# Dualband meander monopole antenna

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## Introduction

Due to their simple structure and omnidirectional radiation, monopole antennas have been found widespread applications in mobile communication systems [1]. To meet the miniaturization of modern mobile communication equipments, the design of compact monopole antennas is of particular importance. A simple way has been proposed in [2] where a meandering conductor line printed on a dielectric substrate is used to reduce the size of a monopole antenna. But the resulted antenna was mainly applicable for single-band operation. To achieve dual-band operation in a compact monopole antenna design, we propose a novel design of monopole antenna by extending a conductor line from the end of a rectangular meander monopole. The proposed antenna is fed by a CPW line and is printed in a single metal layer. Therefore, this antenna can be manufactured in a simple procedure. Moreover, due to the presence of an extended conductor line in the proposed design, the antenna is not only capable of providing the GSM/DCS dual-frequency operations, but also can have an antenna-size reduction at a given dual-frequency operation.

## Antenna design considerations

Fig. 1 shows the geometry of the proposed GSM/DCS dual-band monopole antenna. This antenna is printed on an FR4 substrate with thickness of 1.6 mm and relative permittivity of 4.4. A 50-$\Omega$ CPW transmission line is used to excite the antenna. The basis of the antenna structure is a rectangular meander monopole, which has the dimensions of height 28 mm and width 11 mm. A conductor line of height 26 mm is extended from the end of the rectangular meander monopole. This extended conductor line is located relatively close to the rectangular meander monopole, i.e. the space between the two conductors is 0.5 mm. In this design, the extended conductor line increases the current path of the antenna's first resonant mode, which reduces the required size of the proposed antenna for a fixed operating frequency. Moreover, as the two conductors are close to each other, the electromagnetic

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coupling is created between the two conductors, which leads to the second resonant mode excited with good impedance matching. That is, by introducing the extended conductor line, the proposed compact dual-frequency monopole antenna with good impedance matching can be obtained.

## Experimental results and Conclusions

Fig. 2 shows the measured return loss for the proposed antenna with an extended conductor line connected to a rectangular meander monopole (denoted as antenna A). For comparison, the result of the simple antenna with a rectangular meander monopole only (denoted as antenna B) is also shown in Fig. 2. For antenna B, the first resonant mode is excited at 1451 MHz, and the second resonant mode is excited at 3059 MHz (but with poor impedance matching, not shown in this figure). However, for antenna A, two resonant modes are excited at 910 and 1800 MHz simultaneously with good impedance matching. The 10-dB return-loss bandwidth at the lower frequency is 90 MHz (875-965 MHz). And the bandwidth at the upper frequency reaches to 218 MHz (1706-1924 MHz). Obviously, the obtained bandwidths cover both the GSM (880-960 MHz) and DCS (1710-1880 MHz) bands.

The measured radiation patterns of the dual-band antenna at 900 and 1800 MHz are shown in Fig. 3. Measurements at other operating frequencies in the GSM and DCS bands have similar radiation patterns as shown in Fig. 3. For the 1800-MHz operation, a good omnidirectional pattern in the x-y plane is observed. However, for the 900-MHz operation, the x-y plane pattern has a dip of about 7.5 dB (with respect to the peak radiation) at $\phi = 90^\circ$. From the obtained results, the upper operating band demonstrates more monopole-like pattern. The antenna gains for operating frequencies throughout the GSM and DCS bands are also measured and studied. The peak antenna gains are 1.3 dBi and 3.0 dBi in the GSM and DCS bands, respectively. As for the design of triple-band monopole antenna, the results will be described and discussed in the presentation.

## References


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[2] CHOI, W., KWON, S., and LEE, B.: 'Ceramic chip antenna using meander conductor lines', *Electron. Lett.*, 2001, **37**, (15), pp. 933-934.

