

# Compact and Efficient Micro-Strip Fed Monopole Antenna for WLAN Application

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**Abstract-** A single band compact micro-strip fed monopole antenna for Wireless Local Area Network (WLAN) application is presented. The proposed antenna design consists of a Y-Shaped monopole antenna with the ring slot and a designed rectangular slot which surrounds the monopole antenna. The experimental result shows that the proposed single band antenna has a return loss of -22.147 dB and band width is 1.2 GHz which lies at a frequency range of about 5.0 GHz to 6.2 GHz tuned at a centre frequency of 5.8 GHz, which can cover the WLAN-5.8 GHz frequency band. Then, the related radiation patterns have been observed at 5.8 GHz. The gain and efficiency of a proposed antenna is 4.43167 dBi and 80.698%.

**Index Terms-** WLAN, Rectangular slot, Ring slot, Micro-strip fed, Single band, Monopole antenna.

## 1 INTRODUCTION

Nowadays, most of the wireless communication systems such as the Wireless Local Area Network (WLAN) and the Worldwide Interoperability for Microwave Access (WiMAX), many interests are focused on the design of antennas with characteristics of compact size, sufficient impedance bandwidth, omni-directional pattern, gain, efficiency etc. To meet these requirements, various types of antenna designs have been reported [1]–[10]. The proposed monopole antenna, which has different configuration Split-Ring Slot [2], a wide open U-slot antenna with combination of symmetrical L-strips [4], Meandered T-shaped monopole antenna [5], Dual-band CPW-fed Y-shaped monopole antenna [6], and the CPW-fed equilateral triangular-ring slot antennas [7].

In this letter, a relatively efficient single band monopole antenna is presented for WLAN application. Measurement shows that the antenna can effectively cover the bandwidth of 0.6 GHz (5.5 GHz-6.1 GHz), which satisfy the requirement both 5.8GHz WLAN bands. The antenna provides a impedance bandwidth of 0.6 GHz with corresponding frequency band 5.50–6.10 GHz, centered at 5.80 GHz, respectively. Although above antenna has many advantages, and there are some performances can be improved. The designs of antenna may increase cost or complexity for practical terminal design in [2][3]; or the overall dimensions of antenna are with large size in [7] and

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## 2 ANTENNA DESIGN

To achieve an effective single band operation for WLAN application from proposed antenna design. The design process of a proposed antenna is shown in Figure 1.

