Compact Folded Dipole Microstrip Antenna for 2.4 GHz WLAN Application

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***Abstract* – A compact folded dipole microstrip antenna for 2.4 GHz application is presented and investigated in this paper. The design is conducted on FR4 substrate with 0.3 mm thickness and dielectric constant εr = 4.5. The measurement result shows that the frequency resonant of the antenna is at 2.46 GHz with return loss -24.10 dB, bandwidth 193 MHz and gain 1.52 dB.**

***Index Terms* — Folded dipole, microstrip antennas, WLAN.**

I. Introduction

Wireles Local Area Network (WLAN) is one of the example for important application in wireless communication technology. In practical implementation, reducing the size of the antenna dimension becomes an interesting research.

One suitable candidate for this is using microstrip dipole antenna for WLAN which has been studied before [1] – [3]. In [1], the author compared conventional printed dipole antenna with printed folded dipole antenna, and obtained a reduction of antenna dimension of 46.43%. The folded dipole antenna dimension was 8 x 30 mm with gain of 0.3 dBi. Reference [2] achieved a dimension of 2.9 x 40 mm with bandwidth of 19% while [3] arrayed their dipole to achieve bandwidth of 60 MHz.

In this paper, a compact folded dipole microstrip antenna is proposed with wide bandwidth and high gain for WLAN application.

II. Antenna Design

Figure 1 shows the configuration of the proposed antenna. The antenna is simulated using CST microwave studio. The dipole is designed using substrate FR-4 with the dielectric constant of εr = 4.5 and thicknes 0.3 mm. The thickness of the copper on the substrate is 0.035 mm. The feed point of the antenna is A and B.

To reduce the dimension of the antenna, the dipole antenna is folded. The overall dimension of the antenna is 31.5 mm x 20 mm with the gap between dipole 0.5 mm, and the length of the antenna dipole is about a half wavelength. The width of the folding element is 4 mm.

For gain and bandwidth enhancement, the perturbation was given in the middle and in the upper corner of the patch. By adding this, the antenna bandwidth has increased from 157 MHz to 178.9 MHz and the antenna gain from 1.53dB to 1.63 dB.

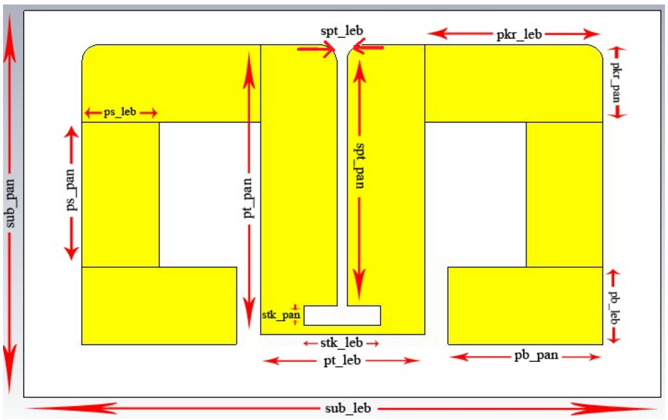

Fig 1. Geometry of proposed antenna

Figure 2 shows the optimization parameter *spt_pan* which is the most important parameter to achieve good impedance matching. The results shows at spt_pan 12.6 mm, the return loss obtained is -35.71 dB, bandwidth 178.9 MHz, and gain 1.63 dB.

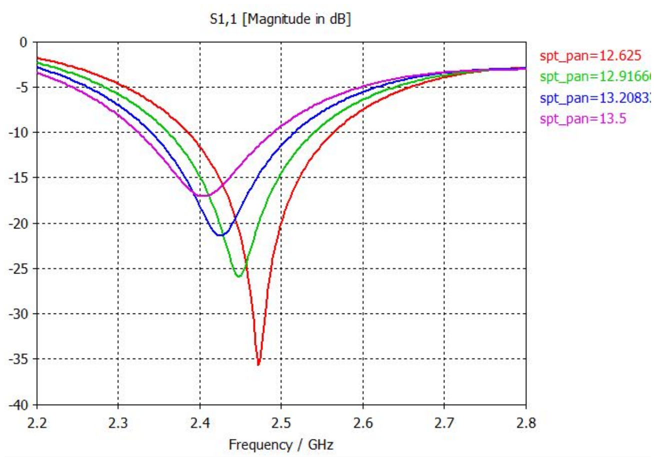

Fig 2. Iteration of parameters spt_pan

III. Simulation And Measurement Results

The antenna design was fabricated and measured in anechoic chamber in Electrical Engineering Department, Faculty of Engineering, Universitas Indonesia. The measurement results compared with the simulation results are shown in Fig 3 to Fig 5. Fig 3 shows the return loss result of the antenna.

