International Journal of Applied Engineering & Technology

DESIGN OF LOW-PROFILE BROAD BAND ANTENNA FOR IOT APPLICATIONS

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ABSTRACT

In today's market, consumers prefer products that are not only lightweight but also considerably smaller in size. Based on this, a broadband flexible antenna that possesses broadband properties is being created for various wireless applications and low power Internet of Things devices, and it is being implemented on a flexible substrate. This is done in order to satisfy the need of consumers. The antenna that is being presented is a small one that has a wide bandwidth and runs from 4.77 GHz to 8.60 GHz simultaneously. An antenna with a resonant frequency of 5.66 GHz is expected to be constructed. The antenna has a maximum directivity of 3.387 dBi, according to the simulation. 57.33% of the bandwidth is provided by the antenna that is being presented. It is envisaged that the antenna will have a low profile, which will make it especially ideal for Internet of Things applications.

Keywords: Broad Band, Jeans Substrate, Gain, Flexible Antenna.

1. INTRODUCTION

Most of the application of flexible antenna is well suited for healthcare and telemedicine, the reason behind this is that they are flexible and compact. The compact antenna plays a crucial role in the field of satellite communication and mobile communication because their gain and bandwidth are relatively high [1-3].The major developments in the field of modern communication system belong to IoT applications. The devices that are required for proper and reliable communication should be compact, cost-effective, wide bandwidth and energy efficient. Nowadays IOT devices are very much suitable for LTE, WLAN, WiMAX application. Due to exponential growth of world population, the demand for compact devices along with the flexible and light weight antenna module will be increased as well. The small gadgets with these modules are used to improve efficiency and reliability [4-5].

The flexible antenna which is utilized in communication devices covers the frequency range from 2.5-2.69 GHz and 2.4-2.48 GHz. Furthermore, it is expected that contemporary antenna design will be adaptable enough to independently control bandwidth [5-9]. To meet the aforementioned requirements, some well-known approaches have been used including line feed technique, CPW feed technique and introduction of slots in the structure.

In addition to these conventional solutions, the literature also examines the utilization of metamaterial and complementary split ring resonator techniques in order to produce higher gain and reduce cross-frequency interference. An impedance bandwidth that was wide and an enhanced gain were both established by Ahmed et al. [10-15] by the utilization of a magneto-electric dipole antenna. On the other hand, such cross-magneto-electric structures are not ideal for mass manufacturing in the Internet of Things (IoT) due to their size and the precise design constraints that they must meet. It has been established in the literature that there are a great number of CPW-fed antennas, including multiband antennas and antennas with an extra strip for WLAN [16–22]. A significant number of these designs, on the other hand, do not cover all of the essential bands of the spectrum and have huge antenna sizes.

2. ANTENNA DESIGN PROCEDURE

The presented antenna low profile and compact in size having the dimension 47.2 mm × 53.8 mm. The length and width of the rectangular substrate is computed and obtained dimensions are used to get the wide bandwidth. In this paper, line feed technique is used to receive significant

