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Design of Multilayer Wideband Monopole Microstrip Patch Antenna with 6 GHz to 12 GHz Frequency Range

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Abstract: *Present day correspondence framework require radio wire with more extensive data transfer capacity, more modest aspect, high addition and high productivity. Different radio wires for wide band activity have been read up for correspondence and radar framework. The utilization of monopole calculation in planning recieving wire has been a new subject of interest. Monopole radio wire is liked because of little size, light weight and simple establishment. A monopole microstrip radio wire is utilized for multiband application in this exposition we give a basic and proficient technique for getting the conservativeness. The proposed radio wire has been reproduced and improved utilizing IE3D Test system to cover standard recurrence groups like UWB its outcome with IE3D programming then, at that point, plan wideband with blend of monopole calculations with keeping same boundaries and radio wire aspects like level, width, length, dielectric steady, misfortune digressions, dielectric material and reenact its outcome with IE3D programming. We think about both outcome and we examine that ultra wideband monopole multi-facet microstrip fix radio wire with 6GHz to 12GHz transmission capacity gives better boundary result like VSWR (VSWR≤2) and Return Misfortune dB (Return misfortune ≤-9.5 dB) and practically 100 percent radiation Effectiveness. I additionally create this radio wire and measure return misfortune for different thunderous frequencies. Viable outcome shows receiving wire thunderous at ten distinct frequencies close enough 1-12GHz. which shows radio wire function as great multiband radio wire.*

Keywords: Complementary source, microstrip patch antenna, monopole loading, wide beam width, IE3D SOFTWEAR.

Introduction

The planar monopole antenna is shown to provide extremely wideband impedance characteristics. Recently, many techniques to tailor and optimize the impedance bandwidth of these antennas have been investigated. These include the use of bevels, slots and shorting posts. These antennas are becoming popular, and have been proposed for modern and future wideband wireless applications. The radiation performance is also shown to be acceptable over a wide frequency range.

WIDEBAND MONOPOLE ANTENNA

Morden and future wireless communications systems are placing greater demands on antenna designs. Many systems now operate in two or more frequency bands, requiring dual- or triple-band operation of fundamentally narrowband antennas. These include satellite navigation systems, cellular systems, wireless LANs, and combinations of these systems. Advances in so Aware-defined and reconfigurable radio networks [4] necessitate their operation over a wide range of frequencies, or operation in a multi-band manner. These networks differ from traditional radio implementations, in that the mode of operation, including the fre146 quince bands used, can be readily changed after manufacture. Typically, these systems are implemented on general-purpose hardware devices, which can be reconfigured through a software change. Reconfigurability is currently restricted to the IF and baseband stages of radio devices, due to hardware limitations [SI, with separate RF modules configured for each of the modes and bands of operation. As hardware develops, programmable functions will be pushed closer to the antenna, yielding terminals with increased functionality and flexibility. A radio terminal capable of operating in multiple, wide-ranging frequency bands is ultimately limited in radiating capability by its antenna configuration. This approach limits the application of such devices, since multiple antennas may he too complex. Furthermore, the process of optimizing multiple antennas to operate in certain predefined frequency bands under predefined radio systems at the time of manufacture limits the possibilities of implementing new radio systems after manufacture. Thus, for maximum flexibility in a reconfigurable radio, a single, broadband antenna, capable of radiating over a radio terminal's entire frequency range, is desired. Ideally, such an antenna would have stable radiation-pattern characteristics over its entire impedance bandwidth. The use of a single wide hand antenna that covers a wide range of frequencies is very desirable for these systems. Moreover, ultra-wideband (UWB) is an emerging new technology for broadband imaging and public-safety applications, employing the spectrum in the region from 1.9 GHz to 10.6 GHz at extremely low power levels, and for communications and measurement systems, in the region from 3.1 to 10.6 GHz. Planar monopole antennas are currently being examined and proposed as wideband antennas Core these and future wireless systems. Planar monopole antennas can be optimized to provide extremely wide impedance bandwidths with acceptable radiation performance. They can he developed to cover frequency extremities from GSM900NADC through GSM1800iPCS1900, IMT2000, the 2.45 GHz and 5.8 GHz ISM hand si US-NII, and including UWB (1.9 GHz -10.6 GHz).

