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DESIGN AND ANALAYSIS OF E-SLOT PATCH ANTENNA FORWIMAX LOWER BAND

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Abstract - The Microstrip patch antenna plays a vital role in mobile and satellite communication due to its easy fabrication and low cost. The feed line is selected for the antenna in such a way that it must have the improved parameters like gain, Voltage standing wave ratio (VSWR) and return loss. Hence, in this paper, a low profile E-slotted microstrip patch antenna using coaxial and microstrip feed line is designed and compared for the applications of worldwide interoperability for microwave access (WI-max) to achieve improved antenna parameters. The coaxial feed line eliminates the spurious feed radiation to accomplish high gain for WI max lower frequency band than the other feed line like microstrip feed. The proposed antenna adopts the Rogers DUROID 5880 substrate to have low dielectric constant (εr = 2.2). The performance of the coaxial feedline antenna offers better parameter like return loss: -13.18db, VSWR: 1.5615 and Gain: 7.05dbat lower frequency band of WI-max application. The antenna is designed and simulated successfully using An-soft HFSS 15.0.

1.INTRODUCTION :

Inaccessible organize going to development and donate basic upgrades, such as higher data rates, diminished end-to-end dormancy, and lower control utilization. Little scale strip settle radio wire comprises of a transmitting fix on one side of a dielectric substrate which highlights a ground plane on the other side as. The settle is by and huge made of conducting texture such as copper or gold and can take any conceivable shape. A Little scale strip Receiving wire in its most effortless shape comprises of a transmitting settle on one side of Dielectric substrate and a ground plane on the other side. The IEEE Standard Definitions of Terms for Receiving wires characterizes the receiving wire or airborne as “a suggests for transmitting or tolerating radio waves. “Antenna is a critical contraption which has gotten to be a fundamentally parcel of our day to day life. WI-MAX may be a family of farther broadband communication rules based on the IEEE 802.16 WI MAX in this application competes with microwave radio, E-line and clear extension of the fiber organize itself. Displaying downlink sub-channelization, allowing chairmen to trade scope for capacity or awful propensity versa. We find receiving wire all over, at homes, work situations, on cars, vehicles, artifacts, ships and not that we carry receiving wire at the side us in mobiles.

When radio repeat hail is associated to a radio wire, the electric and appealing regions are created. Each opening incorporates a specific number of reels, commonly three or five. These are the vertical fragments that are set into development at anything point you tap or press the Turn button. Each reel joins a foreordained number of pictures on it and can stop turning either on a picture or on the dull spaces between pictures

1.1 MICROSTRIP SLOT PATCH ANTENNA:

A ground plane and radiating patch are located on opposite sides of a dielectric substrate in a planar antenna known as a microstrip antenna. The Rogers RT/DUROID (5880) substrate, which contains a moo dielectric steady, is utilized to manufacture microstrip patch recieving wires. The microstrip comprises of an amazingly lean metallic strip that's sandwiched between two pieces of ground plane dielectric fabric. When the recieving wire is enacted, the wave produced interior the dielectric is reflected, and generally small vitality is at that point transmitted from the metal patch's borders. As a result of the bordering areas between the fix edge and the ground plane, microstrip fix radio wires emanate transcendently. A thick dielectric substrate with a moo dielectric consistent is favoured for perfect radio wire execution since it offers higher efficiency, a more broad exchange speed, and better radiation. Be that because it may, this course of activity comes approximately within the following radio wire degree. Due to its moo profile, capacity to adjust to both planar and nonplanar surfaces, ease of manufacture, moo taken a toll, mechanical vigour when mounted on firm surfaces, and compatibility with MMIC plans, microstrip radio wires are utilized. It moreover has downsides counting destitute polarization virtue, a moderately little recurrence transmission capacity, tall Q (quality calculate), moo proficiency, and moo control. Fix recieving wires are appropriate for adherent communication frameworks, remote communication

frameworks, portable phones, pagers, and radar frameworks. The capacity to print microstrip fix recieving wires specifically onto a circuit makes them increasingly viable. Think approximately the microstrip recieving wire and microstrip transmission line. Tall conductivity metal (as a rule copper) is utilized to form the fix radio wire, small scale strip transmission line, and ground 5 plane.

