A Design of printed dual band Antennas for Wireless Communication Systems

YOUNOK CHOI, JEONGMIN PARK, ZHENG GUO PIAO, GEUMBAE CHO
Department of Electrical Engineering
Chosun University
375 Seosuk-dong Dong-gu, Gwangju 501-759
KOREA
yochoi@chosun.ac.kr

Abstract: - This paper presents a printed dual band antenna, which was designed and fabricated two patch lines with a coplanar waveguide-feed, for PCS(Personal Communication Systems) and the IMT2000 band. The proposed antenna has been a broad band and a small size. The measured bandwidth of the proposed antenna obtained about 290 MHz at a lower resonance frequency band (1.63-1.92 GHz) and about 430 MHz at a higher frequency band (1.95-2.38 GHz) for return loss –10 dB, which just corresponds to PCS band (1.75-1.87GHz) and IMT 2000 band (1.92-2.17GHz), respectively. The measurement and simulation results obtained good agreement. This antenna satisfies the bandwidth required for both PCS and IMT 2000 band.

Key-Words: Dual Band, Monopole Antenna, Wireless Communication, IMT 2000 band, PCS band

1 Introduction

As the demands for mobile and satellite communications increase rapidly, high-quality core components for communications system are becoming increasingly important. Accordingly, the station or handset antennas are considered significant factors contributing to the transmission quality of a given wireless system. In addition, the rising popularity of smaller handsets demands smaller and lighter antennas capable of multiple functions. Furthermore, multi-band antennas have increasing request for industry. A two patch lines antenna have proven to be useful in this point, especially for satellite and mobile communications, and they manufacture easily in mass quantity using printed circuit technology [1,2].
Recently, the designs of the CPW-fed patch antennas have received much attention, because the CPW(coplanar wave guide)-fed patch antennas have the advantages of wide bandwidth and easy integration with monolithic microwave integrated circuits(MMIC) and low temperature co-fired ceramic(LTCC). These researches have been attempted many times to increase the bandwidth by CPW-fed patch antennas [3,4].

In this paper, we propose a printed two patch line antenna with a CPW- fed that can accommodate both an antenna and a power feed on a single flat board. The proposed antenna can operate in the PCS band as well as in the IMT2000 band. Simulations and measurements have shown that the proposed antenna has the same radiation features as conventional wire monopole antennas.

2 Antenna configuration and results

The configuration of the proposed antenna involves a two patch line antenna with CPW-fed, as shown in Fig. 1. They printed on the same side of a thin substrate. The substrate is an FR-4 with a dielectric constant of 4.6 and a thickness of 1.6 mm.

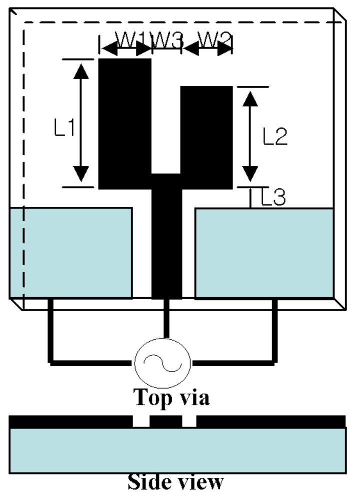


Fig.1. Configuration of the printed dual monopole antenna.

The proposed antenna of PCS and IMT2000 bands are used the parameter values as given in Table 1. The parallel symmetrical two patch lines antenna have the same width(W1=W2), and have lengths of L1 and L2. The gap between two patch lines are represented W3 in the proposed antenna. The gap between the part of two patch line and the part of CPW–fed represented as L3.

