The Performance Comparison between CPW-fed and Microstrip Feedline Leather Antenna for UWB Applications

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ABSTRACT: In the area of wearable technology an enhancement of basic microstrip antenna is evolution of wearable textile antenna. A major requirement for wearable textile antenna is its flexible designed materials which incorporates of fabric in the structure. In this paper, the comparison between microstrip line and Coplanar Waveguide (CPW)-fed antenna design is presented. When the Federal Communication Commission (FSS) has allowed the operation of unlicensed ultra-wideband (UWB) thus it attracted research interest in realizing UWB antennas for wireless applications. The proposed microstrip antenna is designed, simulated and analyzed in Computer Simulation Technology (CST) Microwave Studio.The performance of antenna is analyzed for return loss bandwidth, and VSWR. The wide bandwidth and good performance of return loss are successfully achieved by using proposed design which implemented the CPW technique as compared with the transmission microstrip line technique.

Keywords: *CPW-fed; Ultra-wideband; Wearable antenna*

1. INTRODUCTION

Wearable antenna is gaining exceptional popularity nowadays due to their compactness, reconfigurability, flexibility and durability in a variety of wireless communication applications. The potential of wearable antenna in various fields such as for medical, sports, military and many more applications [2] . As for medical example application, these systems functioning to monitor the performance of the body during exercise, monitor the heart rate and blood pressure for medical used by the medical team and for general network connections [3]. Wearable antenna also known as body worn antenna is mostly comfortable and widely been studied on the usage of fabric as substrate.

The vital advantages of wearable antenna are its miniature in size. Because of the miniaturization it can affect the performance of antenna in term of radiation pattern, gain bandwidth, and radiation efficiency [4]. The miniaturization approaches are based on either the geometry or dimension manipulation (size, shape, or design) or the manipulation of material used (using high value of dielectric material, high electrical conductivity). However, the microstrip antenna has a narrow bandwidth. To overcome its limitation of narrow bandwidth, the CPW-fed is presented. In addition, the CPW is preferred because of low dispersion and hence offers the potential to construct wide band. On the other hand, printed slot antennas fed by coplanar waveguide (CPW) have several advantages over microstrip patch antennas. Slot antennas exhibit wider bandwidth, lower dispersion, and lower radiation loss than microstrip antennas, and CPW also provides an easy means of parallel and series connection with active and passive elements that are required for matching and gain improvement [1].

In the next section authors present the dimensions and materials of radiating patch (copper) and substrate (leather). To make the comparison of the microstrip line and CPW-fed both dimensions are remained same.

2. METHODOLOGY

In this paper, the authors propose a comparison performance between microstrip line with the ground plane is on the opposite of the radiating patch and microstrip line with the ground plane in the same place of the radiating patch is attached onto the leather textile material as substrate and the component parameter of that textile are thickness of 1.3 mm, dielectric constant permittivity (ε_r) 1.79 and loss tangent (tan δ) 0.042 [5].

2.1 Microstrip Feedline

Figure 1 illustrates the top view geometry of the microstrip line antenna on the top of leather substrate is copper. Patch width (Wp) 51 mm, patch length (Lp) 8 mm, inset width (Wl) 1.7 mm, inset length (Ll) 5.16 mm ring 1 (R1) 6 mm, ring 2 (R2) 2.5 mm, ring 3 (R3) 3 mm, ring 4 (R4) 1.5 mm, transmission line width (Wt) 2.98 mm, transmission line length (Lt) 5.16 mm, substrate width (Ws) 60 mm and substrate length (Ls) 40 mm.

2.2 CPW Fedline

The CPW-fed wearable microstrip as shown in Figure 2. Top of the leather substrate is copper as a conductor. The CPW-fed is symmetry which similar to left and right where the optimized dimension is 28 mm x 15.5 mm without the ground plane on bottom of the substrate.

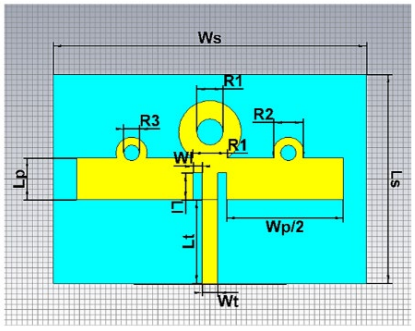

Figure 1 Top View of Microstrip Feedline Antenna

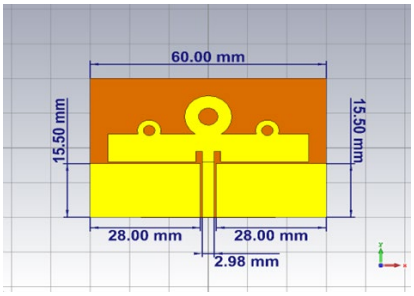

Figure 2 Top View of CPW Fedline Antenna

3. RESULTS AND DISCUSSION

The simulation performance on the microstrip antenna design is simulated using Computer Simulation Technology (CST) Microwave Studio tool. The performance parameters between those two antennas microstrip line and CPW that have been analyzed are return loss (S-11), bandwidth, and Voltage Standing Wave Ratio (VSWR).

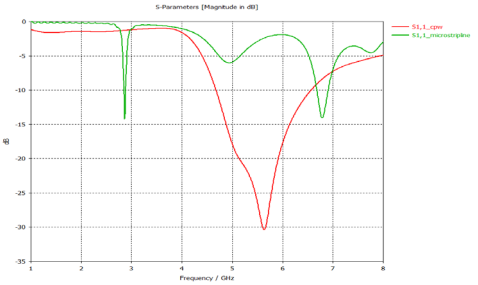

Figure 3 The Plot of S-11 Parameter

The simulated performance value for S-11 for the proposed antennas are plotted as shown in Figure 3. It shows that the CPW-fed (red line) achieved -30.38 dB at operating frequency 5.63 GHz. Meanwhile for microstrip line antenna (green line) having dual-band frequencies at 2.86 GHz and 6.79 GHz and its S-11 values are -14.1 dB and -14.0 dB respectively. For the bandwidth itself the CPW-fed showing wideband bandwidth (from lower frequency 4.68 GHz to high frequency 6.56 GHz). This value allows the antenna covering the -10 dB operating bandwidth of 1.88 GHz, that's means the antenna is suitable for UWB applications which lies under range 3.1 GHz until 10 GHz.

Another performance of antennas is VSWR. The value between 1 and 2 is significant because it ensures that the antenna is matched to the transmission line and that the antenna receives more power. For both antennas it lies under the acceptance values as shown in Fig. 4.

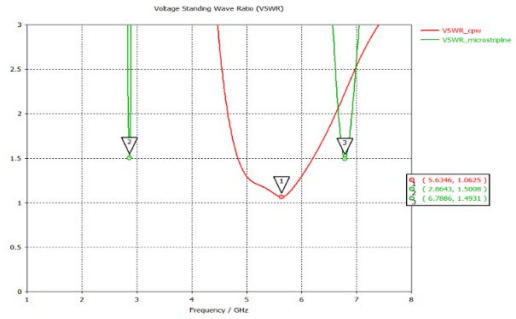

Figure 4 The Plot of VSWR Parameter

4. CONCLUSION

In this paper, a flexible wearable antenna for both microstrip line and CPW-fed line leather antennas are design, simulated and analyzed. The dimensions for both are similar in order to compare both fed methods. As conclusion it can be said that CPW-fed will having wideband bandwidth as compared to microstrip line antenna. However, in terms of gain the microstrip antenna having higher gain compared to CPW-fed.

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