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COMBINATIONAL STRUCTURE OPEN SLEEVE ANTENNA FOR MULTIBAND APPLICATIONS

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ABSTRACT

A coplanar waveguide (CPW) feed multiband combinational structure antenna with open sleeve structure is proposed. Radiator is combined by three parts in which the first part is fed by central feeder line directly, and the other two parts are fed by electromagnetic coupling through slots. This structure helps broaden the bandwidth in a great extent. Meanwhile, an open sleeve structure is also adopted on the ground to achieve broadband and multiband characteristics. The proposed antenna has a small size of 30 × 24 × 0.8mm3 and covers a frequency band from 3.28GHz to 5.85 GHz for return loss less than −10 dB, which is 56.3%. The peak gain of the antenna is 3 dB which appears at 5 GHz.

Keywords: Sleeve, feeder, slots, return loss, peak gain, size, HFSS software

I. INTRODUCTION

Communication systems such as the global position systems (GPS) and vehicular communications require low profile antennas capable of multiple-frequency operation with a single radiating structure and almost omni-directional radiation pattern. The microstrip antenna is the most popular antenna in these applications, and many microwave strip line (MSL) fed antennas have been presented [1–4]. CPW fed printed antennas have more advantages than MSL-fed antennas, such as lower radiation loss and wider bandwidth. There have been many attempts at the design of CPW-fed printed antennas operating at multiple-frequency bands [5–18]. While many of these antennas have large size, most of them have adopted similar monopole structures. A multiband antenna with novel combinational structure and open sleeves is proposed in this paper. The feeder line of this proposed antenna is designed to be a gradually changed structure, which benefits impedance bandwidth. Meanwhile, the radiator is combined by three parts, in which the first part is fed by gradually changed feeder line directly, and the other two parts are coupling by slot respectively. This electromagnetic coupling structure has broadened the bandwidth in a great extent. The ground plane is similar to open sleeve structure which is different from the same kind of antennas. This proposed CPW-fed antenna has a very small dimension of 30 × 24 × 0.8mm3 (which is only 0328λ × 0.262λ ×

0.008λ; λ is the wavelength at 3.28GHz.) and covers IEEE802.16WiMAX system (3.3–3.7GHz) and IEEE802.11a WLAN system (5.15–5.825 GHz) synchronously. This proposed antenna also has very good

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dipole-like Omni -directional radiation characteristic. Details of the antenna design and experimental results are presented and discussed.

II. ANTENNA DESIGN

The geometry of this proposed CPW-fed multiband combinational structure antenna is shown in Figure 1. The radiation patches, central feeder line of CPW and ground plane are printed on the same side of

a FR4 substrate which has a size of $L \times W \times H = 30 \times 24 \times 0.8$mm3 and relative permittivity of 4.4, while the other side of this substrate is without any metallization.CPW -fed antennas have wider bandwidth than others, which has been proved in plenty previous researches. Also we know that the width of the slot between the central feeder line and ground plane greatly affects the bandwidth and other radiation characteristics of a CPW-fed antenna according to many simulations, experiments and previous researches. A gradually changed slot is affirmed to be the best candidate to obtain broad bandwidth, so gradually changed central feeder line is adopted. The effect of the gradually changed structure

of the central feeder line is presented in result and discussion part of this paper. In order to achieve better impedance matching, a novel combinational structure radiator combined by three parts is adopted. The first part of the radiator is fed by gradually changed feeder line, and the other two parts are fed by electromagnetic coupling through slots between radiation patches. Because of the broadband

characteristic of electromagnetic coupling feed, the bandwidth of this proposed antenna has been broadened. We can also understand this structure in the way that the first part of the radiator can be considered as the main radiator, and the other two parts can be taken as parasitic elements which can excite more resonant modes thus broaden the bandwidth. The structure of the radiator have affected the antenna characteristic in a great extent. The effect of the radiator structure on the antenna characteristic has also been shown in result and discussion part of this paper. The parameters of this proposed antenna in Figure 1 are presented as follows: L = 30 mm, W = 24 mm, Ws = 0.5 mm, $W1$ = 10 mm,$W2$ = 7mm, $W3$ = 13 mm, Wf = 3mm, $H1$ = 8mm, $H2$ = 6 mm,$H3$ = 3mm, $H4$ = 3.6 mm, $H5$ = 7.1 mm, $Ws1$ = $Ws2$ = 0.2 mm.Compact in size, wide in bandwidth, this proposed antenna is much improved compared with those antennas in previous researches.

