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Ultra Compact UWB Microstrip Antenna for Use in IOT Sensor

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Abstract—**In this communication, structure of an Ultra Compact, UWB (Ultra Wideband), simple structure, single feed as well as cheap microstrip antenna with two different linear polarizations for using in IOT (Internet of Thing) application is described. According to our approach, antenna compactness is achieved by means of a modified circular patch for current path enlargement and a partial slotted ground providing additional degrees of freedom that help to achieving impedance matching in the whole frequency band. Proposed antenna consists of a circular slotted copper patch and a partial modified ground plane printed on two sides of low cost substrate, FR4-epoxy with dielectric constant 4.3 and loss tangent 0.023. Simulated results provide good radiation characteristics such as omnidirectional radiation pattern, good gain and return loss. The antenna has width impedance bandwidth from 3.1GHz to 11GHz with VSWR<2 as well frequency bandwidth with S<-10 dB. The prototype is fabricated with dimensions of 11 mm width and 15mm length with 1.6 mm thickness (the suggested antenna occupies a small space with footprint of 165$mm2$) and tested for impedance matching and radiation characteristics over a large frequency spectrum. Experimental validation and simulation characteristics are in good agreement.**

Keywords-microstrip antenna,UWB,Dual polarised,IOT Sensor

I. INTRODUCTION(HEADING 1)

Now days, small size become an important design concern for ultra-wideband (UWB) antennas, the main challenges of printed UWB antennas are size reduction, especially for handheld devices and wearable applications regards to antennas are one of integral part of wireless systems. Recently, demands for high data rate wireless has grown up many solutions for this challenge have been suggested; One of solutions is using ultra-wide-band radio spectrum to overcome the challenges. Since the Federal communications commission (FCC) allocated frequency spectrum between 3.1-10.6 GHz for UWB, a considerable literature has grown up around the theme of using compact UWB antenna in such applications as medical applications, surveillance system and, IOT (Internet of Thing), mobile handsets and amative transportation.

Previous studies have reported that miniaturized low-power consumption antenna which can be easily embedded within the sensors' RF circuits are considered essential for portable IOT devices [6-8]. Some of discussed antenna in pervious articles are discussed in [1]-[5]. One of the greatest challenges to designing ultra-compact ultra-wide band (UWB) microstrip antenna is that designing electrically small antenna has many fundamental limitations [9]. For example, miniaturization of the antenna size causes degradation of the impedance matching for the lower frequency and reduction the current path. Perhaps the most common approach to handle this issue is using accurate optimization methods such as modified ground plane (L-shaped stub [8-12], protruded ground plane structure [13], slit below feedline [8], I shaped slots [12]), planar/uniplanar designs [7,11], slot and quasi-slot antenna structures [14,15], as well as the structures with shorting pins [17].

Much research has been conducted on miniaturizing UWB antenna. In this paper, dual-polarized and size reduction of printed UWB antenna using three rectangle slot in ground and seven rectangle slots with two ring slots in patch discussed. The antenna is extremely compact in contrast with most antenna reported in literature; The overall footprint size of suggested antenna is 165 〖mm〗^2. Proposed structure validated both numerically (by High Frequency Structure Simulator (HFSS)) and experimentally, regarding reflection coefficient, VSWR, gain and, radiation pattern. The measurement results are in good agreement with simulation

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II STRUCTURE OF MINIATURIZED ULTRA-WIDE-BAND

Consider a compact microstrip antenna shown in fig. 1. The antenna is fabricated on 1.6 mm-thick FR4-epoxy dielectric substrate (ϵ_r=4.4, Dielectric-Loss-Tangent=0.02). Propose antenna consist of a sloted circle shaped patch fed by a 50-ohm

W_s	L_s	T_s	R_p	R_{s1}	R_{s2}	R_{s3}	R_{s4}	W_s	L
12	1.8	1.6	6	3	2.5	2	1.5	2.2	15
W_{f1}	W_{f2}	L_s	W_{sg1}	W_{sg2}	L_g	L_{sg}	W_f	L_{sg2}	W
0.7	1	1.8	3.2	4.2	4.3	3.7	1.5	4.2	11

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rectangle microstreep feedline printed on top side of substrate and a partial ground plane in the form of modified rectangular slit printed on the bottom. Final design parameters are set out in Table 1(all dimensions are in mm).

