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A Composite Microstrip-Monopole Antenna with 180° 1 dB Beamwidth Based on Complementary Sources Concept as a Review

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Abstract: *Another point of view in light of correlative sources radiation is introduced for dissecting a wide beam composite microstrip-monopole receiving wire. The run of the mill cavity model hypothesis shows that the radiation examples of the microstrip radio wire could be determined by utilizing two equal comparable attractive flows, also, the E-plane beam width of the customary microstrip receiving wire still up in the air by the cluster factor. Stacking the monopoles through the metal fix of the first microstrip receiving wire can build correlative sources. Two monopoles are evenly stacked and two sets of integral sources are invigorated. Strangely, the two sets of correlative sources are adjusted with in-stage attractive current radiation sources and anti phase electronic current radiation sources, which demonstrates two heart shaped radiation designs pointing in inverse bearings. The complete far-zone emanated fields blended by the two heart-formed radiation examples can introduce wide E-plane beamwidth execution. A model receiving wire working at 4.4 GHz is intended for confirmation. With the presentation of a differential taking care of plan for a balanced radiation design, the E-plane radiation design can cover the upper half plane, i.e., 180◦, with a variance of less than 1 dB and a radio wire gain of north of 3 dBi.*

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

Introduction

In Today's world, in order to face the technological development, men need to keep up with the evolution. This evolution leads to the development of cellular devices. This brought up many new areas of investigation the one with main interest for this dissertation is the research of antennas with Monopole geometries. The main problem of common antennas is that they only operate at one or two frequencies, restricting the number of bands that equipment is capable of supporting. Another issue is the size of a common antenna. Due to the very strict space that a handset has, setting up more than one antenna is very difficult. To help these problems, the use of wide band micro strip patch antennas is being studied.

A receiving wire Configuration is a gadget this is utilized to change over directed electromagnetic waves into electrical transmissions as well as the other way around (for example Either in sending mode or in getting method of activity). Recieving wires are recurrence organized gadgets. Every postulation on radio wire is intended for a positive recurrence band and beyond this band, radio wire dismisses the transmission. Thusly, we can say radio wire is a band pass sift through and transducer. Radio

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wires are urgent part in verbal trade structures thusly understanding their basics are significant.

1.2 Aim

The aim of my design a wide band mono pole micro strip patch antenna. These are low profile antennas with moderate gain and can be made operative at multiple frequency bands and hence are multi-functional. In this dissertation, a wide band antenna is presented for the application in the multiband frequency range, which is designed by newest hybrid techniques. To lay foundations for the understanding of the behaviour of such antennas.

1.3 The Objective of the Dissertation

The following aspects of multi band monopole mono pole geometrical antenna.

1. The main objective of this dissertation is overcome some problems of antenna like, reduced the value of Return loss (<-10 dB) and VSWR (1.3), Enhance the efficiency of multiband microstrip patch antenna.
2. Design calculation for a microstrip patch antenna using transmission line model carried out to determine necessary dimensions of the antenna for simulation.
3. A simulation study of the microstrip patch antenna done in Zeland IE3D Software.
4. Conventional wide band mono pole micro strip patch antenna. Design by using Transmission line modal and by using IE3D optimization.
5. I also fabricated and testing wideband monopole micro strip antenna has been done with the FR-4 with dielectric constant 4.4, thickness of 1.6 mm, Length 30mm.width 38 mm.

Testing has been done with the help of Vector network analyzer and compares the both results.

With the advances in telecom, the necessity for reduced radio wire has duplicated widely. In cell dispatch, the necessity for more modest radio wires is enormous, so huge patterns are done to design reduced, negligible weight, low profile receiving wires for both scholar and business networks of telecom. The technologist focused on into the design of micro strip fix receiving wires. Many sorts in planning are suitable with micro strip radio wire. This is the most recent and hotly debated issues on which these days research work have be finished. This has initiated antenna research in various directions, one of which is by using monopole shaped antenna elements.

