JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A COMPACT SQUARE SPANNER WITH L SHAPED PATCH ANTENNA FOR ULTRA WIDEBAND APPLICATION

Dr.Nagaraj Hanchinamani
Senior Scale Lecturer, Dept. of Electronics and Communication Engineering
Sri Channakeshava Government Polytechnic Bankapur, Haveri, Karnataka, India

Abstract : **The letter presents the design of a coplanar compact size ultra-wideband Microstrip line feed square spanner shaped patch antenna for ultra-wideband applications. The square spanner shaped patch antenna with coplanar is proposed in this letter offers improved directivity, bandwidth, and return loss characteristics. The antenna system operates frequency range from 3.05-13.45 GHz frequencies for VSWR≤2. The proposed antenna has simulated using Computer Simulation Technology (CST) microwave studio and suitable for ultra wideband applications.**

IndexTerms - Computer Simulation Technology (CST), Coplanar antenna, Voltage Standing Wave Ratio (VSWR).

I. INTRODUCTION

The antenna design for wideband communication represents challenging task for designers of fixed and mobile wireless communication systems. The continues improvement of mobile systems toward the Sixth-generation (6G systems) needs wideband and UWB antennas suitable to cover mobile and wireless services and to reduce the system complexity, the overall device size, and costs. Many efforts are underway to identify new antenna geometries suitable to satisfy the challenging requirements of the modern wireless communication systems [1].

The federal communication commission (FCC) approved the frequency range of 3.1 to10.6 GHz for commercial ultra-wideband (UWB) communication systems [3], many researchers are paying much attention on UWB technology enable high-speed data transmission rate with low power consumption for various applications such as wireless communications, medical imaging, radar and indoor positioning.

Antenna is passive device which transmits or receives electromagnetic waves. Microstrip antennas have many advantages compared to conventional microwave antenna and therefore are used in a variety of practical applications. Microstrip antenna was first introduced in the 1950s. Microstrip patch antenna act as transducer between the wireless system and free space.[2] A microstrip patch antenna consists of a radiating patch on one side of dielectric substrate (Cr≤10), with a ground plane on other side. Dielectric substrate is placed between two metallic planes; one is upper radiating metallic patch & another grounded metallic plane as shown in figure 1 below.

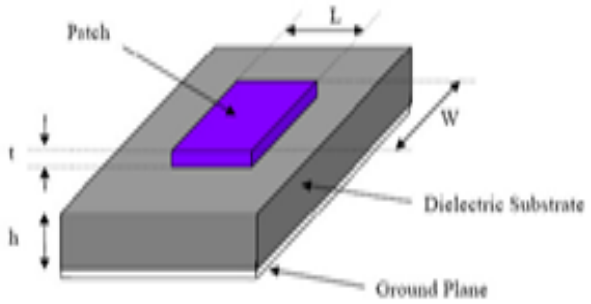

Figure 1: Microstrip antenna configuration

II. ANTENNA DESIGN

The proposed antenna dimension is 25x25mm^2 printed on FR4 substrate having dielectric constant ε_r= 4.4, a tangent loss of 0.02 and a thickness of 1.6mm, the antenna is fed by a microstrip line of 50Ω, 8.8mm length and width w = 3.8mm and square spanner with L shaped patch antenna can be constructed by cutting square shape patch and creating L shaped patch as the antenna

geometry shown in Figure 2. The designed front view and back view single spanner shaped patch antenna shown in Figure.2, and Figure.3 respectively