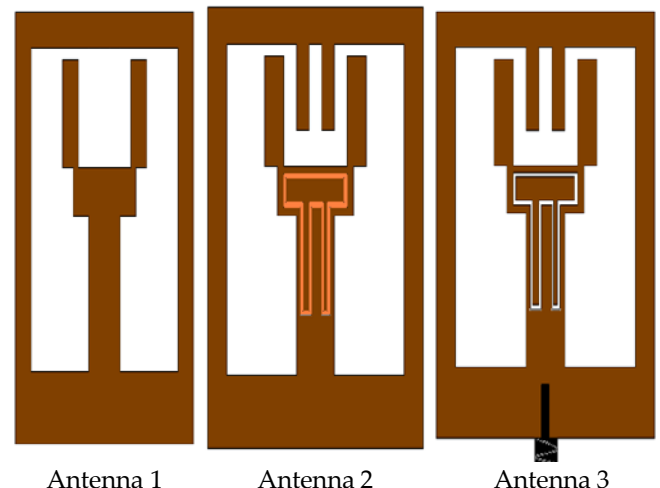


Fig. 1. Various design process of proposed Antenna

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The antenna is simulated by using the FR4 substrate with the dielectric constant of 4.6, TanD of 0.025 and the thickness of the substrate is 1.6 mm. The copper conductor is placed on the FR4 substrate, which has the thickness of 0.3 mm. Then, the feeding line is given to the bottom side of an antenna which has the characteristics impedance of 50 ohm. In this proposed antenna contains three shapes, first one is monopole antenna which is in the shape of Y-shaped slot surrounds by the rectangular slot. Second antenna is a small n-shaped cut, and it placed at top of the Y-shaped slot, and the split ring slot placed on the Y-shaped part of the first antenna. Then, the Y-shaped structure extruded by using the split ring slot. Antenna three (proposed antenna) contains all the rectangular slot, n-shaped cut and extruded Y-shaped slot by using the split ring slot. Thus, the third antenna achieves the efficient single band operation at 5.8 GHz for a WLAN application. Then the design configuration for an Antenna 3 (Proposed antenna) is presented in Figure 2.

The dimensions of a proposed antenna are as follows:

Parameters	Dimensions (mm)
W	15
w1	1
w2	2
w3	3
w4	7
w5	1
w6	2
H	22
h1	5
h2	2
h3	4
h4	2
h5	3
h6	5
a1	0.1
a2	1.8
a3	2.0
a4	0.4
a5	6
b1	0.1
b2	1.8
b3	0.2
b4	0.4
b5	4.8

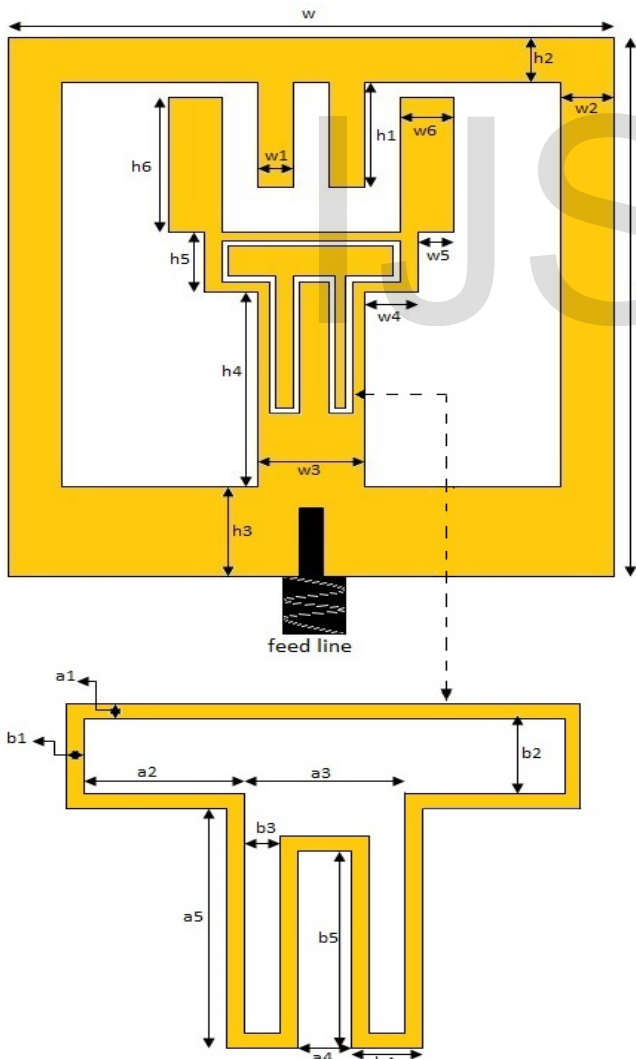


Fig. 2. Geometry of proposed antenna

Table. 1. Optimal dimensions of the designed antenna.

By suitable tuning the geometry parameters of this proposed antenna independently, an efficient single band antenna suitable for WLAN operation at the frequency range of 5.8 GHz is achieved. The antenna performance was simulated using ADS (Advanced Designing System) is prior to its fabrication. The simulated results presented show good agreement.

### 3 RESULTS AND DISCUSSION

Based on the structure of the proposed model, an antenna prototype is simulated. The simulated return loss against the suitable frequency, with the proposed antenna can be resulted. In this proposed antenna, that the split-ring slot could improve the performance at the frequency range of 5.8 GHz band.

