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A Compact Eyewear Microstrip Bluetooth Antenna for Millitary Application

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Abstract: ***In this paper a compact eyewear microstrip Bluetooth antenna for military application is proposed. The microstrip patch is designed to paste on eyeglasses for military applications. The antenna is a wearable specs antenna structure which is able to operate within the 2.40 GHz to 2.485 GHz Bandwidth which is required frequency range for Bluetooth communication system and average gain of antenna is 1.18 dB. The antenna is simulated on LTCC material DuPont 951C2 and simulated results are obtained using Ansoft HFSS. Good unidirectional pattern is obtained for the antenna which is desirable for wearable communication devices for military purpose as well as in HUD and OHMD.***

Keywords: MSA (Micro strip patch antenna), Bandwidth, Wearable antenna, HUD (Head up device), OHMD (Optical Head Mounted Display).

1. Introduction

Microstrip antennas are generally printed antennas which are rigid and hard. The antenna consists of a copper printed at the top and the bottom of dielectric substrate. The copper print on the upper part of the dielectric substrate represents the radiating part and the print on the lower part of the substrate represents the ground plane of antenna.

In this paper in place of solid dielectric substrate, a LTCC material having the required dielectric constant is used. Low temperature co-fired ceramics (LTCC) offers low conductor & dielectric losses, good thermal conductivity, stability and hermiticity. LTCC DuPont 951C2 material is a soft and flexible material[1].

There are applications at present, where the antennas are used in biometric monitoring systems. In order to do this, they need to be so close to the human body all the time so that they can continuously monitor the biometric data and send the information outside world. If the antenna is hard it is not suitable to always keep them attached with the human body as they can make some harm due to their physical structure [2]. If the antenna is made of LTCC material they will not make any harm to human body and will be totally wearable.

In 2006, B. Sanz proposed a Small size wearable button antenna on Velcro substrate operating frequency at 2.4 GHz and 5GHz with an omnidirectional pattern. The radiating structure has the shape and dimensions of a standard denim jeans button [3]. In same year, a UWB wearable button antenna has proposed by same author. The antenna resulted is a rigid wearable antenna structure which is able to operate within the 3.1 GHz to 10.6 GHz bandwidth [4]. In 2012, J. J. Xie designed a Wideband dual polarized patch antenna with electric probe and magnetic feed. Good isolation is obtained by the shorting pin connecting the radiating patch to the ground plane[5].

In this paper simulated results of a compact Bluetooth antenna is presented. The Antenna is designed on LTCC material DuPont 951C2 dielectric substrate (ε_r = 7.8). The antenna resonates at 2.45GHz and covers the Bluetooth frequency band of 2.40 GHz to 2.485 GHz. The observed average gain of antenna is 1.18dB and the radiation pattern is unidirectional.

The rest of the paper is organized as follows: Section II describes geometry of antenna. Section III discusses the simulation results and Section IV concludes the paper.

2. Antenna Design

In this section a Compact size microstrip patch antenna model is proposed on DuPont 951C2 dielectric substrate.

Geometry

Fig. 1 illustrates the geometry of proposed antenna on a dielectric material (ε_r = 7.8) at 2.45 GHz solution frequency. A rectangular patch is modeled on a 3.91 mm thick (fired thickness) & 29.3 x 30mm DuPont 951C2 substrate. An inset feeding of width and length 2 mm and 6.4mm and feed of width 3.6 mm respectively is used. Table 1 shows the parameters of antenna.

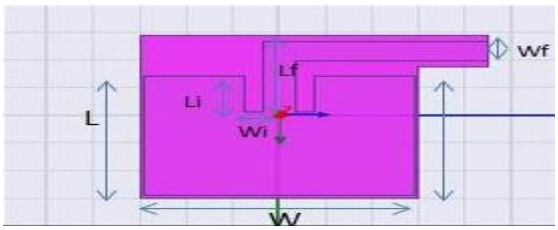

Figure 1: Top view of Antenna

Table 1: Antenna Parameters

Design Parameter	Values
Resonant Frequency	2.45GHz
Substrate Dielectric Constant	7.8
Substrate Thickness	3.91mm
Patch Length(L)	21.5mm
Patch Width(W)	29.18mm
Feed Length(Lf)	12.4mm
Feed width(Wf)	3.6mm

Inset feed length(Li)	6.4mm
Inset feed width(Wi)	2mm

3. Simulation Results and Disscusion

In this section we have discussed optimized results of Compact Size microstrip Bluetooth antenna.

Results

In fig. 2, optimized return loss (S11) is plotted. The resonance frequency of antenna is 2.45GHz and observed return Loss is -20.14dB. Bandwidth of antenna is 2.40 GHz to 2.487 GHz. In fig. 3 Gain vs. frequency plot of the antenna is shown. The average gain of antenna in Bluetooth range is 1.18dB. In fig. 4, the 3D polar plot is shown and it is radiating unidirectional. In fig. 5, the E and H plane radiation pattern is shown it is easily observed that the radiation pattern is unidirectional.

