Small Sized Wide Band T-Shaped Monopole Antenna with Asymmetric Parasitic Elements

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Abstract

This paper introduces the novel small sized wide band T-shaped planar monopole antenna with asymmetric parasitic elements and describes the simulated and the measured results. The return loss less than -9.54 dB was obtained from 1.8 GHz to 10.6 GHz. The simulated and measured return losses were agreed.

Keywords : Wide band Planar monopole Small size

1. Introduction

The wide band antennas are required to support an increasing number of users in mobile cellular phone and to achieve higher data rates for wireless LAN. For example, a wide band antenna will cover IMT-2000 (1.9GHz-2.2GHz), WiMAX, wireless LAN such as IEEE801.11a (4.9GHz-5.8GHz), b/g (2.45GHz) and UWB (3.1GHz-10.6 GHz). The wide band antennas capable of operating in two or more adjacent frequency band are investigating. [1],[2] And the antennas with parasitic elements to achieve the wide band characteristic have been reported. [3],[4]

This paper introduces the novel small sized wide band T-shaped planar monopole antenna with asymmetric parasitic elements and describes the simulated and the measured results. The return loss less than -9.54 dB was obtained from 1.8 GHz to 10.6 GHz. The simulated and measured return loss were agreed.

2. Proposed antenna configuration

Figure 1 shows the proposed antenna 1 with asymmetric parasitic elements. This antenna was consisted of the T-shaped planar monopole antenna for low profile and two asymmetric L-shaped parasitic elements shorted to the finite-sized ground plane for generating different resonance frequencies. The length of the T-shaped monopole was 33 mm to resonate at 2 GHz band. The length of the left side parasitic element was 11.7 mm to resonate at 3.5 GHz. And the length of the right side parasitic element was 9.9 mm to resonate at 5.6 GHz. By using this asymmetric configuration, it is able to realize the wide band at high frequency band. In generally, the width of the marketed mobile phone was from 48mm to 50mm. By considering the substrate width, the length of the T-shaped monopole W5 was 42 mm. The feed point is the center of the ground plane. The T-shaped monopole antenna is fed by the coaxial cable with 50 ohm.

3. Simulated results

Figure 2 shows the simulated return loss as a parameter of the lengths W6 and H7. The antenna size parameters were shown in Table 1. Five resonance frequencies 2.2 GHz, 3.5 GHz, 5.6 GHz, 6.7 GHz and 8.5 GHz were generated by using the asymmetric parasitic elements. The return loss less than -9.54 dB was obtained from 1.8 GHz to 9.6 GHz at W6=H7=7mm. The required band width for UWB was not satisfied.

To realize UWB bandwidth, the configuration of the ground plane at feed point was changed from the rectangle into the convex shape as shown in Figure 3.

Figure 4 shows the simulated return loss of the proposed antenna 2 as parameters of the H2, H4, H6, H7 and H8. The antenna size parameters were shown in Table 2. By optimizing these parameters, the return loss of the 9.2 GHz became shift to high frequency 10 GHz. Return loss less

than -9.54 dB was obtained from 1.8 GHz to 10.6 GHz as shown red line. So, the required band width for UWB was satisfied by the proposed antenna 2.

Figure 5 shows the simulated current distributions of the proposed antenna 2 at each resonance frequency. By cutting the edge of the ground plane and by using the convex shaped ground plane at feed point, it was understood that the current flow smoothness at each resonance frequency.

4. Measured result

Figure 6 shows the photograph of the fabricated proposed antenna 2 to confirm the simulated results. The proposed antenna 2 was soldered between the center of the T-shaped monopole element and the ground plane by using the coaxial cable.

Figure 7 shows the simulated and measured return loss of the proposed antenna 2 as shown in Figure 3. In measurement, the return loss was deteriorated from 4 GHz-6 GHz and 7.5 GHz-9.5 GHz and return loss was become over -9.54 dB. The measured return loss less than - 7dB were obtained from 1.8 GHz to 10.6GHz. And the simulated and measured return losses were agreed.