III. OPEN SLEEVE:

The sleeve antenna is widely used in mobile communication systems and broadcast systems due to its highly suitable radiation characteristics and mechanical simplicity. In **King** employed the method of images to model the sleeve monopole antenna, while Taylor **used** the variation technique on a similar model . The agreement between Taylor's theoretical and experimental results was poor, as his model was not accurate. The radiation pattern has been investigated by Poggio and Mayes**.**To enhance the bandwidth of the sleeve monopole antenna, the feed point was moved from the ground plane in **variation** of this antenna ***is*** the open-sleeve dipole with straight parasitic wire elements in place of the coaxial sleeve. The effects of the spacing and size of the parasitic elements on the voltage standing wave ratio (VSWR) were determined experimentally by King and Wong in Wunsch ***determined*** the impedance and pattern of the sleeve monopole antenna using a Fourier **series** representation of its surface current. Shan **evaluated the** input impedance of **a sleeve** monopole **above** an

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infinite ground plane by **the** modal-expansion method. GAO **employed** the method of moment to analyze the sleeve monopole antenna over **a** finite ground plane. **A** dual-frequency strip-sleeve antenna was analyzed **using** the FDTD method in **.** Usually, the bandwidth of the sleeve antenna is modified by altering the antenna geometry**. A** sleeve dipole can be approximated by an open-sleeve dipole in which the tubular sleeve **is** replaced by two (or more) conductors close to either side of the driven element. **as** shown in Figure1

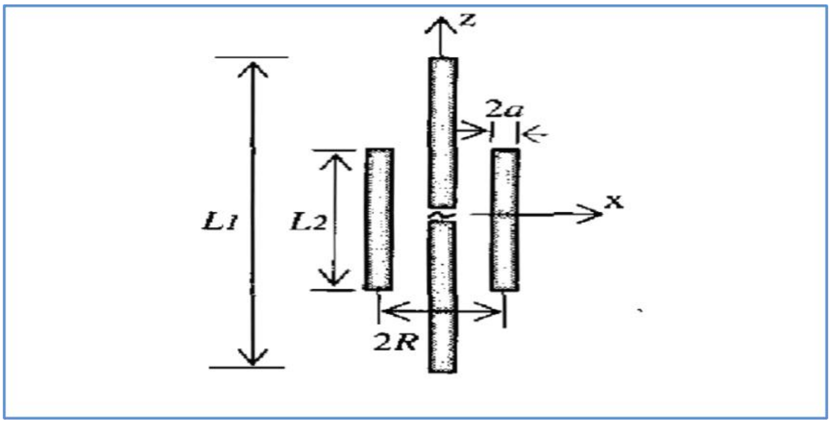
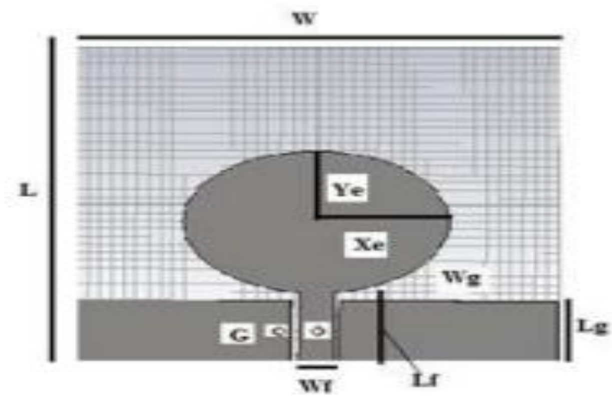
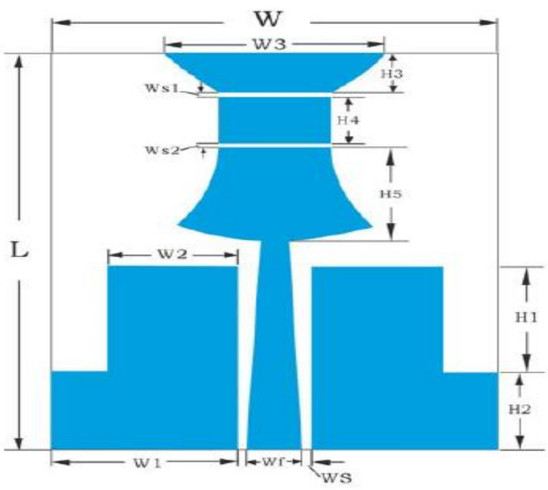


