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3/4-Wave Length Multi-Bent Single Wired Antenna for Mobile Phone

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1. Introduction

The antenna for mobile phone intends to select the internal type antenna recently [1]. On the other hand, the dual band antenna is required in terms of the technical point in order to apply the dual mode terminal which can be useful at 800MHz and 2GHz bands[2] [3]. In addition, this internal antenna should be compact and high efficiency. And it is not likely it to be complex construction for mass-production and cost.

This time, we successfully developed the internal antenna for the dual bands which consists of the multi-bended single wire, whose length is approximately 3/4 wave length at 2GHz band. This 3/4-Wave Length Multi-Bent Single Wired Antenna (we call MBSWA) achieved more than 10% band width in 800MHz and 2GHz bands within 3.0 of VSWR. The radiation efficiency performed -1.5dB in 800MHz and -1.2dB in 2GHz bands.

2. Antenna Construction

The construction of this antenna is shown in Fig.1. This antenna consists of the multi-bended single wire, whose length is approximately 3/4 wave length at 2GHz band, and the small stab. The dimension is 27mm×5mm×5mm. Its size is just fit to the width-direction position of the mobile phone.

3. Simulation

First of all, we tried to optimize the construction of MBSWA from the basic experimental result. After it, the simulations were carried out by the moment methods. The simulated return loss characteristics are shown in Fig.2 when MBSWA is adapted to the narrow side of ground plane whose size is 45mm×150mm. In this case, the feed

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to MBSWA was implemented by 50-ohm micro-strip-line. The bandwidth which the return loss is less than -6dB (VSWR<3.0) is 23% in 800MHz band and 8% in 2GHz band.

4. Experimental Performance

In order to confirm MBSWA performances, we evaluated the return loss and the radiation patterns in 800MHz and 2GHz bands.

The measured return loss is also shown in Fig.2. The bandwidth which the return loss is less than -6dB (VSWR<3.0) is 14% in 800MHz band and 10% in 2GHz band.

The measured radiation patterns are shown in Fig.3. In 2GHz band, the main polarization is reversed but the pattern is similar to omni-directional pattern, which is suitable for mobile phone antenna.

Next we tried to evaluate the radiation efficiency. The efficiency was measured two kinds of the condition, which is without phantom and with phantom. In this case, the radiation efficiency is defined as the ratio of the input power to the integrated value from the measured pattern in 3 planes, which are in x-z, y-z and x-y planes. The efficiency without the phantom achieved -1.5dB in 800MHz and -1.2dB in 2GHz. And with the phantom, they were -6.3dB at 800MHz and -3.5dB at 2.0GHz bands.

5. Re-tunable Performance

As one of the great advantage of MBSWA, the re-tuning versus frequency shift is easy. The simulated return loss characteristics are shown in Fig.4. It is clear that the coverage band can be shift-able easily by adjusting the stub regarding 2GHz band. It is the great advantage as the re-tuning way for frequency shift by the case assemble or the around influences.

6. Conclusion

We successfully developed the internal antenna for the dual band which consists of the multi-bended single wire, whose length is approximately 3/4 wave length at 2GHz band. As its features, it is simple construction, dual frequency band application, high radiation efficiency, easy re-tunable performance. Additionally, MBSWA achieved more than 10% band width in dual bands within 3.0 of VSWR. The radiation efficiencies performed -1.5dB in 800MHz and -1.2dB in 2GHz. And the easy re-tunable performance at 2GHz by adjusting the stub is confirmed.