Table 1. Parameter value of proposed antenna

parameter	L1	L2	L3	W1	W2	W3
Value[mm]	29	24	2	5	5	2

Fig.2 shows measured and simulated return loss of the proposed antenna. As observed in the Fig.2, a very good agreement between the simulations and the measurements was obtained. Fig.3 shows a comparison between the simulated and measured input impedance of the proposed antenna. From these cures, it can be concluded that a good agreement the between simulated and measured data was proximate characteristic impedance. Fig. 4 shows return loss of variable L1, here fixed L2=24, L3=2, W3=2[mm]. Fig. 5 shows return loss of variable L2, here fixed L1=29, L3=2, W3=2[mm]. The high band frequency shifted low frequent direction as increase L2. Fig. 6 shows return loss of variable W1 here fixed L1=29, L2=24, L3=2, W3=2[mm]. As shown fig.6, it didn't change frequency. Fig. 7 shows return loss of variable W3 (fixed L1=29, L2=24, L3=2[mm]. Fig.8 shows the measured and simulated gains of the proposed antenna, and it can be observed that achieved 3 dBi gains.

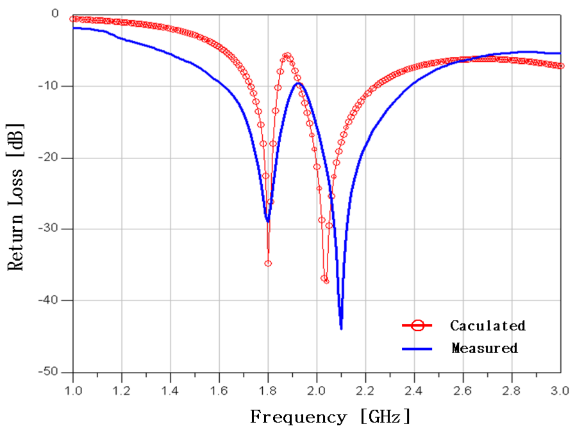


Fig.2. Measured and simulated return loss of the proposed antenna. (solid line is measured data, ring line is simulated data)

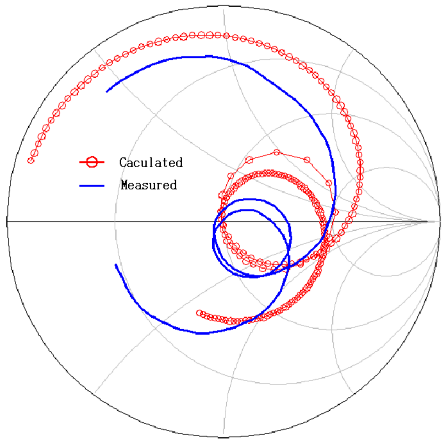


Fig.3. Comparison between the simulated and measured input impedance. (solid line is measured data, ring and solid line is simulated data)

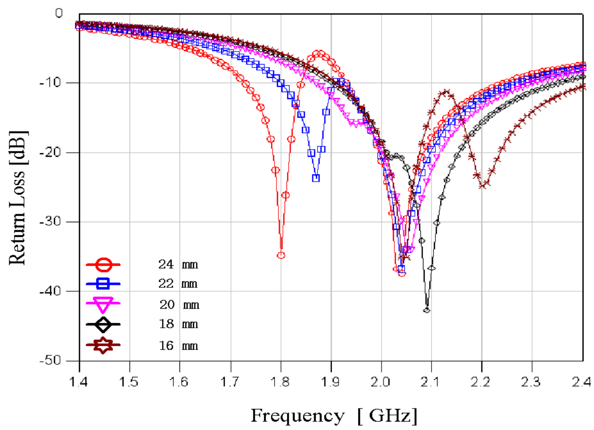


Fig. 4. Return loss of variable L1 (fixed L2=24, L3=2, W3=2[mm]).

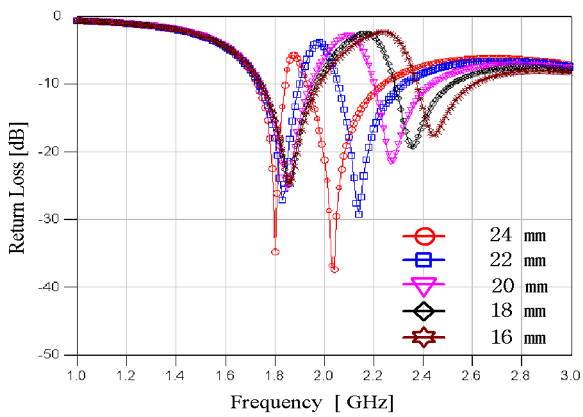


Fig. 5. Return loss of variable L2 (fixed L1=29, L3=2, W3=2[mm]).

