Performance Analysis Rectangular Patch Antenna 3.5 GHz for Wi-Max and WLAN

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Ali Abozied
aliradar@yahoo.com
0000-0001-9318-941X

Abdelaziz Al Dawi
azizedowi@gmail.com
0000-0003-1356-7914

Cihat Seker
Electrical and Electronic Engineering
Karabuk University
Karabuk ,Turkey
cihatseker@karabuk.edu.tr

Abstract—This paper gives the layout and evaluation of a brand-new shape of -hollow rectangular microstrip patch antennas for wi-fi telecommunication programs below the sub-5GHz recurrence band. The prepared patch antenna is appropriate for WiMAX programs worked at 3.5GHz aimed to offer elevation velocity statistics charges and net get admission to for a huge insurance range. The rectangular patch layout supplied on this study exhibited higher overall performance in phrases of put down in area, development in voltage status wave ratio much less than 1.2, impedance and overall performance, is advanced via way of means of putting square slots Simulation end result received the use of CST 2021 software. The patch antenna turned into prepared a FR4 lossy substrate with dielectric permittivity of 4.3 and 1.55mm wideness the use of an ordinary feed line. The patch layout supplied on this study exhibited higher overall performance in phrases of minimization in region, development in benefit and straight with appreciate to the rectangular antenna layout. The cost of every belonging is numerous in order that the overall performance of the antenna along with go back loss, benefit, straight, beam sample and bandwidth at 3.5 GHz may be analyzed. For destiny work, the simulations must be done at tinier period length and wide field. Besides that, the wideness of the substrate may be numerous and the overall performance may be analyzed.

Keywords—patch antenna, WiMAX, VSWR, gain, performance

I. INTRODUCTION

Antennas are developing rapidly due to the interest of researchers due to their need for different uses, mostly in wi-fi verbal exchange software as it gives numerous benefits including little size, easy structure, smooth fabrication, and occasional cost. furthermore, a microstrip antenna has positive barriers including low benefit, little efficiency, slim, impedance and bandwidth. therefore, the scientific research purpose is to enhance the benefit. One of the rapidly growing wi-fi verbal exchange structures is the Wi-Max because of its extensive insurance part. Invest with the IEEE 802.sixteen standard, 3.5 GHz are allotted frequencies for WiMAX applications. that's appropriate for Industrial Scientific and Medical. therefore, the dual-band and multi-band resonant conduct of published and slot antennas may be produced with the aid of using making use of fractal geometries to regulate the antenna slot structures Alone the difficult problems in microwave engineering is to layout compact, high-performance, and wideband antennas. Among the strategies which might be carried out for antenna compactness, miniaturization, and bandwidth enhancement in shifting in the direction of to 5G systems, many research had been performed on patch antennas due to their compactness, reasonably-priced and speedy manufacturing. In this studies paper, a rectangular antenna is proposed for dual-band operation focused at 3.5 GHz for Wi-Max software. It carries slots withinside the patch to achieve appropriate benefit, VSWR, impedance and bandwidth on the preferred frequencies.

Therefore, improvement of wi-fi networks is critical due to the fact 5G generation makes use of rising frequency bands and huge sign bandwidth to growth the transmission bit charge, for this reason supplying higher insurance with much less strength consumption. Be advanced withinside the wi-fi 4G and 5G communique technology to fulfill the desired overall performance. wireless communication is a couple of structures convergence in cellular data get entry to technologies. Consequently 3.5 GHz has large utility potentialities in 5G implementation. In a cellular data communications system, one of fundamental desires is to recognition on subsequent technology via a few required have to acquire are better statistics charge utility and offerings which includes a picture withinside the nearby insurance network, net browsing, cellular data teleconference and multimedia. This predominant task element for subsequent generations. For maximum cell statistics wherein inner visitors is generated, antenna distribution performs a more and more substantial function in indoor wi-fi communique structures. In addition, to offer higher communique offerings, many frequency bands are designed and commercially utilized in one-of-a-kind communications structures which includes 4G WiMAX and cellular data nearby vicinity network WLAN. Therefore, a successful broadband distribution antenna is needed in concurrently assembly a couple of provider frequency bands. The antenna with many advantages, which includes little size, lowest price, and smooth integration with lively circuits; appropriate for multi-band layout and dual-polarization antennas, are extensively utilized in revealed circuits. Main downside of microstrip patch antenna is its slender bandwidth. Therefore, many strategies were used to growth the bandwidth finally, in this paper, an antenna running at 3.5GHz can be designed the usage of CST software. This recurrence is chosen as used the 5G running frequency, and their overall performance can be analyzed

The goal is to own a high advantage and performance to make sure that the foremost records switches in any wi-fi communication space antenna are the amount one requirement. once birth out any microstrip patch antenna, several improvement ways are used, and twin feed. Wide

information measure antennas are applied for a huge type of community frequencies, that are larger inexperienced for a few distance space implementations. With a twin-feed antenna, section distinction is simple to maintain the foremost common issue in wi-fi communication is the orientation of receivers and transmitters. Multiband operation and antenna length miniaturization could also be performed by utilizing the noted options of self-similarity and area filling.

