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Research Article

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# Design & Simulation of Low Profile Collinear Monopole Antenna

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**ABSTRACT**

The paper presents an idea on the development of collinear type of antenna. The genetic algorithm is used to optimize the two antenna architecture.The ground plane is taken as dimension 100×100×1.5. .On the other hand metal plate have dimension 16.7×1.5×110.5 mm. The main goal of the article is a comparison of directivity and bandwidth of the proposed antennas. In our analysis, the method of moments (MoM) is used to compute the currentdistribution and directivity of the yagi antenna. Microstrip technology is used for planar collinearmonopole antenna and simulation with ground plane has been performed using Ansoft HFSS 3Dsimulator. Prototypes have been realized and measured.

**KEYWORDS:** ***Collinear, Monopole, HFSS, Return Loss, Gain***

## Introduction

Growing interest in 802.11b, 802.11g and 802.11a and other applications has precipitated the needfor omnidirectional antennas at 2.4-2.5 GHz, 5.15-5.35 GHz and for special applications in the Cband. A number of approaches for gained omnidirectional antennas researchers have taken inthe past. One of these most promising designs are the collinear dipole arrays built up from halfwavelength radiators. The radiators are connected to each others either using transmission lines ordirectly by insertion of 180 degree phase shift.

One of such solution uses half-wavelength sections of coaxial transmission line which have theirinner and outer conductor connections reversed at each junction. This reversal causes the currenton the outer conductor of each segment to be in phase and radiate an omnidirectional pattern. This type of antenna is often called coaxial collinear antenna (COCO).

A geometry for a planar microstrip omnidirectional antenna introduced by Bancroft and Bateman is presented [1]. The basic idea is to create alternating sets of 50- microstrip transmission lines. Each section is approximately one-half wavelength long at the frequency of operation. Each groundplane section was initially set to be about 5 times the conductor width of the micro strip transmission line and later optimized for driving point impedance.

The circular YagiUda antenna geometry is started from the linear element antenna and byrotating of the elements we have a low profile omnidirectional antenna. The antenna is optimizedby varying the lengths and spacings of the circular elements.



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As comparison the radiation pattern, gain, input reflection and bandwidth are compared for the two antennas.

The rest of the paper is organized as follows. Section II outlines the complete design of zero iteration star patch antenna. Measured and simulated results of the proposed antenna are discussed in Section III. The conclusions are given in Section IV.

**Collinear Monopole Antenna**

An FR-4 substrate with 4.4 and thickness 1.5 mm was used in this design. A patch of area 16.7 ×1.5×110.5 mm was selected. Such a patch resonatedat 10.28 GHz in normal operating mode. To reduce theresonant frequency of the patch antenna, monopole wasetched out from its radiating patch at its center. After that it is compare with collinear which was etched out from its radiating patch .

In the design of the monopolepatch, the dimension was varied and the antenna was tuned to resonate at 10.28 GHz using the commercial software HFSS. The final design obtainedis shown in Fig. 1. The length of each side was 17 mm.The coaxial feedwhich givesa characteristic impedance of 50 Ω. The top view of patch antenna is as shown in the fig 1.

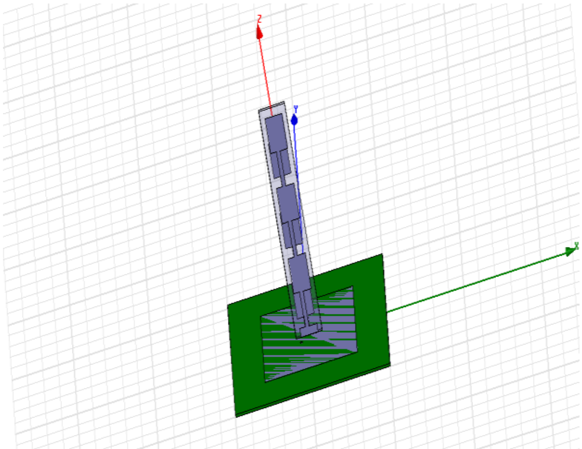

**Fig 1.** Front View of Monopole Antenna

The back patch is printed on Rogger metal plate . A copper sheet is etched on it with dimension 17 ×16.7 mm. On the other hand a short pin is attached to ground with dimension 17×2.2 mm.

