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Effect of Wire Monopole Antenna for Different Feed Position

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ABSTRACT: In this paper we represent a wire monopole antenna used for microwave imaging we increase the bandwidth of earlier wire monopole antenna by changing feed location point. The proposed antenna is improving return loss and bandwidth has change up to 625.4 MHz Monopole antennas have several advantages but for their narrow bandwidth. Broadband planar monopole antennas have all the advantages of the monopole in terms of their cost, and ease of fabrication besides, yielding very large bandwidths. For many applications large bandwidth is required. This design will helps to explain without changing the original antenna just by changing its feed location point we can a wider bandwidth and improved return loss.

KEYWORDSMonopole antenna, Effect due to change feed position, UWB, HFSS

I. INTRODUCTION

A monopole antenna is a class of radio antenna consisting of a straight rod shaped conductor often mounted perpendicularly over some type of conductive surface called a ground plane. Monopole Antennas can be of various geometries [1-9] and are in in broad casting and car radios. One of the simplest is a wire monopole antenna over ground plane. In order to increase the bandwidth wire monopole antenna loaded in different ways [4-5]changing feed location is one of the way to increase the bandwidth[3-7].

The monopole antennas are convenient to match to 50 ohms, and are unbalanced. This eliminates the need for a balun, which may have a limited bandwidth (BW) [6]. The simplest member of the family is the quarter wave monopole above a prefect ground plane.A typical feed line for the monopole antenna is a coaxial cable with its inner conductor connected through a hole to the ground plane to the vertical monopole element and its outer conductor connected by means of a flange to the ground plane. The inner conductor's diameter is equal to the monopole element's diameter and the outer conductor's diameter is equal to the ground plane hole diameter [2-9]. Monopole antennas, having Omni-directional radiation pattern characteristics, are very suitable for indoor applications.

II. ANTENNA GEOMETRY, MODELING

The monopole consists of a 30 mm long wire on the 100*100 mm ground plane having a material of copper and is the inner conductor of coaxial 0.45mm 50 ohm SMA probe. The position of the monopole is not in the centre of the ground plane but is a little offset. We analysed the monopole at different feed position. The simulations are performed with ANSOFT HFSS over the frequency range 0 to 12GHz [10].

We design a monopole antenna having radius of 1 mm made up of copper material which is feed by coaxial feed with a pin of radius 0.45mm connected to a monopole and outer conductor of coaxial feed having 1.9 mm radius and 10 mm height below the ground surface which is connected to a ground surface having radius of (λ/2) mm i.e. 60mm and height 2mm below origin and dielectric of coaxial feed which is made up of Teflon and 1.5 radius and 10 mm height below ground surface[8]. All this structure we placed in on a ground surface for a different position. We can select the

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best result from the below table for wider bandwidth. From the TABLE 1 we conclude that as we go away from origin return loss and bandwidth vary of wire monopole geometry at center feed position.

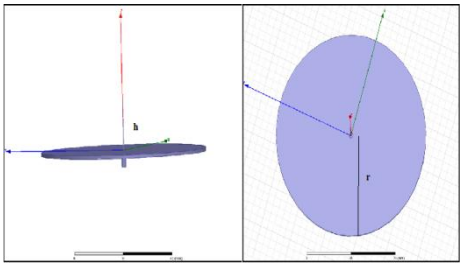

Fig1: - shows the simple wire monopole placed at origin wire monopole made up of copper, a ground plane and a coaxial cable feeding.

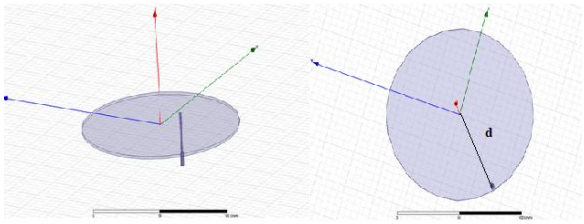

Fig.2. a)Side view b) Top view of a feed located wire monopole antenna geometry Where d is distance of antenna which is placed 40,40 mm from origin in x,y direction respectively.Fig2: - shows the geometry of a monopole placed at a distance of(40,40) mm from origin.

