Study of Microstrip Patch Antenna for WiMAX and WLAN

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Abstract— The investigation of microstrip patch antenna has gained awesome ground as of late. At the point when microstrip patch antenna is contrasted and ordinary receiving wires, the microstrip patch antenna have more focal points and better prospects. They are lighter in weight, low volume, minimal effort, littler in measurement and simplicity of creation and congruity. Also the microstrip patch reception apparatuses can give double and roundabout polarizations, double recurrence operation, recurrence nimbleness, bolster line adaptability, shaft examining and Omni directional designing. In this paper we talk about the micro strip patch antenna and its distinctive sorts of setups and parameters.

Key words: Microstrip Antenna, Patch Antenna, Configuration, Feed Techniques, Gain, VSWR, Radiation Pattern, Efficiency

I. INTRODUCTION

In elite, air ship rocket, satellite and in rocket applications where the execution, size, cost, simplicity of establishment and streamlined profiles are requirements, so that the position of safety radio wires are required. There are numerous administration and business applications like portable and remote interchanges have comparable determinations. Microstrip patch antennas are utilized in light of the focal points it has to meet these necessities.

Microstrip reception apparatuses are modest and it can be incorporated with the Printed Circuit Boards. They are mechanically hearty when mounted on inflexible surfaces. At the point when specific patch shapes are chosen then they are exceptional regarding resounding recurrence, design impedance also, polarization. The increase of microstrip receiving wires can be expanded by building a broadside receiving wire exhibit. By energizing various microstrip reception apparatus components to make them transmit in the same stage at the broadside heading. The effectiveness can be enhanced by expanding the stature of the substrate.

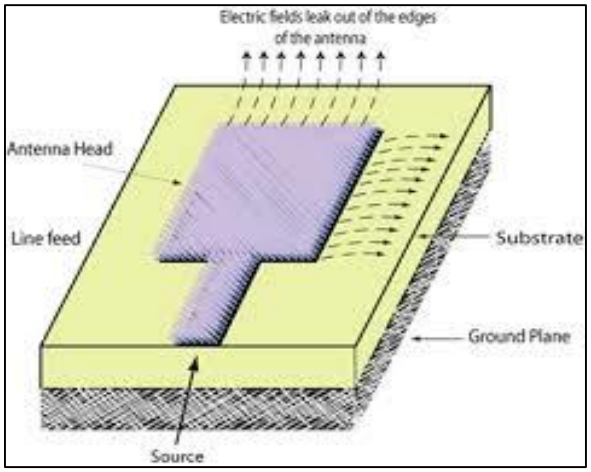

Fig. 1: basic structure of microstrip patch antenna.

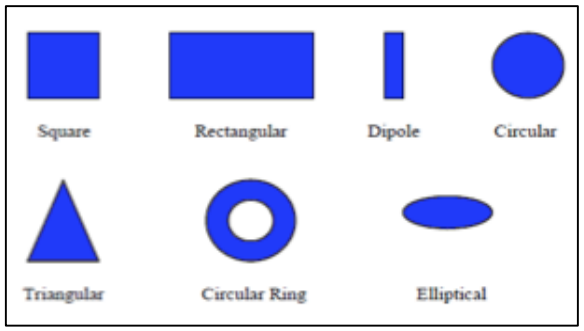

Fig. 3: Common shapes of Microstrip patch elements

II. MICROSTRIP ANTENNA AND ITS CHARACTERISTICS

The microstrip patch antennas are likewise called patch reception apparatuses. These are restricted band and wide shaft reception apparatuses. It comprises of a patch which is thin and is set over a ground plane. The patch is flimsy ($t << \lambda o$ where λo is the free space wavelength).The microstrip reception apparatus is composed so its example most extreme is ordinary to the patch (broadside radiator). For a rectangular patch the Length L is normally $\lambda o/3 < L < \lambda o/2$.