II. PROPOSED RECTANGULAR ANTENNA.

The important three layout parameters of antenna are the ringing recurrence (fr), relative permittivity of the substrate (εr) and the density of the substrate (h). The ringing recurrence of the antenna needs to be appropriate for the WiMAX, 3.5 GHz. The patch is product of FR4 lossy substrate layers which have a permittivity (Ɛr) of 4.30, a loss tangent (tanδ) of 0.0009, and a density of 1.575 mm. Broadband implementations, excessive advantage antenna styling, and occasional loss tangent produce loss because of excessive humidity is only some of the advantages of FR4 lossy collection laminate. The substrate fabric decided on layout the patch is FR4 epoxy which has a dielectric permittivity of 4.3 and the density of the substrate have to know no longer be cumbersome in order that it could be utilized in transportable gadgets and the thickness is selected to be 1.61mm. the square slotted are utilized in layout to lower the mirrored image coefficient and growth the impedance matching and efficiency. The designed antenna is (39.85 ×36.70 ×1.575mm3) The shape of rectangular patch is proven in fig 1.

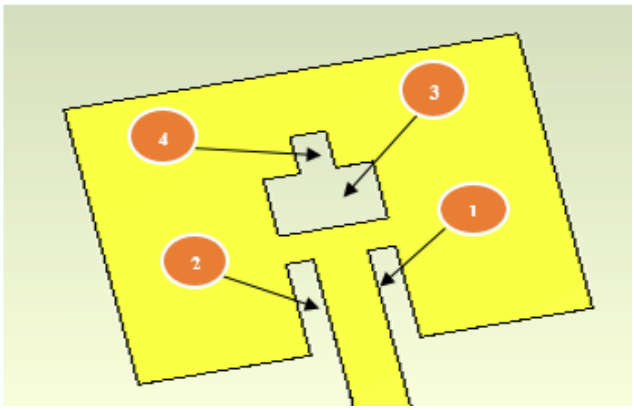

Fig. 1. Shape Rectangular Patch.

TABLE I. ANTANNA HOLES SIZES

Number	X min	X max	Y min	Y max	Z min	Z max
1	25.53	27.06	20.45	26.89	1.575	1.61
2	20.94	22.47	20.45	26.89	1.575	1.61
3	20.94	27.07	28.85	32.85	1.575	1.61
4	23.0	25.0	32.55	35.45	1.575	1.61

A. *Simulation outcome.*

Microstrip patch become explained and simulated usage of the present-day model for CST to take a look at the overall achievement parameters of the radiating patch element. The device has validated to have higher reliability and accuracy to assess the antenna layout parameters which includes mirrored image coefficient, efficiency, gain, creativity, radiated power, powerful angle, etc. The width and duration of the proposed antenna to be operated at 3.5GHz Here we're taking FR4 lossy dielectric cloth which has a dielectric consistent of 4.3 and top of substrate is taken as 1.61 mm. The Operating Frequency of the antenna is 3.5 GHz, which is chosen for WIMAX applications. By those parameters we will calculate the duration (L), Width (W) of patch easily.

B. *S-Parameter*

The S11 defines the energy transmitted from port one to port one itself, for this reason defining the mirrored image withinside the antenna. For most radiation, the mirrored image has to be as much less as feasible to make the antenna extra efficient. S11 parameter decrease than -20 dB with a value of -26.523 dB on the ringing recurrence 3.5 GHz.

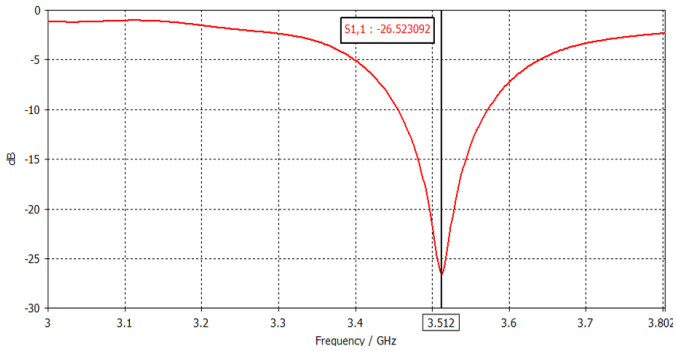

Fig. 2. S11 Simulated Parameter curve.