Figure 1. The structure of open-sleeve dipole

Existing method:



Proposed method:



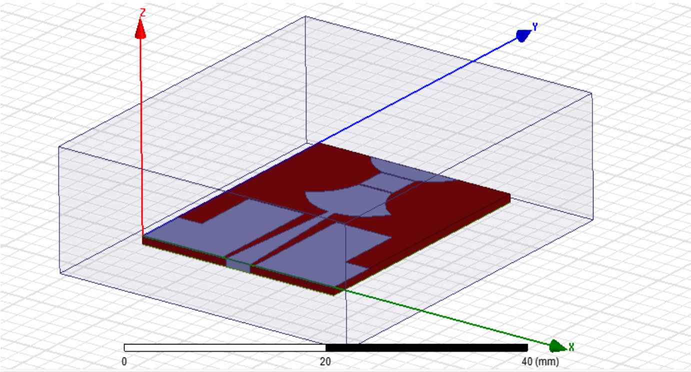
Geometry of proposed CPW-fed antenna.

Measurement Table:

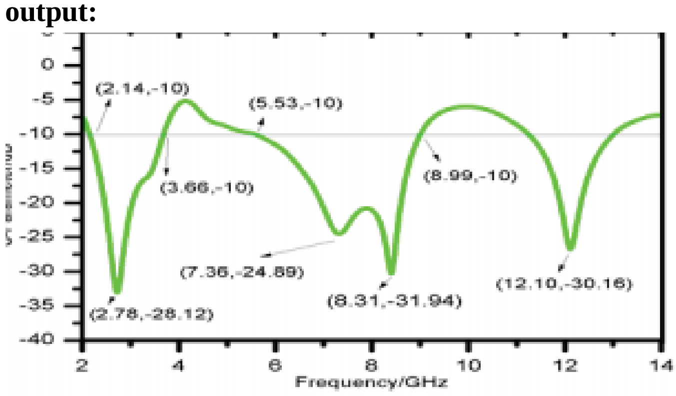
PARAMETERS	VAIUES in mm
L	30
W	24
Ws	0.5
W1	10
W2	7
W3	13
Wf	3
H1	8
H2	6
H3	3
H4	3.6
H5	7.5
Ws1	0.2
Ws2	0.2