After simulation, the resulted return loss is shown in Fig. 3, here the impedance bandwidths for -22.147 dB return loss of the individual operating band is about 900 MHz (5.3 GHz to 6.2 GHz), which covering the centre frequency at 5.8 GHz for WLAN operation band.

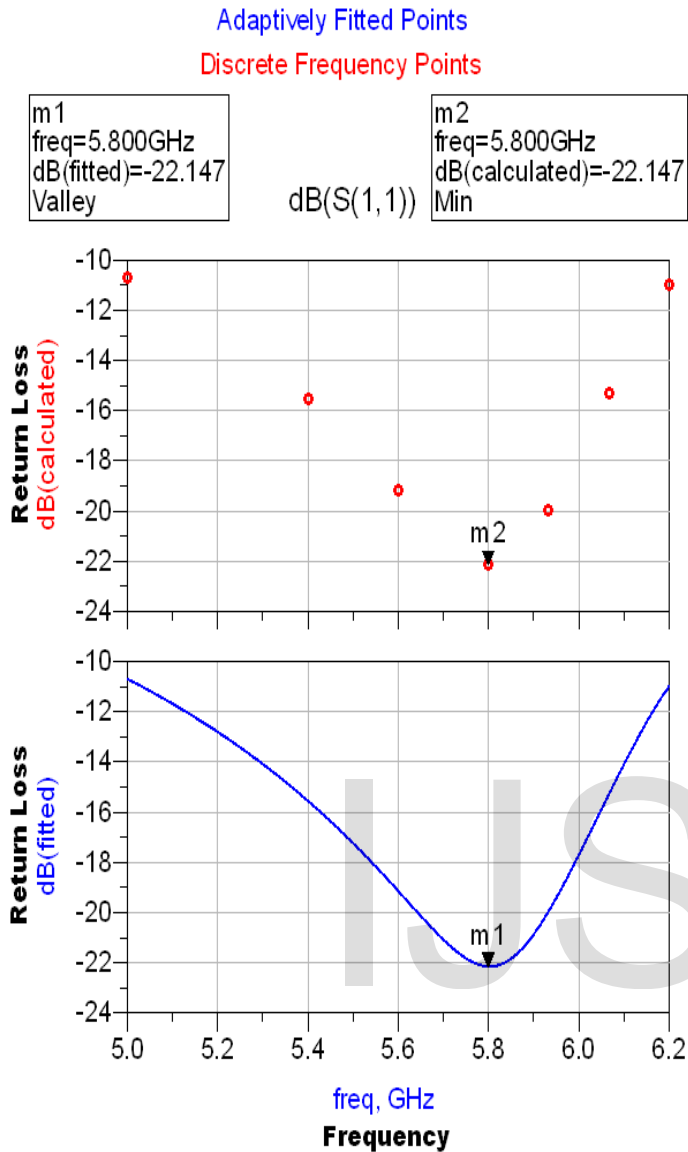


Fig. 3. Simulated return loss for proposed antenna

The different return losses at corresponding frequencies are given as follows:

Frequency (GHz)	Return Loss (dB)
5.0	-10.695
5.2	-13.282
5.4	-15.553
5.6	-19.145
5.8	-22.147
5.9	-19.947
6.0	-15.295
6.2	-10.991

Table. 2. Return loss analysis

The power excitation mechanism of the proposed antenna scenario is shown in Fig. 4, the simulated proposed

antenna produced surface current at the WLAN operating frequency band of 5.8 GHz.

