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Design of Planar Passive Antenna for Wireless Communication

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Abstract

This work articulates a narrowband planar radiator which is for Ham Locator particularly for recognition of Ham radio users. They use frequency bands of 725MHz, 850MHz, 925MHz and 2200MHz.To accomplish the radiating element's constraints that has the attributes of narrowband, here we can follow one of the strategies as , adding parasitic elements. This proposed antenna is etched on Arlon AD 1000 with a dielectric constant of 10.2 and substrate thickness of 1.6mm. By harnessing this, frequency band is acquired as 750MHz- 2010MHz and has a bandwidth of 1260MHz.

Keywords: *Planar Passive; Narrowband; Ham Locator; Parasitic elements*

1. Introduction

The rapid improvement in wireless field, imposing the use of diverse frequencies in one gadget, where this design focuses on. One challenge posed though is the deficit of communication on special frequency bands. Thus finding of Ham radio using the locator is not an easy task, hence it requires a specified operating frequency with higher efficiency. To support monitoring of systems it should possess system tracking quality and higher signal mobility, which is discussed detail in this model. The name indicates the model is planar(all axis meeting at one plane) and passive(usage of only inductance and capacitance) [2,9].

This paper will address the narrow band planar antenna which can operate in the frequency spectrum that includes 725MHz, 850MHz, 925MHz and 2200MHz for Ham application. Ring shaped monopole radiators using CPW as host transmission line for a wide bandwidth achievement [8].

2. Ease of Use Material Selection

Arlon AD 1000 is used as a base or substrate material, this is a composite material where the physical and chemical properties vary. This helps in improving the electrical strength of the antenna. The thermal property of this material can be varied to make them as foldable foil. The main attraction of this material is higher dielectric constant, with which it can achieve good efficiency at shorter ranges. Arlon is prepared mainly due to its cost and behavior at different circumstances. It also has higher dimensional stability.

3. Design of Passive Radiator

The suggested antenna is a planar passive antenna [1] which is modeled to be integrated with wireless Ham locator . The antenna design uses Arlon substrate with relative dielectric constant of 10.2 and thickness of 1.6mm.The modeling is carried out using FEM based EM simulator Ansys (HFSS). Design development approach to accomplish the narrowband function for use with Ham and A-GPS application as shown in Fig.1.The design incorporates stepped impedance resonators[7,10,11], to achieve the resonance at desired range.

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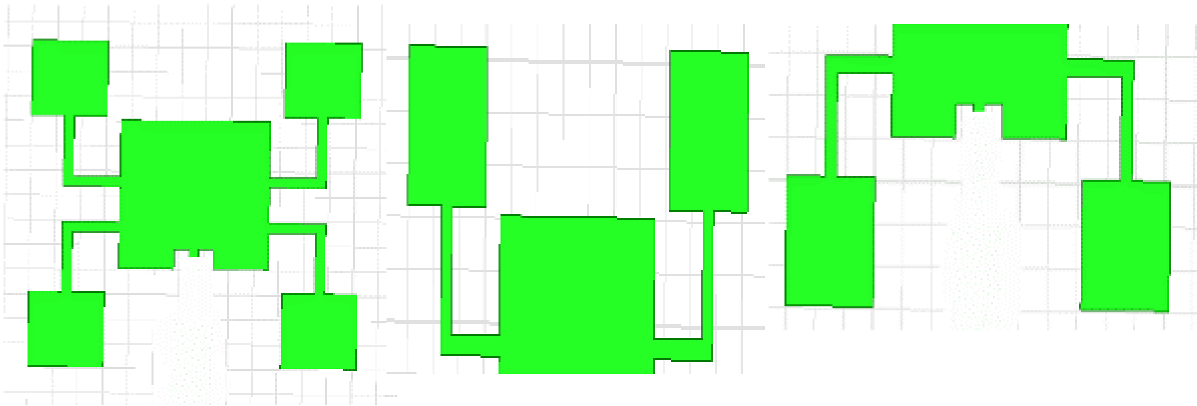

(a) (b) (c)

Fig.1 (a) The Antenna patch design (b)Transmitting part (c) Receiving part

According to Fig.2,the antenna with array of patches which has both transmitting and receiving part produces 90 degree phase shift, hence we get a return loss of -12.5db at 750MHz and -10.5db at 2010MHz. Thus due to Fig. 1(b) the first shift in transmitting part produces return loss at 750MHz and as of 1(c) the second shift in receiving part produces return loss at 2010MHz and the entire model will produce increased bandwidth.

