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A New Patch Antenna for UMTS Band: Narrow Compact CPW-fed Monopole

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Abstract: - A novel narrow compact CPW-fed rectangular monopole patch antenna is proposed for UMTS band. The purpose is to design a new narrow compact antenna structure by using of a new CPW feeding technique. The most significant characteristics of proposed antenna are: narrow compact size of 67.3×7.8×0.762 mm^3 and very simple structure. The proposed low profile antenna is printed on a single layer dielectric substrate and fed by 50Ω CPW transmission line. The proposed antenna effectively covers UMTS band (1.885–2.200GHz). The antenna gain is nearly about 1.9 dB at 2 GHz and the radiation pattern is almost as the radiation pattern of a monopole antenna and gain remains nearly constant within UMTS band. This antenna is suitable for application in wireless communication systems.

Key-Words: - Coplanar waveguide (CPW) fed, monopole antenna, planar antenna, printed antenna, transmission line, wideband operation.

1 Introduction

In recent years, more and more attention is paid to develop small-size and low-profile antennas for mobile communications. For optimum system performance, the antennas must have high radiation efficiency, small volume, isotropic radiation characteristics, simple impedance matching, and simple mechanical construction [1].

Recently, planar monopole antennas have found widespread applications in mobile communication systems because of their wide impedance bandwidth, omni-directional radiation pattern, compact and simple structure, low cost and ease of construction. To meet the miniaturization of new mobile communication equipment, the design of compact monopole antennas that operating at a wide frequency range is considerable.

Moreover, there is growing research activity on broadband antennas for various wireless communication applications. In particular, a great interest in coplanar waveguide (CPW) fed antennas has been presented in the literature because of their many attractive features such as, simplest structure of a single metallic layer, no soldering point and easy integration with active devices or MMICs [2].

An improved feeding method witch takes advantage of the CPW transmission line is proposed for Sierpinski fractal antenna and has been shown that when the length and the width of the ground planes in the CPW feeding structure are similar to the length and the width of the main body of the Sierpinski gasket, better matching and improved return loss will be achieved [3].

In this paper the improved feeding method in [3] is used to feed a narrow planar monopole antenna. Wideband operation is obtained in UMTS band. The simulated results are presented using (ADS) software package of Agilent Technologies and discussed.

2 Antenna design

Fig.1 shows the geometry of the proposed CPW-fed monopole antenna. Both the antenna and the CPW fed line are considered on a single layer dielectric substrate. The substrate is roger/RO4350 with 0.762 mm thickness and relative permittivity of ε_r =3.48. The proposed antenna consists of a 50Ω CPW transmission line (CPW-fed matching network) and a conventional monopole radiator. The 50Ω CPW transmission line has been designed and the central metal strip width w =1.4 mm and the gap dimension g=0.8mm are obtained. The length and the width of the CPW feeding structure are similar to the length and the width of the main body of antenna (Fig.1). Main body of the antenna is on the top of the 50 Ω CPW transmission line. Moreover, we chose the antenna main body width same as the width of the central line in 50 Ω CPW transmission line to achieve size reduction and simple structure. The central line in total structure consists of CPW-fed structure's central line and main body of the antenna and has 67.3 mm length (length of CPW-fed's central line is

33.5mm and length of antenna main body is 33.8mm) and 1.4mm width. Each ground plane has dimensions of 2.4×33.5 mm^2. The wideband operation of the proposed antenna can be excited with good impedance matching. The antenna structure is relatively small because of using the improved CPW feeding method.