5. Conclusions

This paper describes the novel small sized wide band T-shaped planar monopole antenna with asymmetric parasitic elements and the convex shaped ground plane at feed point. The return loss less than -9.54 dB was obtained from 1.8 GHz to 10.6 GHz in simulation. And the return loss less than -7 dB was obtained from 1.8 GHz to 10.6 GHz in measurement. The band width was 134 %. The simulated and measured return losses were agreed.

The proposed antenna size was 42 mm x 45.7 mm. And its antenna can be set into the marketed mobile phone.

The proposed antenna can be used for high speed wireless communication systems such as IMT-2000, WiMAX, IEEE802.11a or b/g and UWB.

References

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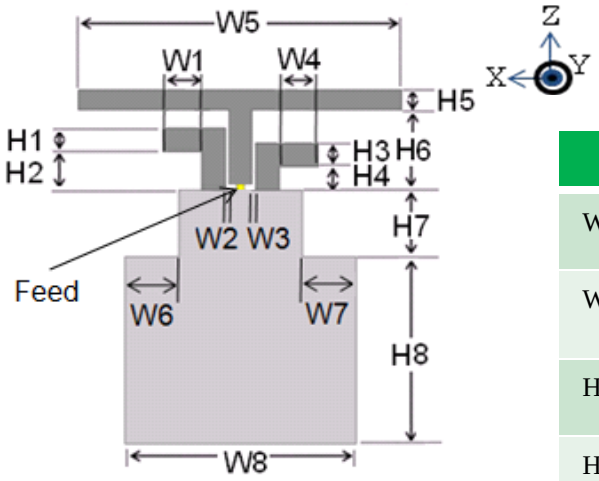

Figure1: Proposed antenna configuration 1.

Table 1 Antenna size parameters.

Parameter Unit:[mm]			
W1=5.1	W2=0.5	W3=0.5	W4=5.3
W5=42	W6=parameter	W7=7	W8=30
H1=3	H2=6.6	H3=3	H4=4.6
H5=3	H6=12	H7=parameter	H8=24.2

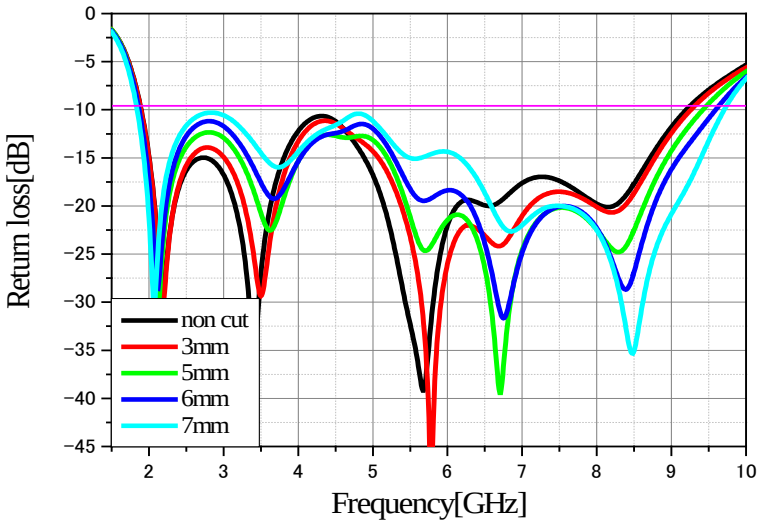

Figure 2: Simulated return loss as a parameter of the lengths W6 and H7.

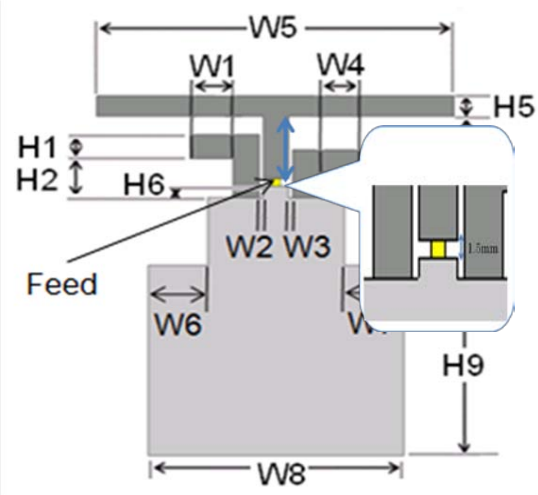

Table 2 Antenna size parameters.

