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A Wideband Printed Antenna for Covering Major Cellular Bands with a C- Shaped Patch

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Abstract

In this paper the design of a new multistandard antenna is proposed suitable for major cellular bands. A C-shaped radiator with a microstrip feed line is proposed which supports major cellular communication band like AWS, DCS, DECT, PCS, PHS, 3G, UMTS, DSR, Wi-Bro, ISM, and DMB in the range of 1.7-2.9 GHz. The designed antenna is simulated using CST Microwave Studio to achieve such wide frequency coverage. The simulation results of the designed structure in terms of return loss, VSWR and radiation pattern are presented.

Keywords: *Patch, wideband, monopole, return loss*

1 Introduction

Planar antennas are widely used in a lot of applications, because of their inherent characteristics of low cost, low profile, ease of fabrication, light, weight, conformability and integration with RF devices. Recently many antennas with multiband and wideband characteristics have been successfully designed for wireless applications [1-5]. In the design of a printed antenna, the radiator and ground plane shapes as well as the feeding structure can be optimized to achieve a broad impedance bandwidth [6-10]. With the development of wireless communications, there is a growing demand for both voice and data services. The service providers are upgrading their networks with advanced technologies since the number of mobile phone subscribers, as well as usage rate, is growing tremendously. One technique to provide such features is to integrate a multiband antenna that operates over specific narrowband frequencies such as broadband dual-frequency meandered monopole antenna. However, it would be extremely difficult to achieve the frequency requirements of all future communication systems accurately. Alternately, a single antenna that covers a wide range of frequencies with the same polarization would be an ideal candidate not only for present multiband applications but also for future communication systems. In this paper, a new monopole antenna with a C shaped radiator with a lateral feed line is proposed which supports major cellular communication band like AWS, DCS, DECT, PCS, PHS, 3G, UMTS, DSR, Wi-Bro, ISM, and DMB in the wide range of 1.7-2.9 GHz with good radiation characteristics.

2 Antenna Design

The geometry of proposed antenna shown in fig 1 comprises of a 50Ω microstrip line feed of width 3 mm on FR4 substrate (dielectric constant 4.5) of thickness 1.6 mm with a C-shaped patch. The feed line is attached laterally to the radiator. The structure is analyzed by proper modeling of ground plane and patch size to operate in wideband. The antenna dimensions are given in table 1.

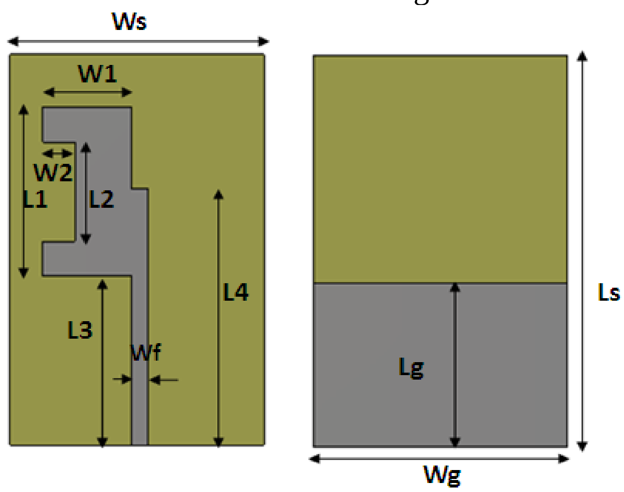

Fig 1: Proposed Antenna Geometry

Table 1: Antenna Dimensions

Ws	47 mm
Wg	47 mm
Lg	28 mm
Ls	67 mm
L1	29 mm
L2	17 mm
L3	29 mm
L4	44 mm
W_f	3 mm
W1	16.5 mm
W2	6 mm

3 Simulation Results

The designed antenna is simulated using CST Micro- wave Studio and the return loss graph is studied to achieve wide band width and to cover the required bands.

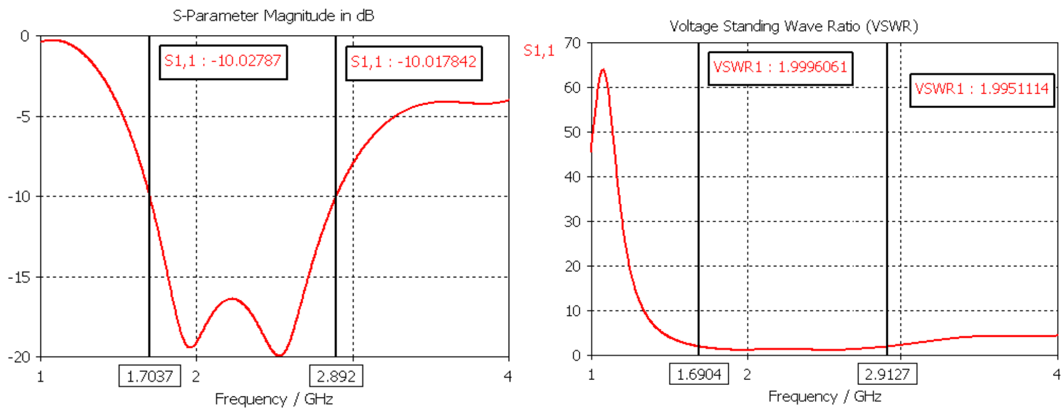

Fig 2: Simulated Return Loss and VSWR Plot

The return loss plot and VSWR plots shown in fig 2 for the designed structure satisfies the antenna operating bandwidth from 1.7 to 2.92 GHz which fulfils the operation at desired bands.