IV.RESULTS

4.1 Hfss software design:



4.2 Existing method output:



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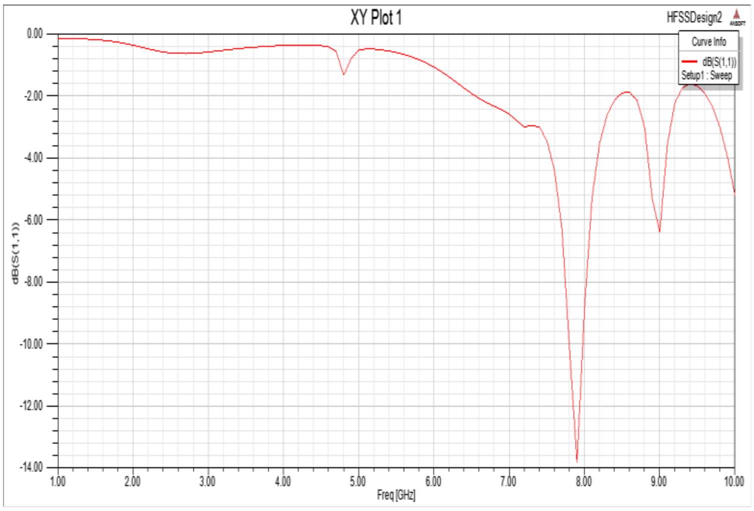
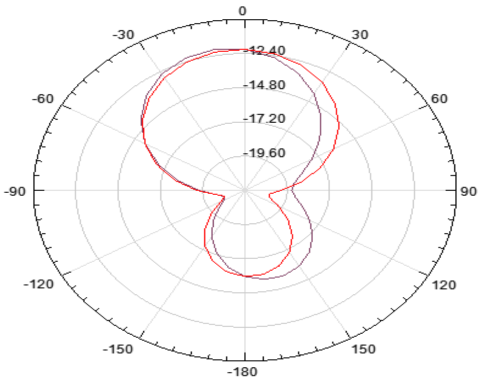
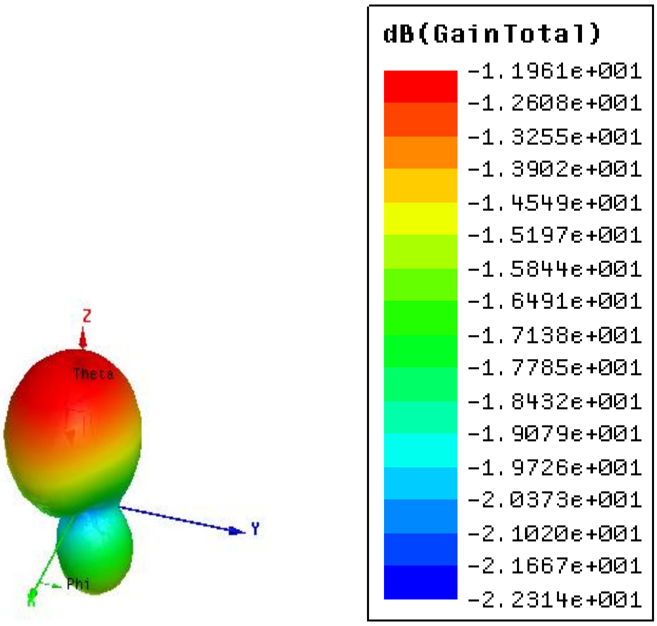
4.3 Proposed method Outputs:



4.4 Polar plot:



4.5 D polar plot:



4.6 Comparisons

Existing method CPW FED PRINTED ANTENNA	proposed method CPW WITH OPEN SLEEVE ANTENNA
1 .Size 40*40*1.59 mm^3	**1. Size 30*24*0.8 mm^3**
2 .Band width 1.8GHz	**2. Band width 2.5GHz**
3. Gain 2.31dB at frequency 4.45GHz	**3.Gain 3dB at frequency 5 GHz**

V. CONCLUSION

A CPW-fed multiband combinational structure antenna with open sleeves has been designed and manufactured. This proposed antenna has a small dimension of 30 × 24 × 0.8mm3 and can support two important communication frequency bands that is x-band and USB.compact in size, broad in bandwidth and omni-directional in radiation characteristics. This proposed antenna can be a good candidate for wireless communication.