Parameter	**Unit:[mm]**		
W1=5.1	W2=0.5	W3=0.5	W4=5.3
W5=42	W6=7	W7=7	W8=30
H1=3	H2=be 6.6 af 5.1	H3=3	H4=be 4.6 af 3.1
H5=2.5	H6=be 2 af 1.5	H7=be12 af 10.5	H8=be 7 af 8.5
H9=24.2	Feed=1×1		

Figure 3: Proposed planar monopole antenna 2 with asymmetric parasitic elements and the convex shaped ground plane at feed point.

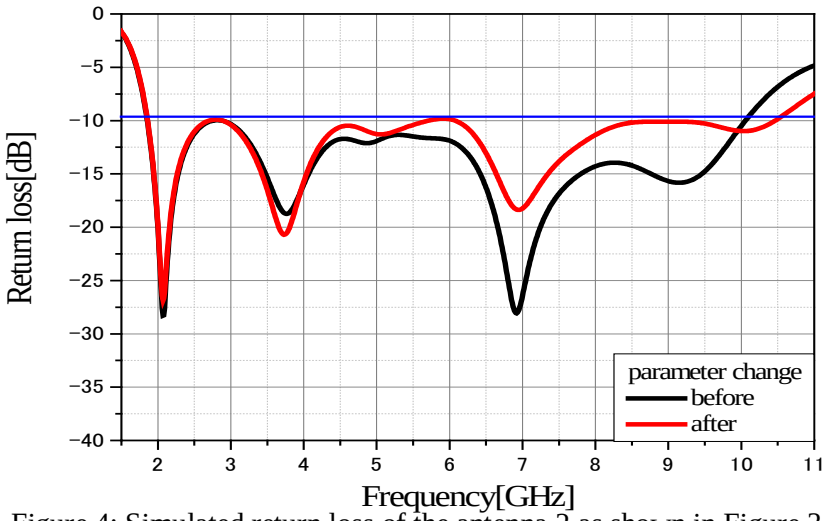

Figure 4: Simulated return loss of the antenna 2 as shown in Figure 3.