C. *VSWR*

The value of the return loss of - 26,523 dB with the bandwidth obtained at 120.5 MHz. While in Fig 3 obtained VSWR at 1.099, which means that the antenna can radiate almost all power flowed and little power is reflected back from the antenna.

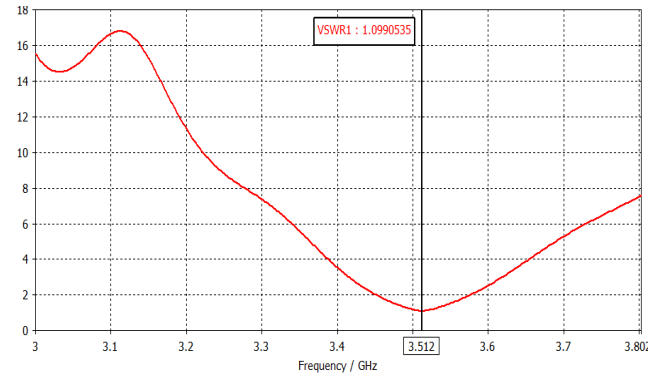

Fig. 3. Voltage Standing Wave Ratio simulation.

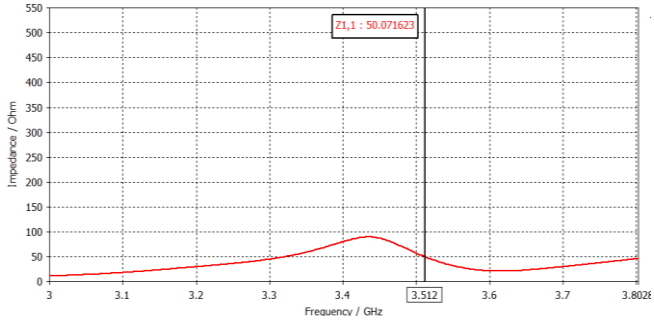

Fig. 4. Z11 Impedance simulation.

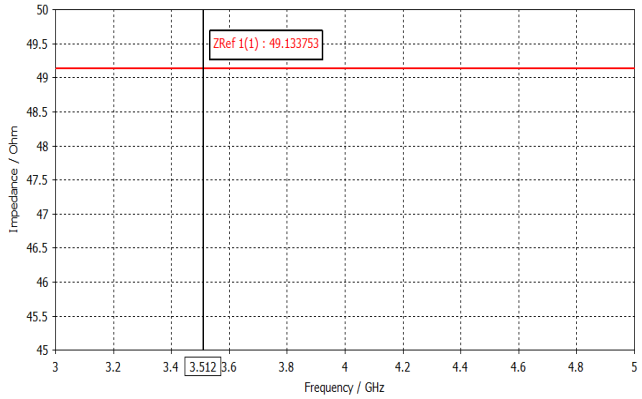

Fig. 5. Z Ref Impedance simulation.

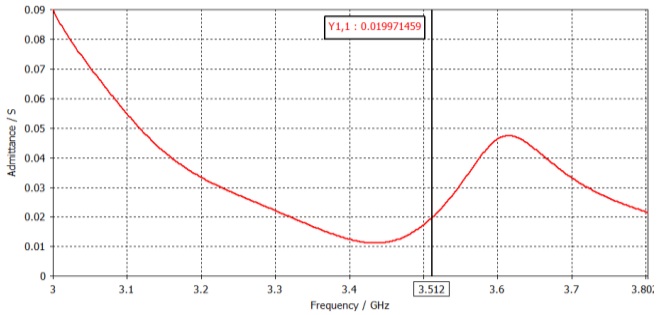

Fig. 6. Y Parameters simulation.

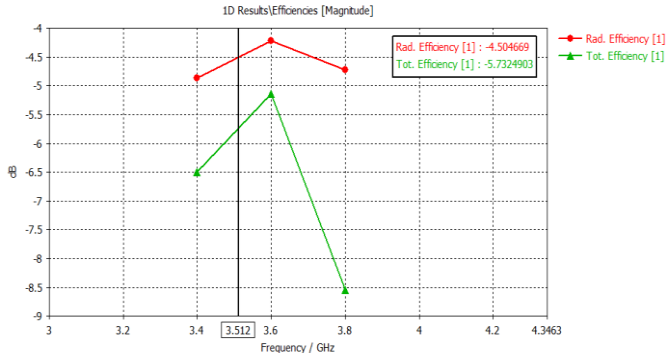

Fig. 7. radiated and total Efficiency simulation.

