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Textile Antenna for Wireless Health Monitoring System Applications

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ABSTRACT

An Ultra Wide Band textile antenna along with partial ground is anticipated for health monitoring system. The proposed antenna resonates at 1.9328 GHz frequency and the simulation is performed by CST software and the simulated results of proposed antenna such as reflection coefficient, gain and efficiency is presented. The proposed antenna has been designed, simulated and fabricated. The prototype antenna has also been characterized with reflection coefficient of -41dB. Measured result shows a good agreement with simulated ones.

Keywords: Return loss, VSWR, Efficiency and CST software.

1. INTRODUCTION

Microstrip antenna has numerous beneficial properties which includes low cost, light weight, ease of installation but the main limitations of printed antennas remains their narrow bandwidth features which limits the range of frequency over which the antenna can work effectively. Microstrip antenna comprises three most important parts which is substrate, patch, and ground. The thickness of patch antenna is less than the free space wavelength. One side is radiating patch and other side ground plane and a dielectric substrate sandwiched between it. The conducting patch is placed on the dielectric substrate which is used as radiating element [1]-[4]. On other side of dielectric substrate there is conducting layer used as ground part. Nowadays the fast development of modern communication systems is required for transportable devices for some important features which include easy designing, small in size, compatible with microwave, millimetre wave integrated circuits, less production cost and easy fabrication of microstrip antennas [5]-[8].

Microstrip antenna plays a major role in any wireless communication system. They are used in high performance aircrafts, radar, missiles and other spacecraft. These antennas have attracted the attention of many researchers due to its reward such as light weight, effortless formation, low profile configuration, ease of combination with other circuits and low fabrication cost [9]-[14]. The conventional monopole antenna suffers limited bandwidth and low gain. To overcome this problem researchers have developed various shapes for obtaining large bandwidth. It has many advantages over other microstrip feeing techniques, some of them are as: low distribution, low radiation outflow, and the skill to control the distinctive impedance [15]-[20].

In this article, a prototype of novel microstrip line-fed patch antenna with partial ground is proposed for Ultra Wide Band application. The overall size of anticipated antenna is 90x86x1 mm^3 which operates in the frequency band between 1.39 to 11.79 GHz.

2. Antenna Configuration

The presented antenna is fabricated on low cost jeans substrate with dielectric constant of 1.7 and height of the substrate is of 1mm. The overall size of anticipated antenna is $90 \times 86 \times 1$ mm^3 which operates in the