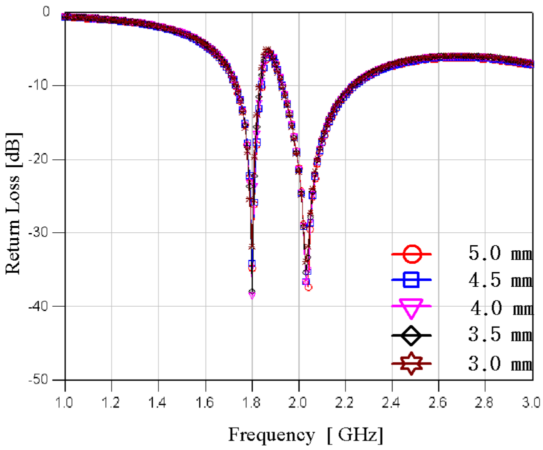


Fig. 6. Return loss of variable W1 (fixed L1=29, L2=24, L3=2, W3=2[mm])

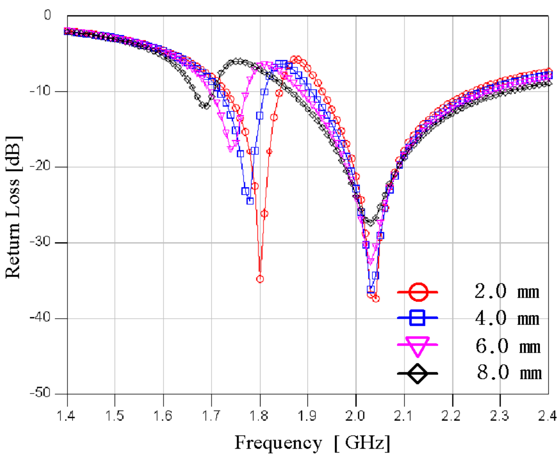


Fig. 7. Return loss of variable W3 (fixed L1=29, L2=24, L3=2[mm])

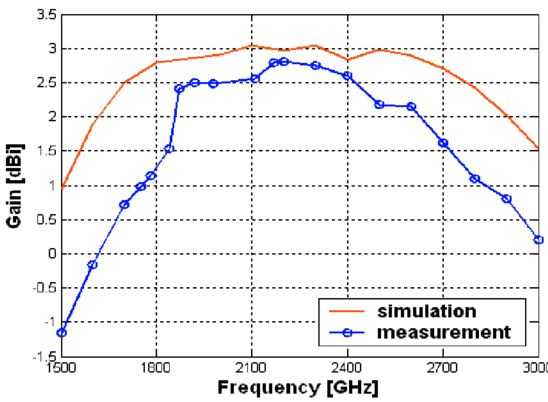
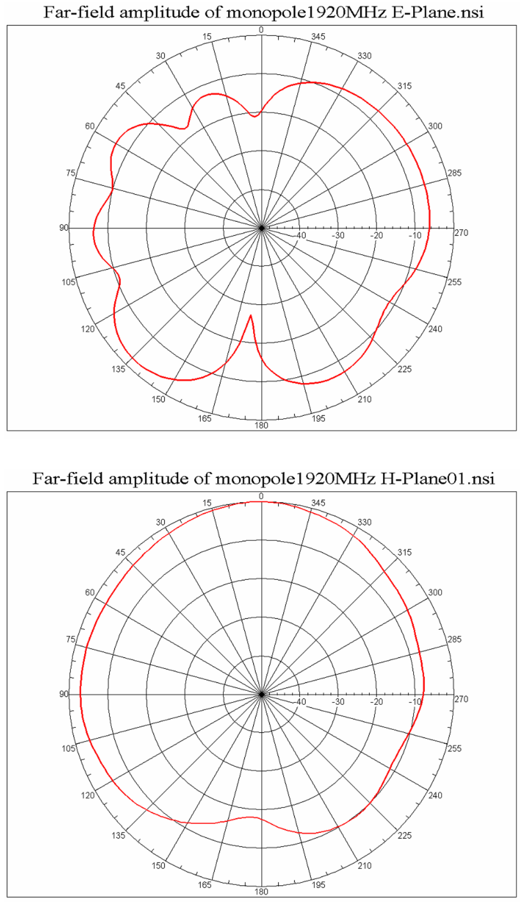
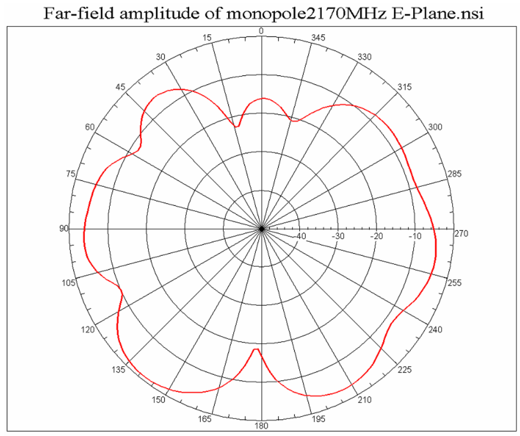