The following figure shows radiation pattern in fig 8,9,10 and fig 11.

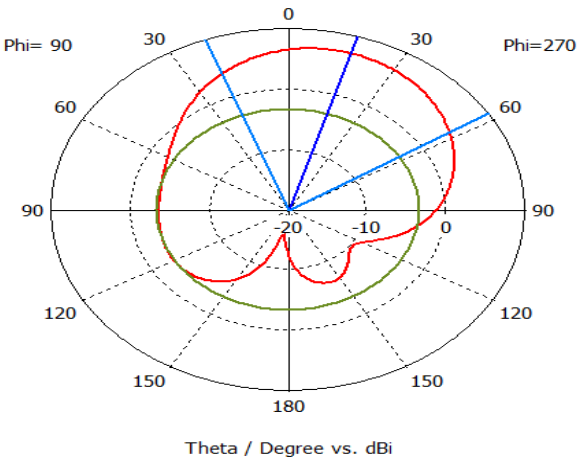

Fig. 8. Antenna radiation pattern to Phi= 270 at 3.5 GHz

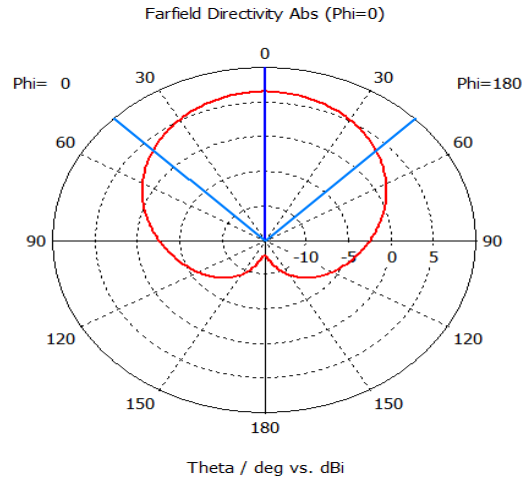

Fig. 9. Antenna radiation pattern to Phi=0 at 3.5 GHz.

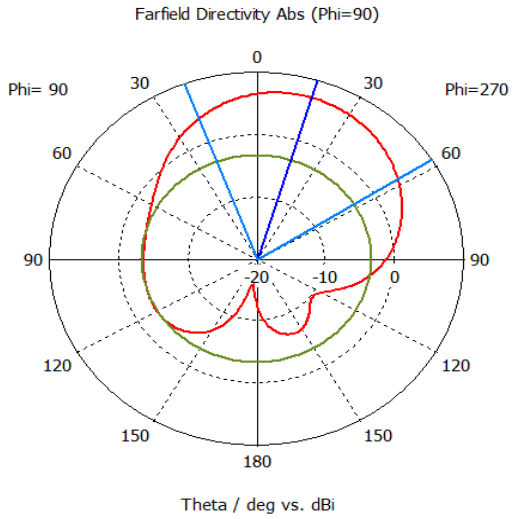

Fig. 10. Antenna radiation pattern to Phi=90 at 3.5 GHz.

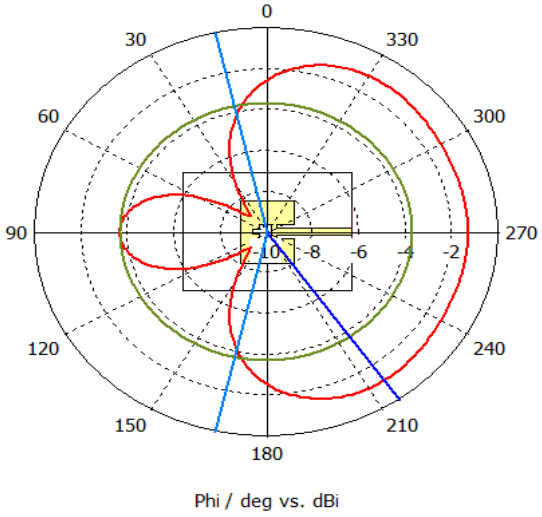

Fig. 11. The radiation pattern of antenna Phi vs deg. dBi at 3.5 GHz.

III. SURFACE CURRENT DISTRIBUTION

Antenna surface current simulation shows in fig 12.