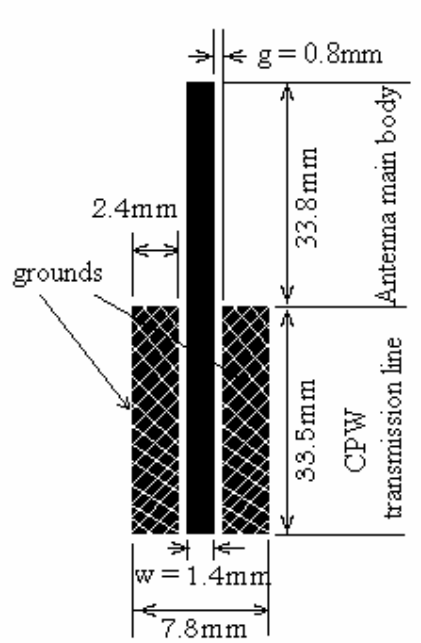

Figure 1. Geometry for proposed narrow compact CPW-fed monopole antenna for UMTS band.

3 Results

Fig. 2 shows the return loss versus frequency for the proposed planar CPW-fed monopole antenna in the range of 1 to 3 GHz. It is clearly seen that wide operating bandwidth is obtained in UMTS band (1.885–2.200GHz). The radiation patterns in the $\varphi=0^o$ and $\varphi=90^o$ planes at 2 GHz are presented in Fig. 3. The results show that nearly omni-directional radiation patterns is obtained.. Fig. 4 shows the antenna gain versus frequency in the UMTS band. As it is seen the gain variation in UMTS band is between 1.83 dB and 1.93 dB.

4 Conclusion

The design and analysis of a narrow compact CPW-fed monopole antenna with low cost and simple structure for UMTS band with a new feeding technique for application to wireless communication systems is presented. Simulation results show that the wideband operation of the proposed antenna can be obtained. Gain remains nearly constant and monopole-like radiation patterns are achieved for UMTS band.

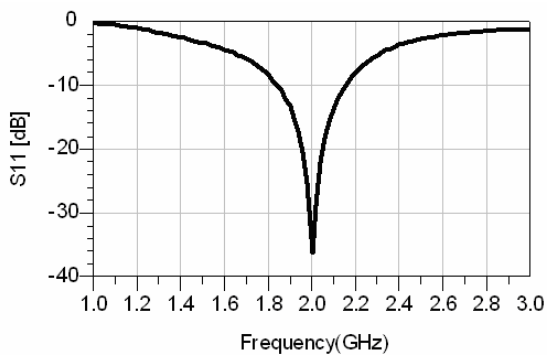

Figure 2. Return loss performance for proposed narrow compact CPW- fed monopole antenna.

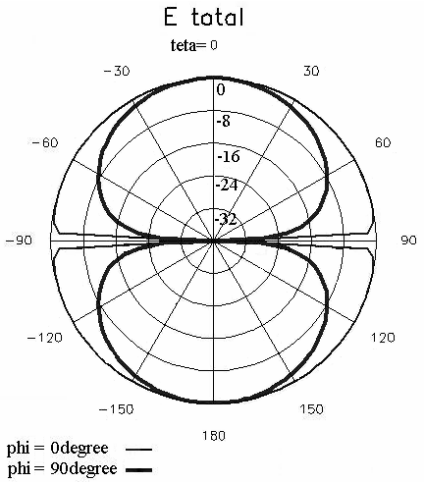

Figure 3. Radiation patterns of the proposed antenna at $\varphi = 0^o$ and $\varphi = 90^o$ for 2 GHz.

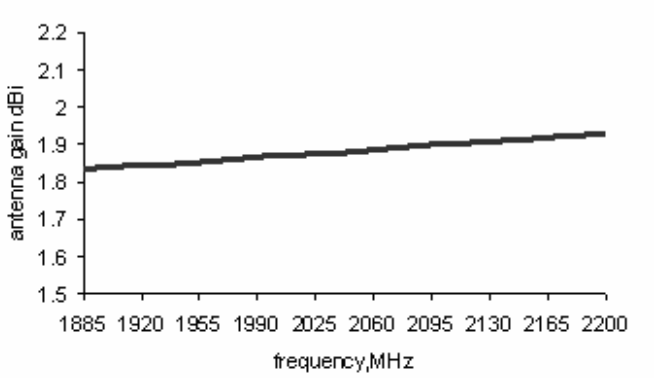

Figure 4. Gain versus frequency for proposed antenna within UMTS band.

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