Design of wide band mono pole micro strip patch antenna. SWB innovation has as of late gotten a lot of consideration and is turning into a fundamental piece of current remote correspondences because of its capacity to yield an incredibly expansive transfer speed and give exceptionally high information rate administration and has tracked down significant applications in military and regular citizen frameworks: one of key parts of electronic counterwork hardware in the data fighting. SWB radio wires with a proportion transmission capacity more than 10:1 were first evolved by Rumsey et al, in the late 1950 and mid 1960, which were called as the recurrence free radio wire [1]. Since 1970s, numerous new style SWB planar radio wires have been proposed [2-5]. All the more as of late in [6] a SWB radio wire with electrical aspect of 0.25 λ × 0.28 λ (λ is the frequency of the most minimal useable recurrence) and the impedance data transmission from 5 to 150 GHz was effectively evolved. Anyway this receiving wire doesn't cover the a few significant groups working at frequencies under 5 GHz, for example, the lower band of UWB, Bluetooth, WiMAX2500, and LTE2600.

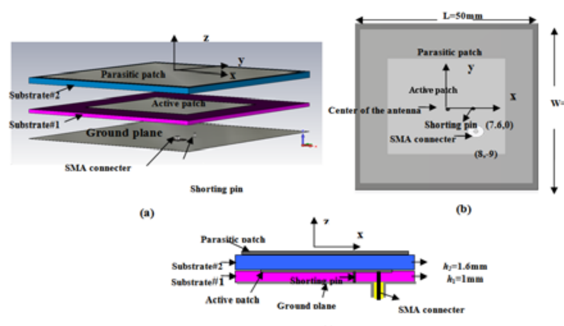

Figure 1: Wide Band Mono-pole Micro Strip Patch antenna.

II. Design Procedure

In the typical design procedure of the microstrip antenna, the desired resonant frequency, thickness and dielectric constant of the substrate are known or selected initially. In this design of rectangular microstrip antenna, FR 4 dielectric material (ε_r=4.4) with dielectric loss tangent of 0.02 is selected as the substrate with 1.6 mm height. Then, a patch antenna that operates at the specified operating frequency f_0 = 2.4 GHz can be designed by the following steps using transmission line model equations. The antenna is existed by the INSET feed away from the center of the patch.

Steps required for calculating width (W) and Length (L) of microstrip antenna

- Step 1. Initially, select the desired resonant frequency, thickness and dielectric Constant of the substrate.
- Step 2. Obtain Width (W) of the patch by inserting ε_r and λ0.
- Step 3.Obtain Length (L) of the patch after determining ΔL and ε_r.

The three essential parameters for the design of a rectangular Microstrip Patch Antenna:

- Frequency of operation (f_o): The resonant frequency of the antenna must be selected appropriately. The Mobile Communication Systems uses the frequency range from 2100-5600 MHz Hence the antenna designed must be able to operate in this frequency range. The resonant frequency selected for my design is 2.4 GHz.
- Dielectric constant of the substrate (ε_r): The dielectric material selected for our design is FR4 which has a dielectric constant of 4.4. A substrate with a high dielectric constant has been selected since it reduces the dimensions of the antenna.
- Height of dielectric substrate (h): For the Microstrip patch antenna to be used in cellular phones, it is essential that the antenna is not bulky. Hence, the height of the dielectric substrate is selected as 1.6 mm.
- Hence, the essential parameters for the design are:

f_o= 2.4 GHz ε_r= 4.4 h = 1.6 mm

Basic parameters for design of wideband mono pole antenna are given by:

Table 2.1: Propose Design Parameters

Sr. No.	Geometry parameter	Value
1	Operating frequency	2.4 GHz
2	Relative dielectric constant	4.4
3	Loss tangen δ	0.01
4	Substrate thickness(h)	1.6mm

- Calculation of the width W of antenna, which is given by:

$$W=\frac{c}{2f_0\sqrt{\frac{(\varepsilon_r+1)}{2}}}$$

Substituting c = 3.00*10^8 m/s, ε_r =4.4 and f_o = 2.4 GHz,

$$=\frac{3.00*10^{8}}{2*2.4*10^{6}\sqrt{\frac{(4.4+1)}{2}}}$$

W = 38 mm

- Calculation of Effective dielectric constant (ε_{reff}): The effective dielectric constant is:

$$\varepsilon_{reff}=\frac{\varepsilon_r+1}{2}+\frac{\varepsilon_r-1}{2}\left[\frac{1}{\sqrt{[1+12\frac{h}{W}]}}\right]$$

$$\varepsilon_{reff}=\frac{4.4+1}{2}+\frac{4.4-1}{2}\left[\frac{1}{\sqrt{[1+12\frac{1.6}{38}]}}\right]$$