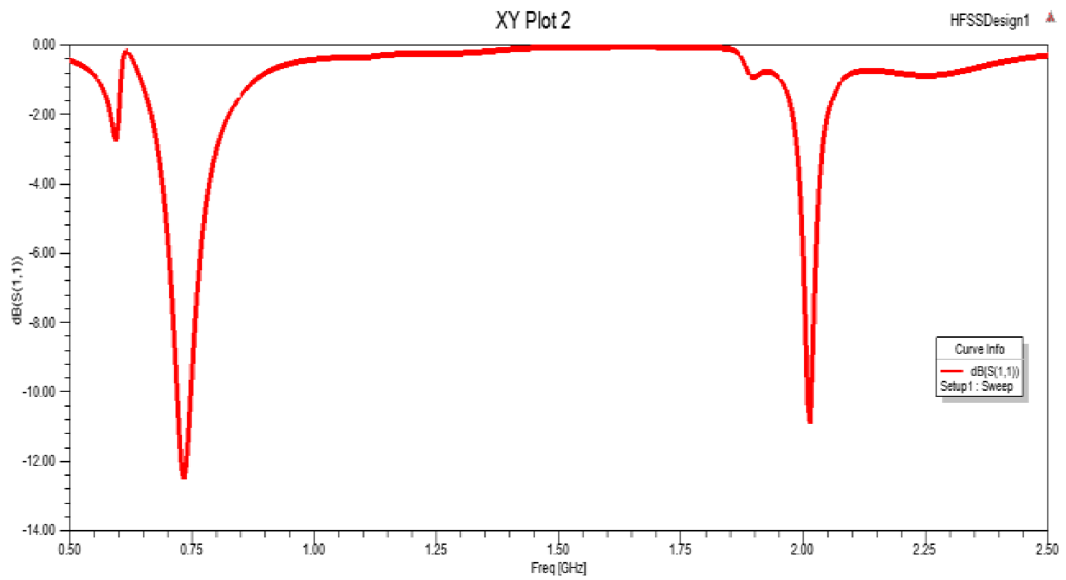

Fig.2. S11 Characteristics Of The Antenna Design

Spatial frequency is considered in terms of wavelength[6]. Therefore waves at high frequency have shorter wavelength while low frequency will have longer wavelength. This inversed wavelength offers about a phase change of 90 degree. It use maxwell's unit equation ($|\Delta E| \times |\Delta H| = 1$).

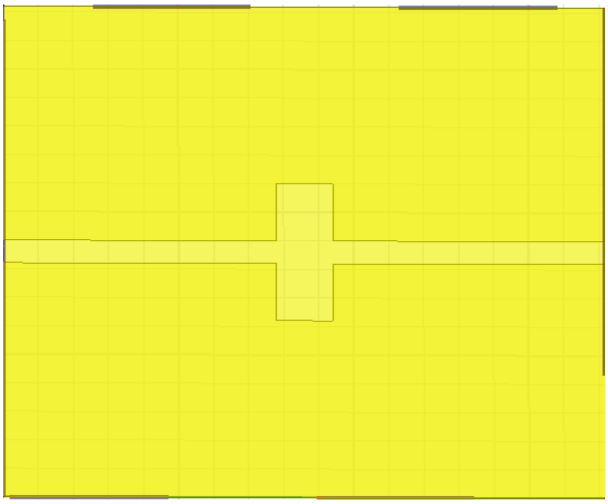

Fig.3 The Parasitic Ground

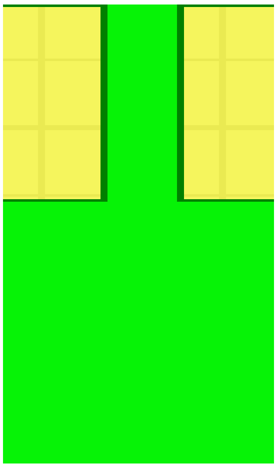

Fig.4.The Feed Of The Antenna

Fig.3 represents the Parasitic ground used in this design. Parasite is the one which is known to be as external agent. By using the external agent we are separating the ground. The ground is separated because in radiating part, this separation gives the proper radiation, so we say this as a passive source because we have not used any active components in this (only inductance and capacitance).The dimension of 86x86mm is used. Fig.4, represents the feed with full port and half port impedance is used. Stub matching concept is included in feed to get the accuracy of return loss at the specified frequency range.