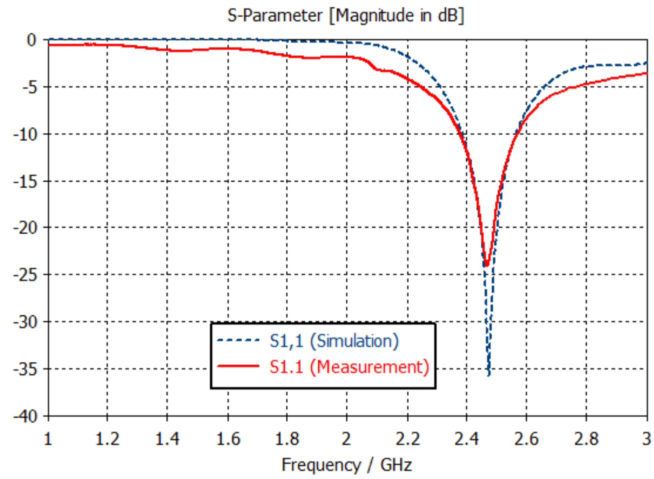

Fig 3. Simulated and measured return loss of proposed antenna

The measured impedance bandwidth with return loss less than -10 dB is from 2.377 GHz to 2.57 GHz. This frequency covers the WLAN band (2.400-2.485) with the bandwidth 193 MHz.

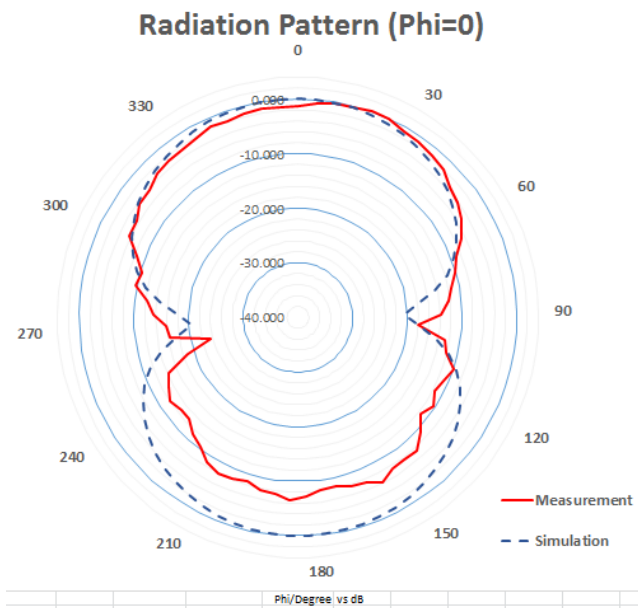

Fig 4. Radiation Pattern (Phi = 0)

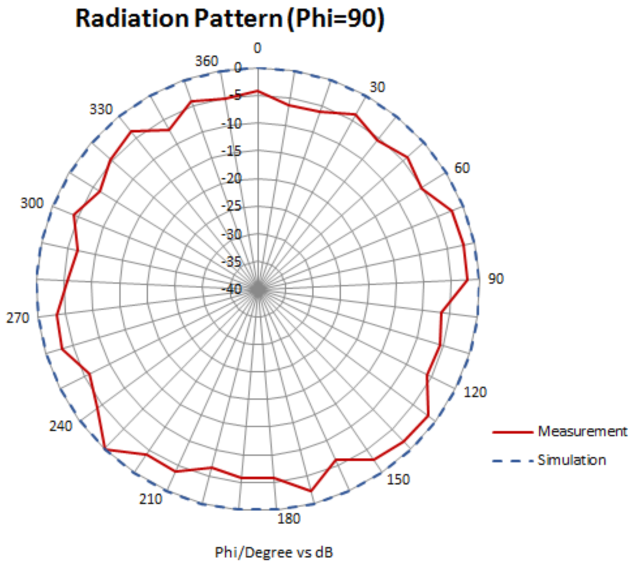

Fig 5 . Radiation Pattern (Phi = 90)

Fig. 4 and Fig. 5 shows the radiation pattern between the simulation and measurement of the antenna at frequency 2.45 GHz. The result shows that the antenna has omnidirectional radiation pattern. In addition, the simulated antenna gain is 1.63 dB, while the measurement antenna gain is 1.52 dB.

The slight difference between simulation and measurement result is due to imperfect fabrication of the antenna and additional coaxial line is used in the measurement, which was neglected in the simulation.

IV. Conclusion

A compact folded dipole microstrip antenna for 2.45 GHz application has been designed, fabricated and measured. The measured result of the antenna shows that the antenna has impedance bandwidth of 193 MHz, return loss -24.10dB at 2.46 GHz and gain of 1.52 dB. The antenna radiation pattern shows omnidirectional characteristic.

References

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