HISTORY

One of the most popular antennas employed in mobile and wireless communications systems is the monopole antenna and its family. These antennas are generally convenient to match to 50 n, and are unbalanced, thus eliminating the need for a balun, which may have a limited bandwidth. The simplest member of the family is the quarter-wave monopole above a perfect ground plane. The impedance bandwidth achievable for the quarter-wave monopole antenna is dependent on the radius of the cylindrical stub, and increases with increased radius. This is true up to a point where the stepped radius from the feed probe to the cylindrical element becomes abrupt. Tapering this transition is often employed in wideband elements, such as hiconical dipoles and conical monopoles, but cost limits these to laboratory applications. Typically, the fractional impedance bandwidth (I0 dB return loss) for length to-radius factors of 20 and 100 is approximately 25% and 16%, respectively, in the frequency region of 1-6 GHz. A simpler technique, with lower cost, is to replace the cylindrical stub of a conventional monopole with a planar element, yielding a planar monopole. The planar monopole antenna was first dcscrihed briefly in a textbook, who mentioned it as a variant of the cylindrical and conical monopole. It was described in more detail by Duhost and Zisler in 1976 [7], who observed the wide impedance characteristics of this antenna. A disc-shaped planar monopole antenna was subsequently studied in 1991 by Honda [SI, who proposed this antenna for the Japanese television hand (90-770 MHz). In 1992, he reported. one antenna that had a retum loss greater than 10 dB over an impedance bandwidth ratio in excess [9]. A model for determining the value of the input impedance of the circular disc-shaped monopole was reported in 1993 by Hammoud [10]. A radio terminal capable of operating in multiple, wide-ranging frequency bands is ultimately limited in radiating capability by its antenna configuration.

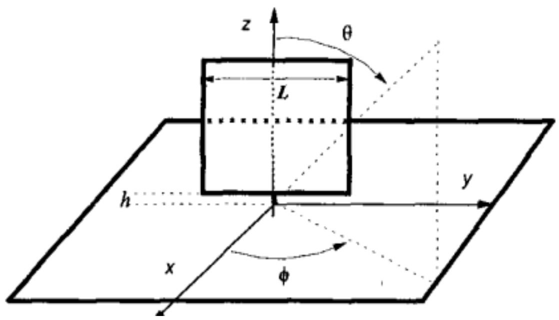

Figure 1.1: The square mono pole antenna.

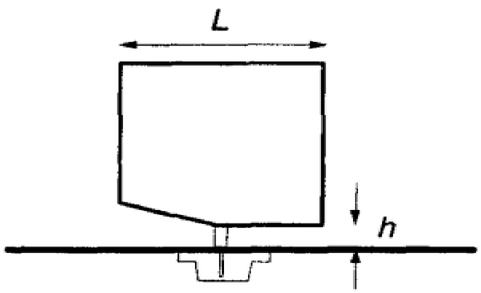

Figure 1.2: The square monopole asymmetrical monopole antenna.

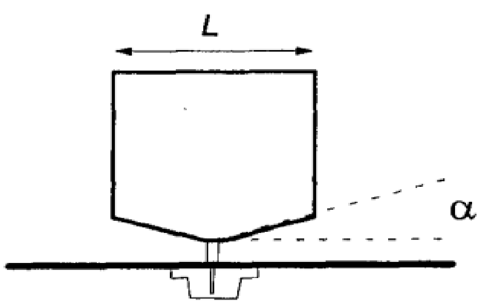

Figure 1.3: The square monopole symmetrical monopole antenna.

