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Review and Comparative Study on Different Shape Microstrip Patch Antenna

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ABSTRACT - In this paper shown the comparative study of different shape microstrip patch antenna. Microstrip patch antenna plays a vital role in WLAN communication, mobile communication, 3G, 4G, and Wi-Fi, Wi-MAX devices in different range. S-shape microstrip patch antenna is very interesting shape for researchers .There are different S-shape based antenna presented in the last decade for WLAN and Wi-MAX devices. In this survey paper discussed S-shape and other shape based patch antenna for wideband and narrowband. In this survey paper also discussed the survey of different shape antenna and used tool.

***Keywords*-- Microstrip Patch Antenna, Wi-MAX, WLAN, VSWR, Return Loss (RL), Wide band (WB), Narrow band**

I. INTRODUCTION

An antenna could be a specialized radiating device that converts radio-frequency (RF) fields into electrical energy and vice-versa. There are two basic types: the receiving antenna, that intercepts RF energy and delivers AC to equipment, and also the transmittal antenna, that is fed with from equipment and generates an RF field. Low profile antennas are essential for several wireless and tele-communication systems and hand-held mobile devices, where size, weight, cost, performance are forced. They normally contains a rectangular or square metal patch on a thin layer of insulator or substrate on a ground plane. The bandwidth specification of antennas should be satisfied for VSWR, radiation pattern and polarization properties.[11]

The main benefits of the microstrip patch antenna area unit flat profile, simple fabrication, compatibility with PCB and microcircuit technology. An additional feature of microstrip antenna is that they will be simply integrated with RF devices.[12]

II. MICROSTRIP AMTENNA

In a most basic form a microstrip antenna comprises of two thin metallic layers ($t<<\lambda_0$, where λ_0 is wavelength in Free space) one as radiating patch and second as ground plane and a dielectric substrate sandwiched between them. The conductor patch is placed on the dielectric substrate and used as radiating element. On the other side of the substrate there is a conductive layer used as ground plane. Copper and gold is used normally as a metallic layer. Radiating patch can be of any shape but simple shapes are used to design a patch because patches basic shapes are easy to analysis by the available theoretical models and it is easy to predict the performance. Square, rectangular, dipole, triangular, elliptical, circular are some basic shapes. Circular, rectangular and dipole are the most often used shapes because of easy of analysis and fabrication. [14] [15]

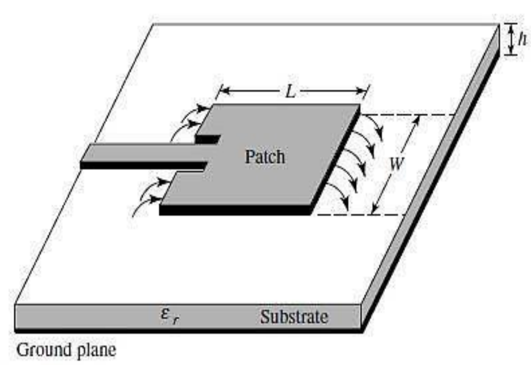

Fig. 1 Microstrip Patch Antenna

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A variety of dielectric materials are available for the substrate with dielectric constants $2.2 \le \varepsilon_r \ge 12$ [8]. The height of substrate plays an important role in antenna characteristics generally are in the range $0.003\lambda_0 \le h \ge 0.05\lambda_0$. [16]

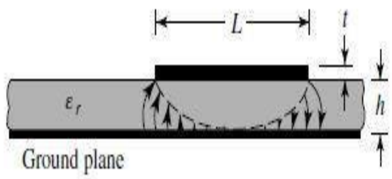

Fig. 2. Side view of Microstrip Patch Antenna

Microstrip antenna suffers from very Narrow frequency bandwidth. However some application where narrow bandwidth is essential such as government security systems, microstrip antennas are useful. Bandwidth of microstrip antenna is directly proportional to height of substrate. There are two main techniques two improve the bandwidth; one circuit theory and second structural. [17]

III. Literature Survey

Srivastava H. et al. shows the investigation of Z-Shape MSA for W/L communication system [01]. On device antennas have emerged to cater to the current necessity of device miniaturization. Antenna size could be a major issue that limits the manufacture of economical little devices. Over the past few years, new designs supported the small Strip Patch Antennas (MSPA) have return to the fore for hand-held wireless devices as a result of these antennas have low-profile geometry and may be embedded into the devices. It's additionally vital to look at examine.