TABLE I: - Different feed location point for wire

FEED LOCATION (X,Y) (mm)	S11 (dB)	BANDWIDTH (MHz)
(0,0)	-19.99	559.8
(10,10)	-17.2009	459.9
(15,15)	-15.6508	431.7
(25,25)	-17.4873	461.8
(30,30)	-19.2963	518.0
(35,35)	-26.3784	605.6
(40,40)	-19.2441	625.2
(35,25)	-19.7155	531.2
(25,20)	-18.7825	490.6
(40,35)	-18.6023	501.2

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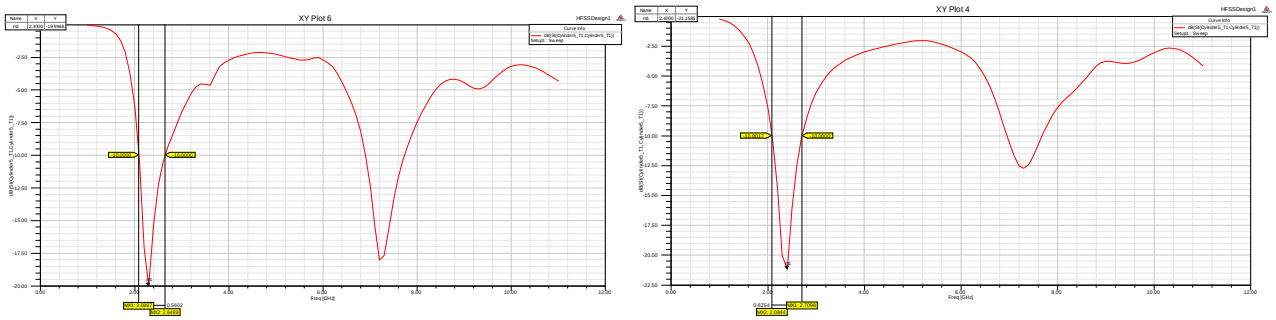
III. SIMULATED RESULTS

In this work, a wire monopole antenna was considered. The proposed antenna was simulated using ANSYS HFSS software, and the results compared, the feed point is selected where the Return loss (RL) is most negative. The feed point location co-ordinate (X, Y) = (40, 40) from the origin (center of patch) was varied in order to locate the optimum feed point. The optimum feed point is found to be at (X, Y) = (-40,-40) where the RL of -21.1585 dB is obtained. The bandwidth of the antenna for this feed point location is 625.5 MHz with the center frequency of 2.5 GHz. The substrate material used for this work is copper with dielectric constant of 6 and dielectric loss tangent of 0.001. The operational frequency range is from 1GHz to 12 GHz, with a design frequency of 2.45 GHz.

i) RETURN LOSS(S11)

Return loss is the difference between forward and reflected power, in dB, generally measured at the input of the coaxial cable connected to the antenna, for maximum power transfer the return loss should be as small as possible, this mean return loss should be a large negative number as possible.

The a designed antenna shows a good return loss approximately -21.1585 dB at 2.45GHz which is an good result and having bandwidth of 625.4 MHz compare to result centrally placed monopole which is -14.7575 dB and having bandwidth of 560.2 MHz.Fig3.a shows the return loss of centrally placed wire monopole and Fig 3.b a monopole placed away from origin at a distance of(40,40)mm.



(3.a) (3.b)

Fig.3.(a) Return loss of center feed monopole.(b) Return loss of a monopole placed at a distance of (40,40)mm.

ii) DIRECTICITY(dB): -

The centrally located monopole antenna having directivity is 2.4922 dB is improved to 3.6573 dB at 2.45 GHz. Fig4.a shows the directivity of centrally placed wire monopole and Fig 4.b a monopole placed away from origin at a distance of(40,40)mm.

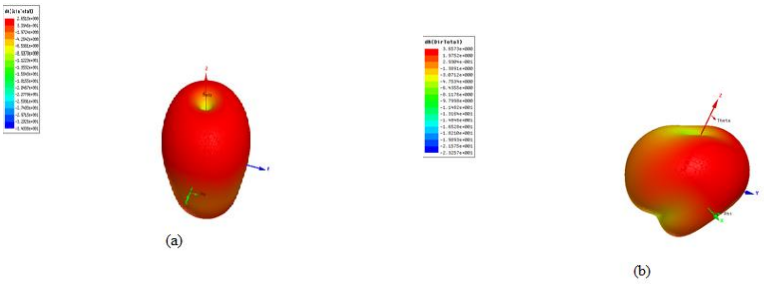


Fig.4.Directivity of a) Central feed monopole
b) Feed located monopole

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iii) GAIN(dB): -

Gain is defined as the ratio of the intensity, in a given direction, to the radiation intensity that would be obtained if the power is accepted by the antenna is radiated isotropically.