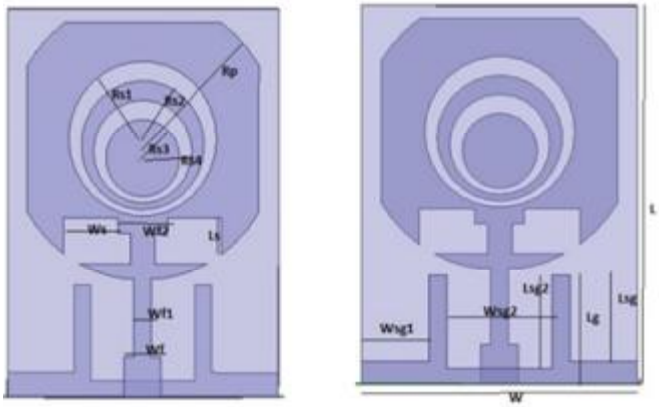


Figure 1

III Results and discussion:

The simulated and measured return loss are illustrated in figure 1 and figure2. As simulated and measure results indicated, the antenna has good return loss in UWB band and fulfill the UWB antenna requirements. Figure.3 shows simulated axial ratio. As proposed in figure.3 the antenna has two different polarizations. The antenna has omnidirectional pattern as illuminated in Figure 4. Antenna has very compact footprint, about 165 〖mm〗^2 ,in comparison with other antenna presented in literature. As depicted in Figure 4. Antenna has linear polarizations.

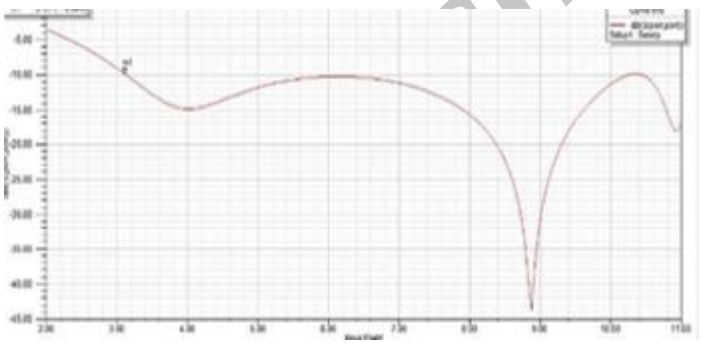


Figure 2

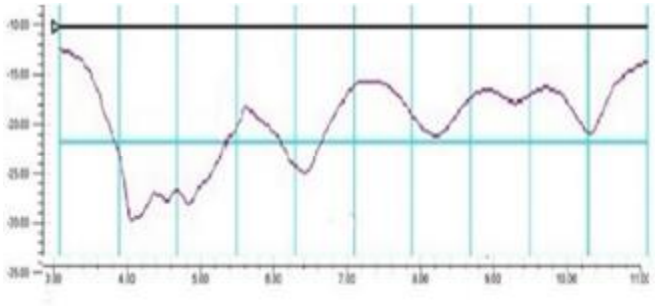


Figure 3

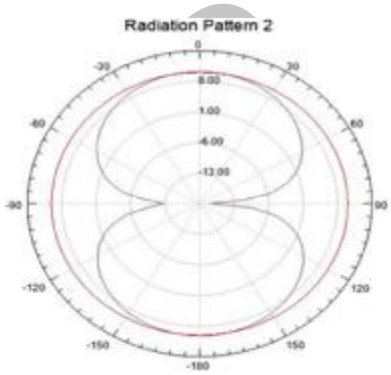
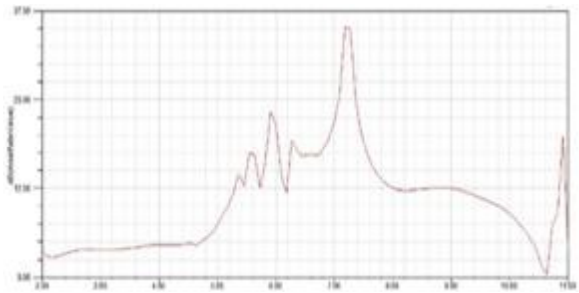