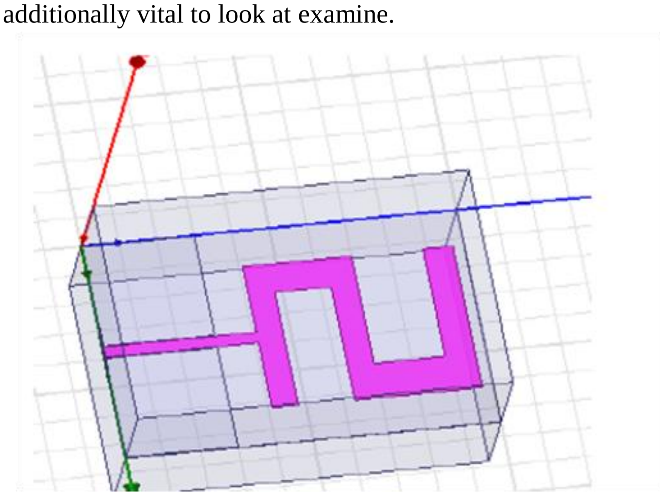

Fig-3:- Z-shape antenna

The fundamental limits and parameter trade-offs involved in size reduction. The performance analysis of Z shape Microstrip Patch Antenna, by victimization completely different insulator substrate materials, to work within the frequency vary of 0.6 GHz to 2 GHz has been given here. a scientific constant analysis has been enforced mistreatment HFSS package to optimize the bandwidth of the planned antenna. The aim of this paper is to broaden the electrical resistance information measure together with the maximization of gain, thereby rising upon the performance of antenna.[01] the shape and size of antenna is additionally shown in figure 3.

Md. S. Hossain et. al, proposed an probe and performance analysis of Z-shape MSA for wide band.[2] It is a personal analysis of Z-shape microstrip patch antennae design by using completely different insulator substrate materials, to control in frequency vary of 0.6GHz to 2GHz .By comparison completely different substrate materials and thickness, an acceptable substrate has been to choose to design microstrip patch antennae .This design may be compatible with varied communication application like wireless and antennae application .This antennae will be used for mobile broadband wireless protocols supported accepted specific use like IEEE 802.20 or ATIS/ANSI HC-SDMA which might be operated at around one.6GHz.In some special case mobile network ,like GSM ,use the low microwave frequencies around one.78GHz .DVB-SH and S-DMB use 1.452 to 1.492 GHz frequency international Positioning Satellite use 1.575 GHz and 1.227 GHz.[02]

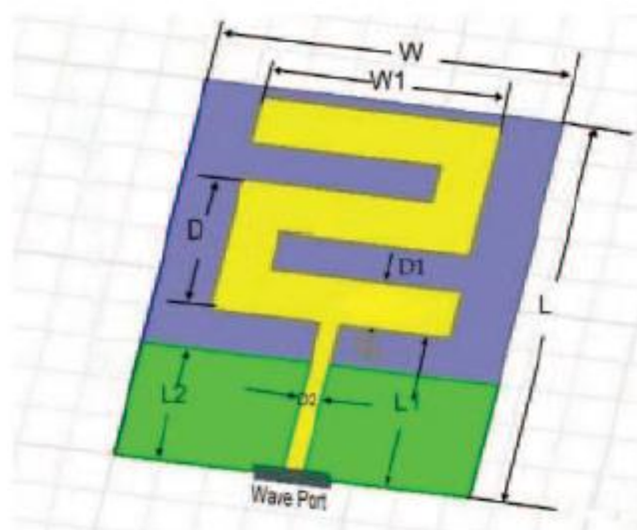

Fig. 4:-Top view of Z-shape antennae

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S. A. Shelke et.al. present double band MSA for W/L application. The antenna is extremely essential part of communication because it is employed for a transmission and receiving magnetism waves. Communication devices like mobile phones become terribly skinny and smarter, support many applications and better bandwidth wherever the microstrip antennas are the higher selection compare to standard antennas. local area network (Wireless local space Network) has been established by the IEEE 802.11a unit, additionally it works with band (5.10-5.50 and 5.85-6.25 GHz) This paper presents a literature survey of slotted microstrip patch antenna's these are dual-band rectangular MSA, Single S-slot MSA, Multi band H formed MSA, U-slot MSA, compact L- slot MSA for Wi-MAX and local area network applications with sort of substrates and slots. [03]

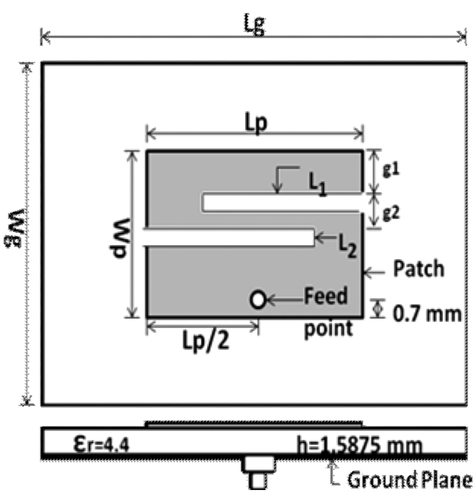

Fig.5 Geometry of the Dual-Band microstrip antennae

C. Elavarasi, et. al. proposed an asymmetric CPW-Fed Conjoined S-Shape MSA. [04] A novel asymmetric CPW fed with conjoined S-shape antenna is presented for multiband applications.