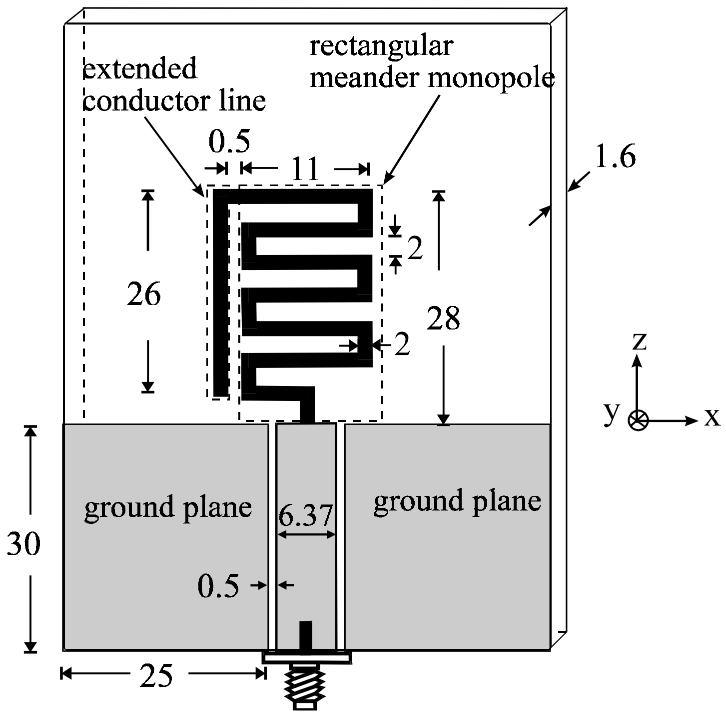


Fig. 1 Geometry of the proposed GSM/DCS dual-band monopole antenna

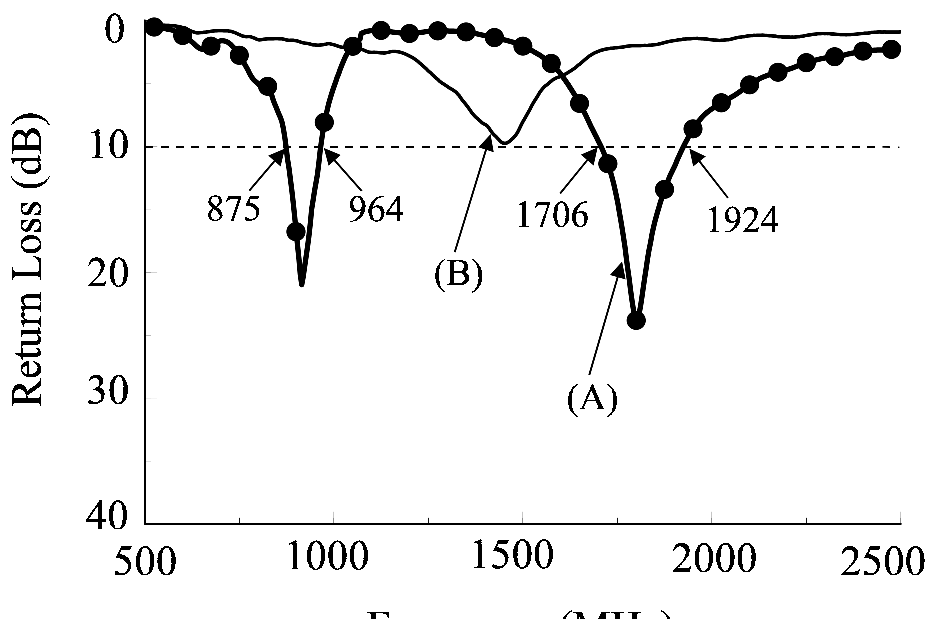


Fig.2 Measured return loss against frequency;

(A) the proposed antenna with a rectangular meander monopole and an extended conductor line