II. Proposed Work and Design

In this dissertation, aim to designing multifunctional and small antenna by using wideband antenna. Although many wideband antenna are identified, and mathematically studied for long time, their applications into electromagnetic is fairly recent. Within the past decade few wideband antenna have been proposed as antenna elements and special antenna characteristics introduced by the use of these geometries have been widely acclaimed. It has been claimed that the self-similarity of the is the cause of multi-band characteristics of the resulting antenna. This thesis aims at furthering the understanding the effectiveness of these geometries in antennas, and to bring about true advantages of their use in antenna engineering. Monopolemicrostrip antenna is used for multiband application in this dissertation provides a simple and efficient method for obtaining the compactness. A Monopole based monopole antenna is designed for multiband applications. Antenna's compactness and less weight are the major parameters for our design.

The designed antenna provides better efficiency. This dissertation explores one of familiar in monopole antenna , Monopole. Maximum iteration that applies to these antennas is three. In this dissertation I also design newest hybrid monopole antenna which known as Monopole with combination of Wideband antenna. In this design I combine two different like Monopole and Wideband antenna for that the first iterations of Wideband antenna are applied on the edges of a square patch, and a Monopole mono pole is formed on its surface. I also applied Wideband antenna on inner square edge of Mono pole for further enhancement of gain, bandwidth and efficiency. In this dissertation I simulate both antenna design using IE3D Simulator software and observe various antenna parameters like return loss (RL), Bandwidth, Gain, Directivity, radiation pattern and efficiency. In this dissertation I design both types of antenna using same parameters and antenna dimensions like height, width, length, dielectric constant, loss tangents and dielectric material. In this dissertation I study the advantages achieve by implementing of Wideband antenna on normal other monopolelike Monopole. I know that higher than 3rd iteration in Monopole design becomes complex. But by new hybrid combination techniques I can achieve more multiband behavior both types of antennas such as return loss, number of iteration and radiation pattern are investigated in this dissertation. The aim of this dissertation is to design compact multiband monopole antenna by using mathematical two different regular which cover most of the communication bands.

DESIGN -1

Factual Square Slotted microstrip Patch Antenna Design with Ground plan

Fig 1.4 depicts Return loss of proposed design with respect to frequency. Firstly designed conventional design on IE3D Simulator, after simulation we found that reflection at 4GHz is very high and VSWR is 5.212, this is a theoretical design with respect to centre frequency but with respect to standard system results cannot be useable. for effective using at 5.8 GHz to 6.4GHz we required good impedance matching, for providing good impedance matching we used stub matching technique of transmission line and found position of stub and length of stub, using resonance theory we found width of the stub, After finding stub dimension, substitute stub on the edges of middle layer patch, optimization completed by using appropriate dimension of ground plan. From this optimization, we found return loss up to -36dB, and VSWR at 4GHz is 1.023. In stub matching technique we used square slot and appropriate dimension of ground plan. Achieved 40% impedance bandwidth from 3.2 GHz to 4.8 GHz with low VSWRs ≤ 2. VSWR Shown in fig 6. Elevation and Azimuth Radiation pattern at 4GHz present in figure, polarization of antenna demonstrate by axial ratio in figure.

Table 1.1: Propose Design Dimension

Design of Single Band Microstrip Patch Antenna	
Width of the Patch(W)	38 mm
Effective dielectric constant of the Patch (εeff)	4.085
Length of the Patch(L)	30 mm
Maximum iterations	2
Input Resistance of the Patch	50 Ω