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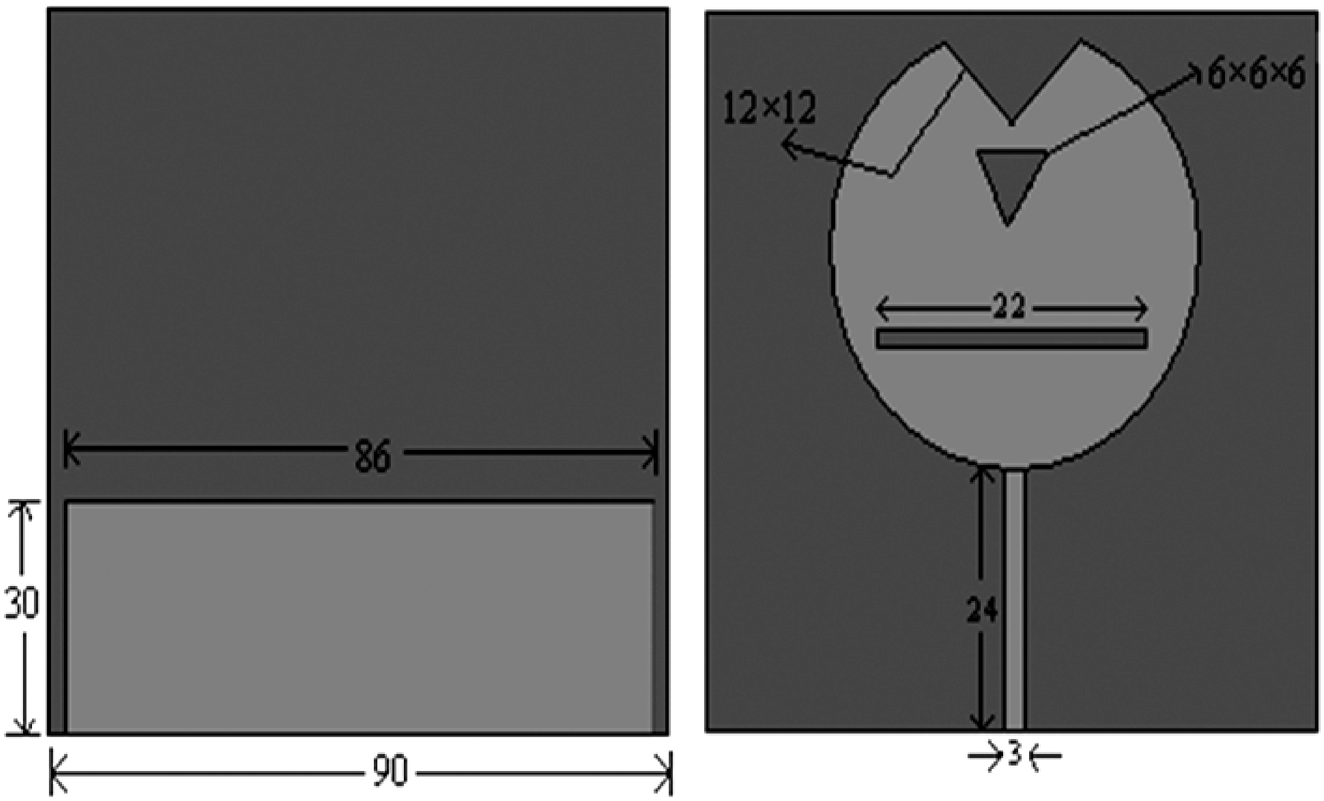


Figure1: Proposed antenna geometry (a) Back view (b) Front View

Table 1
Textile Antenna design specifications.

Parameters	*Values*
Relative permittivity (ε_r)	1.7
Substrate thickness [mm]	1.0
Substrate dimension [mm]	90 × 86
Partial ground plane [mm]	86 × 30
Upper Square slot radius [mm]	12 × 12
Centre triangular slot Dimensions [mm]	6 × 6 × 6
Microstrip feed line	24 × 3