(B) the simple antenna with a rectangular meander monopole only

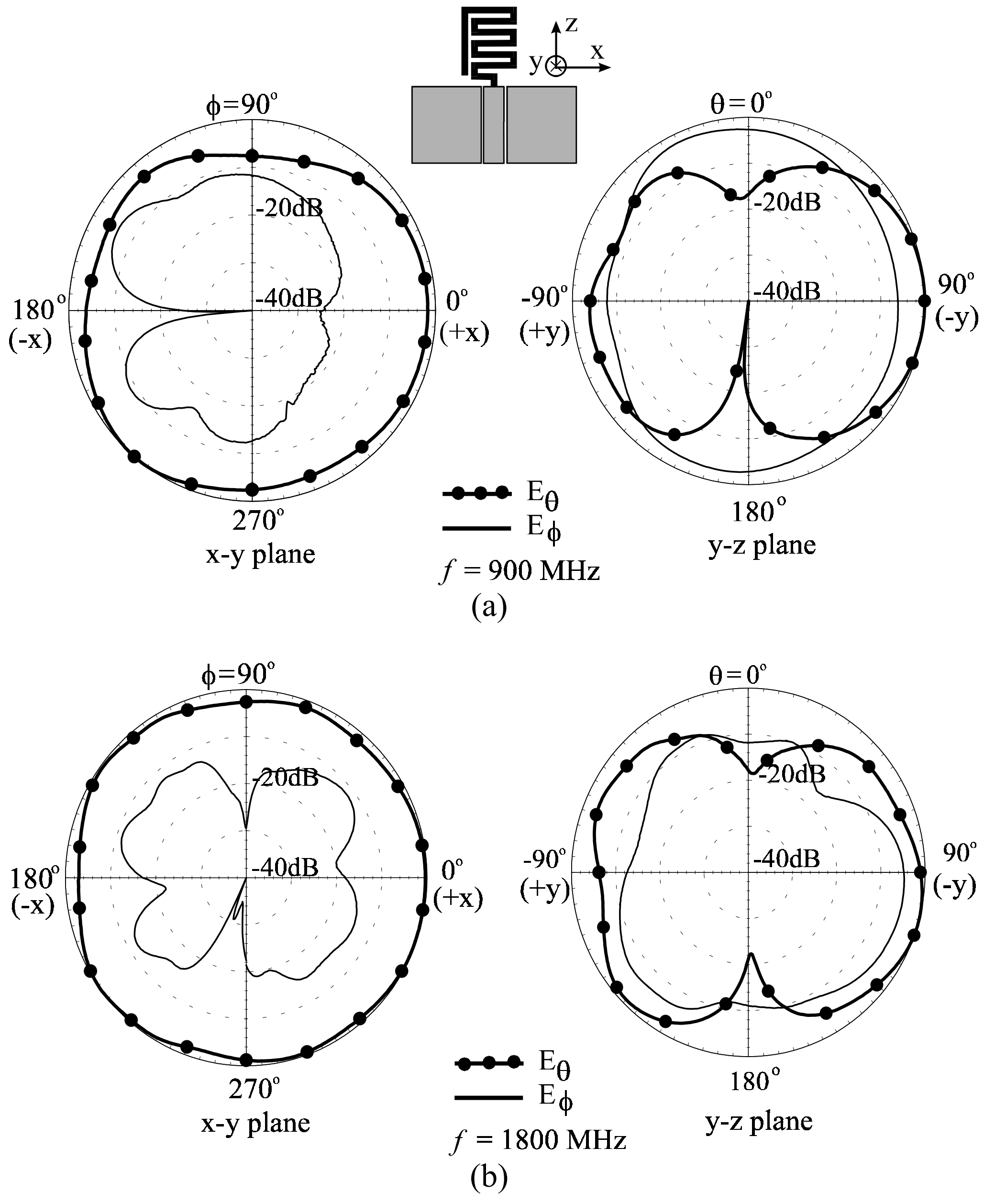


Fig. 3 Measured radiation patterns for the proposed antenna; (a) *f* = 900 MHz (b) *f* = 1800 MHz.