4. Result and Discussion

Many parameters notably working frequency, bandwidth, gain and Radiation pattern are used to evaluate the antenna efficiency.

A. The Simulated Results of S11 Parameters

The bandwidth is defined by the region bounded by the working frequency having reflection coefficient of < -10dB [2],[3]. Here a narrow bandwidth is achieved The simulated result of the proposed antenna is depicted in Fig.5

B. The Simulation Result of the Radiation Pattern

The radiation pattern determines the directional constant in antenna, it gives the bidirectional pattern in this simulation at the frequencies 725MHz, 850MHz, 925MHz and 2200MHz.The pattern approaching was more directional at 750MHz [4] and 2010MHz and it is shown in Fig.6. In Fig.6 the bidirectional pattern has (phi='90 degree') And Omnidirectional pattern has (phi='0 degree').

C. The Simulation Result of the Gain

The gain is usually a power produced from far field resource to lossless isotropic antenna. Here we get a negative gain nearly equal to -3db which is mainly seen in couplers, filters etc and shown in Fig.7. This is due to the increase in traffic of users in a specified locality. The negative gain is generated due to low frequency design and users increases every running distance within the same locality.

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D. The Simulation Result of the Directivity

The directivity is a measure of radiation emitted which is concentrated in a single direction. This is very important in determining the efficiency of the antenna and shown in Fig.8.

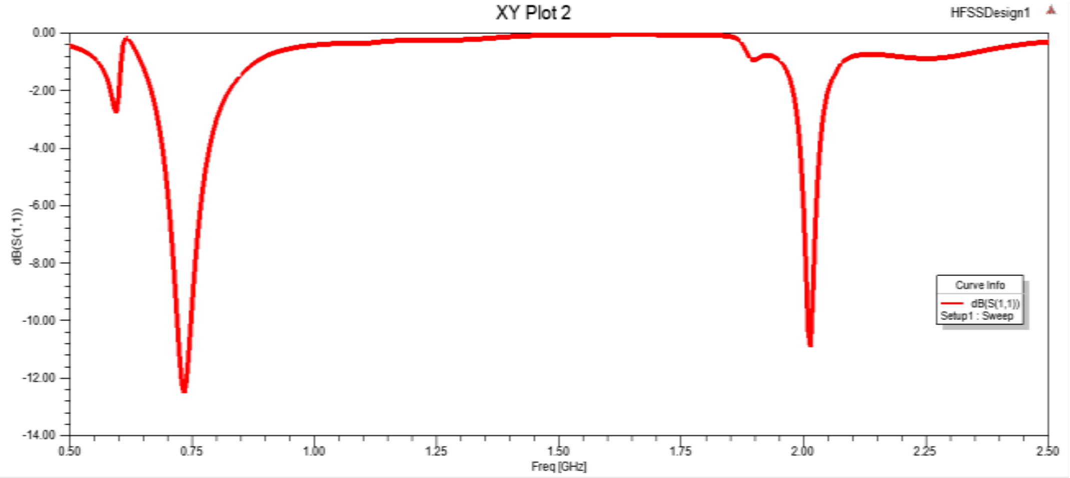
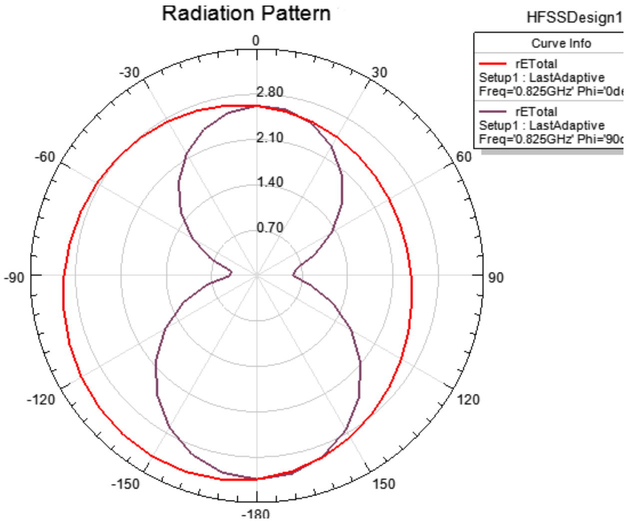