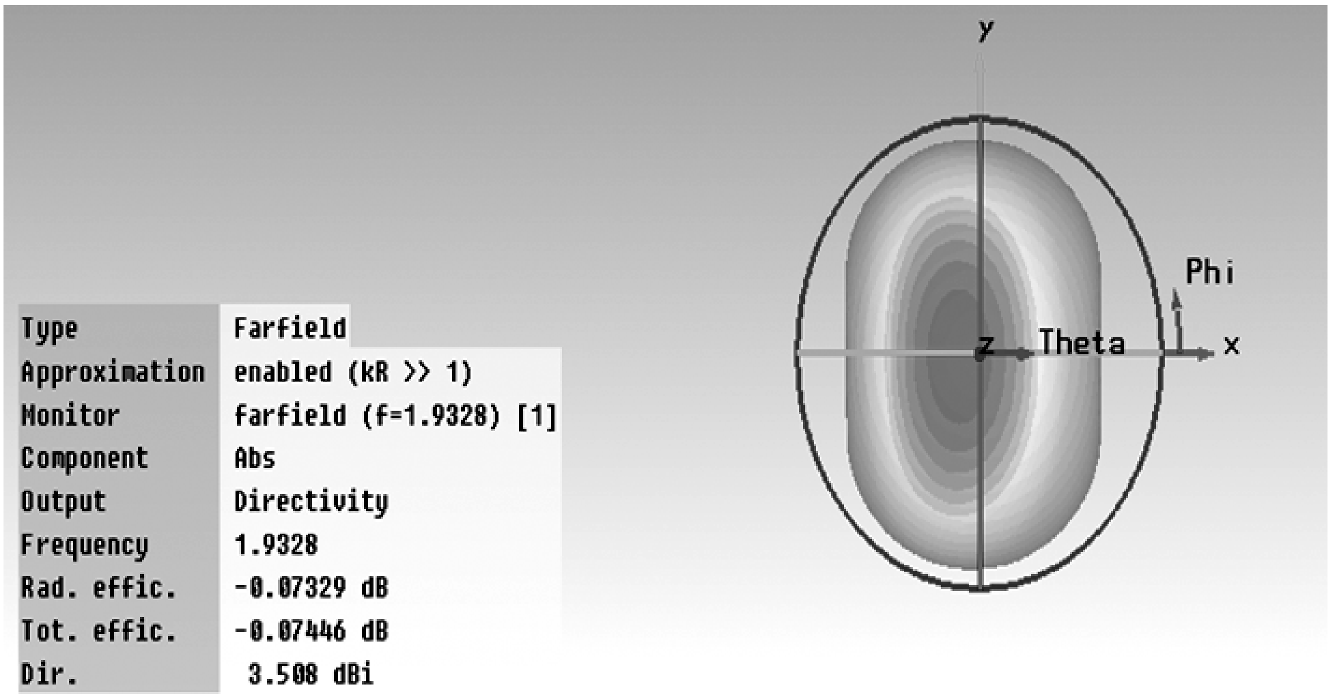
frequency band between 1.39 to 11.79 GHz as a result, the anticipated antenna is suitable for Ultra Wide Band applications. The proposed antenna has two resonant frequencies 1.9328 GHz, and 3.6693 GHz respectively. Figure 1, depicts the schematic configuration of proposed textile antenna for Ultra Wide Band applications.

3. RESULT AND DISCUSSIONS

Figure 2 describes 3D Radiation patterns at frequency 1.9328 GHz & 3.6639 GHz. Figure 3 shows measured return loss vs. frequency of proposed textile antenna. The optimized proposed antenna is resonating at 1.9328 GHz and gives -41dB return loss at resonating frequency. The reflection coefficient verses frequency plot in the figure 1.6 shows that the proposed antenna gives 157.8% large bandwidth with the gain of about 3.5 dBi which is shown in table 2.

Table 2
Performance comparison between the proposed antenna and some existing antennas

S. No.	*Reference*	*Frequency band (GHz)*	*Bandwidth (%)*	*Gain (dBi)*
1	[13] 2013	(3.0-12)	120	2.8
2	[14] 2014	(4.04-7.28)	60.30	3.0
3	[15] 2015	(6.48-9.50)	37.79	8.2
4	Proposed Antenna	(1.39-11.79)	157.8	3.5