The fix is opposite to the substrate (a few dielectric circuit board) and has measurements of L, W, and permittivity. It isn't vitally critical how thick the ground plane or microstrip

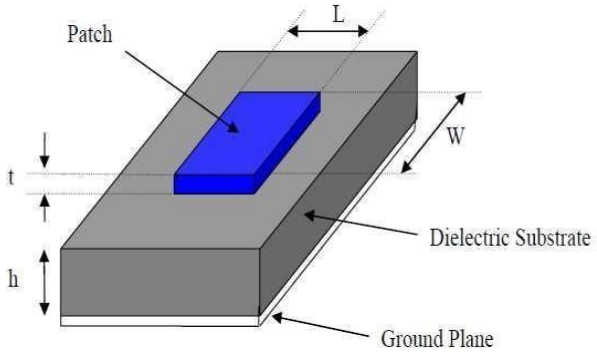


Figure 1: Structure of a MicrostripPatchAntenna

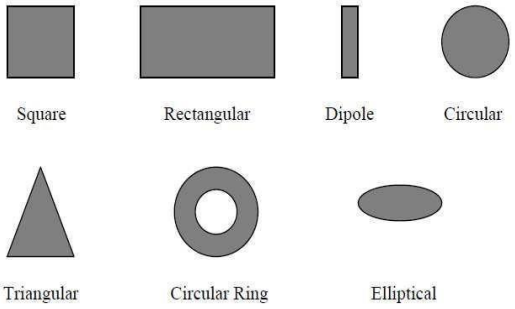


Figure 2: Common shapes of microstrip patch elements

1.2 ANTENNA PARAMETERS:

The performance of the antenna is evaluated using any parameters such as VSWR, Return Loss, Antenna Gain, Directivity, Antenna Efficiency, and Bandwidth.

a) Gain: An antenna's gain is defined as the ratio of the intensity in one direction to the radiation intensity achieved if the power absorbed by the antenna were radiated isotropically.

b) Radiation pattern: An antenna's Radiation pattern is characterized as theproportion of the escalated in one course tothe radiation concentrated accomplished on the off chance that the control retained by the recieving wire were transmitted isotropically.

Antenna Efficiency: It is the ratio of anantenna's total power radiated to its input power.

c) Bandwidth: The recurrence run overwhich a radio wire may work effectively. The transmission capacity is the distinctionbetween the upper and lower cut-off frequencies

d) VSWR: Voltage standing wave ratio (VSWR) is defined asVSWR=Vmax/Vmin.

e) Return misfortune: Return misfortune is the reflection of flag control caused by the addition of a gadget into a transmission line. As a result, the RL, just like the VSWR, could be a degree that shows how well the transmitter and radio wire have been coordinated is utilized to calculatethe RL. Return Loss=-20 log10 () dB Reflection coefficient = and ReturnMisfortune = dB for idealize coordinating between the transmitter and the recieving wire, suggesting that no control is reflected back, though a = 1 has an RL = dB, suggesting that all occurrence control isreflected. A VSWR of 2 is reasonable for common-sense applications since it compares to an RL of -9

2. ANTENNA DESIGN:

The length and breadth of a rectangular microstrip patch antenna are calculated using factors such as the dielectric constant (€r), resonant frequency (fo), and height (h).

Width of patch (w):

$$W = \frac{c}{2fo\sqrt{\frac{\varepsilon r + 1}{2}}}$$

Effective dielectric constant of antenna (€reff):

$$\varepsilon reff = \frac{\varepsilon r + 1}{2} + \frac{\varepsilon r - 1}{2}\left[1 + 12\frac{h}{w}\right]^{-1/2}$$

Effective electrical length of antenna:

$$Leff = \frac{c}{2fo\sqrt{\varepsilon reff}}$$

The extended length of antenna (ΔL):

$$\frac{\Delta L}{h} = \frac{0.412(\varepsilon reff + 0.3)(\frac{w}{h} + 0.264)}{(\varepsilon reff - 0.258)(\frac{w}{h} + 0.8)}$$

The length of the patch is:

$$L = Leff - 2\Delta L$$

3. FEEDING TECHNIQUES:

A nourish is utilized to fortify radiation by coordinate or circuitous contact. The nourish of a microstrip radio wire can be arranged in an assortment of ways, counting microstrip line, coaxial, gap coupling, and nearness coupling.Be that as it may, microstrip lines and coaxial

bolsters are less troublesome to make. Coaxial test bolster is utilized since it is basic to utilize and the inputimpedance of coaxial cable is 50 ohm in common. There are different 50 ohm impedance areas on the fix. We must recognize such spots and coordinate them to the input impedance. These spots are found employing a scientific demonstrate.

