficient shows what fraction of an incident signal is reflected when a source drives a load. A **reflection coefficient** magnitude of zero is a perfect match, a value of one is perfect reflection. The symbol for reflection coefficient is uppercase Greek letter gamma (Γ). Note that the reflection coefficient is a vector, so it includes an angle. Unlike VSWR, the reflection coefficient can distinguish between short and open circuits. A short circuit has a value of -1 (1 at an angle of 180 degrees), while an open circuit is one at an angle of 0 degrees. Quite often we refer to only the magnitude of the reflection coefficient.

Return Loss shows the level of the reflected signal with respect to the incident signal in dB. The negative sign is dropped from the return loss value, so a large value for return loss indicates a small reflected signal. The **return loss** of a load is merely the magnitude of the reflection coefficient expressed in decibels. The correct equation for return loss is:

Return loss = -20 x log [mag(Γ)]

Thus in its correct form, return loss will usually be a positive number. If it's not, you can usually blame measurement error. The exception to the rule is something with negative resistance, which implies that it is an active device (external DC power is converted to RF) and it is potentially unstable (it could oscillate).

1.4.7 Bandwidth

The bandwidth of an antenna is defined as the range of frequencies within which the performance of the antenna with respect to some characteristics conforms to a specific standard. The reason for this qualitative definition is that all the antenna parameters are changed with frequency and the importance of the different parameters as gain, return loss, beam-width, side-lobe level etc., much depends on the frequency band. The bandwidth of an antenna for gain (-3dB from the maximum) is defined as

$$\text{Bandwidth } (\%) = (f_v - f_l) * 100 / f_c \qquad \textbf{(1.4)}$$

Where f_v is the upper frequency, f_l is the lower frequency, and f_c is the centre frequency.

1.4.8 Beamwidth

Associated with the pattern of an antenna is a parameter designated as *beamwidth*. The *beamwidth* of a pattern is defined as the angular separation between two identical points on opposite side of the pattern maximum. In an antenna pattern, there are a number of beamwidths. One of the most widely used beamwidths is the *Half-PowerBeamwidth* (*HPBW*), which is defined by IEEE as: ―In a plane containing the direction of the maximum of a beam, the angle between the two directions in which the radiation intensity is one-half value of the beam.‖ This is demonstrated in Figure 2.2. Another important beam width is the angular separation between the first nulls of the pattern, and it is referred to as the *First-Null Beamwidth* (*FNBW*). Both the *HPBW* and *FNBW* are demonstrated for the pattern in Figure 1.8 for the pattern. Other beamwidths are those where the pattern is−10 dB from the maximum, or any other value. However, in practice, the term *beamwidth*, with no other identification, usually refers to *HPBW*. The beamwidth of an antenna is a very important figure of merit and often is used as a trade-off between it and the side lobe level; that is, as the beamwidth decreases, the side lobe

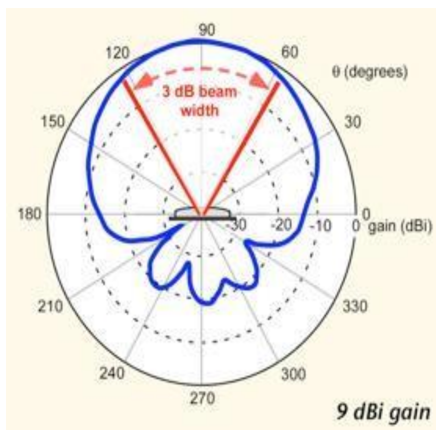

Figure 1.4: A polar diagram showing beamwidth.

increases and vice versa. In addition, the beamwidth of the antenna is also used to describe the resolution capabilities of the antenna to distinguish between two adjacent radiating sources or radar targets. The most common resolution criterion states that *the resolution capability of an antenna to distinguish between two sources is equa lto half the first-null beamwidth (FNBW/2), which is usually used to approximate the half powerbeamwidth (HPBW)* .