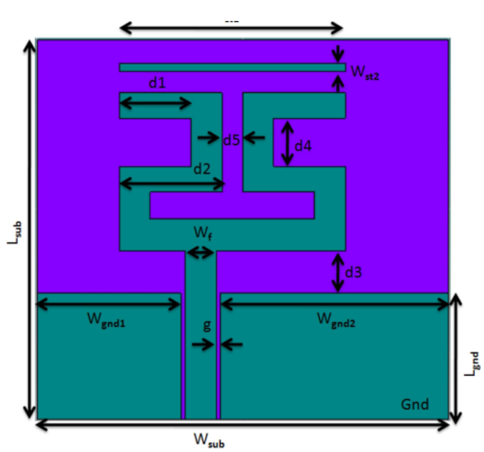

Fig. 6 Configuration of the CPW-fed square patch antenna

The antenna is intended on the Taconic RF-35 insulator substrate of twenty mm (width) x eighteen mm (length) K 0.76mm (thickness) with relative permittivity 3.5. The parallel slots are placed on top of the diverging patch, further resonances square measure excited. The planned antenna consists of joint curve and parallel slot that operates at 3 bands, covering 3 gig cycle per second at S band, 7 gig cycle per second at C band and ten gig cycle per second at X band. The simulation result shows higher performance, come loss, smart radiation diagram with cheap gain across the operative bands. The planned antenna is analysed by Central Time Microwave studio supported finite integration technique (FIT) technique. [04]

Jigar M. Patel et. al. discuss S-Shaped MSA different band application S-shaped microstrip patch antenna is intended and analyzed. to attain multiband applications that are needed in today's situation. Here formed meandered patch of dimension 50×50 mm square is analyzed. This design has three operating bands targeted around 1374 megacycle per second, 2476MHz and 3076 megacycle per second which might be used for multiband application functions. Design results are obtained by a HFSS (High Frequency Structure Simulator) that is employed for simulating microwave passive parts. [05]

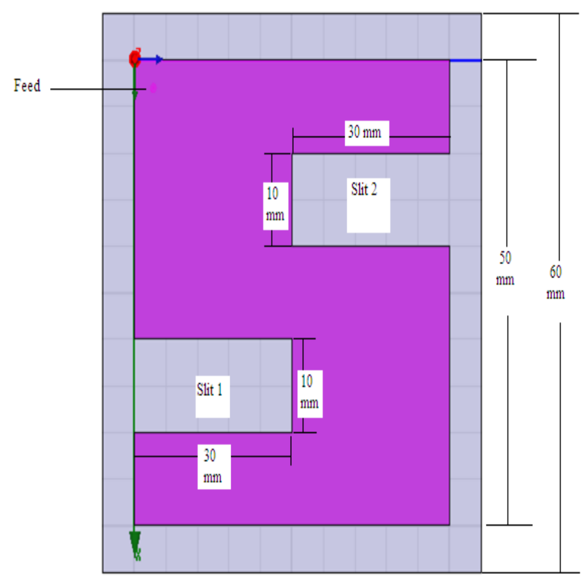

Fig.7 Actual HFSS Model (top view)

R. Jothi Chitra et. al., presents L-slot MSA array for 802.11 devices. A double L-slot microstrip patch antenna array is employed for worldwide ability for microwave access (Wi-MAX) and wireless native space network (WLAN) applications. The coplanar wave guide (CPW) fed microstrip patch antenna includes of two rectangular patch parts every embedded on two L-shaped slots. This design leads to a discount in size and weight and permits simple integration in hand-held devices.