Table -1: **Comparing the different feeding techniques:**

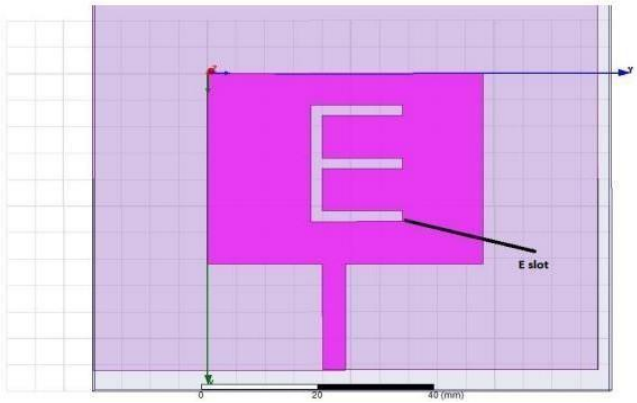
Characteristics	**Micro strip line**	**Coaxial feed**	**Aperture Coupled**	**Proximity coupled**
Spurious feed radiation	more	More	Less	Mini mum
Reliability	Better	Poor due to soldering	Good	Good
Easy of Fabrication	Easy	Soldering and drilling needed	Alignment Require	Alignment required
Impedance Matching	Easy	Easy	Easy	Easy
Bandwidth	2-5 %	2-5%	2-5%	13%

SLOTTED MICTROSTRIP PATCHANTENNAS:

The concept of a microstrip radio wirewith a conducting fix on a ground plane isolated by a dielectric substrate was obscure until the 1970 transformation in electronic circuit miniaturization and large-scale integration, after which numerous analysts portrayed the radiation from the ground plane by a dielectric substrate for different arrangements. Munson's early work on miniaturized scalestrip radio wires for utilize as moo profile flush mounted recieving wires on rockets and rockets illustrated that this was a practical concept for application in a wide extend of recieving wire framework challenges. For this recieving wire, a few scientific explanatory models were built up, and its pertinence were extended to numerous other disciplines. Smaller scale strip recieving wires are the current radio wire designer's choice.

E-SLOT MICROSTIP PATCH ANTENNA

Patch's fundamental objective is to build and recreate a little strip opening fix recieving wire for lower band applications.It has an omnidirectional and steady radiation pattern.As a result, the rectangular frame radio wire may be recreated utilizing the ANSOFT HFSS program. Return misfortune, VSWR, and radiation design are all measured. Micro strip opening fix radio wires are getting to be progressively well known dueto their ease of examination and development, moo fetched, light weight, and ease of manufacture.This advertised a few shapes utilizing bolstering approaches that have successful recurrence transmission. Fix for smallscale strip Patch's primary objective is to build and reenact a little strip space fix recieving wire for lower band applications. It has an omnidirectional and reliable radiation design. It has an omnidirectional radiation design that's consistent. MSA with E space stacked rectangular fix and hole -coupled Feeding is suggested, alongside four truncated corners on the four corners of theemanating fix.

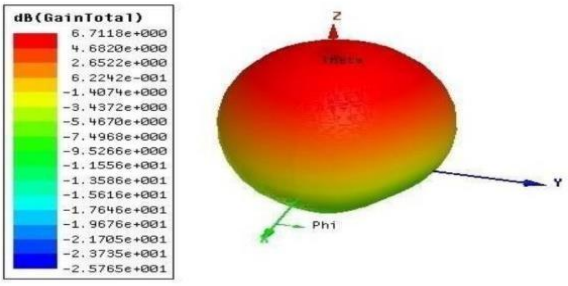


E-Slot Patch of(a) MicroStrip Feed Line

E-Slot Patch of

SIMULATION RESULTS:

A patch that is activated by a micro strip line feed. This feed configuration has the benefit of being able to be etched on the same substrate, keeping the overall structure flat. The disadvantage is that radiation from the feed line raises the cross-polar level. Micro strip patch antennas are used in wireless communication systems such as satellite communication and Global Positioning Satellite (GPS) systems. RFID and mobile communication Tele-55 medical application and WI-Max based communication Rectangular. The goal of this study is to design and manufacture an inset fed rectangular antenna with high gain for 2.4GHz. The primary parameters are width and length, as well as feed line depth.



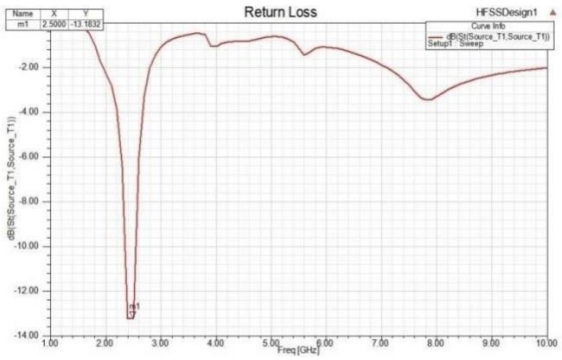
Gain of the antenna Micro strip feed line 67118 dB

Return loss of the Micro Strip Feed Line:

Patch antenna with a micro strip Feeding methods The stack patch Return loss A micro Strip feed line on the bottom substrate is electromagnetically connected to the patch an antenna's forward and reflected power differential, in dB Loss on Return.

Illustrates the division of radio waves arriving at the receiving wire input that are rejected as a rate of those recognized. It is given in decibels (dB) in comparison to a brief circuit (100 percent expulsion). Consider the receiving wire when it is in transmit mode.

