FILTERING MICROSTRIP PATCH ANTENNA USING FILTER SYNTHESIS APROACH

MAYUR THAKARE, SHASHIKANT OVHAL, GHORPADE AKSHAY

ABSTRACT: **The aim of this work is to design the compactintegrated microstrip patch antenna and filter which having one resonator, patch and single feed line for high frequency applications. The components together works as high pass filter at frequency above 2 GHz which improves return loss in range -10 to -35 dB and gain up to 6.25 dB. The patch used here not only radiates but also acts as resonator which radiates energy at high frequencies. This paper having several results of simulation that confirms desired characteristics ofmicrostrip antenna.**

Key-words:
Microstrip patch antennas, antenna gain, return loss.

INTRODUCTION:

In wireless communication, components are used of very plays important role. Now day's microstrip antennas are vital & key elements used in wireless communication having light weight &more reliability. It is needed to operate antenna of higher frequency range with band pass filtering characteristics. Asthe communication devices produced in small size, so the antenna size has to be decrease. Hence the antenna having compact size, light weight, is operating at higher frequencies must be designed.

The proposed structure of microstrip antenna is operated at higher frequencies and developed for wireless applications. The dimensions of antenna are chosen for proper operation of antenna in wireless communication. This proposed antenna has advantage, as frequency increases the return loss decreases rapidly. This antenna consists of feed line, patch, which also acts as a resonator and dielectric substrate. This antenna structure gives well gain, high efficiency, low return loss, high bandwidth.

ANTENNA PARAMETERS :

An antenna is an electrical conductor that radiates electromagnetic energy in space.

Antenna Gain:

It is measure of ability of antenna to direct input power to radiate in particular direction and is measured at peak radiation intensity. Consider power density with input power Po at distance R given as $S=Po/4\pi R^2$. The gain of actual antenna increases power density in direction of peak radiation.

$$S=Po*G/4\pi R^2=[E]^2 / \eta$$

Antenna Efficiency:

The surface integral of radiation intensity over radiation sphere divided by input power Po is measure of relative power radiated by antenna.

$$\eta=Pr/Po$$

Pr= Radiated power, Po= Input power

Effective Area:

Antenna captures power from passing waves and delivers some of it to terminals. Given power density of incident wave and the effective area of antenna, power deliver to terminals is product.

$$Pd=S*Aeff$$

Pd= Power delivered, S= Power density of incident wave, Aeff= Effective area

Directivity:

It is measure of concentration of radiation in direction of maximum.

Directivity=Max.radiation intensity/Avg.radiationintensity=Umax/Uo

Directivity and gain differ only by efficiency, but directivity is easily estimated from patterns

Return Loss:

It is a parameter which indicates amount of power that is lost to load and does not return as reflection. Hence return loss is parameter to indicate how well matching between transmitter and antenna has taken place.

DESIGN OF ANTENNA &RESULT;

The designed microstrip antenna is shown in following fig 1.with patch dimensions of 7.5mm X 3 mm and substrate of 32mm X 30mm. The material used for substrate is of epoxy FR_4 with relative permittivity of 4.4. The thickness of substrate kept 1.53 mm. The coaxial feed is given to antenna for better performance and better results.

The excitation is given through coaxial to form coupling between feed line and the patch. The feed line couples energy to the radiating patch. The microstrip band pass filter shown in fig 1.is designed to have impedance of feed line of Zo=50 ohms.

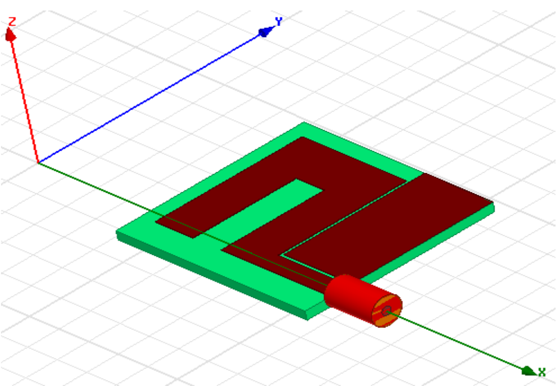

Fig 1. Microstrip Antenna

The simulations of this antenna are done on AnSoft HFSS 11.1. Thedesign dimensions of components of this antenna are also done with help of same software. All simulations results are shown in below figures. The return loss of this simulated antenna gets reduced up to -35 dB and it is shown in fig 2.

