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# SUSPENDED MULTIBAND MICROSTRIP PATCH ANTENNA

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## Abstract

In this paper, we present the simulated results of triple band, and suspended micro strip antenna with a single coaxial feed has been proposed. The bandwidth of 80MHz, 200MHz, and 100MHz has been obtained corresponding to VSWR < 2, Return loss (S11) less than -10dB, and 6.03dB Gain has been achieved for the suspended antenna which is designed at 0.85GHz for cellular application, 2.05GHz frequency for wireless application, and 2.55GHz frequency for wi-max application. Theoretical results have been validated with HFSS (High Frequency Structure Simulator) 11.0v software. The design was optimized to meet the best possible result. Substrate used was FR4 which has a dielectric constant of 4.4 with height of 1.6mm.

## INTRODUCTION

The telecommunication does not stop to increase; it always tries to reach the best performances, thereliability and the efficiency with the lowest possible costs. In this domain, antennas establish a basicelement allowing the transmission of the electromagnetic waves in free space. We find several types ofantennas which different by cuts, geometrical shape, capacity of transmission.However, the new generation of the communication, mobile or satellite communication provokes considerable changes in patch antenna, from which the various modern applications require a functioning in wideband and multiband band. Simulations of multiband and Broadband microstrip Patch antenna compacts conception with a wideband, a triple frequency, an enhanced gain of operation, was announced during the last years.

In this paper, we are interested in the simulation of suspended microstrip antenna wideband, by the software Ansoft HFSS "Hight Frequency Structure and simulator" software. Microstrip patch antennas are well known for their advantages in terms of small weight, low profile and ease of manufacture. However, the main limiting factor in implementing these antennas in many applications is their low impedance bandwidth. One popularly used technique of enhancing the bandwidth is to use suspended microstrip, which in view of the air layer next to the ground plane, offers improved efficiency. The aim of this paper is to study the bandwidth and radiation characteristics of suspended microstrip rectangular patch antennas with dielectric. Using this technique a single layer suspended microstrip antenna which offers 80MHz, 200MHz and 100MHZ (S11 < ¡10 dB) impedance bandwidth has been reported in this paper.

The antenna developed here is suitable for various wireless applications 0.85GHz, for cellular phone, 2.05GHz is for wireless application and 2.55 GHz is used in Wi-Max.

## ANTENNA STRUCTURE AND DESIGN

The dielectric constant of the substrate is closely related to the size and the bandwidth of the micro strip antenna. Low dielectric constant of the substrate produces larger bandwidth, while the high dielectric constant of the substrate results in smaller size of antenna. A trade-off relationship exists between antenna size and bandwidth.

The multiband suspended microstrip patch antenna is designed on FR-4 substrate at 50Ω matching impedance dielectric constant εr = 4.4 and height from the ground plane d=1.6mm, and height of air gap is 6mm.The parameter of rectangular microstrip patch antenna are La=135mm,Wa=90mm,Lb=16mm,Wb=5.6mm,Lc=30mm, and Ld= 17mm. the centre square is rotated. In this patch two hexagonal shapes are used to obtain dual frequency and by varying the feeding point we get the triple band. As the proposed antenna is made suspended due to that technique Gain is increases. Slots are cut in the patch to increase the bandwidth.

The designed Microstrip antenna resonates at 0.85GHz, 2.07GHz and 2.55GHz frequency.

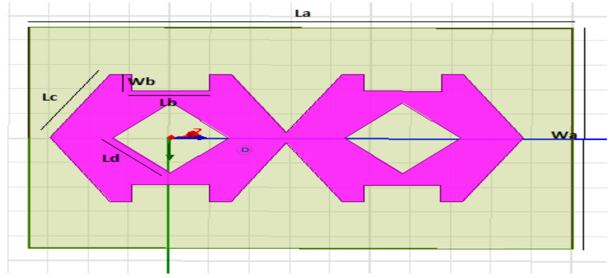


**Fig.1. GEOMETRY OF PROPOSED ANTENNA**

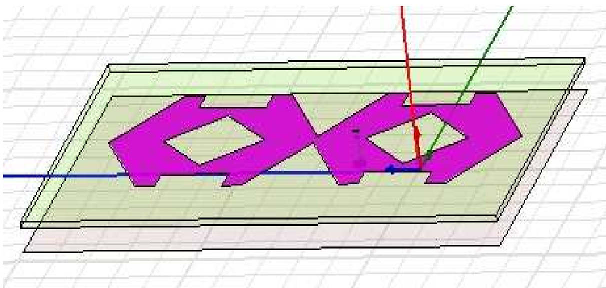

**Fig.2. SUSPENDED MICROSTRIP ANTENNA**

**Fig3. FABRICATED ANTENNA**

**RESULTS AND DISCUSSION**

Two measures of stating the impedance matching are commonly used, both of which are based on the reflection coefficient, which is a measure of how much energy is reflected back into the source from the antenna's terminals. The first measure shows the reflection coefficient on a logarithmic scale as |S11|.

Common definitions require that |S11| be below the -10 dB line to declare an acceptable impedance match. Figure (4) shows the return loss curve. Results showing that the antenna is resonating at two frequencies. At 0.85GHz, 2.07 GHz and 2.55GHz the return loss values of -19.64,-31.48dB, and -24.91dB are getting from the current design.

