Wide Band Planar Antenna with Asymmetrical Configuration

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***Abstract* – This paper introduces the novel wide band planar antenna with asymmetrical configuration. VSWR less than 2 was obtained from 0.62 ~ 5.8 GHz. The simulated and measured results of VSWR and radiation pattern were agreed very well. The antenna size was 100 x 171 mm.**

***Index Terms* — Wide band antenna, Planar antenna, Asymmetrical configuration, Mobile communication.**

I. INTRODUCTION

Wide band antennas are required to support increasing number of users in mobile communications and to achieve higher data rate for wireless LAN. For example, a wide band antenna is necessary to cover LTE (700~800 MHz band), 3G (900 MHz band and 1.9~2.2 GHz), WiMAX (2.5GHz band) and wireless LAN such as IEEE802.11a (4.9~5.8GHz), IEEE802.11b/g (2.45GHz). Wide band antennas capable of operating in two or three adjacent frequency bands are investigating [1] ~ [4].

This paper introduces the novel wide band planar antenna with asymmetrical configuration and describes the simulated and measured results. The simulated and measured results were agreed very well and wide band was realized.

II. PROPOSED ANTENNA CONFIGURATION

Fig.1 shows the proposed wide band planar antenna with asymmetrical configuration. This antenna consists of asymmetric U-shaped antenna element for low profile and symmetrical finite-sized ground plane. The feed point was shifted from center of ground plane. Many different resonance frequencies were generated by this antenna configuration. The antenna size was 100 x 171 mm. The proposed antenna is fed by a coaxial cable with 50 ohm.

III. SIMULATED AND MEASURED RESULTS

This antenna was simulated by using ANSYS-HFSS. Fig.2 shows the simulated VSWR as a parameter of H7=W9. The parameters of antenna size were shown in Fig.1. In proposed antenna model 2, VSWR less than 2 was obtained from 0.62~5.8 GHz. So, the band width of VSWR less than 2 was 161.4 %. The many resonance frequencies were generated at 0.75GHz, 1.2 GHz, 1.6 GHz, 2.1 GHz, 2.6 GHz, 3.6 GHZ, 4.4 GHz and 5.4 GHz by using the asymmetrical U-shaped antenna element and the offset feed point from center as shown in Fig.1.

Fig.3 shows the simulated current distributions of the proposed antenna model 2 at resonance frequencies 1.5 GHz and 5.5 GHz. The red shows strong current distributions and the blue shows weak current distributions. In Fig.3, the strong currents flows lower side of U-shape antenna and upper side of ground plane. However, the directions of these currents were opposite each other. So, these currents were not contributed for radiation. At 1.5 GHz, the strong current was flows between a and b. The total length from a to b was about $\lambda/2$ (100mm) at 1.5 GHz. On the other hand, the strong current was flows between c and d. The total length from c to d was about $\lambda/2$ (27mm) at 5.5 GHz. The operational mechanism was cleared by these current distributions.

Fig.4 shows the photograph of fabricated proposed antenna model 2. Fig.5 shows the simulated and measured VSWR of proposed antenna. The simulated and measured VSWR were agreed very well. VSWR less than 2 was realized and the band width of VSWR less than 2 was about 160 %. Therefore, the wide band planar antenna was realized.

Fig.6 shows the simulated and measured $E\theta$ radiation patterns at 1.5 GHz and 5.5 GHz. The simulated and measured radiation patterns were agreed very well. And, an omni-directional radiation pattern was obtained at X-Y plane.

IV. CONCLUSION

This paper introduces the novel wide band planar antenna with asymmetrical configuration. The VSWR less than 2 was obtained from 0.62 ~ 5.8 GHz. The simulated and measured results of VSWR and radiation pattern were agreed very well. The antenna size was 100 x 171 mm. So, the proposed antenna is suitable for mobile communication systems in underground use.

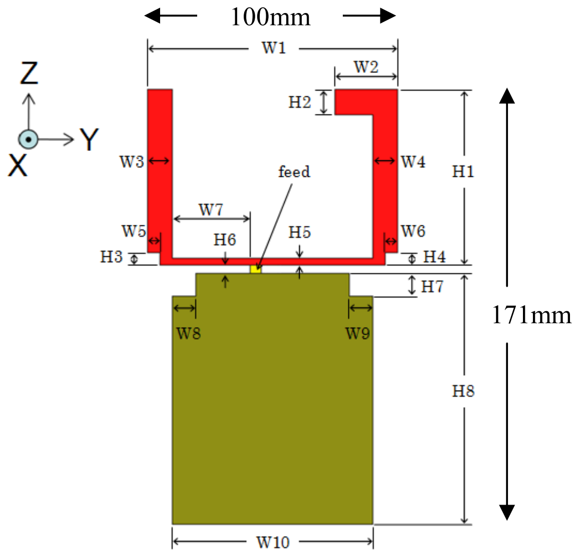
REFERENCES

[1] G.Perikos and J.M. Rigelsford, "A Broadband Antenna for AMPS+GSM Applications," 3d European conference on Antenna and Propagation, pp.2083-3806, March, 2009.

[2] S. Sugimoto and H. Iwasaki, "Wide Band Planar Monopole Antenna with asymmetric Parasitic Elements," EuCAP2010,Thur-6, April,2010.