Figure 4



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Conclusion: A new, very compact and linear polarized ultra-wide band microstrip antenna proposed in this paper. An antenna prototype has been fabricated and validated by measuring return loss

References

1 Schantz, H.: 'The art and science of ultrawideband antennas' (Artech
House, Norwood, MA, 2005)

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2 Valderas, D., Sancho, J.I., Puente, D., Ling, C., and Chen, X.:
'Ultrawideband antennas: design and applications' (Imperial College
Press, London, 2010, 1st edn.)
3 Dumoulin, A., John, M., Ammann, M., and McEvoy, P.: 'Optimized
monopole and dipole antennas for UWB asset tag location systems',
IEEE Trans. Antennas Propag., 2012, 60, (6), pp. 2896–2904
4 Li, X., Bond, E.J., Van Veen, B., and Hagness, S.: 'An overview of
ultra-wideband microwave imaging via space-time beamforming for
early-stage breast-cancer detection', IEEE Antennas Propag. Mag.,
2005, 47, pp. 19–34
5 Ning, H.: 'Unit and ubiquitous internet of things' (CRC Press, Boca
Raton, FL, 2013)
6 Chahat, N., Zhadobov, M., Sauleau, R., and Ito, K.: 'A compact UWB
antenna for on-body applications', IEEE Trans Antennas Propag.,
2011, 59, (4), pp. 1123–1131
7 Guo, L., Wang, S., Chen, X., and Parini, C.G.: 'Study of compact
antenna for UWB applications', Electron. Lett., 2010, 46, (2), pp. 115–116
8 Bekasiewicz, A., and Koziel, S.: 'Structure and
computationally-efficient simulation-driven design of compact UWB
monopole antenna', IEEE Antennas Wirel. Propag. Lett., 2015, 14,
pp. 1282–1285
9 Balanis, C.A.: 'Antenna theory analysis and design' (John Wiley &
Sons, Hoboken, NJ, 2005, 3rd edn)
10 Koziel, S., and Bekasiewicz, A.: 'Fast EM-driven size reduction of
antenna structures by means of adjoint sensitivities and trust regions',
IEEE Antennas Wirel. Propag. Lett., 2015, 14, pp. 1681–1684
11 Huang, C.-Y., and Su, J.-Y.: 'A printed band-notched UWB antenna
using quasi-self-complementary structure', IEEE Antennas Wirel.
Propag. Lett., 2011, 10, pp. 1151–1153
12 Li, L., Cheung, S.W., and Yuk, T.I.: 'Compact MIMO antenna for portable
devices in UWB applications', IEEE Trans. Antennas Propag., 2013, 61, (8), pp. 4257–4264
13 Li, J.-F., Chu, Q.-X., Li, Z.-H., and Xia, X.-X.: 'Compact dual bandnotched
UWB MIMO antenna with high isolation', IEEE Trans. Antennas Propag., 2013, 61, (9), pp. 4759–4766
14 Gautam, A.K., Yadav, S., and Kanaujia, B.K.: 'A CPW-fed compact
UWB microstrip antenna', IEEE Ant. Wirel. Propag. Lett., 2013, 12,
pp. 151–154
15 Chu, Q.-X., Mao, C.-X., and Zhu, H.: 'A compact notched band UWB
slot antenna with sharp selectivity and controllable bandwidth', IEEE
Trans. Antennas Propag., 2013, 61, (8), pp. 3961–3966
16 Liu, Y.-F., Wang, P., and Qin, H.: 'Compact ACS-fed UWB monopole
antenna with extra Bluetooth band', Electron. Lett., 2014, 50, (18),
pp. 1263–1264
17 Wong, S.W., Huang, T.G., Mao, C.X., Chen, Z.N., and Chu, Q.X.:
'Planar filtering ultra-wideband (UWB) antenna with shorting pins',
IEEE Trans. Antennas Propag., 2013, 61, (2), pp. 948–953
18 CST Microwave Studio, ver. 2014, CST AG, Bad Nauheimer Str. 19,
D-64289 Darmstadt, Germany, 2014
19 Roshna, T.K., Deepak, U., Sajitha, V.R., and Mohanan, P.: 'Coplanar
stripline-fed compact UWB antenna', Electron. Lett., 2014, 50, (17),
pp. 1181–1182

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