There are numerous sorts of substrates that can be utilized for the configuration of microstrips patch antenna and their dielectric constants are in the scope of $2.2 \leq \varepsilon r \leq 12$.The thick substrates are typically favoured whose dielectric steady is in the lower end of the reach since they give better productivity, bigger data transmission, inexactly limited fields for radiation yet to the detriment of bigger component size. The stature of the substrate ought to be in the reach $h << \lambda o$, typically $0.003 \lambda o \leq h \leq 0.05 \lambda o$. The emanating components and feed lines are generally photo etched on the dielectric substrate.

III. LITERATURE SURVEY

The idea of microstrip patch antenna with directing patch on a ground plane isolated by dielectric substrate was undeveloped until the upheaval in electronic circuit scaling down and vast scale reconciliation in 1970. After that numerous scientist have portrayed the radiation starting from the earliest stage by a dielectric substrate for various arrangements. The early work of Munson on micro strip antenna for use as a position of safety flush mounted reception apparatuses on rockets and it demonstrated that this was a reasonable idea for use in numerous radio wire framework issues. Different numerical investigation models were produced for this radio wire and its applications were reached out to numerous different fields. The small scale strip antennas are the present day reception apparatus designer's decision. In this segment, the microstrip reception apparatus writing overview is examined.

A two fold L-opening microstrip patch antenna [1] exhibit with CPW bolster innovation has been proposed for

microwave access and remote neighbourhood applications. This paper results in very small antenna with great omnidirectional radiation. It can be seen that the gain can be higher than 3dBi at 3.5 GHz.

A microstrip patch antenna [2] for double band WLAN purpose is proposed. So here a double band L-formed Microstrip patch antenna is imprinted on a FR-4 substrate for WLAN, and it achieves a recurrence range from 5.0GHz to 6.0 GHz with greatest addition of 8.4 and 7.1 dB.

A microstrip slot antenna [3] fed by a microstrip line has been proposed here. The bandwidth of antenna has improved and this antenna was presented for satellite application and WLAN.

A Broadband antenna [4] for WLAN and WiMAX is proposed. These developed antennas have a wideband characteristic that is based on various parameters like circular probe–fed patch and U-slot dimensions. This antenna has more than 90% antenna efficiency, 36.2% impedance bandwidth and is suitable for 2.3/2.5GHz and 2.4 GHz WLAN application and WiMAX.

A dual Wideband antenna[5] for WiMAX/WLAN application is proposed . For band broadening A microstrip feedline for excitation and a trapezoidal conductor- backed plane is used. The measured return loss is 10dB bandwidth from 2.01 to 4.27 GHz and 5.06 to 6.79 GHz , covering all the WiMAX bands 2.5/3.5/5.5 GHz to 2.4/5.2/5.8 GHz WLAN.

A tiny rectangular patch antenna [6] has described for WLAN and Wi-MAX purpose. This antenna is very simple, compact, low cost, simple structured and suited for frequency bands of WLAN and Wi-MAX applications.

IV. FEEDING TECHNIQUES

A feed is used to excite to radiate by direct or indirect contact.there are four type of feeding techniques, named as-(1) microstrip line coupling. (2) coaxial coupling.(3) aperture coupling.(4) proximity coupling.

Microstrip line and coaxial feeds are comparatively easier to manufacture.

Coaxial probe feed is used because it is easy to use and the input impedance is 50 ohm. We have to find out some points which has 50 ohm impedance and match it with input impedance. and These points are find out with the help of a mathematical model .