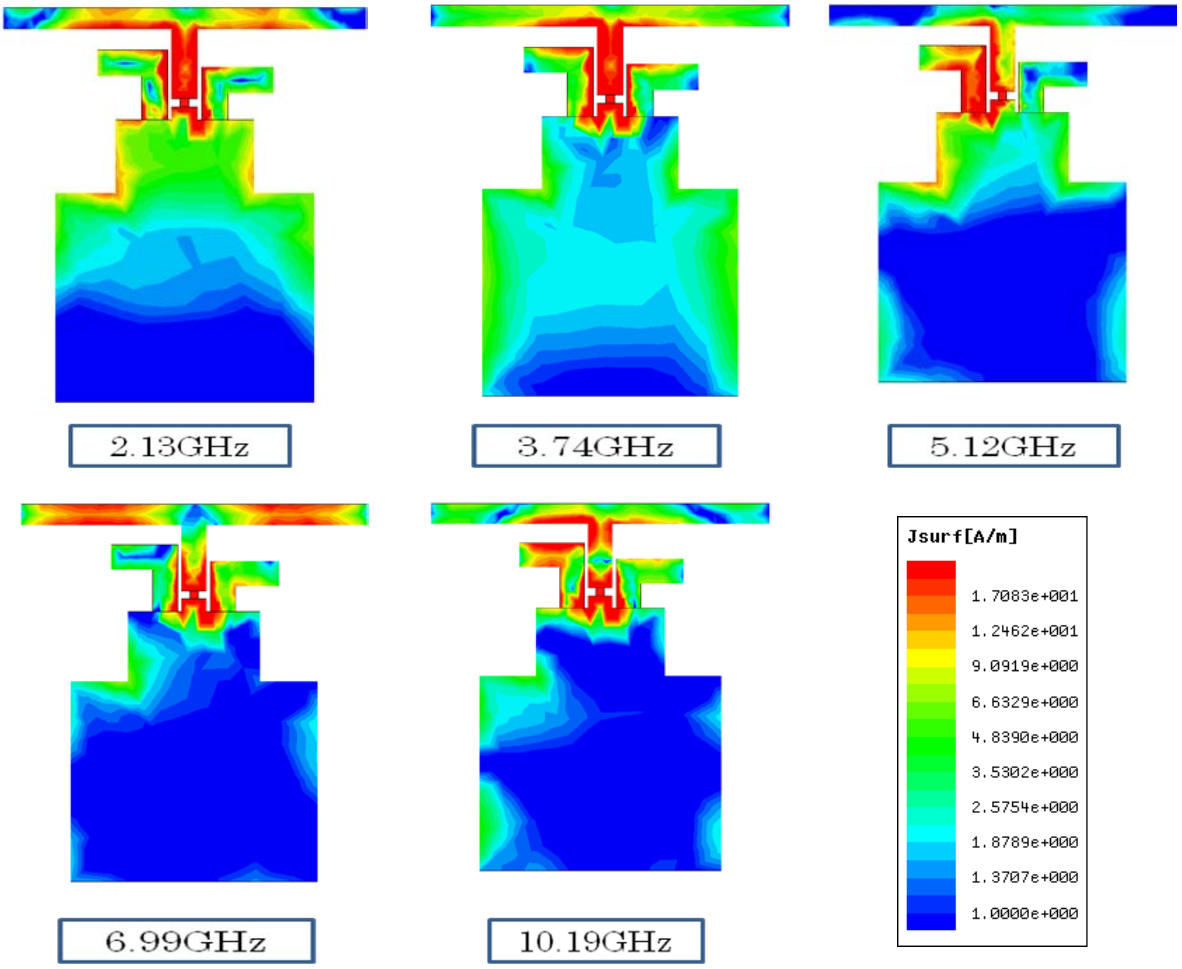

Figure 5: Simulated current distributions of the proposed antenna 2 as shown in Figure 3.

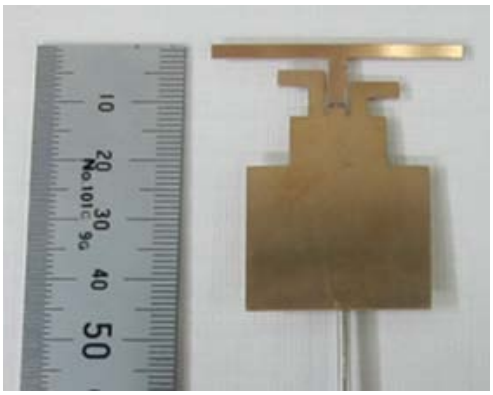

Figure 6: Photograph of fabricated antenna of proposed antenna 2.

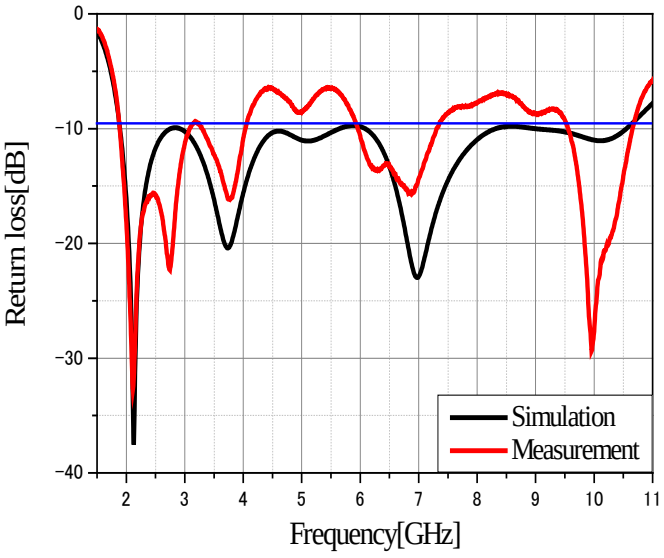

Figure 7: Simulated and measured return losses.