The centrally located monopole antenna having gain is 2.6513 dB is improved to 3.7420 dB by simulated antenna placed at (40, 40) distance from center at 2.45 GHz.Fig5 shows the gain variation between origin feed monopole and a monopole feed away from origin

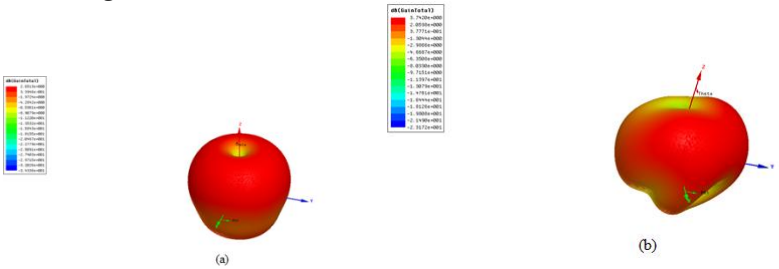

Fig.5. Gain of a) Central feed monopole

b) Feed located monopole.

iii) VSWR: -

This Voltage standing wave ratio (VSWR) parameter is used for matching and tuning of the transmitting antennas. For practical applications the value of VSWR lies between 1 and 2.

The centrally located monopole antenna having VSWR value 1.5313is which is improved to1.2836 at 2.45 GHz.

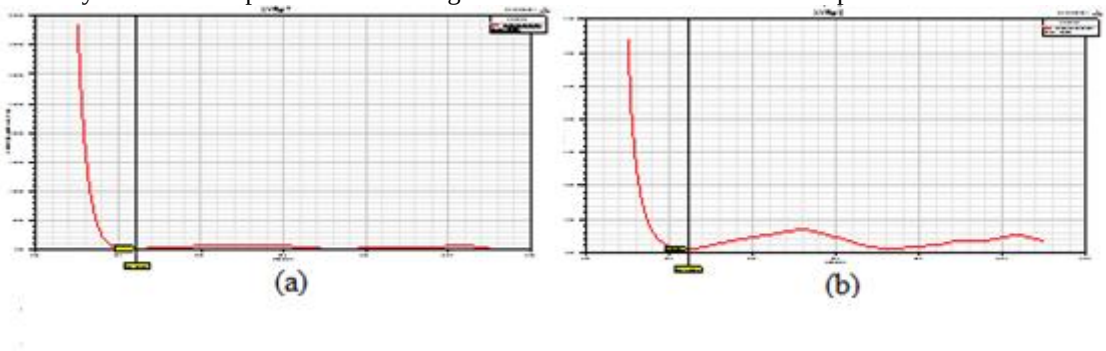

Fig.6. VSWR of a) Central feed monopole
b) Feed located monopole

The results of the above designed antenna are summarized in the following table 2:-

TABLE2:-summarized both the monopole

Parameter	Monopole at centrally feed	Wire monopole feed at (40,40.) position
Return loss(dB)	-14.7575	-21.1585
Bandwidth (MHz)	560.2	625.4
Directivity(dB)	2.4922	3.6573
Gain (dB)	2.6513	3.7420
VSWR(linear)	1.5313	1.2836

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TABLE 2 Shows the proposed design is improve return loss from -14.7575dB to -21.1585 dB,bandwidth from 560.2 MHz to 625.4 MHz,directivity from 2.4922 dB to 3.6573 dB ,gain from 2.6513 to 3.7420 dB ,and VSWR should be between 1 to 2 VSWR is changed from 1.5313 to 1.2836

IV. CONCLUSION AND FUTURE WORK

This paper designed a wire monopole antenna for different feed location point. This design will give us a wider bandwidth, improved return loss, with improved directivity and gain and VSWR also.This parametric study also shows that without changing the existing profile of simple wire monopole antenna, by changing feed location we can tune antenna to operate in the desired frequency range. We analyse the wire monopole antenna having 1 mm radius initially is placed at center then for increase the bandwidth we change feed location point table 2 shows all the analyzed result from that return loss and bandwidth result we take better result and taking Gain, Directivity, VSWR.

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