Coupled-fed Meandered Loop Antenna for Mobile Phone Applications

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***Abstract* - In this design, a meandered loop antenna with multi-band operation is proposed for 3G (WWAN) mobile phone application. The antenna is fabricated on the FR4 substrate of thickness of 0.8 mm and permittivity of 4.4. The meandered loop antenna coupled by a multi-line monopole produces the lower band (0.824 - 0.960 GHz) and higher band (1.71 GHz - 2.17 GHz) to cover the applications band of GSM850/900/1800/1900, UMTS.**

***Index Terms* — mobile antenna, WWAN, loop antenna.**

I. INTRODUCTION

In recently years, mobile systems are a mainstream of the market of wireless products. How to make a smart phone with a small size and more functions is the most important target of manufactures. The products of laptop [1] and tablet also have the demands. The five frequency bands for WWAN applications include GSM850 (824-894 MHz), GSM900 (880-960 MHz), GSM1800 (1710-1880 MHz), GSM1900 (1850-1990 MHz), and UMTS (1920-2170 MHz). Some designs for mobile phone application have been published in literature. The multi-arm monopole[1] is designed for WWAN systems. Meandered monopole antenna[2] is designed for mobile phone applications. PIFA type antenna[3] is employed for mobile handset. The loop antenna with coupled-feed [4-5] is proposed for wireless applications. In the paper, a meandered loop coupled by multi-line monopole excites five-modes and a 6-dB impedance bandwidth from 0.7997 GHz ~ 1.0542 GHz and 1.706 GHz ~ 2.1722 to meet the requirement of WWAN applications. The overall dimensions of design are 60 × 115 × 0.8 mm^3.

II. ANTENNA CONFIGURATION

Fig. 1 shows the geometry of the proposed antenna and the detailed dimensions of the proposed antenna are listed in Table 1. Fig. 2 shows the portion of the multi-line monopole and Fig. 3 shows the portion of the meander loop antenna. The antenna is fabricated on FR4 substrate with dielectric constant of 4.4, thickness of 0.8 mm, and loss tangent of 0.0245. The size of antenna portion is 60 × 15 mm^2 and the ground size is 60 × 100 mm^2. The multi-line monopole is printed on the front side of the FR4 substrate and the antenna is feed by a 50-ohm microstrip line. The meander loop is printed on the back side of the FR4 substrate and extended from the ground plane. The multi-line monopole is divided into right arm and left arm. The right arm is to be coupled to the meander loop and the left arm is for matching.

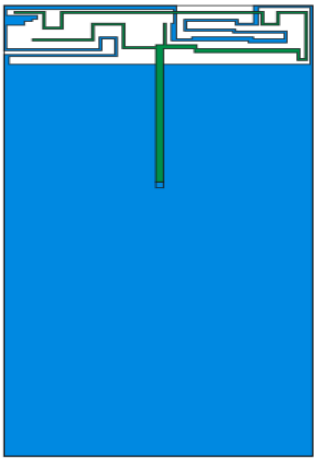

Fig. 1 Geometry of the proposed antenna

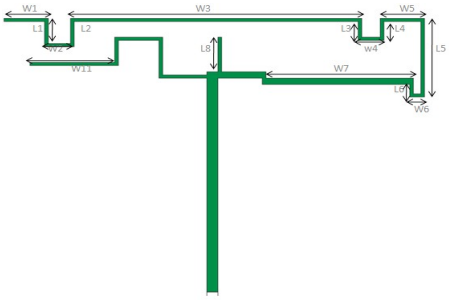

Fig. 2 Multi-line monopole portion

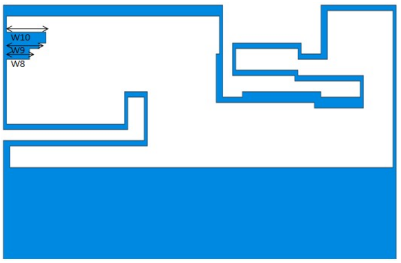

Fig. 3 Meandered loop antenna portion

Table 1.Detailed dimensions of the proposed antenna.

Parameter	Unit(mm)	Parameter	Unit(mm)
W1	6	L1	4
W2	4	L2	4
W3	39.5	L3	3.5
W4	3.5	L4	3.5
W5	6	L5	12.5
W6	2	L6	3
W7	20.5	L7	30
W8	8	L8	5.5
W9	5		
W10	6		
W11	12		

III. Results and Discussion

The design antenna is design and implemented in the paper. Fig. 4 shows the measured and simulated return losses of the proposed design. From the results, both measured and simulated ones show in good agreement to verify the reliability. Measured bandwidths based on 6-dB return loss are from 0.7997 to 1.0542 GHz and from 1.76 to 2.1722 GHz. The impedance bandwidth of the antenna can meet the required bandwidth of WWAN systems (GSM850 (824-894 MHz), GSM900 (880-960 MHz), GSM1800 (1710-1880 MHz), GSM1900 (1850-1990 MHz), and UMTS (1920-2170 MHz)).

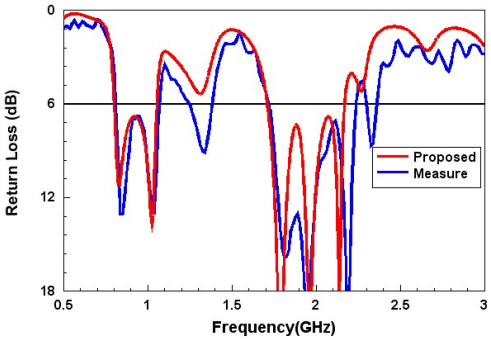

Figure 1. The simulated and measured return losses of the proposed antenna.

Fig. 5 shows the simulated return losses of the proposed antenna with/without the lengths of L6, W6. The parameters (L6, W6) control the amount of coupling. When the L6, W6 has been changed to the proper length as listed in Table 1, the amount of coupling of the multi-line monopole and the loop antenna could generate the best impedance matching. Fig. 6 shows the simulated return losses of the proposed antenna with/without L1, L2, W2. The parameters (L1, L2, W2) affect the impedance near 2.1365 GHz.

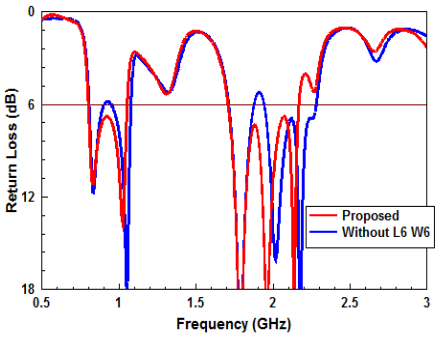

Fig. 5. The simulated return losses of the proposed antenna with/without L6,W6

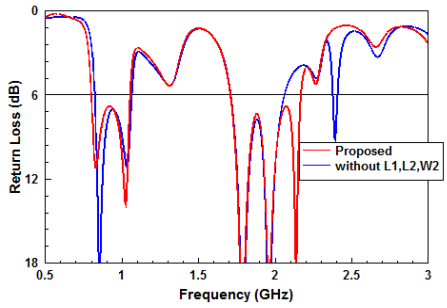

Fig. 6. Simulated return loss of the proposed antenna with/without L1, L2, W2.

IV. Conclusion

The antenna with a multi-line monopole and a meander loop antenna for five-band application has been proposed. The meandered loop antenna coupled by multi-line monopole is easy to implement. The obtained bandwidth can cover the bands of GSM850, GSM900, GSM1800, GSM1900, and UMTS.

Acknowledgment

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V. References

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