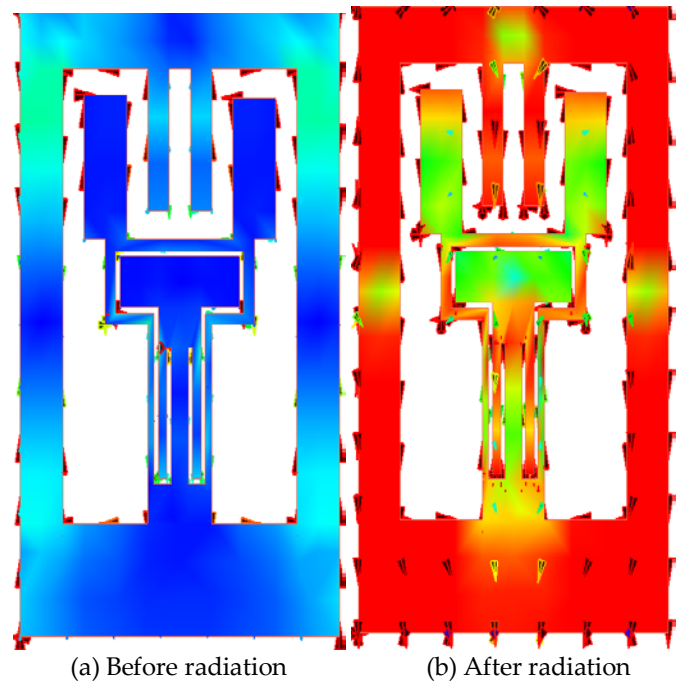


Fig. 4. Surface current distribution and radiations of a proposed antenna.

In Fig. 4(a) and 4(b), blue color represents the no radiation at the starting point of the power distribution, green and red color indicates the minimum and maximum radiation during the effective power distribution. The current distributes mainly along the designed rectangular slot at 5.8 GHz. And the modified rectangular slot acts as a resonator for the lower resonance generation.

At 5.8 GHz, the far field radiation pattern of the simulated antenna is shown in Fig. 5, here the field radiated at all the four sides of the plot and which produces the efficient far field antenna parameters.