4 Current Distribution on Patch

Surface current distribution shows the physical behavior of the antenna. The surface current distributions on the patch at different frequencies are studied which are given in fig 3.

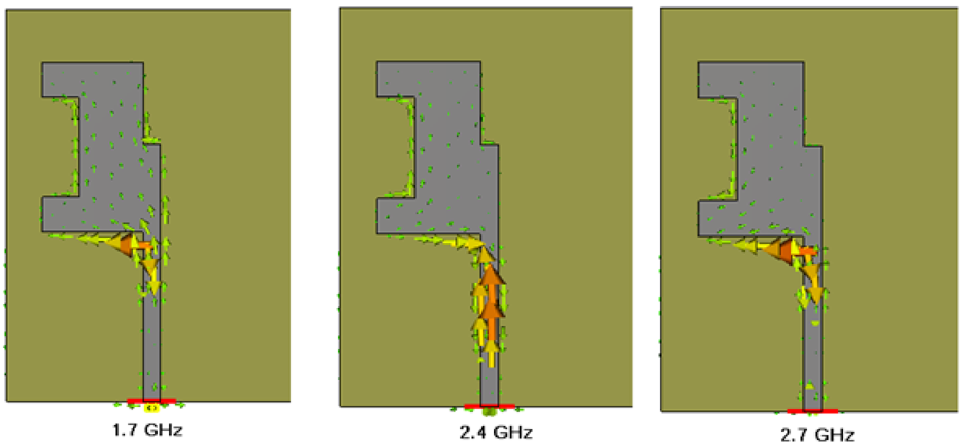

Fig 3: Surface Current Distribution

The current distribution on the patch shows that the upper stub of C Shaped patch is responsible for lower resonant mode and lower stub is for higher resonant mode.

5 Radiation Patterns

The radiation patterns in terms of polar plot and 3D view are shown in figure 4 and 5 for different frequencies. The antenna gain for various bands are given in table 2. Measured antenna gains in different bands, listed in table indicate the reasonable gain offered over the entire band of operation.