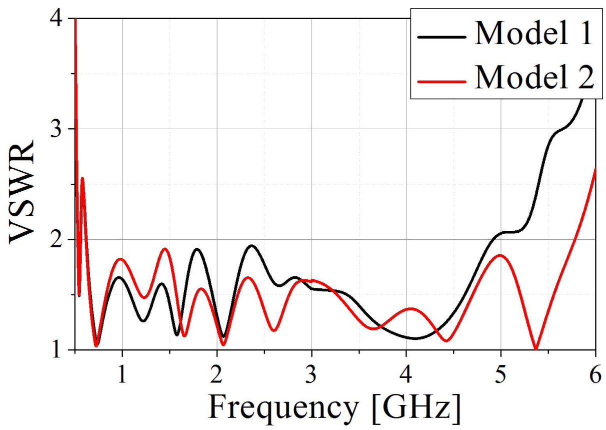
[3] T. Sugiyama , Y. Watanabe and H. Iwasaki, "Small Sized Wide Band T-shaped Monopole Antenna with Symmetric Parasitic Element," ISAP2011,

[4] A. Furuta, T. Iwase and H. Iwasaki, "Low profile Multi Band Antenna for Underground," ISAP2011, FrP1-34,Oct.



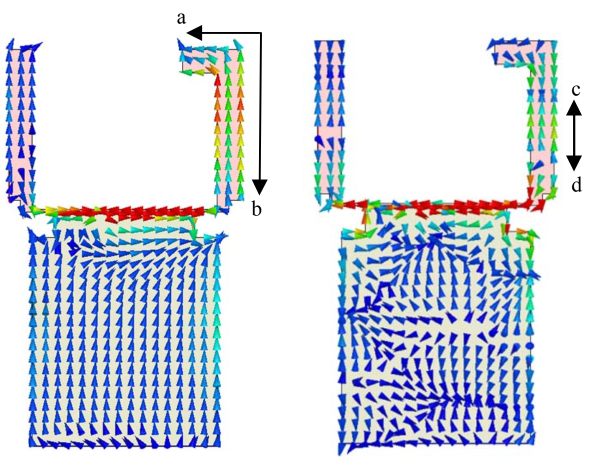
(H1=70, H2=10, H3=H4=5, H5=H6=1, H8=100, W1=100, W2=25, W3=W4=10, W5=W6=5, W7=29.5, W8=10, W10=80, thickness=0.3, Feed=1×1 [mm])

Fig. 1. Proposed antenna configuration.



Model1 H7=W9=0.5mm, Model2 H7=W9=10mm

Fig. 2. Simulated VSWR results as a parameter of H7=W9.



F = 1.5 GHz F = 5.5 GHz

Fig. 3. Simulated current distributions of proposed antenna model 2.

Fig. 4. Fabricated antenna for measurement.

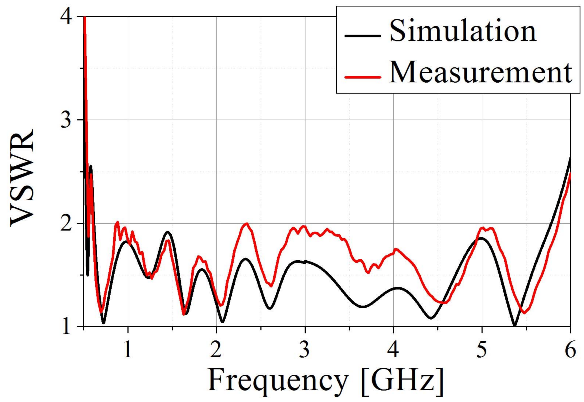
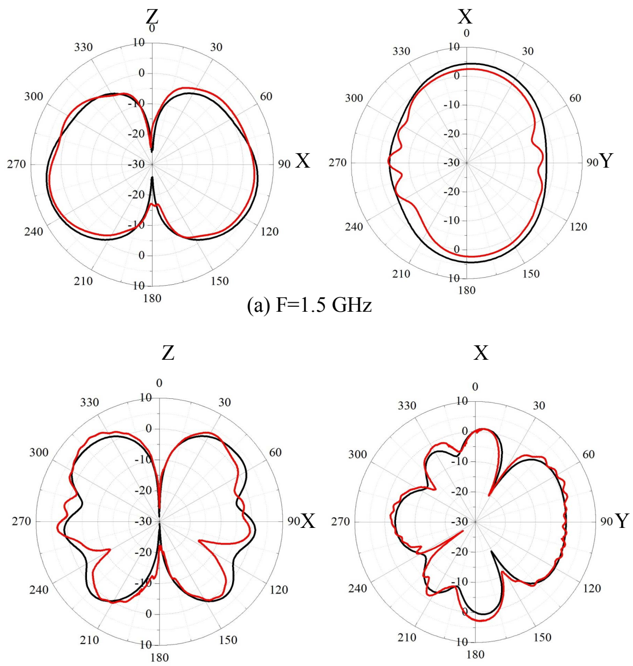


Fig. 5. Comparison of simulated and measured VSWR.



(b) F=5.5 GHz

Fig. 6. Comparison of simulated and measured ***E*θ** radiation pattern.

Simulation Measurement