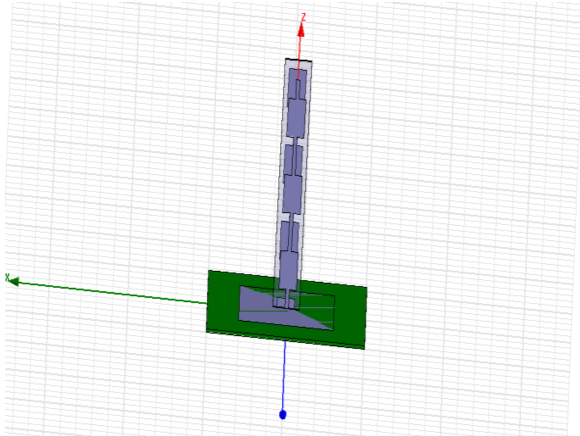

**Fig 2.** Back View of Monopole Antenna

Return Loss is important parameter for an antenna design. The ideal return loss is assumed to be -10db. Return loss should be minimum. The antenna is simulated in HFSS tool and return loss is measure. In case of monopole antenna return loss is -26.9273 db. The return loss of zero iteration is given by fig 3. This graphs shows that impedance matching of port to the antenna

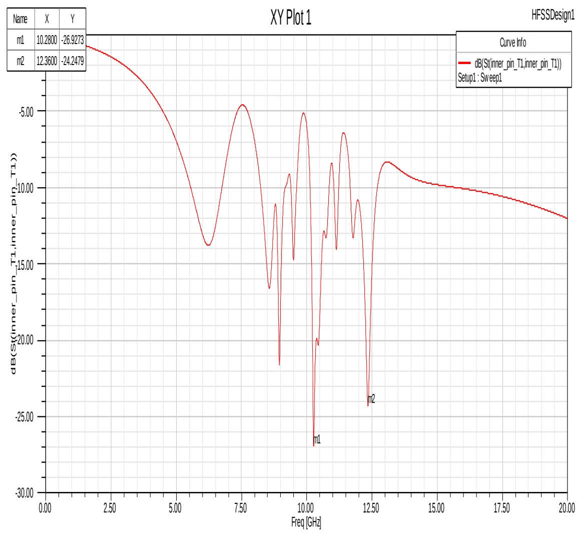


**Fig 3.** Return Loss of MonopoleAntenna

The current distribution gives an idea to distribute a charge to the whole surface. The distributed current is gives in ampere per meter. In case of zero iteration current distribution is given as 2.144 ampere per $m^2$.Current distribution of Monopole is shown in fig 4.



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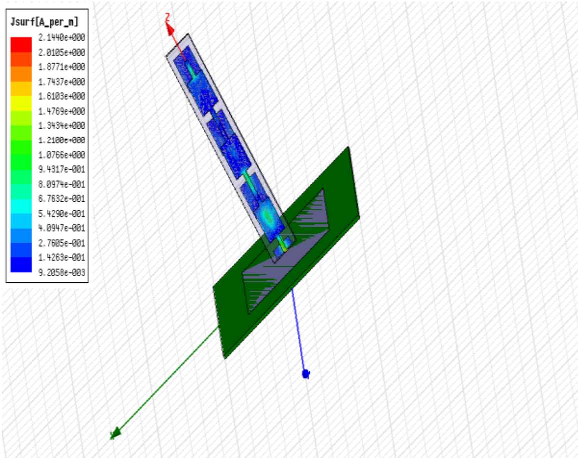

**Fig 4.** Current Distribution of Monopole Antenna

Gain is also an important parameter to design an antenna. The Gain enhanced by drawing different slots. Radiation pattern of gain given in fig 5. Gain of zeroth iteration antenna is 9.6638 db

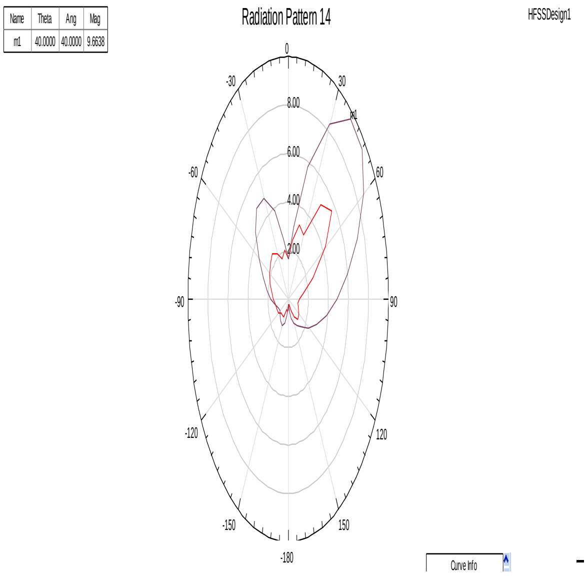


**Fig 5.** Radiation Pattern of Gain of Monopole Antenna

Measuring Parameter

| Antenna | Return Loss | Gain | B.W |
|---|---|---|---|
| Monopole | -26.9273 | 9.6638 | 1.2 Ghz |

## Conclusion

After Simulation, it is found that simplepatchantenna has low return loss with high gain andbandwidth. Simulated return loss is -26.9273 with gain 19.6638 db and bandwidth 23% is obtained from monopole patch antenna

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