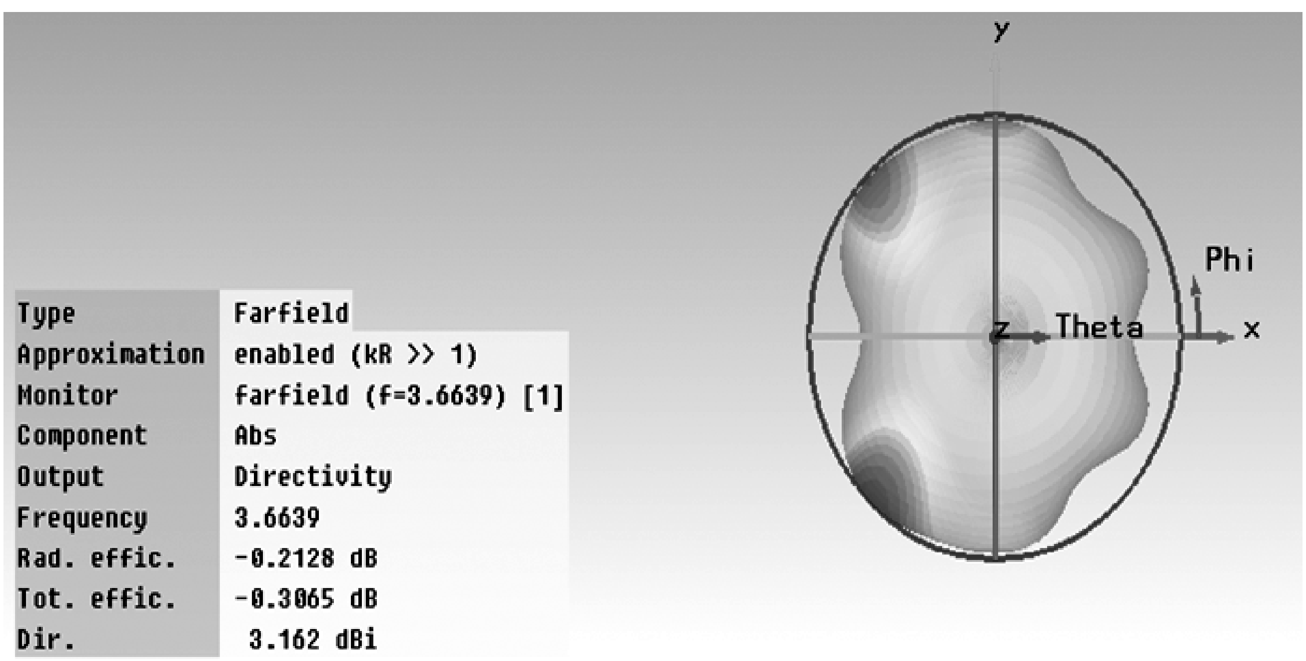


Figure 2: 3D Radiation patterns at frequency 1.9328 GHz & 3.6639 GHz

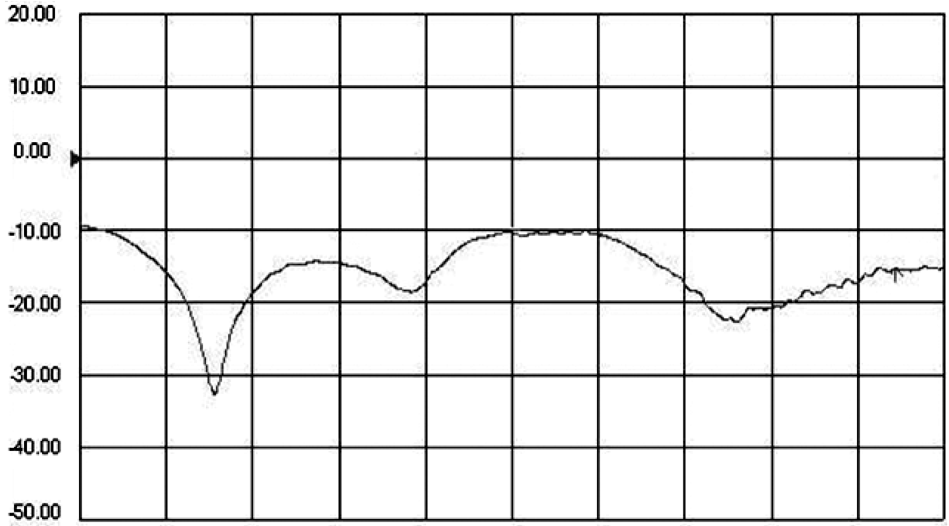


Figure 3: Measured Return Loss vs. frequency of proposed textile antenna

Table 3
Simulated results of gain and efficiency of textile UWB antenna

Frequency (GHz)	*Gain (dB)*	*Efficiency (%)*
2	3.5	89
3	3.1	92
4	2.9	92
5	3.4	94
6	3.3	93
7	2.8	92
8	3.2	88
9	3.4	91
10	3.1	91
11	3.1	93
12	3.1	86