References

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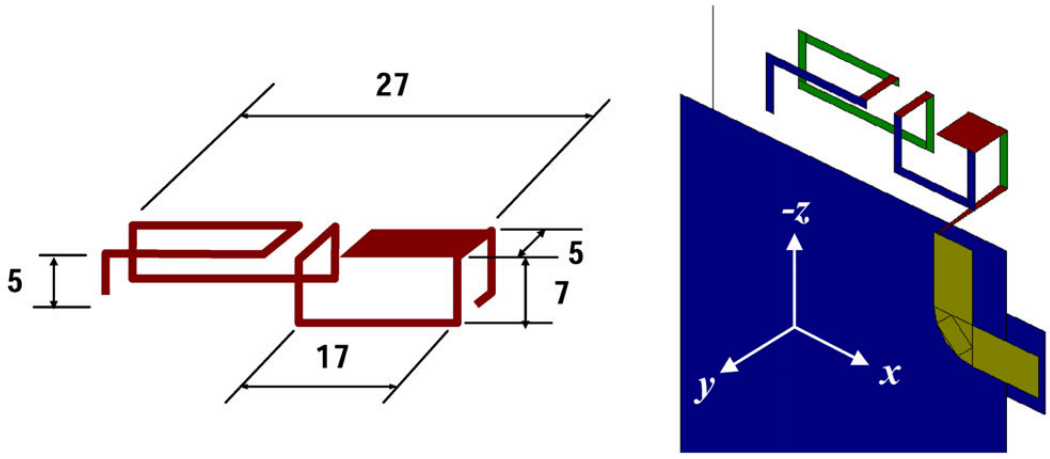
[3] E.Vasiyeva and A.YTaflove, " A Dual-Band Antenna for Cellular Applications: Influence of plastic Embedding", IEEE APS Int. Symp.,vol.1,pp.108-111, July 1999