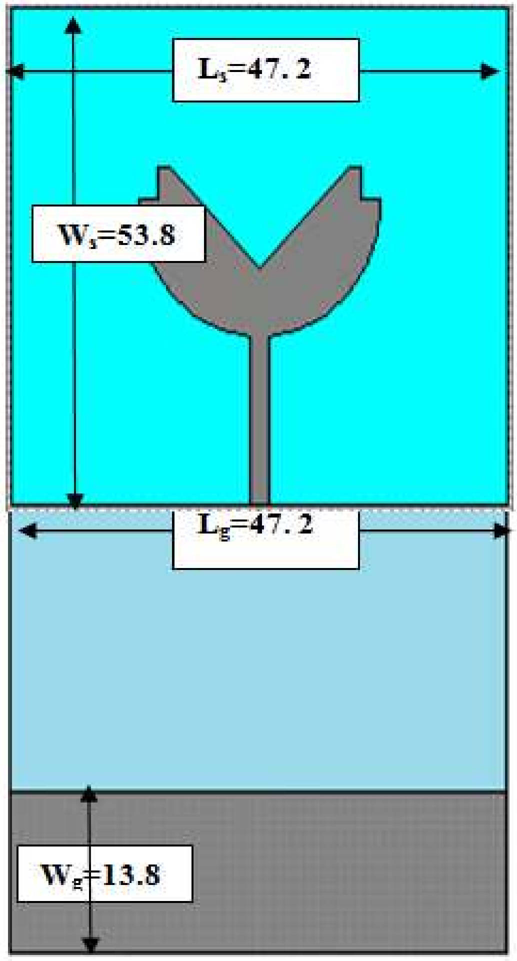

Figure 1: Structure of anticipated textile antenna (a) Front View (b) Back View

large bandwidth and gain. The CST software is utilized for modelling and simulation of the proposed antenna which gives wide band width in operating range from 4.77–8.60 GHz. All The design parameters are shown in table 1. In the antenna design the ground plane plays the crucial role in the improvement of the antenna parameters. Usually the ground plane is infinite while in the present design significant portion was removed and after all we got improved bandwidth and directivity.

Table 1: Designed parameters of presented antenna

Length(L_g)	47.2
Width(W_g)	13.8
Length(L_s)	47.2
Width(W_s)	53.8
Patch Radius (mm)	12
Square Site Slot Length (mm)	10

3. RESULTS AND DISCUSSIONS

When compared to the patch, the ground plane is often larger than the patch. It is not possible to create a ground plane that is literally limitless, despite the fact that the ground plane ought to be unlimited. It is necessary to make a compromise between the size of the antenna and its performance in order to achieve greater radiation performance and a wider bandwidth. The low-profile slotted flexible antenna that was designed using the CST software antenna is depicted in Figure 1. Table 2 and Figure 2 both make it very evident that the broad band widths of 57.33% have been accomplished. There is no doubt about this. At a frequency of 5.66 GHz, the expected flexible antenna will have a maximum directivity of 3.387 dBi, as depicted in Figure 3. Figure 4 depicts the Smith Chart, which is a graphical depiction that provides information regarding the impedance of the connection.

Table 2: Frequency range and Bandwidth of proposed Antenna

Parameters	Cut of Frequency and Bandwidth
f_1	4.77 GHz
f_2	8.60 GHz
Bandwidth	57.33%