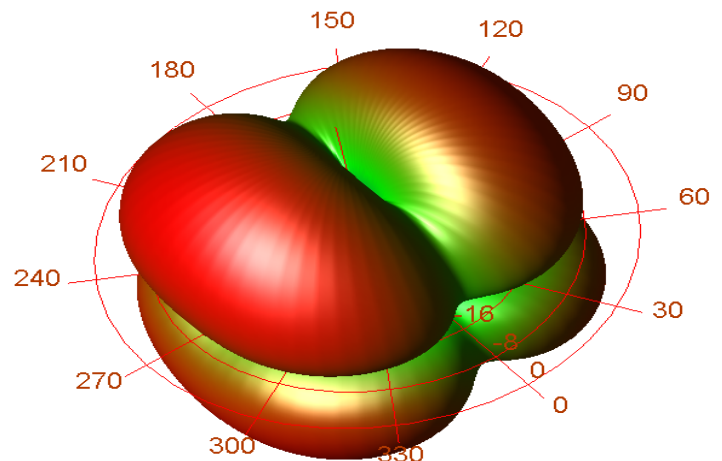
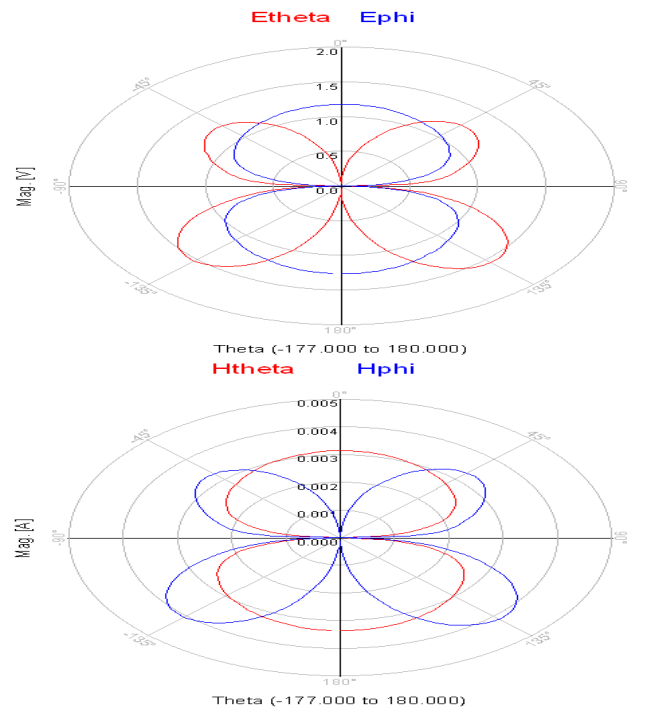
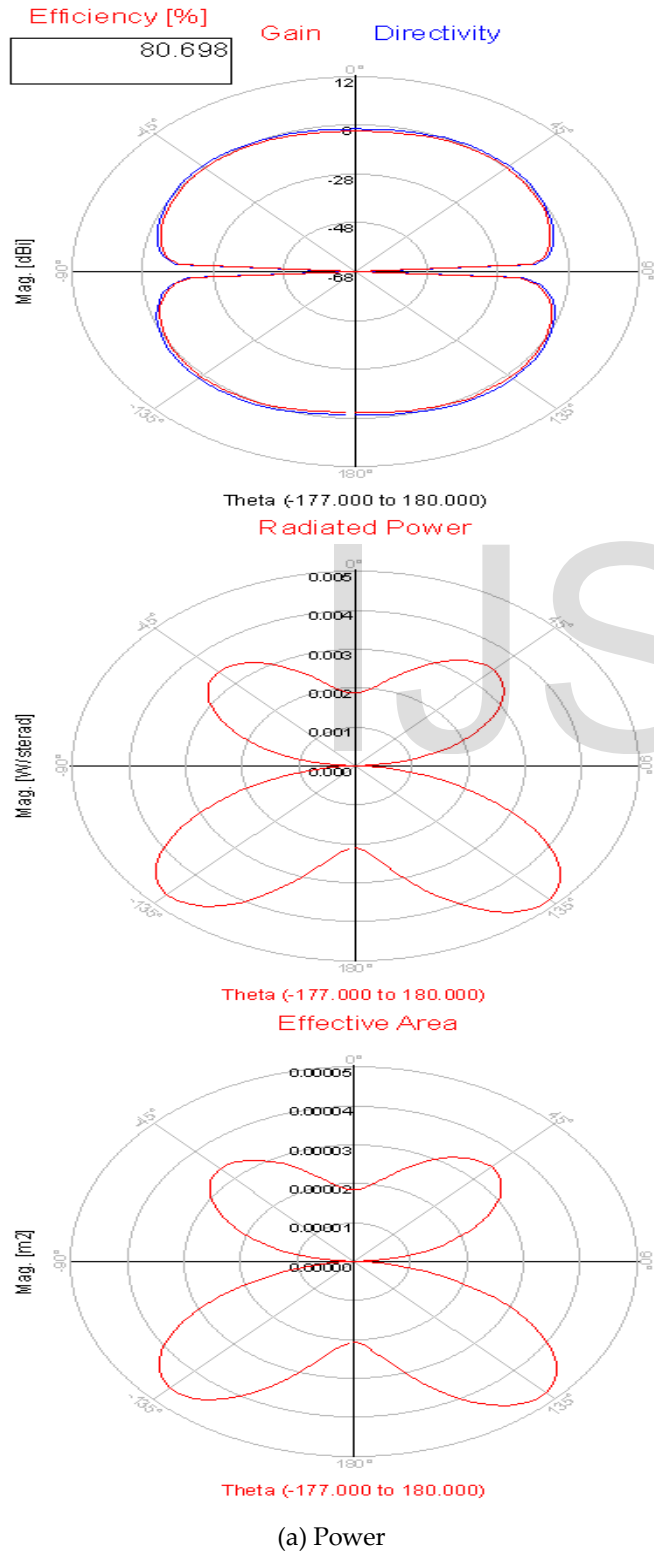
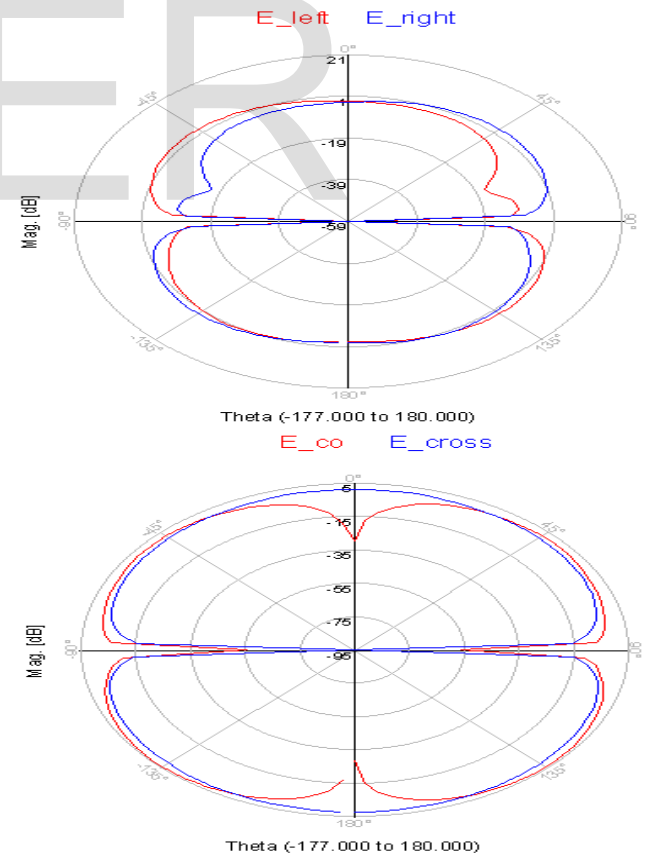