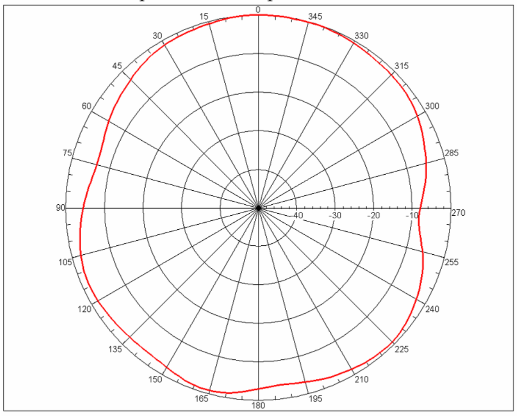
Fig. 8. Measured and simulated gains for the proposed antenna in Table 1.

Fig. 9 shows the measured radiation patterns in E plane and H plane, respectively. It is obvious that the proposed printed monopole antenna in this paper has characteristics of nearly omni-directional radiation with higher gain. Radiation pattern of Fig. 9 is measured Star gate -32 made by SANTIMO in France.



(a) Measured E-plane and H-plane at 1920[MHz]





(b) Measured E-plane and H-plane at 2170[MHz]

Fig. 9. Measured E-plane and H-plane radiation patterns of the proposed antenna

3 Conclusions

In this paper, a printed monopole with CPW feed for both PCS and IMT2000 applications was proposed. The measured nd 430 MHz at operating frequency 1.8 GHz and 2.1 GHz, respectively. This can satisfy PCS and IMT2000 band requirements. The simulated and measured radiation patterns in E-plane and H-plane patterns band width of the proposed antenna is 290 MHz awere nearly omni-directional. The printed monopole antenna proposed in this research is an embedded antenna and it holds a lot of advantages over conventional wire monopole antennas. For instance, it can be easily fed, manufactured and miniaturized. Due to the above special structures and characteristics, the proposed antenna in this paper can be expected to use in mobile communications handsets

References:

[1] Kai Fong Lee, Wei Chen, *Advanced in Microstrip and Printed Antennas*, Wiley Interscience, 1997, pp. 71-109

[2] W. Menzel and W. Grabherr, A microstrip patch antenna with coplanar feed line, *IEEE Microwave Guided Wave lett.*, vol. 1, pp. 340-342, Nov. 1991

[3] Rainee N. Simons, Coplanar Waveguide Circuits, Components, and Systems, *IEEE transactions on antennas and propagation*, vol. 50, NO. 3, April 2002.

[4]Horng-Dean Chen and Hong-Twu Chen, A CPW-Fed Dual-Frequency Monopole Antenna, *IEEE transactions on antennas and propagation,* vol. 52, NO.4, April 2004.