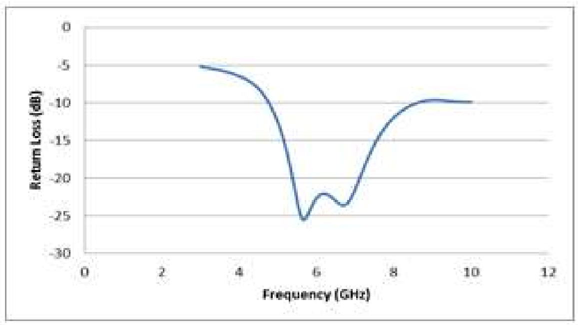

Figure 2: S_{11} parameter of proposed antenna

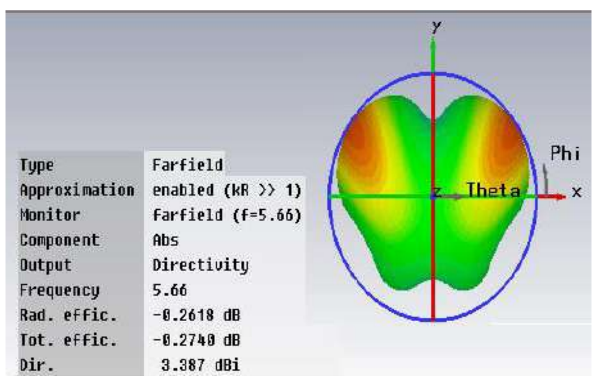

Figure 3: 3-D Radiation pattern at 4.587 GHz

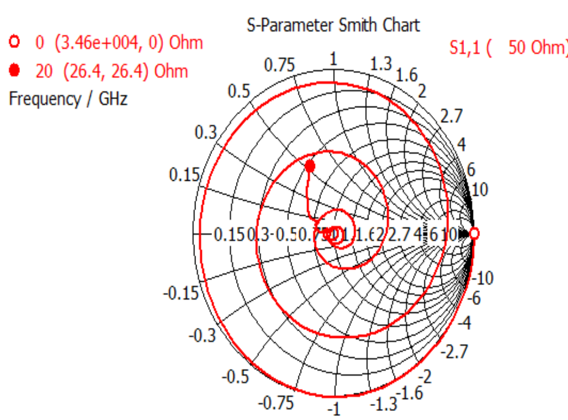

Figure 4: Smith chart of the proposed antenna

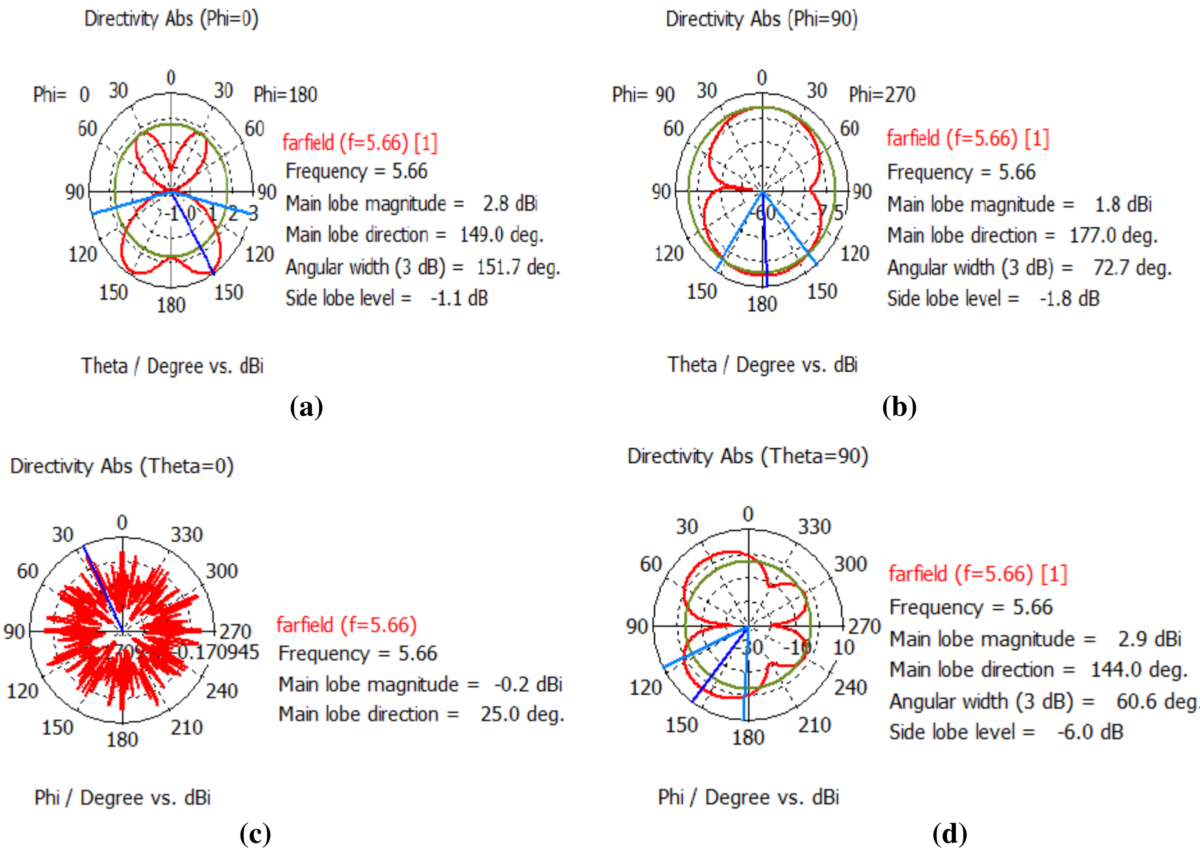

Figure 5: 2-D Radiation pattern at 5.66 GHz (a) with phi=0 (b) with phi=90 (c) with theta=0 (d) with theta=90

4. CONCLUSION

A novel broadband flexible antenna with rounded edges is proposed and implemented. Triangular slot on the patch is introduced to get broadband width of 57.33%. Partial ground technique is used to achieve wide bandwidth from 4.77 GHz to 8.60 GHz to improve antenna gain. The significant improvements have been observed in radiation pattern, directivity and radiation efficiency. The anticipated antenna is compact with wide bandwidth which makes it exceptionally suitable for IoT applications.

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