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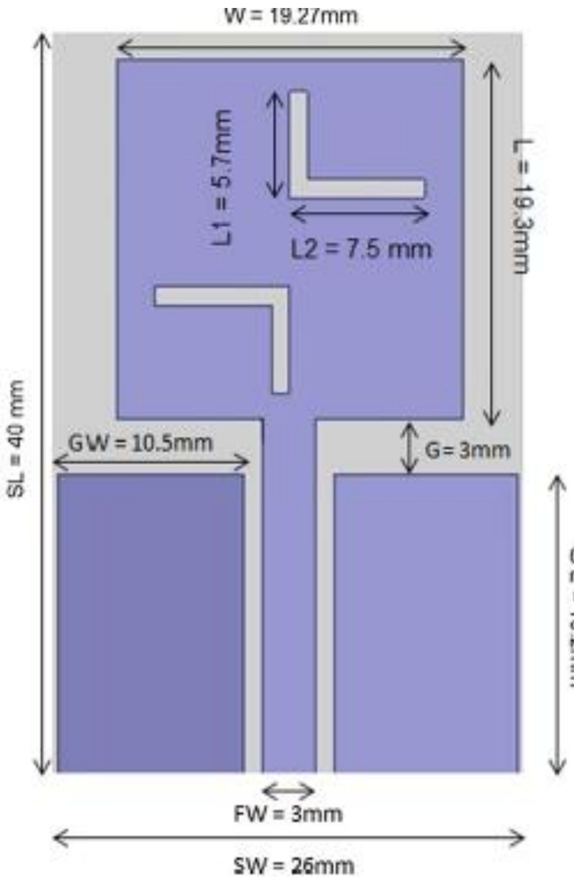

Fig. 8 Geometry of the double L-slot microstrip patch antenna

The parametric study of the considered design shows that the radiation pattern, return loss, voltage standing wave ratio (VSWR), and gain are optimized within the band of operation. The results obtained with Ansoft HFSS simulations and real time measurements are in good agreement with each other.[06]

Huiqing Zhai, et. al suggested a small MSA for tri Band WLAN/Wi-max. A novel compact printed antenna for triple-band WLAN/Wi-MAX applications is given. The planned antenna consists of 3 easy circular-arc-shaped strips, whose whole geometry appears like "ear" kind. By adjusting the geometries and also the sizes of those 3 circular-arc-shaped strips, three completely different resonance modes will be effectively created for 3 distinct frequency bands, severally. Measured results show that the given antenna will cowl 3 separated electrical resistance bandwidths of four hundred megacycle per second (2.38–2.78 GHz),480 MHz (3.28–3.76 GHz), and 1000 MHz (4.96–5.96 GHz), that are well applied for each 2.4/5.2/5.8-GHz local area network bands and a couple of.5/3.5/5.5-GHz Wi-MAX bands.[07].

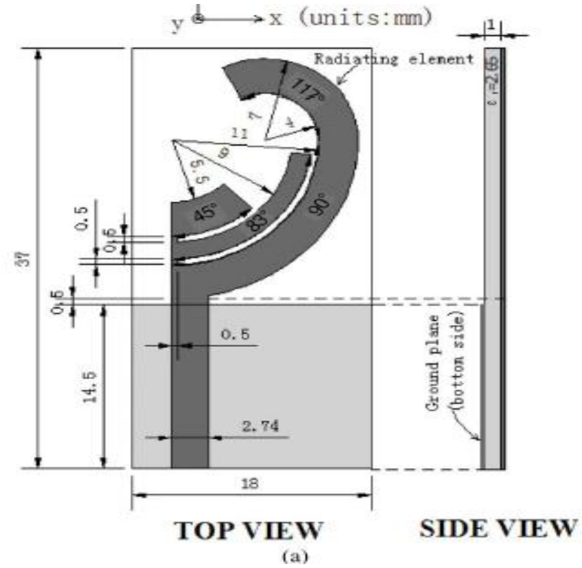

Fig. 9 Configuration of the presented antenna

Dharmendra et. al presents a Dual Patch MSA boost up bandwidth at 2.4 GHz**.** A compact size rectangular microstrip twin patch has been introduced to boost bandwidth of 2.4 gigacycle per second easy rectangular microstrip patch antenna that works on IEEE 802.11b and IEEE 802.11g customary applications. This antenna is mounted on rectangular patch with air gap to boost bandwidth up to 60 % for local area network applications. [08]

