

# Meandered loop MIMO Antenna with Neutral line for USB Dongle Application

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**Abstract** - In the paper, the proposed design consists of two symmetrical meandered loop antennas with a neutral line of half-wave length long. By proper choosing the dimensions of the proposed design, a design of MIMO antennas with acceptable performances and isolation can be obtained. From the results, acceptable radiation efficiency and gain, omni-directional radiation, available bandwidth used in WLAN 2.4 GHz, the isolation larger than 15dB are suitable for WLAN dongle applications.

**Index Terms** — Meandered loop, multi-arm monopole, neutral line, MIMO antennas, USB Dongle.

## I. INTRODUCTION

Nowadays, the wireless system has advanced from SISO to MIMO for faster transfer speed and longer transmission distance. Actually, the antennas in MIMO system contain two or more antennas operating in the same frequency bands. Loop antenna [1] with less effect from ground plane and stable characteristics is widely used in wireless applications. In [1], the antenna is fabricated on FR4 substrate; the overall size is 27.5 mm \* 15 mm \* 1.6 mm. The loop antennas are adapted to MIMO antennas have less published in open literature [2]. The antenna published in [2] uses loop patterns and coplanar waveguide-fed to excite mainly low-frequency modes, and then coupling with monopole to adjust mode. For isolation design, neutral line [3-5] are used in some antenna types, such as monopoles, PIFAs. Neutral line inherently is narrow band isolation, but the bandwidth will be enhanced a little.

In the proposed design, two identical meandered loop with a neutral line can form a MIMO antennas with good isolation for WLAN 2.4GHz band. Detailed sizes, antenna geometry, results will be presented and discussed in the next section.

## II. ANTENNA CONFIGURATION, RESULTS AND DISCUSSION

This proposed antenna geometry shown in Fig. 1. It is fabricated on FR4 substrate with thickness of 1.6 mm, relative permittivity of 4.4, and loss tangent of 0.024. The detailed dimensions of the proposed antenna are listed in Table 1. The overall dimensions of 27.5 × 60 mm<sup>2</sup> contain an antenna portion 27.5 × 15 mm<sup>2</sup> and ground plane 45 × 27.5 mm<sup>2</sup>, and a 50 ohm feed-line is used as input RF signal.

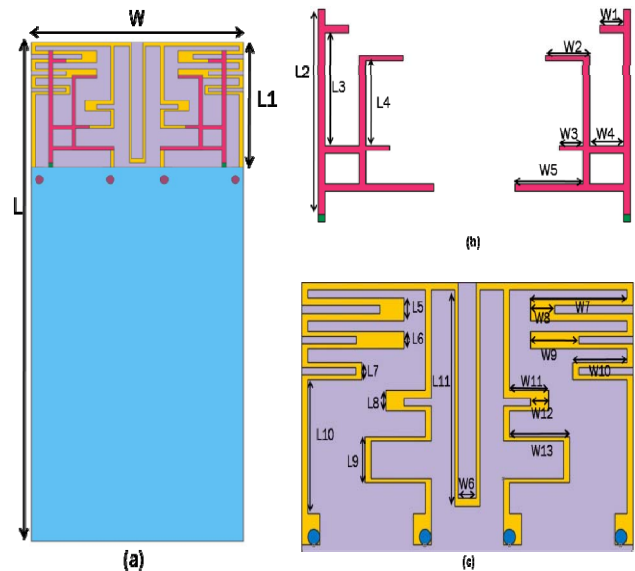


Fig. 1. (a) antenna geometry (b) description of multi-arm monopole portion (c) description of meandered loop portion

In this design, it uses four via(via radius 0.5mm × height 1.6mm) connected to ground plane and four ends of the two loop. A multi-arm monopole coupled with loop structure then frequency resonances the band of WLAN 2.4GHz. By using a neutral line with half-wave length connected the two meandered loops, a design of MIMO antennas with a good isolation larger than 15dB can be obtained.

The measured and simulated S-parameters of the proposed design are shown in Fig. 2. Measured and simulated results are almost the same to ensure the reliability of the design. It can be found that the antenna isolation is larger than 15dB within the WLAN 2.4GHz band.