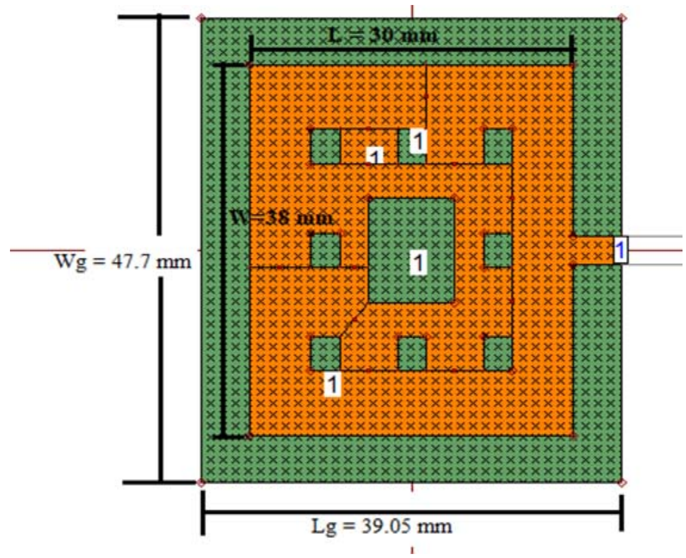

Figure 1.4: 2D Design of square slot and appropriate dimension of ground plan monopole microstrip patch antenna.

Design - II

Wideband Monopole Patch Antenna Design With Ground Plan

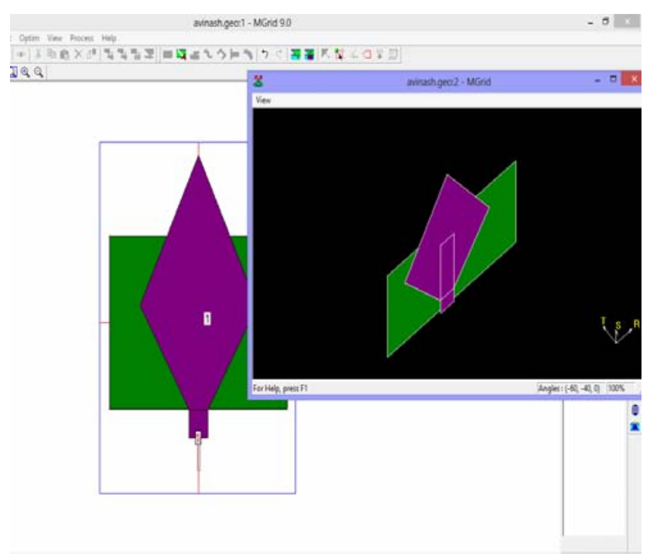

Figure 1.5: Proposed Design for Ultra wide band Monopole micro strip patch antenna.

III. Simulation Results

DSIGNE - I

Table 1.2: Squre Slotted Microstrip Patch Antenna

Sr.No	Resonant Frequency	Return Loss	Fractional Bandwidth (FBW)	Covers Band
1	2.535 GHz	-29.42	302.96 MHz	ISM/WLAN/Bluetooth, RADAR, Hiper-Lan2
2	4.071 GHz	-18.81	147 MHz	UWB, RADAR
3	9.061 GHz	-8.07	42.3 MHz	UWB,RADAR
4	14.82 GHz	-11.04	66.8 MHz	RADAR

Return Loss vs. Frequency Graph and Band width

Return loss, as stated before, represents the amount of power which is reflected back to the source due to the impedance mismatching. It is calculated in dB. The acceptable value is -10 dB. Show in figure.

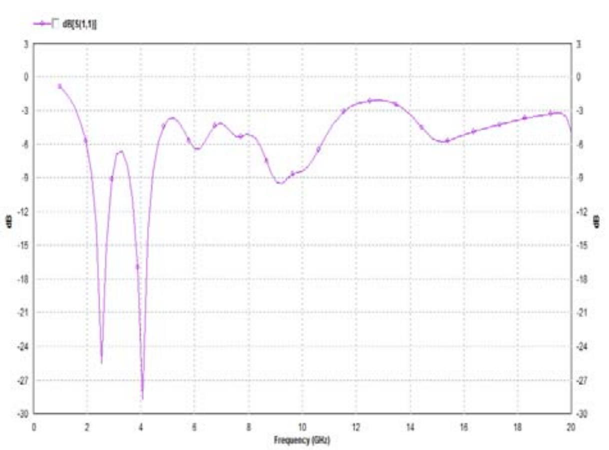

Figure 1.6: Return Loss vs. Frequency Graph and Band width.

DSIGNE - II

Table 1.3: Comparison of Previous and our Results.