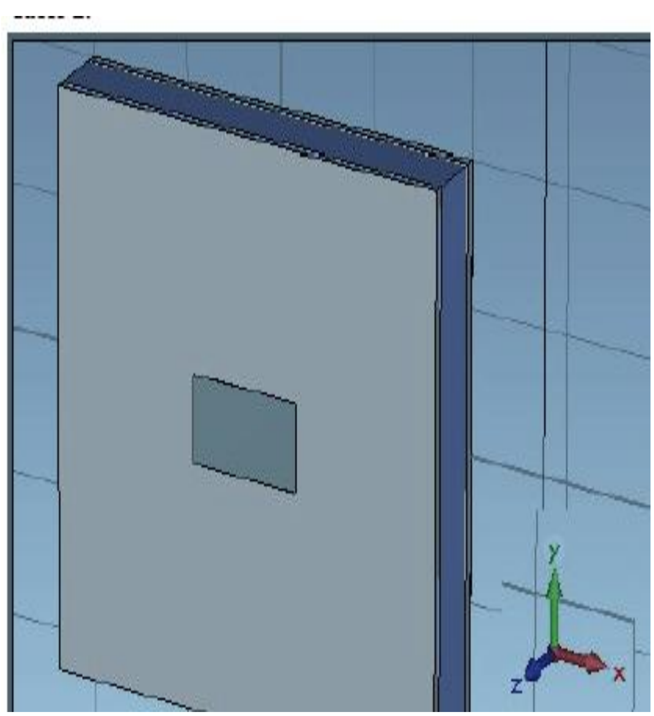

Fig. 10 Microstrip patch antenna

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Shobhit K et. al. presents a meta material based MSA with square patch. Magnetic properties will be imparted to a naturally nonmagnetic material by gold inclusions. A multiband meandered square microstrip patch antenna loaded with such a Meta material is reported. Meta materials exhibit qualitatively new magnetic force response functions that can't be found in nature. The antenna was designed to operate in multiple bands within the frequency vary 0.6–2.2 GHz. The antenna has eight operating frequency bands and its centre frequencies are 670 MHz, 1185 MHz, 1293 MHz, 1747 MHz, 1909 MHz, 1999 MHz, 2063MHz and 2134 megacycle per second. Meta material additionally enhances the gain of the antenna, which is applicable for many wireless applications. [09]

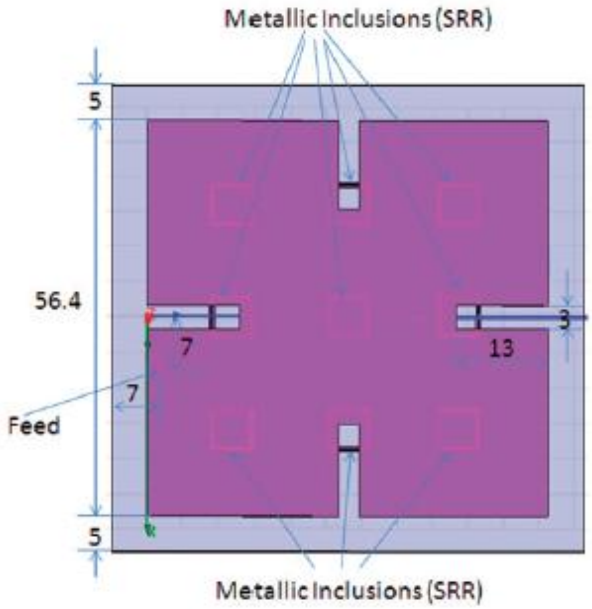

Fig. 11 Actual HFSS model design (top view).

Shobhit Patel, et. al represents MSA for mobile ranges. The enhancing bandwidth and size reduction mechanism that improves the performance of a standard small strip patch antenna on a comparatively skinny substrate (about zero.006 λ), is given during this analysis. the planning adopts meandered patch structure. Introducing the novel meandered sq. patch, provide a low profile, broadband, high gain, and compact antenna component. The projected patch features a compact dimension of zero.384 λ × 0.384 λ (where λ is that the radio-controlled wavelength of the centre operative frequency). The planning is appropriate for applications with relation to a given frequency of 750-1100 MHz. The simulated bandwidth of the planned antenna is regarding 39 present [10]

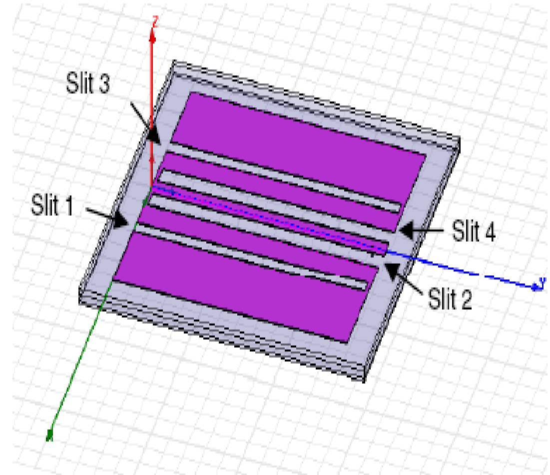

Fig. 11 Actual HFSS Model (top view) of mendered microstrip patch

Shobhit K.et. al, design an E-shape MSA for mobile communication. Area of small strip antennas has seen some ingenious add recent years and is presently one amongst the foremost dynamic fields of antenna theory. E-shape microstrip patch antenna has been designed for GPS application (GPS L2 1227.5 MHz band) and covering the 1200 to 1280 MHz band.. The study shows that modelling of such antennas, with simplicity in coming up with and feeding, will well meet GPS application. A designed antenna for the GPS application at the civilian GPS frequency (1227.5 MHz) has been simulated. Two parallel slots square measure incorporated to perturb the surface current path, introducing native inductive result. This antenna is fed by a concentrically probe feeding.[11]