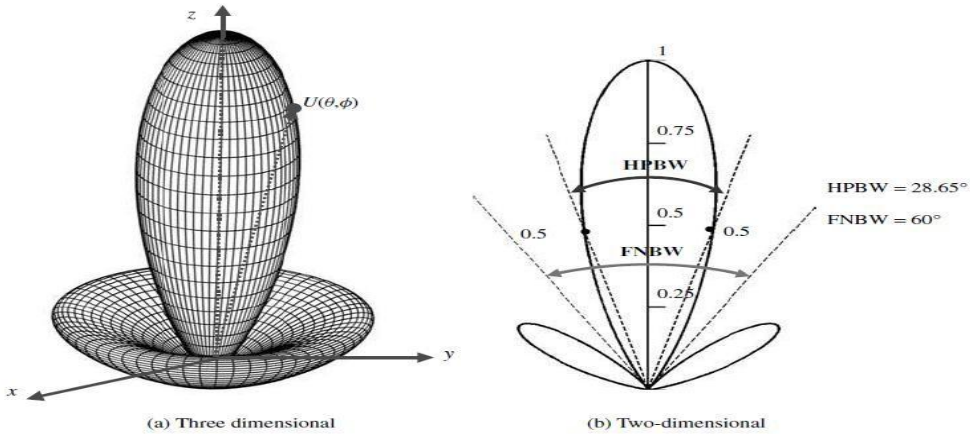

Fig 1.5 Three and two-dimensional power patterns(in linear scale) of *U(θ)* =cos2*(3θ).*

The beamwidth is the angle between the half-power (-3dB) of the peak effective radiated power.It is usually expressed in degrees and is shown in the horizontal plane by being displayed in a polar diagram. Figure 1.9 shows a beamwidth in a polar diagram. By a simpler description it can be said that the received signal can be reached within abeamwidth-margin of the pointed direction. It can be calculated by the following equation.

e,

θ_0 = *The pointing direction*.

λ_0 = *The free space wavelength*.

l = *The total length of the patch*.

1.4.9 Types of Antennas

There are two fundamental types of antenna directional patterns, which, with reference to a specific two dimensional plane (usually horizontal [parallel to the ground] or [vertical perpendicular to the ground]), are either:

1. Omni-directional (radiates equally in all directions), such as a vertical rod (in the horizontal plane) or

2. Directional (radiates more in one direction than in the other). In colloquial usage "omni-directional" usually refers to all horizontal directions with reception above and below the antenna being reduced in favor of better reception near the horizon. A directional antenna usually refers to one focusing a narrow beam in a single specific direction such as a telescope or satellite dish, or, at least, focusing in a sector such as a 120° horizontal fan pattern in the case of a panel antenna at a cell site.

The present antenna in the thesis i.e., Microstrip antenna is an omnidirectional antenna which radiates normal to the patch surface into the upper hemisphere (180° in elevation plane) and 360° in azimuth plane.

1.4.8 Basic Models of Antennas

There are many variations of antennas. Below are a few basic models.

- The **isotropic radiator** is a purely theoretical antenna that radiates equally in all directions. It is considered to be a point in space with no dimensions and no mass. This antenna cannot physically exist, but is useful as a theoretical model for comparison with all other antennas. Most antennas' gains are measured with reference to an isotropic radiator, and are rated in dBi (decibels with respect to an isotropic radiator).

- The **dipole antenna** is simply two wires pointed in opposite directions arranged either horizontally or vertically, with one end of each wire connected to the radio and the other end hanging free in space. Since this is the simplest practical antenna, it is also used as a reference model for other antennas; gain with respect to a dipole is labeled as dBd.

- The **Yagi-Uda** antenna is a directional variation of the dipole with parasitic elements added which are functionality similar to adding a reflector and lenses (directors) to focus a filament light bulb.

- The random **wire antenna** is simply a very long (at least one quarter wavelength) wire with one end connected to the radio and the other in free space, arranged in any way most convenient for the space available. Folding will reduce effectiveness and make theoretical analysis extremely difficult.

- The **horn** is used where high gain is needed, the wavelength is short (microwave) and space is not an issue. Horns can be narrowband or wideband, depending on their shape. A horn can be built for any frequency, but horns for lower frequencies are typically impractical. Horns are also frequently used as reference antennas.

- The **parabolic antenna** consists of an active element at the focus of a parabolic reflector to reflect the waves into a plane wave. Like the horn it is used for high gain, microwave applications, such as satellite dishes.

- The **patch antenna** consists mainly of a square conductor mounted over a ground plane. Another example of a planar antenna is the tapered slot antenna (TSA), as the Vivaldiantenna.

Similarly the other chapters will follow

At the End of all chapter mention references you have used as per following format

And cite the references in your main body with number and bracket like [1]

This is very important part in your Report.

Please your references in the text of the body of your Report

References (Font size -10 times new roman)

[1] G. Eason, B. Noble, and I. N. Sneddon, ―On certain integrals of Lipschitz-Hankel type involving products of Bessel functions,‖ Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955. *(references)*

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