COMPACT MICROSTRIP MEANDER ANTENNA

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Received 30 March 1999

ABSTRACT: An electrically small microstrip meander antenna incorporating the folded technology is fabricated and experimental results are presented in this paper. This antenna has the advantages of compact size, ease of manufacturing, broad bandwidth, and multiband characteristics. Different-feed and different-length antennas are tested. Techniques to reduce the antenna size are presented, and performance trends are established. The measured results show that the variation of the return loss can be easily tuned by changing the feeding points and the microstrip-line length. The maximum measured bandwidth is approximately 770 MHz (12.6% operational bandwidth around 6.115 GHz) when the middle feeding point is chosen. © 1999 John Wiley & Sons, Inc. Microwave Opt Technol Lett 22: 413–414, 1999.

Key words: microstrip antenna; microstrip meander antenna; meander lines

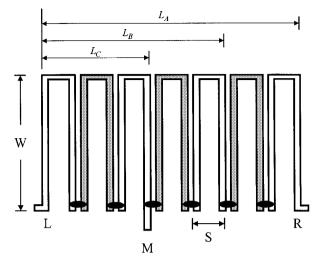
I. INTRODUCTION

Small antennas have become popular in antenna investigation and research because of the development of numerous mobile communication systems. Previous work on the miniature subject includes either changing the geometrical structure of the antenna, such as in the Koch fractal monopole antenna [1] and the wire meander antenna [2], or the shorting posts [3]. Although the line techniques can successfully reduce the transverse size of the antenna, the longitudinal size is still large. It is not easy to obtain a good impedance by selecting the position of the shorting posts. Here, we provide a microstrip meander antenna to solve the above problems. This antenna has the advantages of small size, multiband characteristics, easily tuned performance, and broad bandwidth. In our paper, we discuss the effect of the different feeding points and the different radiating lengths.

II. DESIGN OF THE COMPACT MICROSTRIP ANTENNA

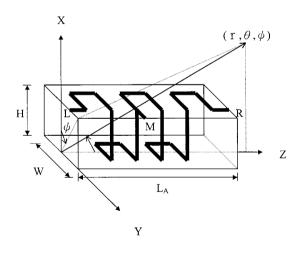
The measurements have been fabricated in the form of a microstrip monopole folded on the upper and bottom surfaces of the microwave substrate; the dielectric constant $\varepsilon_r = 7.8$ and the height H = 59.7 mils. A schematic diagram of the proposed compact microstrip antenna for wideband and miniature operation is shown in Figure 1. The main configuration consists of a feed point and an antenna embodiment. $L_A = 1.2$ cm, $L_B = 0.8$ cm, and $L_C = 0.55$ cm denote the geometric lengths of antennas A, B, and C; W = 0.7 cm is the width of the antenna, and the separation S between two coils is 53 mils. The radiated coils of the antenna are connected to each other in series form by using via holes. The geometry and the coordinate system of the microstrip antenna are shown in Figure 2. The whole microstrip antenna is distributed along the longitudinal direction (the Z-axis). In our experiment, three feeding points, the middle (M), left (L), and right (R) terminal points, are tested and measured. Meanwhile, in order to understand the effect of the antenna length, we also change the right microstrip-line length of the anntena embodiment.





antenna elements on the upper plane
antenna elements on the bottom plane
via hole between the upper and bottom planes

Figure 1 Topology of the microstrip meander antenna



M: fed by the middle point
L: fed by the left terminal point
R: fed by the right terminal point

Figure 2 Geometry and coordinate system of the microstrip meander antenna

III. EXPERIMENTAL RESULT

The proposed antenna has been constructed and measured. Figure 3 shows the variation of the measured return loss for the different feeding points of the antenna. The lowest measured input impedance bandwidth ($S_{11} < -10\,$ dB) is 170 MHz, from 1.77 to 1.94 GHz, fed by the right point; the bandwidth is 180 MHz, from 1.71 to 1.89 GHz, fed by the left point. The resonant bands result from the microstrip meander monopole mode. The resonant bandwidth of this compact

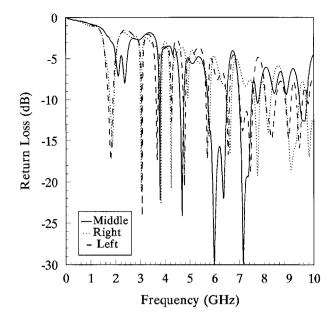


Figure 3 Variation of return loss for different feeding points of the antenna

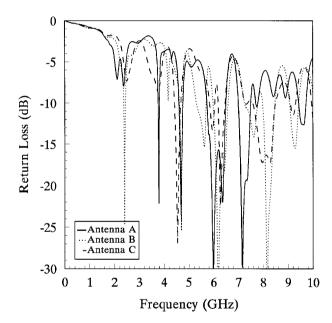


Figure 4 Measured return losses of different-length meander antennas

antenna is broad enough for the specification of the digital communication system (DCS 1800) application. The maximum bandwidths are approximately 770 MHz at 6.12 GHz in the middle feed case (M), 540 MHz at 7.28 GHz in right feed case (R), and 620 MHz at 9.11 GHz in the left feed case (L). Figure 4 shows the measured return losses of the different-length meander antennas (see Fig. 1). Measured results show that we can change the antenna length to vary the resonant frequency instead of matching the impedance or designing another antenna topology.

IV. CONCLUSION

A small microstrip meander antenna configuration with multiband characteristics is presented, and experimental results are given. The antenna size reduction and bandwidth improvement compared to traditional microstrip antennas are mainly due to folding the microstrip line as the meander monopole. The resonant band can be modified by choosing the feeding points or changing the length of the meander antenna. This antenna technique may be suitable for an integrated communication system, which combines the GSM, DCS, WLN, or other ISM bands.

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DUAL-POLARIZATION BROADBAND PATCH ANTENNA

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Received 19 April 1999

ABSTRACT: A dual-polarization wideband microstrip patch antenna is designed that has a VSWR ≤ 2 in the bandwidth about 2.5 times wider than that of a standard square patch of the same dimension. Several characteristics of the antenna are analyzed using both Ensemble and an in-house finite-difference time-domain (FDTD) code. The dependence of the input impedance on the different parameters of the antenna is also given. The antenna can receive circularly polarized waves with less than 1.5 dB polarization loss factor. © 1999 John Wiley & Sons, Inc. Microwave Opt Technol Lett 22: 414–420, 1999.

Key words: patch antennas; satellite communication; FDTD; Ensemble

1. INTRODUCTION

Microstrip antenna technology has been rapidly developing for the last two decades. It has found applications in a wide variety of microwave systems due to many advantages (e.g., low profile, light weight, low cost). However, it has some inherent drawbacks too. Narrow impedance bandwidth (typically only a few percent) is probably the most significant disadvantage for this type of antenna [1]. Thus, much of the research has been devoted to various techniques for increasing the microstrip antenna bandwidth [2-9]. An electrically thick substrate increases the bandwidth, but the impedance locus becomes increasingly inductive [2, 3], making impedance matching difficult. In addition, surface waves are excited, and lower the antenna efficiency. External impedance matching is another way of increasing the bandwidth [4, 5]. The bandwidth can also be increased by introducing dual or multiple resonances, by using stacked multiple patches, multilayer elements [6, 7], or coplanar multiple-resonator elements [8, 9]. These structures, however, are characterized by increased complexity, enlarged volume, or an increased surface area of the radiating structure. Usually, an improvement in band-