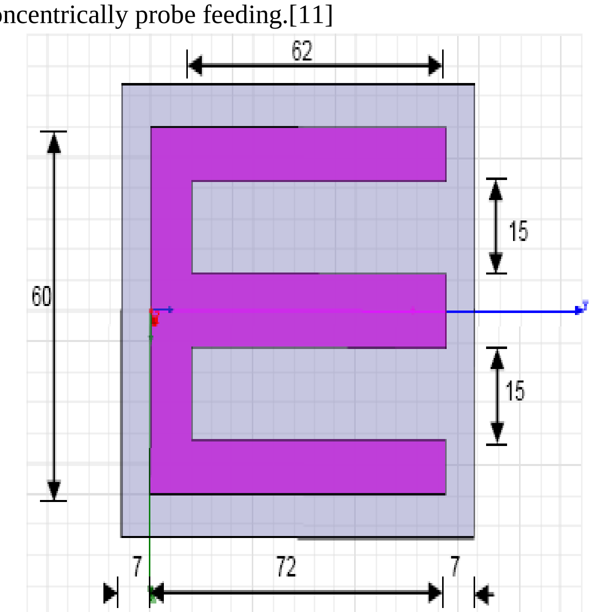

Fig. 12: Actual HFSS Model (Top view)

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M A Matin, et. al Broadband MSA for 2 to 6 GHz wireless range. A broadband dual layer rectangular U-Slot patch antenna for Wi-MAX and local area network applications is employed. The antenna exhibits band characteristics that depend upon numerous parameters like U-slot dimensions, circular probe-fed patch etc. The antenna shows thirty six.2% electrical resistance information measure with quite ninetieth antenna potency and is best suited to 2.3/2.5GHz Wi-MAX and a couple of.4 GHz local area network applications [12]

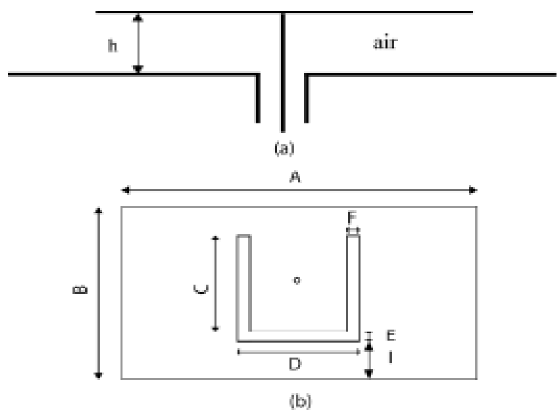

Fig.13:- Geometry of U-slot patch antenna (a) side view (b)top view

M. Koohestani et. al. present U-shaped MSA with unique parasitic tuning stubs for UWB cases. A novel compact microstrip antenna with an ultra-wide bandwidth is given. The planned antenna could be a formed square patch combined with two parasitic calibration stubs that is fed by a planar wave guide (CPW). the full size of the fancied antenna is 24 X 28 X0.787 mm3.Simulated associate degreed experimental results indicate that the antenna achieved an ultra-wideband electrical resistance bandwidth (S11 < -10 dB) as high as 029 The measured gains vary from 1.6 to 5.3 dBi against frequency. [13]

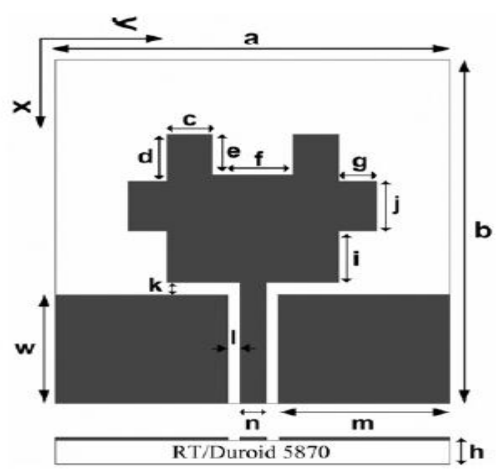

Fig.14:-Antenna geometry and its design

Wen Tao Li et. al., projected a UWB Monopole MSA with advance notched characteristics**.** A novel spade-shaped ultra-wideband (UWB) printed flat monopole antenna with triple band-notched characteristics is planned. By using a hook-shaped defected ground structure (DGS) in either side of the bottom plane, embedding an D-shaped slot on the diverging patch similarly as adding a semi-octagon- formed resonant ring on the rear facet of the antenna, triple notched frequency bands are achieved. The measured electric resistance bandwidth outlined by VSWR<2 of 10.1 GHz (2.9–13 GHz), with the triple notched bands of three.3–3.9, 5.2–5.35, and 5.8–6.0 GHz, is obtained.[14]