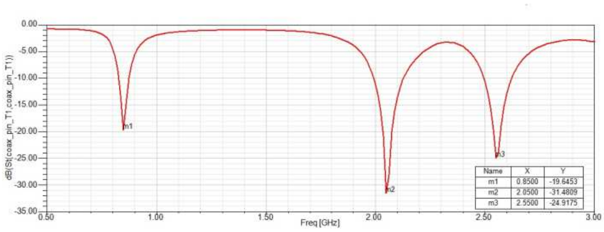


**Fig. 4. RETURN LOSS OF AN ANTENNA**

A standing wave in a transmission line is a wave in which the distribution of current, voltage or field strength is formed by the superimposition of two waves of same frequency propagating in opposite direction. Then the voltage along the line produces a series of nodes and antinodes at fixed positions. The second measure is similar, but on a linear scale and is referred to as VSWR (Voltage Standing Wave Ratio). In this terminology an antenna is deemed to be well matched to the line where VSWR is less than 2:1. Figure (5) showing the VSWR Vs Frequency curve for the proposed antenna. The VSWR of 1.23, 1.08, and 1.13 is obtained at two frequency values.

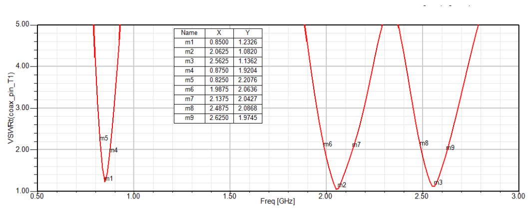


**Fig. 5. VSWR OF AN ANTENNA**

The bandwidth of an antenna refers to "the range of frequencies within which the performance of the antenna, with respect to some characteristic, conforms to a specified standard". The most common usage of bandwidth is in the sense of impedance bandwidth, which refers to those frequencies over which an antenna may operate. Figure (6) shows the input impedance smith chart and from which bandwidth of 80MHz, 200MHz and 100MHz are attained.

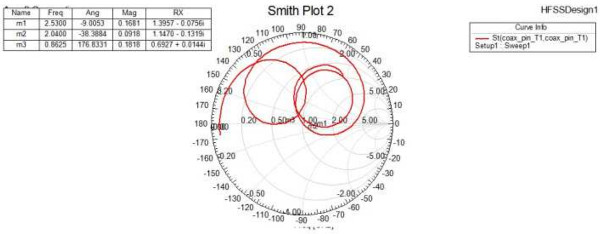


**Fig. 6. INPUT IMPEDANCE SMITH CHART**

The radiation pattern represents the energy radiated from the antenna in each direction, often pictorially. Antenna gain is often related to the gain of an isotropic radiator, resulting in unitsdBi. Antenna gain may be viewed with the aid of a radiation pattern. The gain of the proposed suspended antenna obtained is 6dBi.

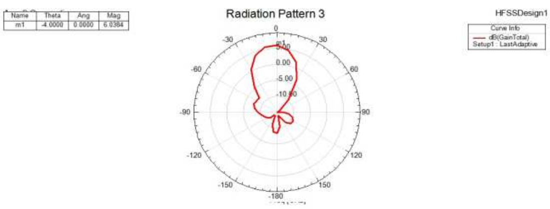


**Fig. 7. GAIN OF AN ANTENNA**

The current distribution along the substrate and the patch is given in the figure (8). The triangular zones at patch are having higher concentration over the zones on the substrate, which indicates the amount of current distribution and concentration on the surface of the antenna.

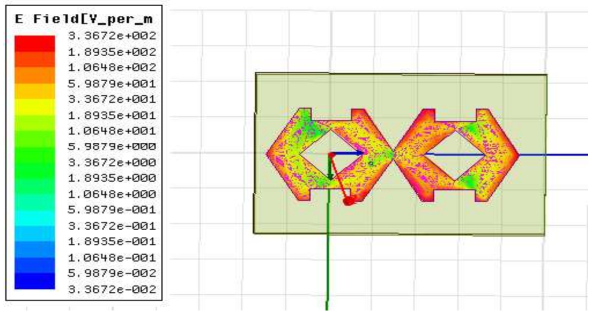


**Fig. 8. CURRENT DISTRIBUTION**

**TABLE I. PARAMETRIC STUDY**

| Frequency | 0.85GHz | 2.05GHz | 2.55GHz |
|---|---|---|---|
| Return loss | -19.64dB | -31.48dB | -24.91dB |
| VSWR | 1.2 | 1.0 | 1.1 |
| Bandwidth | 80MHz | 200MHz | 100MHz |
| Gain | 0.98dB | 6.03dB | 0.98dB |

**CONCLUSION**

A design of multiband band suspended antenna have been presented and it is analysed HFSS. The main quality of the proposed antenna is that provides triple band operation at 0.85GHz, 2.05MHZ and 2.55MHZ frequencies and it provides high gain of 6dBi. Moreover, this antenna has a good effectiveness on the totality of the two covered bands UMTS, WLAN and wi-max frequency bands. The thickness of the air gap is chosen such that theshifted responses are brought in the desired range. The proposed wide band antenna generates resonant modes covering the multi-operation bands for DCS/PCS/UMTS/WLAN operations.

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