Characteristics	**Micro strip line feed**	**Coaxial feed**	**Aperture coupled feed**	**Proximity coupled feed**
Spurious feed radiation	more	More	Less	Minimum
Reliability	Better	Poor due to soldering	Good	Good
Easy of fabrication	Easy	Soldering and drilling needed	Alignment requried	Alignment required
Impedance matching	Easy	Easy	Easy	Easy
Bandwidth	2-5%	2-5%	2-5%	13%

Table 1: Characteristics

V. ANTENNA PARAMETERS

Diverse parameter, for example, VSWR, Return Loss, Antenna Gain, Directivity, Antenna Efficiency and Bandwidth is examined

A. Gain

The gain of an antenna is defined as the ratio of the intensity, in a given direction, to the radiation intensity that would be obtained if the power accepted by the antenna were radiated isotropically. Formula for gain is $G=4\pi.U(\theta,\Phi)/Pin$, where, $U(\theta,\Phi)$ is a intensity in a given direction, Pin is input power.

B. Radiation Pattern

The radiation pattern is defined as a mathematical function or a graphical representation of the radiation properties of the antenna as a function of space coordinates.

C. Antenna Efficiency

It is a ratio of total power radiated by an antenna to the input power of an antenna.

D. VSWR

Voltage standing wave proportion is characterized as VSWR=Vmax/Vmin. It ought to lie somewhere around 1 and 2.

E. Return Loss

Return loss is the impression of sign influence from the insertion of a gadget in a transmission line. Subsequently the RL is a parameter like the VSWR to demonstrate how well the coordinating between the transmitter and receiving wire has occurred. The RL is given as by as: RL=-20 log10 (Γ) dB For impeccable coordinating between the transmitter and the receiving wire, Γ = 0 and RL = ∞ which implies no force would be reflected back, while a Γ = 1 has a RL = 0 dB, which infers that all episode force is reflected. For pragmatic applications, a VSWR of 2 is satisfactory, since this relates to a RL of - 9.54 dB.

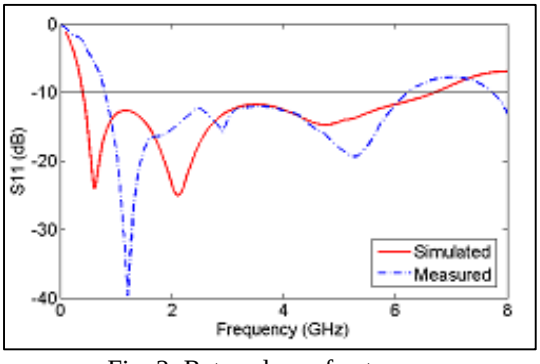

Fig. 2: Return loss of antenna.

VI. ANTENNA DESIGN

To design a rectangular microstrip patch antenna following parameters such as dielectric constant (Єr), resonant frequency (fo), and height (h) are considered for calculating the length and the width of the patch. Width of patch (w): $W=c2fo\ \varepsilon r$+12 Effective dielectric constant of antenna

(€reff): $\varepsilon reff = \varepsilon r + 12 + \varepsilon r - 12\ 1 + 12hw\ -1/2$ Effective electrical length of antenna: $Leff = c2fo\ \varepsilon reff$ The extended length of antenna (ΔL): $\Delta Lh = 0.412\ \varepsilon reff + 0.3\ (wh + 0.264)\ \varepsilon reff - 0.258\ (wh + 0.8)$ The length of the patch is: $L = Leff - 2\Delta L$.

VII. Advantage and Disadvantage

Sr. No.	Advantage	Disadvantage
1	Low weight	Low efficiency
2	Low profile	Low gain
3	Thin profile	Large ohmic loss in the feed structure of arrays
4	Required no cavity backing	Low power handling capacity
5	Linear and circular polarization	Excitation of surface wave
6	Capable of dual and triple frequency operation	Polarization purity is difficult to achieve
7	Feed lines and matching network can be fabricated simultaneously	Complex feed structure required high performance arrays

Table 1: Advantage and Disadvantage

VIII. Conclusion

This paper presents a survey on microstrip patch antenna. After investigation of different research papers it presumed that poor power handling and low gain of antenna can be overcome through a cluster design and opened patch.

Also various antenna parameters and Some characteristics of feeding technique are discussed here.

Different advantages are compared with conventional microwave antenna. and for each application Particular microstrip patch antenna can be designed .

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