Fig. 5. Overall far field radiation pattern.

The Fig. 6 shows the far field cut of the simulated radiation pattern. The resulted antenna parameters are, the radiated power is 0.219405 watts at the effective angle 3.65518 steradians which produces the gain of 4.43167 dBi and the directivity is 5.36302 dBi. The efficiency of the proposed antenna is 80.698%.



(b) Absolute fields



(c) Circular and linear polarization

Fig. 6. Far field cut of the simulated radiation pattern.

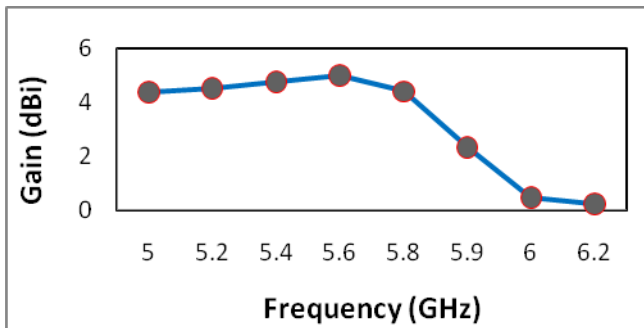


Fig. 7. Gain vs Frequency plot.

These far field radiation characteristics and antenna parameters are revealed that the proposed antenna is suitable and competent for the Wireless Local Area Network (WLAN) application.

#### 4 CONCLUSION

A new micro-strip fed efficient single band monopole antenna has been proposed. By employing and exercising various types of resonant antenna structures in the scenario and later extruding a split ring slot in the y-shaped structure of the monopole antenna the design has been proposed. The proposed antenna can obtain the efficient single band operation in between the frequency range of 5.0 GHz to 6.2 GHz, which can cover the centre frequency at 5.8 GHz band for WLAN application. The layout of the proposed antenna is designed, and then simulated. The observed results show reasonable agreement, due to the better radiation pattern performance and achieves the effective gain in the required band, the proposed antenna is suitable and competent for WLAN application.

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