Fig.5. The Return Loss Simulation Results



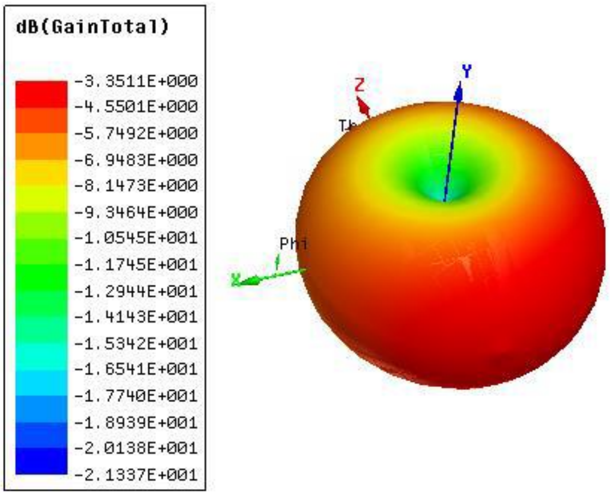


Fig 6. The Radiation Pattern of the Antenna **Fig.7 The Gain of the Antenna**

E. The Simulation Result of VSWR

Voltage Standing Wave Ratio is defined as the ratio between the peak voltage or amplitude level in a signal to the minimum voltage/amplitude level along the transmission line. VSWR=1 is the one where there is no reflected power and the others are given in the below Fig.9.

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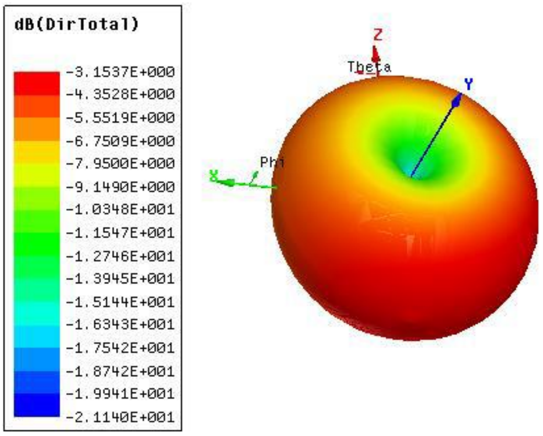
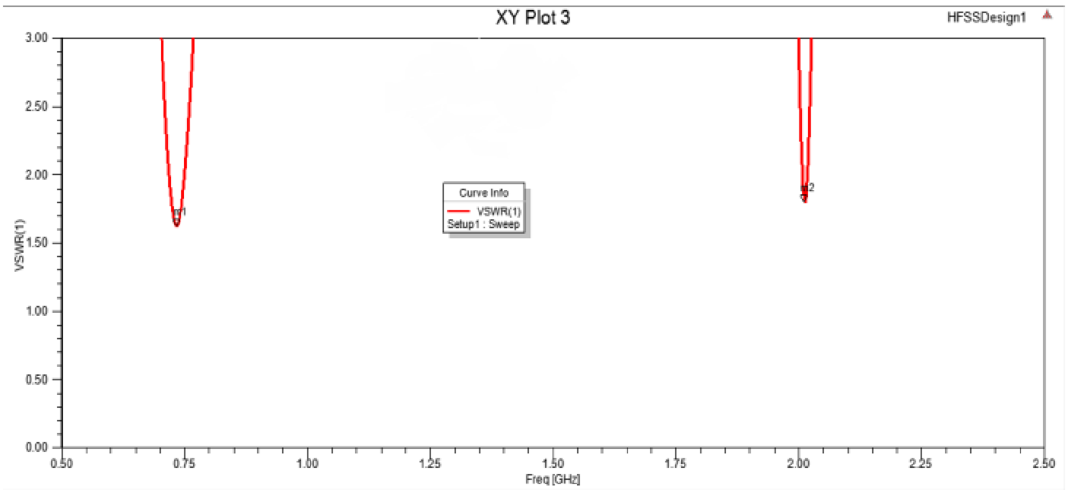


Fig.8 Directivity of the Antenna



Name	X	Y
m1	0.7339	1.6194
m2	2.0131	1.7932

Fig.9.The VSWR Chart

F. Effciency of the Antenna

Efficiency = (Gain/Directivity) x 100%

Since the gain here is negative, it should be tripled and subtracted from efficiency. Thus it is 95.5%.

5. Conclusion

Hence the proposed antenna was found to resonate at the desired frequencies with optimum performance which made the proposed antenna a good selection for the wireless applications. There are two specified application mentioned in this design. They are Ham locator and A-GPS (Assistant Global Positioning System) which is used in mobile phones.

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