Unit : mm

Fig.1 Construction of Antenna

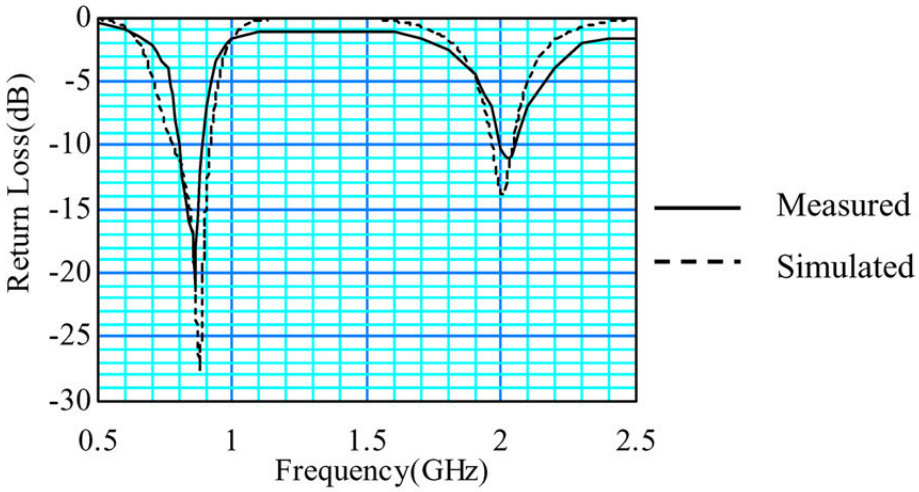


Fig.2 Simulated and Measured Return Loss

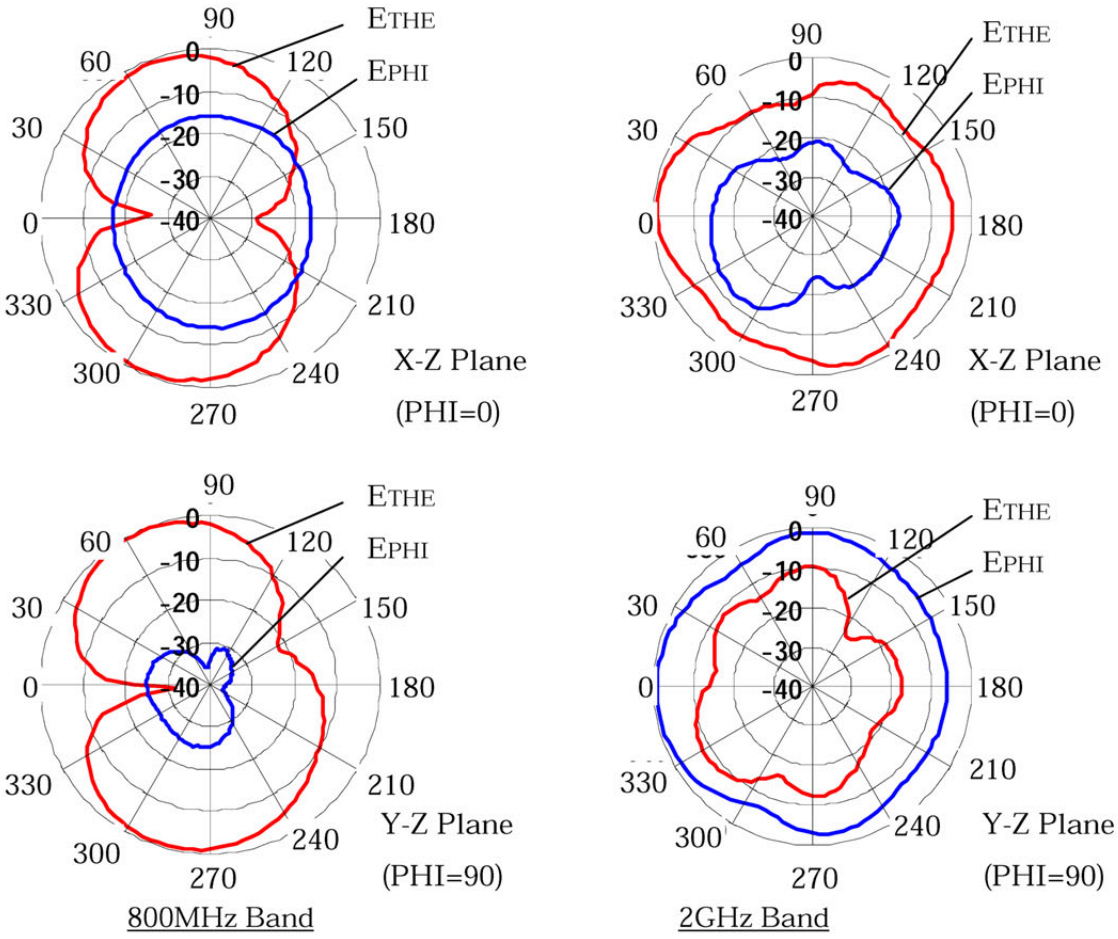


Fig.3 Measured Radiation Pattern

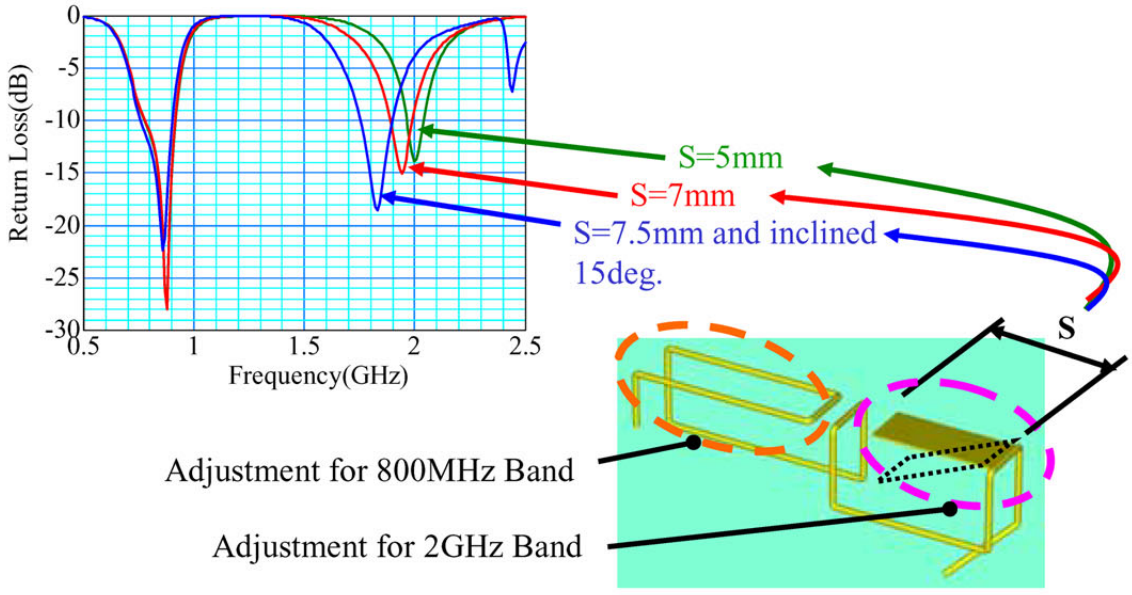


Fig.4 Return Loss Changing according to stub adjustment