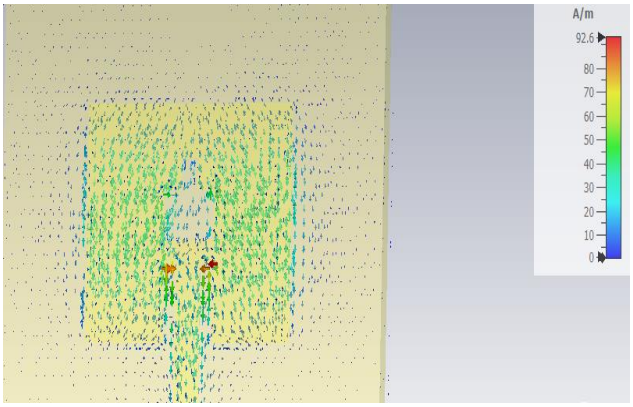

Fig. 12. surface current simulation.

A. Gain

Antenna Gain is likewise referred as Power advantage or clearly gain. This combines of antenna performance and creativity. The advantage acquired with inside the antenna simulation process. Advantage on the center frequency of 3.5 GHz at 7.07 dBi. For a transmitting antenna, it suggests how efficaciously the antenna is capable to radiate the given energy into an area in a selected direction. While in case of receiving antenna, it suggests how nicely the antenna is to transform the obtained electromagnetic waves into electric energy. as well in figure 11 and 12 shows the gain in the antenna process simulation, the gain at the middle frequency of 3.5 GHz at 7.07dBi.

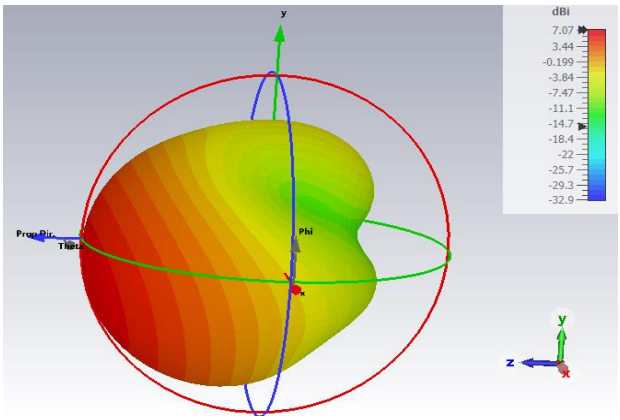

Fig. 13. 3-D radiation pattern of antenna Simulation Results.

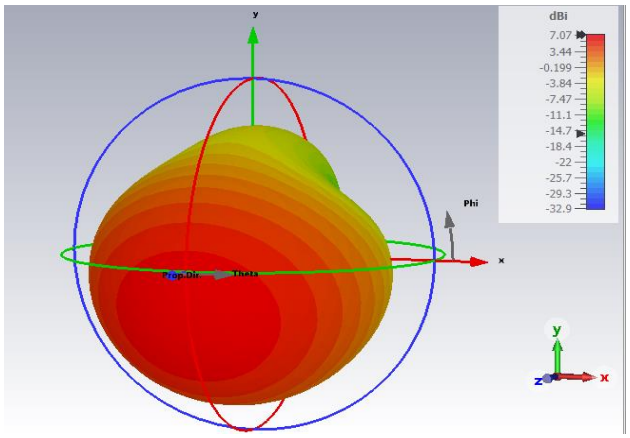

Fig. 14. 3-D radiation pattern and gain.

CONCLUSION

The analysis paper conferred the planning and simulation of the oblong patch antenna at 3.5 megacycle per second this state of labor includes the design procedure of the micros trip patch at a ringing recurrence of 3.51 GHz. It will turn out an antenna with a comeback loss of -26,523 and a VSWR of 1.0990. However, the parameters are thought of well enough, because it is glad of the specified parameters. It's as a result of the information measure decreased. The VSWR, return loss, and gain are satisfied the desired parameters. Also, the bandwidth satisfies the bandwidth for 5G a minimum of one hundred and twenty-one MHz Finally, the simulation results show that the antenna is in accordance with the specified parameters. The antenna is helpful for 5G applications. The results show the improved bandwidth, the gain is high and also the s parameters graphical results show the rise within the potency and wide radiation patterns elaborated experimental studies will be concerned at a later stage to seek out a style procedure for balanced amplifying antennas.

CONTRUBITION OF THE AUTHORS

The contributions of the authors to the article are equal.

CONFLICT OF INTEREST

There is no conflict of interest between the authors.

STATEMENT OF RESEARCH AND PUBLICATION ETHICS

Research and publication ethics were observed in this study

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