4. EXPERIMENTAL RESULTS

Figure 4 shows the top and bottom view of the fabricated textile antenna. The proposed antenna is fabricated by using the jeans as substrate and copper tape as the conductive patch of the antenna. The fabricated

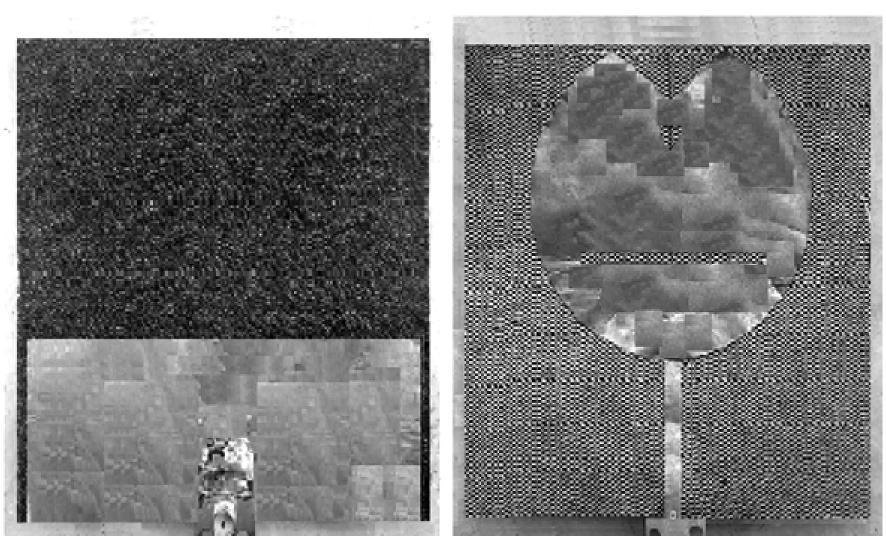


Figure 4: Hardware of proposed antenna (a) top view (b) bottom view

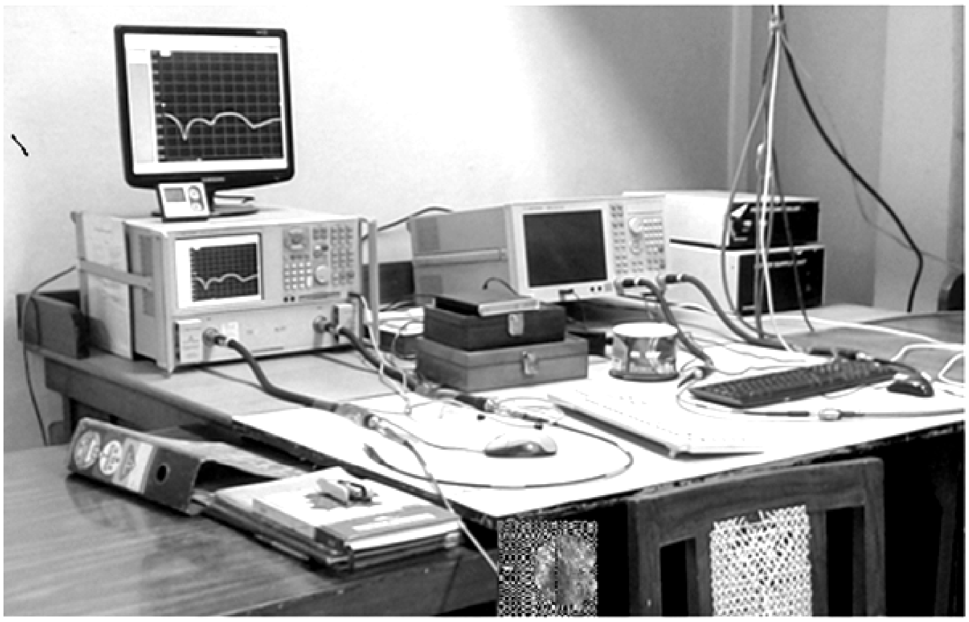


Figure 5: Proposed antenna while measuring results on vector network analyzer

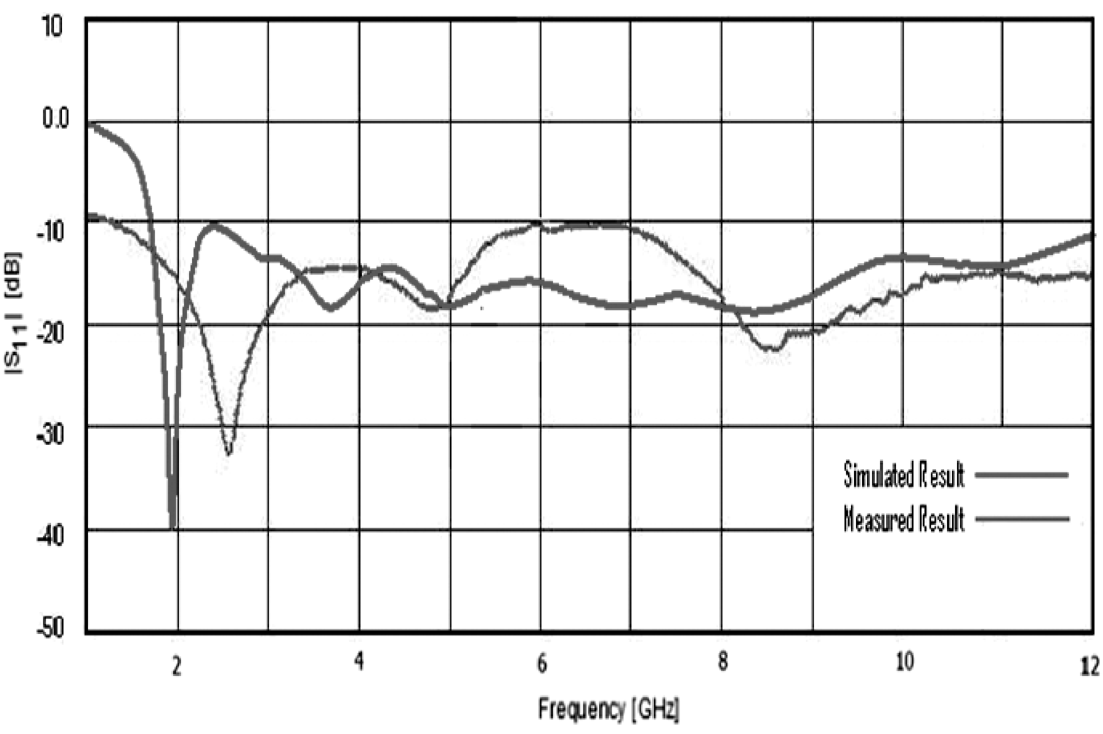


Figure 6: Comparison of Return loss vs. frequency plot of the simulated and measured results of proposed antenna

antenna is tested and the results are recorded. The recorded results are plotted on the graph which shows quite compromising results with the simulated one. Figure 5 shows the proposed antenna while measuring results on vector network analyzer. The comparison of the return loss of both the measured and the simulated antenna is shown in figure 6.

5. CONCLUSION

A textile patch antenna has been designed, simulated, and fabricated for the wireless health monitoring system using CST software. The antenna resonates at the frequency of 1.9328 GHz and the corresponding simulated value of reflection coefficient is -41 dB which suggests that there is good impedance matching at the given frequency range. The proposed antenna is compact in size and simple in design, and also finds application for UWB application.

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