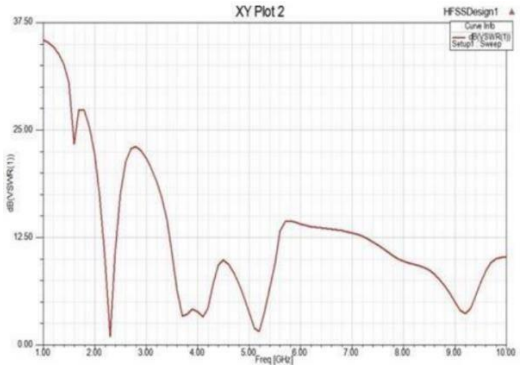
Efficient antenna capable of transferring high data rate streams while maintaining a low return loss, high directivity, and bandwidth. For such applications, micro strip patch antennas are preferred.



Return Loss of the Antenna (a) Micro Strip Feed Line24.8554db

VSWR of the Antenna Micro Strip FeedLine:

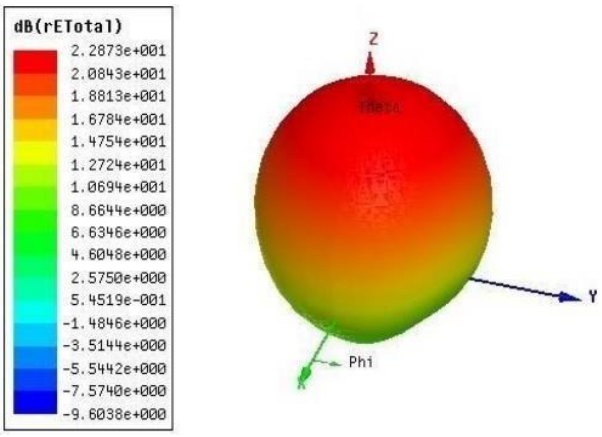
The Input Impedance, VSWR, and Return Misfortune of a Conformal Smaller scale Strip Printed Radio wire for TM01 Mode Utilizing Two Diverse Substrates. Curvature has a significant impact on the fringing field of a micro strip antenna, and hence the fringing field influences the effective dielectric constant and other antenna characteristics. Because of the transmission line and patch impedance, there is greater power of perfect impedance matching and so VSWR is low. Displays the simulated output of VSWR versus frequency in GHz. A receiving wire with a VSWR less than 2 is suitable. At lower band working recurrence 2.5GHz, the recreated VSWR for miniaturized scale strip



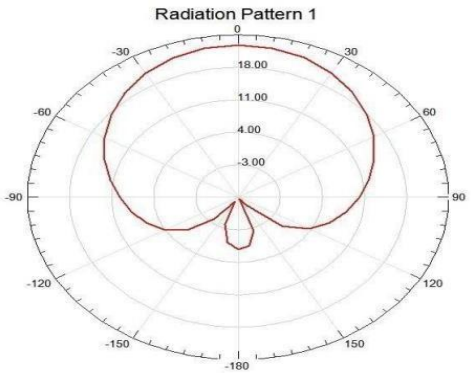
VSWR (a) Of the Micro strip Feed Line Antenna

Radiation Pattern of Micro Strip Feed Line:

The antenna radiation pattern is a visualization of the radiated power. The radiation pattern of a micro strip feed line is shown in 3D. The 3D radiation pattern is denoted by spherical coordinates such as r. The suggested antenna has higher transmission directivity than the micro strip feed line. A radiation design portrays alter in control transmitted by a receiving wire as a work of separate from the receiving wire. This change in power as a function of arrival angle is seen in the antenna's far field. An antenna's gain is just the amount of power in the direction of highest emission divided by the average power (which is unit less) you may integrate the total power in picture Decibels if the radiation pattern has cylindrical symmetry about the axis of highest radiation. The radiation pattern of the coaxial and micro strip feed line is shown, which provides more directivity in the antenna's main lobe.



3D View of the Radiation Pattern of micro strip feed line



The Radiation Pattern of Micro Strip Feed Line

3. CONCLUSIONS

We began by researching micro strip antennas, which are popular because to their low profile, light weight, and inexpensive cost. The E- slotted micro strip patch antenna is created with HFSS software to optimize antenna performance measurements like as gain, voltage standing wave ratio (VSWR), and return loss. In the proposed work, a micro strip patch antenna for the WI-max lower frequency band, specifically 2.5GHz, is built employing coaxial and micro strip feed lines. The proposed antenna's performance metrics are expressed as return loss: For coaxial feed line, the loss is -13.18db, the VSWR is 1.5615, and the gain is 7.05db. For return loss, the loss is -13.18db, the VSWR is 1.5615, and the gain is 7.05db. Among them, the coaxial feed line outperforms the micro strip feed line and similar work in the literature.

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