REFERENCES

1. Yang, H. and S. Yan, "A novel P-shaped printed monopole antenna for RFID applications," Microwave and Optical Technology Letters, Vol. 51, No. 2, 554–556, February 2009.
2. Song, Y., Y.-C. Jiao, H. Zhao, Z. Zhang, Z.-B. Weng, and F.- S. Zhang, "Compact printed monopole antenna for multiband WLAN applications," Microwave and Optical Technology Letters, Vol. 50, No. 2, 365–367, February 2008.
3. Srifi, M. N., O. E. Mrabet, F. Falcone, M. S. Ayza, and M. Essaaidi, "A novel compact printed circular antenna for veryultra wideband applications," Microwave and Optical Technology Letters, Vol. 51, No. 4, 1130–1133, April 2009.
4. Lin, C.-C. and H.-R. Chuang, "A 3–12 GHz UWB planar triangular monopole antenna with ridged ground-plane," Progress In Electromagnetics Research, Vol. 83, 307–321, 2008.
5. Maeng, J. H., Y. J. Lee, and W. G. Yang, "Design and implementation of UWB CPW-fed planar monopole antenna," Microwave and Optical Technology Letters, Vol. 51, No. 3, 650–653, March 2009.
6. Sujith, R., V. Deepu, D. Laila, C. K. Aanandan, K. Vasudevan, and P. Mohanan, "A compact dual-band modified T-shaped CPW-fed monopole antenna," Microwave and Optical Technolog Letters, Vol. 51, No. 4, 937–939, April 2009.
7. Jiao, J.-J., G. Zhao, F.-S. Zhang, H.-W. Yuan, and Y.-C. Jiao, "A broadband CPW-FED T-shape slot antenna," Progress In Electromagnetics Research, Vol. 76, 237–242, 2007.
8. Krishna, D. D., M. Gopikrishna, C. K. Aanandan, P. Mohanan, and K. Vasudevan, "Compact dual band slot loaded circular microstrip antenna with a superstrate," Progress In ElectromagneticsResearch, Vol. 83, 245–255, 2008.
9. Liu, W.-C., C.-C. Song, S.-H. Chung, and J.-L. Jaw, "Striploaded CPW-fed pentagonal antenna for GPS/WIMAX/WLAN applications," Microwave and Optical Technology Letters, Vol. 51, No. 1,48–52, January 2009.

10. Liu, W.-C., C.-M. Wu, S.-H. Chung, and J.-L. Jaw, “Notched CPW-fed pentagonal monopole antenna for dual wideband operation,” Microwave and Optical Technology Letters, Vol. 50,No. 12, 3104–3108, December 2008.

11. Liu, W. C., “Optimal design of dualband CPW-fed Gshaped monopole antenna for WLAN application,” Progress In Electromagnetics Research, Vol. 74, 21–38, 2007.

12. Song, Y., Y.-C. Jiao, G. Zhao, and F.-S. Zhang, “Multiband CPW-fed triangle-shaped monopole antenna for wireless applications,” Progress In Electromagnetics Research, Vol. 70, 329–336,2007.

13. Li, Z., C.-X. Zhang, G.-M. Wang, and W.-R. Su, “Designs on CPW-fed aperture antenna for ultra-wideband applications,” Progress In Electromagnetics Research C, Vol. 2, 1–6, 2008.

14. Yin, X.-C., C.-L. Ruan, C.-Y. Ding, and J.-H. Chu, “A planar U type monopole antenna for UWB applications,” Progress In Electromagnetics Research Letters, Vol. 2, 1–10, 2008.

15. Choi, S. T., K. Hamaguchi, and R. Kohno, “Small printed CPWfed triangular monopole antenna for ultra-wideband applications,” Microwave and Optical Technology Letters, Vol. 51, No. 5, 1180–1182, May 2008.

16. Lin, D.-B., I.-T. Tang, and M.-Y. Tsou, “A compact UWBantenna with CPW-fed,” Microwave and Optical Technology Letters, Vol. 49, No. 3, 564–567, March 2007.

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17. Gao, G.-P., X.-X. Yang, and J.-S. Zhang, “A printed volcano smoke antenna for UWB and WLAN communications,” Progress In Electromagnetics Research Letters, Vol. 4, 55–61, 2008.

18. Liang, X.-L., S.-S. Zhong, and W. Wang, “Tapered CPW-fed printed monopole antenna,” Microwave and Optical Technology Letters, Vol. 48, No. 7, 1242–1244, July 2006.