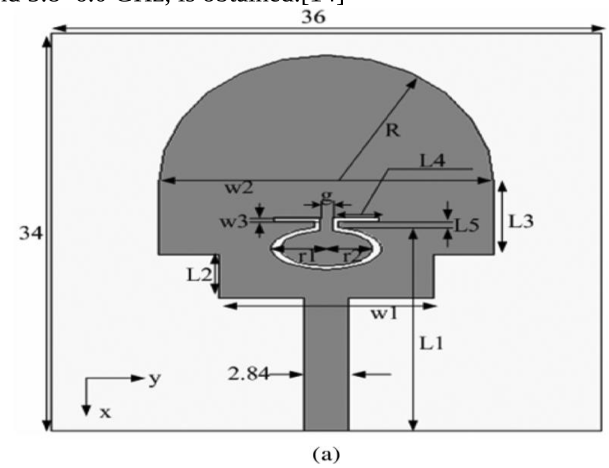

Fig:-15 Geometry of the proposed antenna with notched bands

S. Zhou, et. al. double band notched UWB gange antenna represent in this work. A novel dual band-notched monopole ultra-wideband (UWB) antenna that consists of a radiation part, a ground patch and a number of other calibration stubs is planned. The antenna with compact size of 20mm × 31.5mm works within the band of 3.1 to 10.6 GHz with voltage standing wave ratio (VSWR) below two, except the bands of 3.3–3.8 GHz for WIMAX and 5.1–5.8 GHz for local area network. By dynamical the lengths of the calibration stubs, the central frequencies of the twin notched bands will be adjusted simply. [15]

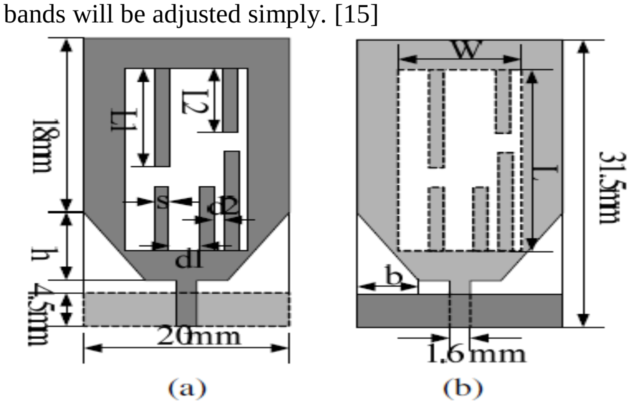

Fig. 16 The geometry and configuration of the proposed antenna. (a) Front view, (b) back view.

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Kenny S. R, et. al present a UWB dual band-notches MSA**.** To prevent interference issues because of near communication systems at intervals and ultra-wideband (UWB) operative frequency, the importance of an efficient band-notched style is multiplied. Here, the band-notches are accomplished by adding freelance manageable strips in terms of the notch frequency and also the width of the band-notches to the fork shape of the UWB antenna. the dimensions of the flat kind band-notched UWB antenna is etched on 24 36 mm□ substrate. Two novel antennas are given. One antenna is intended for single band-notch with a separated strip to hide the 5.15–5.825 gig cycle per second band. The second antenna is intended for twin band-notches mistreatment two separated strips to hide the 5.15–5.35 GHz band and five.725–5.825 GHz band. The simulation and mensuration show that it achieves a large bandwidth from 3 to 12 GHz with the twin band-notches with success.

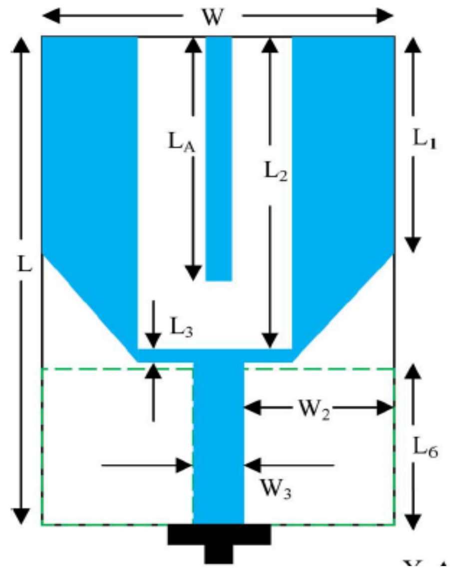

Fig.17 Configuration of the single band-notch UWB antenna (a) top view (b) bottom view

Table 1 Shows the Result Comparison of Different Shape Antenna of Previous Researcch