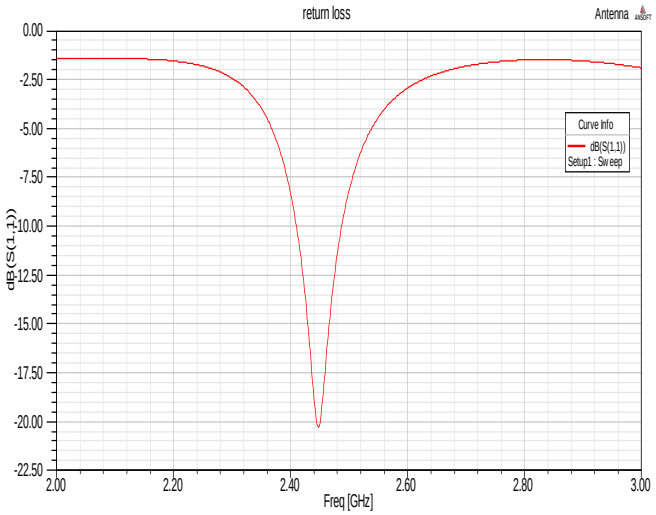

Figure 2: Return Loss Curve (S_{11} vs Frequency)

Discussion

Table 2 shows the results of the proposed antenna. This antenna is Bluetooth in nature and unidirectional. Average gain 1.18dB is calculated for Bluetooth range i.e. 2.40GHz to 2.485 GHz. Although the antenna size is compact so it will be easy to paste it over an eyeglass for military application. This antenna can also be used in HUD and OHMD devices for communication. A patch antenna on eyeglass is shown in figure 6.

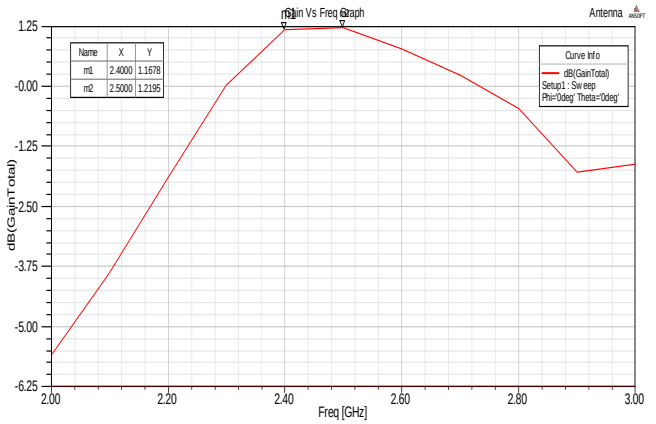

Figure 3: Gain Vs Frequency Curve

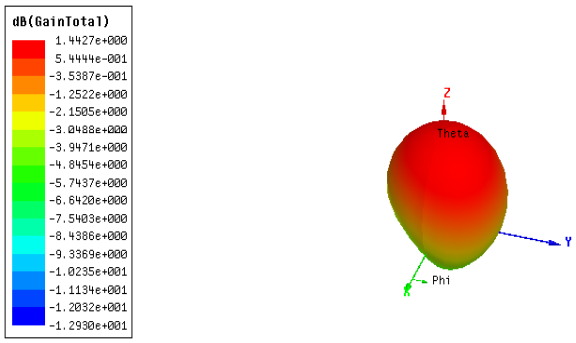

Figure 4: 3D polar plot curve

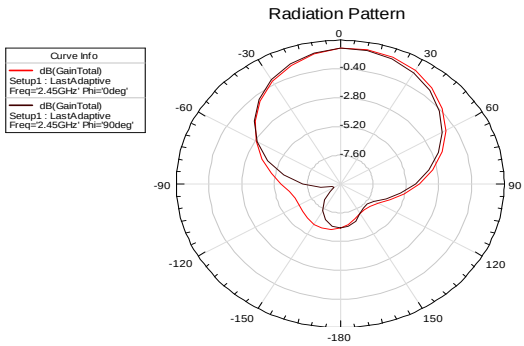

Figure 5: Radiation Pattern

Table 2: Results

Antenna	Simulation Results
Bandwidth	2.40 to 2.487 GHz
Average Gain	1.18dB
Radiation Pattern	Unidirectional

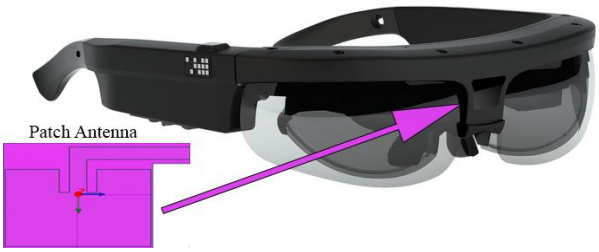

Figure 6: prototype of antenna

4. Conclusion

The Compact Size Microstrip Patch Bluetooth antenna is proposed for wireless communication system for military application. An optimized prototype has been simulated. It has been demonstrated via simulated results that the gain of antenna is good and the radiation pattern is unidirectional very well suitable for wearable application. A further improvement of the designed antenna will be done in near future to provide a more compact size WLAN antenna to increase data transfer rate and its range.

References

[1] A. C. Buena, D. Neculiu, M. Lathi, T. Vaha-Heikkila, "Strip line micro strip patch antenna for 35GHz application", IEEE conference on Semiconductor conference (CAS), Sinaia, 2014.
[2] B. Gupta, s. Sankaralingam and S. Dhar, " Development of Wearable and Implantable Antennas in the Last Decades: A Review", IEEE conference on microwave symposium (MMS) , Guzelyurt, 2010.
[3] B. Sanz – Izquierdo, F. Huang and J.C. Batchelor, " Small Size Wearable Button Antenna ", first European conference on antennas and propagation, 2006.
[4] B. Sanz – Izquierdo, J.C. Batchelor and M. Sobhy, " UWB Wearable antenna", First European Conference on Antennas and Propagation, 2006
[5] J.J. Xie, Y.Z. Yin, J.Ren, and T. Wang, " a wideband dual polarized patch antenna with electric probe and magnetic loop feeds", Progress in Electromagnetic Research, 2012.