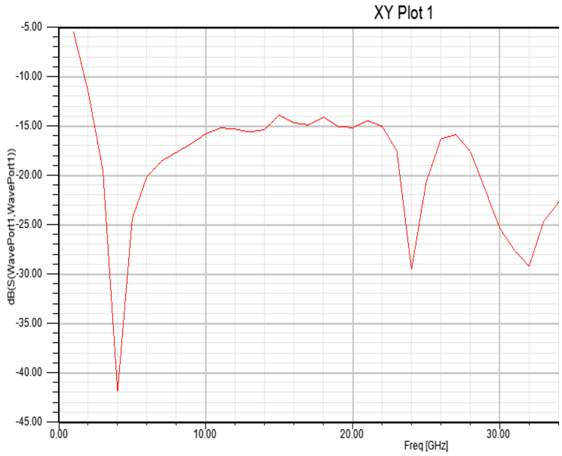

Fig 2. Simulated return loss of proportional antenna w.r.to normal antenna

The radiation pattern is shown in below fig 3.

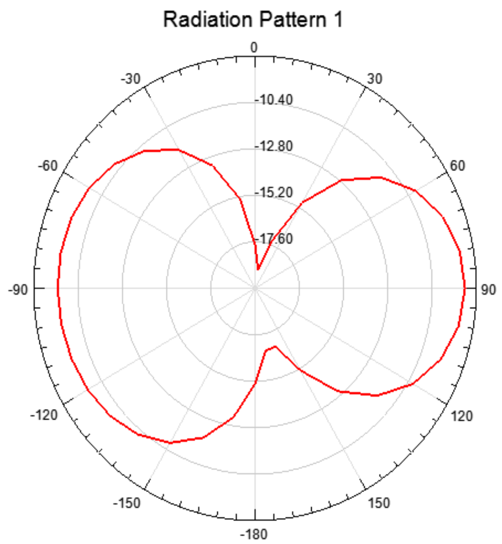

Fig3. Simulated radiation pattern of proposed antenna.

The Voltage Standing Wave Ratio shown in below fig 4.

.

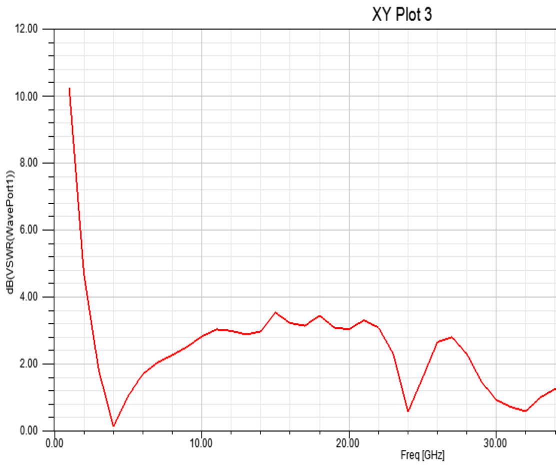

Fig 4. Simulated VSWR of proposed antenna

CONCLUSION:

The proposed antenna is operated at higher frequencies of above 2 GHz frequency which is used mostly for wireless applications with high gain, high radiation efficiency, low return loss and well-shaped radiation pattern.

REFERENCES;

1)Queudet, F. I. Pele,B.Froppier, Y.Mahe, and S.Toutain, "Integration of pass-band filters in patch antennas"*Proc.32nd Eur.Microw.conf.,685-688,2002.*

2) James, J. R., P. S.Hall, and C. Wood, "Microstrip Antenna: Theory and Design", *Peter Pereginus, London 1981.*

3) Yang, Y. and M. J. Lancaster, "Waveguide Slot Antenna with integrated filters"*32 European Space, Agency Workshop,2012.*

4)Hong, J. S., M. J. Lancaster, "Microstrip Filters for RF/Microwave Applications", *John Wiley & Sons, New York, USA, 2001.*

5) Lim, E. H., K. W. Leung, "Use of the dielectric resonator antenna as a filter resonator" *IEEE Trans. Antennas Propag.,Vol. 56, No. 1,5-10, Jan.2008.*

6) Wu, W.J., Y. Z. Yin, S. L. Zuo, Z. Y. Zhang. And J. J. Xie, "A New Compact Filter Antenna for Modern Wireless Communication Systems" *IEEE Antennas and WirelessPropogation Letters,Vol.10,1131-1134, 2011.*