Title	Patch Shape	Feed type	Range (GHz)	S – 11	VSWR	No. of Bands
Dual-Band Microstrip Patch Antenna for Wireless Application	S	Probe Fed	0-10	5.47 GHz= -20.45 6.10 GHz= -29.5	5.47 GHz = 1.39 6.1 GHz = 1.07	2
A Novel Assymetric CPW -Fed Cojoined S-shape Antenna For Multiband Applications	S	Co planar wawegui de fed	02-12	3 GHz =-36 7 GHz =-22 10.GHz =-35	NM	Multi
Design of S-shape Multiband Microstrip Patch Antennae	S		0.50-3.50	1.37 GHz=-27.613dB 2.47 GHz=-38.181dB 3.07 GHz=-22.151dB	1.37 GHz = 1.15 2.47 GHz = 1.02 3.07 GHz = 1.50	Multi
Double L-slot microstrip patch antenna array for Wi-MAX and WLAN application	L	Co-planar wawegui de fed	2 to 6.	5.2GHz = -23 and -14 5.8GHz = -7 and -9 3.5GHz = -15 and -10 5.8GHz = -14 and-12.5	5.2 GHz = 1.2 5.8 GHz = 2.8 2.5GHz = 2.9 3.5GHz = 1.4 5.8GHz = 0.8	2
A compact printed antenna for Triple Band Triple-Band WLAN/WiMAX Applications	Circular arc shape		2 to 6	2.5Ghz=35dB 3.5 GHz=-40dB 5.5GHz=-15dB	NM	3
Rectangular microstrip dual patch antenna to enhance bandwidth at 2.4Ghz for WLAN applications	Rec-tangular	Microstrip Fed	2.30-2.49	Single patch 2.4GHz--30dB Double patch 2.4GHz=-40dB	2.4GHz= 1.40 2.4 GHz=1.26	Multi

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Meandered Multiband Metamaterial Square Microstrip Patch Antenna Design	Square shape	Co-axial prob fed	0.60-2.2	0.670GHz=-17 Db 1.185GHz=-26Db 1.293GHz=-22Db 1.747GHz=-18Db 1.909GHz=-28Db 1.999GHz=30Db 2.036GHz=-14Db 2.134GHz=-31Db	0.670GHz=1.35 1.185GHz=1.11 1.293GHz=1.23 1.747GHz=1.31 1.909GHz=1.16 1.999GHz=1.12 2.036GHz=1.57 2.134GHz=1.07	Multi
Design of Microstrip Meandered Patch Antenna for Mobile Communication	Mean Rec tangula r		0.70-1.15	0.91GHz =-35.5Db	0.918GHz=1.1	Multi
E-shaped Microstrip PatchAntenna Design for GPS Application	E		1.0-1.4	1.23GHz=-60Db	1.237GHz=1.00	Multi
Design of Breaodband Patch Antennae for Wi MAX and WLAN	U	Circular co-axial	1.5-3	NM	NM	1
U-shaped microstrip patch antenna with novel parasitic tuning stubs for ultra wideband applications	U	Coplana r wave guide	2-14	8.7GHz=-37dB	NM	1
UWB Antennae with Single or Dual Band Notches for lowerWLAN Bamd and Upper WLAN Band	U		02-12	NM	VSWR=2 VSWR=2.5 UPPER 5.7-5.8 5.72-5.82	2

TOOLS USED

Since the performance of electronic devices depends on electromagnetic behavior (EM), you need a quick and accurate account of how your design will behave in real world implementations - long before any prototype is built. The results of the CST ™ simulation give you the confidence you need: the technology offers the most accurate response possible with the least involvement of the user. As a reference simulation tool for 3-D electromagnetic wave simulation, HFSS is essential for the design of high-frequency and / or high-speed components used in modern electronic devices. Understanding the EM environment is essential to accurately predict how a component - or subsystem, system or end product - works in the field, or how it influences the performance of other components in the vicinity. CST addresses the full spectrum of EM problems, including losses due to reflection, attenuation, radiation and coupling. [18] [19].

IV CONCLUSIONS

This survey paper the basics of microstrip patch antenna also discussed the different shape based patch antenna which is used in 1 to 10 GHz for different wireless communication devices, IEEE802.15 devices also discussed the comparison of different S-shape and different shape antenna with the help of table. In this table compared different microstrip patch antenna parameters ,they are antenna shape, antenna fed ,frequency range ,return loss ,gain voltage standing wave ration(VSWR),number of bands. On the above comparison we have conclude that coaxial probe fed shows netter result as compared to other fed for different S-shape antenna that is shown table in Design of S-shape multiband microstrip patch antenna[3].Apart from S-shape, L-shape and rectangular patch also shows better result. In future try to implement wide band antenna which is used for 4G and 5G communication. Also focus to design an antenna for TDLTE communication. [20]

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