ε_{reff} =4.085

- Calculation of the effective length, L_{eff} which is given by:

$$L_{eff}=\frac{c}{2f_0\sqrt{\varepsilon_{reff}}}$$

$$L_{eff}=\frac{3*10^{8}}{2*2.4*10^{9}*\sqrt{4.085}}$$

L_{eff}=31.458mm

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- Calculation of the length extension, ΔL, which is given by:

$$\Delta L = 0.412*1.58\left[\frac{(\varepsilon_{reff}+0.3)(\frac{W}{h}+0.264)}{(\varepsilon_{reff}-0.258)(\frac{W}{h}+0.8)}\right]$$

$$\Delta L = 0.412*1.58\left[\frac{(4.085+0.3)(\frac{38}{1.6}+0.264)}{(4.085-0.258)(\frac{38}{1.6}+0.8)}\right]$$

$\Delta L = 0.729$

- Calculation of the effective length extension of patch L which is given by:

$L = L_{eff} - 2\,\Delta L$

$L = 31.458 - 2*0.729$

$L = 30$ mm

- Calculation of the ground plane dimensions (L_g and W_g):

The transmission line model is applicable to infinite ground planes only. However, for practical considerations, it is essential to have a finite ground plane. It has been shown by that similar results for finite and infinite ground plane can be obtained if the size of the ground plane is greater than the patch dimensions by approximately six times the substrate thickness all around the periphery. Hence, for this design, the ground plane dimensions would be given as:

$L_g = 6h + L = 6(1.6) + 30 = 39.6$ mm

$W_g = 6h + W = 6(1.6) + 38 = 47.6$ mm

- The feed point determination :

As there feed type has been specified and the parameters are calculated. The matching impedance is 50Ω. In order to have a matching of the impedance the connecter has to be placed at some distance from the edge which has a match of 50Ω. There is a trial and error method that has been adopted to check the minimum value of the Return loss. That is the reason why the coordinate-Y_f is set to be zero and X_f is varied to have the optimal feed point [24]

Table 2.2: 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

III. Problem Identification

In writing overview we examined different monopole calculation were applied for the plan and acknowledgment of recurrence autonomous and multiband radio wires. Duplication of a receiving wire size by a variable for the most part diminishes the working recurrence of the receiving wire by a similar element. On the off chance that a radio wire is a lot more modest than the frequency of the working recurrence, its effectiveness crumbles radically since its radiation opposition diminishes and the receptive energy put away in its close to handle increments. These two elements make the matching of a little receiving wire to its taking care of organization troublesome. Thusly, monopole receiving wires are a practical contender for their scaling down. Radio wire calculations and aspects are the primary variables deciding their working frequencies. For a radio wire to function admirably at all frequencies, it should fulfill two measures: it should be balanced about a point, and it should be self comparative, having a similar fundamental appearance at each scale: that is, it must be a fractal. The greater part of scientist chips away at planning monopole receiving wire by utilization of normal monopole calculations. These sorts monopole radio wire can accomplish multiband conduct by carrying out more than second emphasis. The vast majority of analyst presumes that while going to higher cycle receiving wire accomplish more multiband conduct. As the cycles continue expanding the stacking causes numerous reverberation and a shift down in reverberation recurrence, which might prompt a successful radio wire scaling down and multiband qualities. Be that as it may, for cycles higher than the subsequent emphasis, the radio wire configuration turns out to be very confounded and its manufacture turns out to be extremely challenging. So the Half breed procedures is exceptionally helpful for accomplish multiband conduct of radio wire.

IV. Conclusion

Monopole antenna engineering is newest field for research that combines monopole geometry with antenna theory. Through the study it can be summarized that increasing the monopole iteration of lead to higher antenna miniaturization and multiband characteristics but it also give high complexity in structure of antenna and fabrication process. The need is to develop less complex and less iteration techniques. So that miniaturized antenna can be fabricated using only a few generating iteration of generating procedure and cover maximum multiband characteristics. The aim of this dissertation to investigate novel hybrid techniques implemented by combination of two well known Monopole geometries. While its surface area remains constant without any more space occupation consequently, the antenna miniaturization and maintenance of its gain and increase of its relative frequency bandwidth are achieved.

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