Parameters	Previous work result	Proposed Design with simulated result
Operating Frequency Range	4.31–4.5 GHz	6GHz -12 GHz in Triple Band
Gain	3(dBi)	3.5891 (dBi)
VSWR	1.24 at 4.4 GHz	1.6 at 6.43 GHz 1.21at 10.16 GHz, 1.33 at 11.53 GHz
Bandwidth	4.3%	7.8%
Total Height	11.5mm	7.2mm

RETURN LOSS VS FREQUENCY

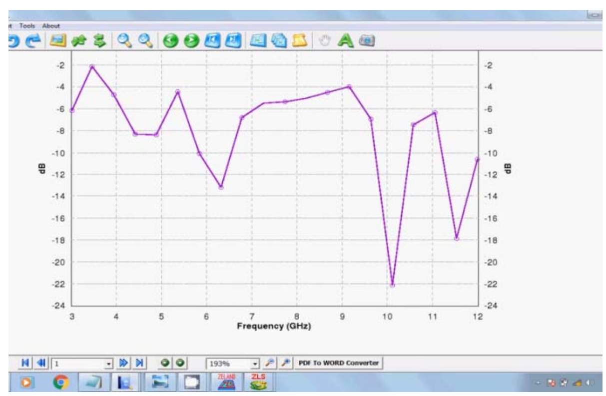

Figure 1.7: Return loss Vs Frequency**.**

VSWR Vs FREQUENCY

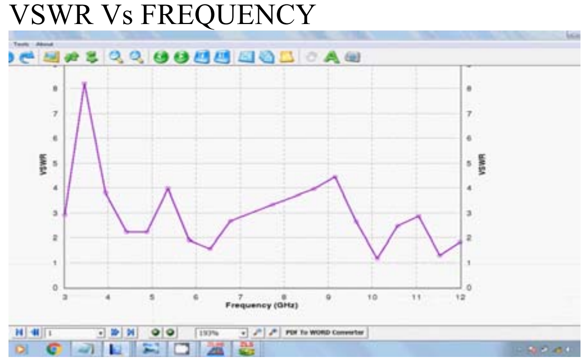

Figure 1.8: VSWR Vs Frequency**.**

Table 1.4: Comparison of proposed work

Compression of proposed design	Return Loss (in dB)	Bandwidth (in %)
Design-I	-36.16	40
Design-II	-18	126

IV. Conclusion

In this Research work, another viewpoint for a wide beam composite microstrip-monopole receiving wire is proposed and examined in detail. In light of commonplace microstrip receiving wires, monopoles are upward stacked to build correlative sources matches.The attractive current radiation wellsprings of the two sets of correlative sources are in stage, while the two electronic current radiation sources are out of stage. Consequently, the arrow model radiation designs produced by the integral sources point in inverse headings with a similar stage. In this way, the orchestrated far-zone radiation examples of the receiving wire can present wide E-plane beam width execution. A model working at 6 GHz to 12 GHz hear we getting triple band frequency having good VSWR, s11, Bandwidth and etc.. is planned, created, and tried. To keep the radiation designs even, a differential taking care of plan is presented. Estimated results show that the 1 dB beam width in the E-plane is reached out to 186◦. Furthermore, the planar size of the model radiation fix is just 0.28λ0 × 0.28λ0, so it is a reasonable contender for wide-point examining staged cluster applications.

V. Future Scope

Presently a days, the interest of radio wires is rising a result of the quickly development of remote correspondence. It particularly enjoys satellite correspondence framework, for example, route hand held gadgets fitted to vehicle, boat and airplane. What's more, it typically involves in common and military application such things as examination and salvage. This work shows that few qualities of dielectric substrates influence fix receiving wire execution. By seeing the consequences of this work the creators can find out about which substrates ought to be liked to manufacture the microstrip fix recieving wire. They can have a more extensive approach to picking a dielectric substrate. Polyester and RT Duroid gives preferred execution over the other substrate. Polyester can be utilized to manufacture wearable material receiving wire. Material receiving wires are getting famous nowadays.

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