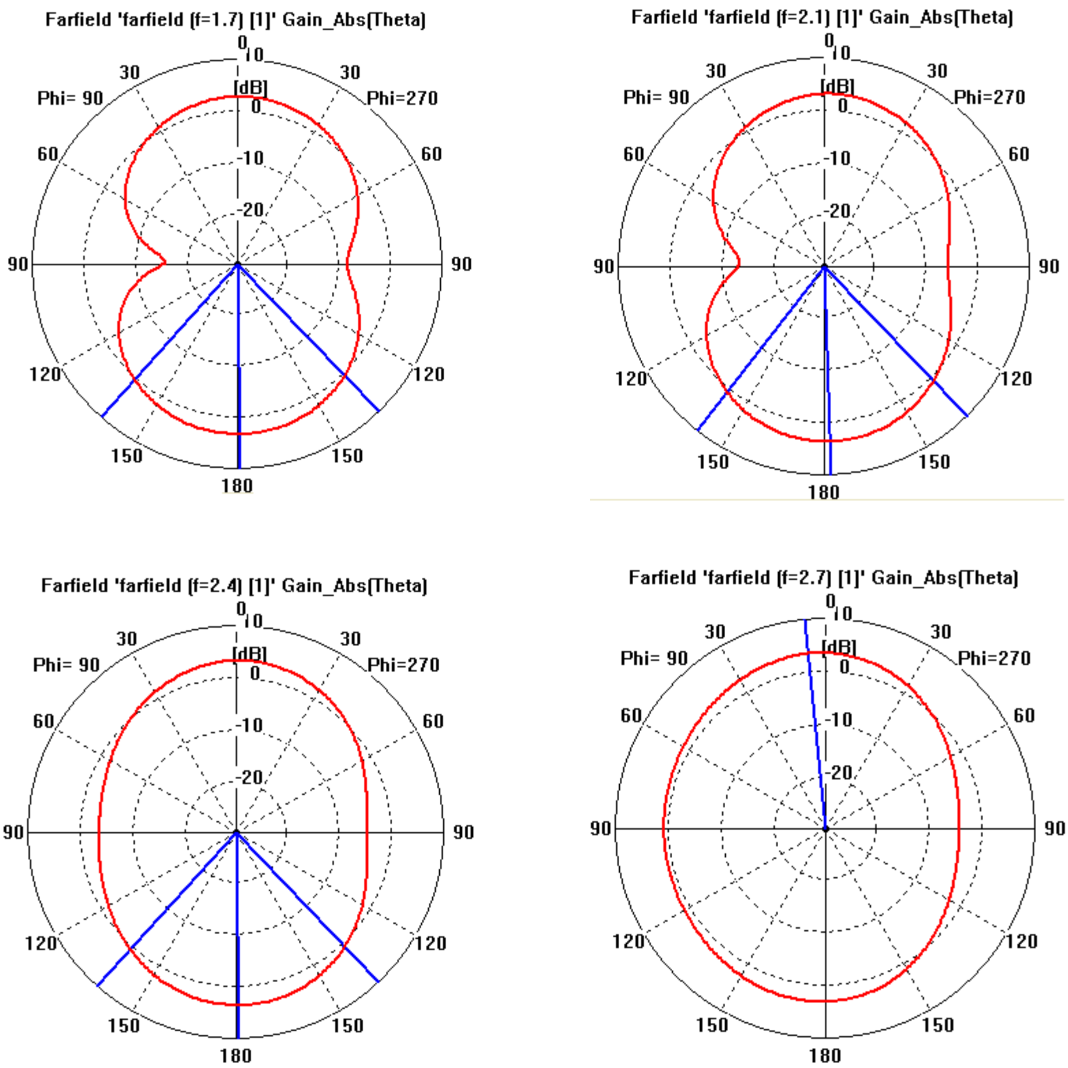

Fig 4: Radiation Patterns in terms of Polar plots

Table 2: Antenna Gain at Different Bands

Frequency bands	Gain in dB
AWS (1710–1755 MHz)	3.288
DCS (1710–1880 MHz)	3.359
PCS (1850–1990 MHz)	3.509
DECT (1880–1900 MHz)	3.475
PHS (1905–1920 MHz)	3.501
3G (1920–2170 MHz)	3.615
UMTS (1920–2180 MHz)	3.618
AWS (2110–2115 MHz)	3.644
DSR (2290–2300 MHz)	3.648
Wi-Bro (2300–2390 MHz)	3.637
ISM (2400–2485 MHz)	3.599
DMB (2605–2655 MHz)	3.632

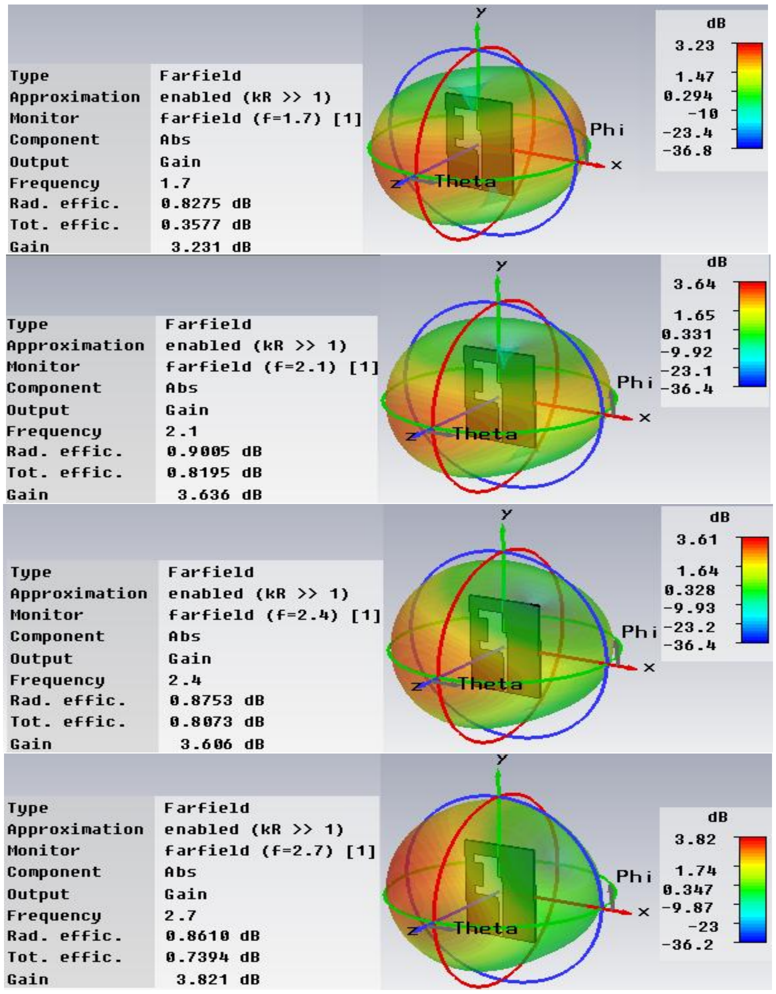

Fig 5: Radiation Patterns (3-D View)

6 Conclusion

The designed antenna satisfies the wideband operation. The simulation result in terms of VSWR and return loss shows that the designed antenna is a good candidate to meet the requirement for major cellular bands with good radiation characteristics. Also the antenna is compact which makes it suitable for the cellular communication applications.

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