TABLE I  
ANTENNA PARAMETERS FOR THE PROPOSED DESIGN

W=27.5	W1=1.75	W2=3.25	W3=1.75	W4=2.5	W5=5
W6=1.5	W7=8	W8=2	W9=4	W10=4.5	W11=3.2
W12=1.5	W13=5	L=60	L1=15	L2=13.5	L3=7.5
L4=5.7	L5=1.5	L6=1.1	L7=1.1	L8=1.3	L9=3
L10=8.7	L11=14				Unit:mm

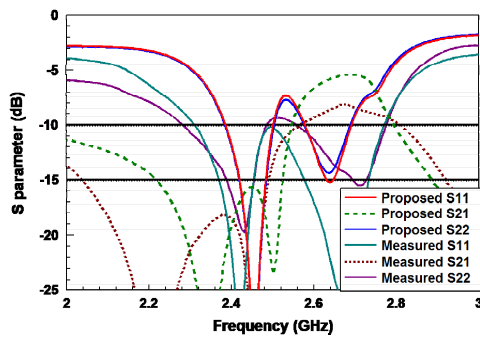


Fig. 2 . Simulated and measured S parameters of the proposed design

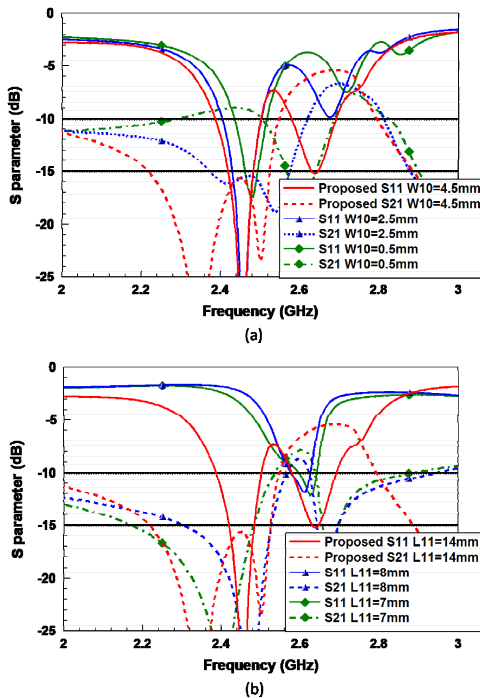


Fig. 3. Simulated S parameters of the proposed antenna (a) in different lengths of W10, (b) in different lengths of L11

The simulated S parameters of the proposed antennas with different lengths of W10 and L11 are shown in Fig. 3. From the results in Fig. 3 (a), it is observed that the length of the meandered will affect the isolation effect and resonant bandwidth of the two antennas. From the results in Fig. 3 (b), it is observed that the length of the neutral line will affect significantly the bandwidth for isolation. Fig. 4 shows the simulated radiation patterns of the proposed MIMO design in X-Y, X-Z and Y-Z planes. The patterns in Y-Z plane show an omni-directional characteristic.

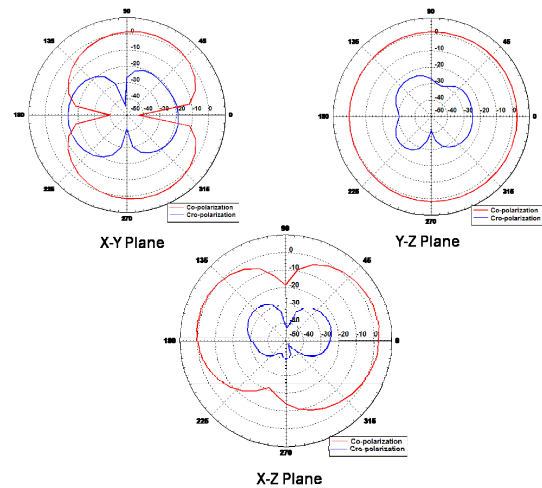


Fig. 4. Simulated radiation patterns for the proposed design

### III. CONCLUSION

The two meandered loop antennas with neutral line between them achieving a good isolation has been implemented and verified. The simulated radiation pattern is omni-directional and the simulated gain and efficiency is also acceptable for USB dongle applications. The MIMO antenna design with good isolation and performances is good for wireless USB applications.

### ACKNOWLEDGMENT

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