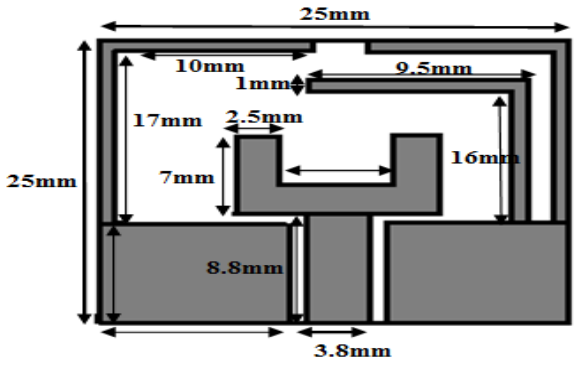

Figure.2 Geometry of proposed spanner shaped patch anteena front view

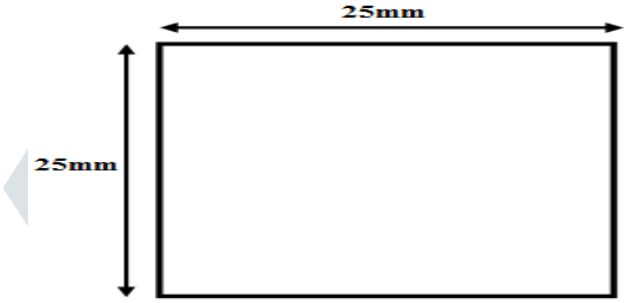

Figure.3 Geometry of proposed spanner shaped patch anteena back view

III. RESULTS AND DISCUSSION

The proposed square spanner with L shaped ultra wideband microstrip patch antenna is designed using a CST Microwave studio suit 2015 which works on principle of FIT (Finite Integration Technique). The simulation results of the return loss of the proposed antennas are shown in Figure. 4 from the figure we can conclude that the proposed spanner shaped patch antenna operate frequency range is 3.00-13.43 GHz. The proposed compact square spanner shape patch antenna is much suitable for ultra wideband application. The VSWR of proposed antenna is less than 2 over entire operating frequency range. The VSWR plot of the proposed antenna is shown in Figure.5.

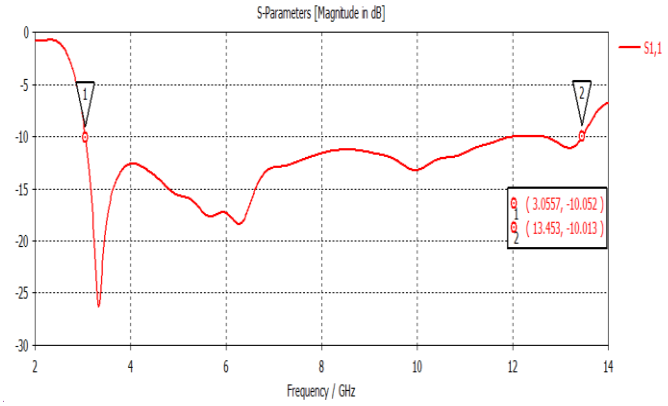

Figure. 4 scattering parameters of proposed spanner shaped patch antenna

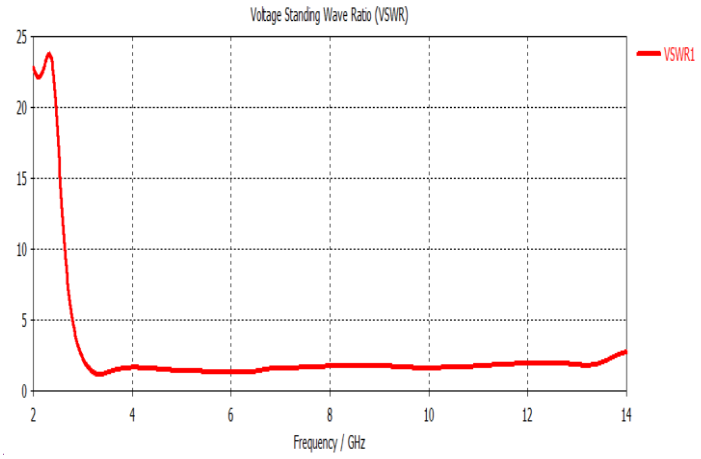

Figure.5 VSWR of proposed spanner shaped patch antenna

The characteristics impedance is determined by varying the space amongst the signal strip and the ground strip for static substrate height and the dielectric constant. The effect of reflection characteristics of gap 'g' between the signal strip and coplanar ground is arbitrarily varied from 0.3mm to 0.8mm shown in figure 6. Results from figure 5.3 the reflection coefficient shift towards the lower side frequency as the gap is reduced. The change of resonant frequency and bandwidth with effect of gap g for all the four cases that is g=0.3, 0.4, 0.6 and 0.8 shown in Table 1. At g=0.4mm the antenna system explores the frequency range 3.05-13.49 GHz and resonant frequency 3.34GHz and 6.3GHz with 10 dB Bandwidth is 10.44GHz. Figure 7 illustrations the effect of the gap g over the voltage standing wave ratio for all the four cases that is g=0.3mm, 0.4mm, 0.6mm and 0.8mm

Table 1. Variation of Resonant frequency and Bandwidth with effect of gap g

Gap g (mm)	Resonant Frequency (GHz)	Frequency Range (GHz)	10 dB Bandwidth (GHz)
0.3	3.28, 6	3.013-13.57	10.56
0.4	3.34,6.3	3.05-13.49	10.44
0.6	3.38, 6.6	3.1-10.5	7.4
0.8	3.4, 6.88	3.18-9.78	6.6

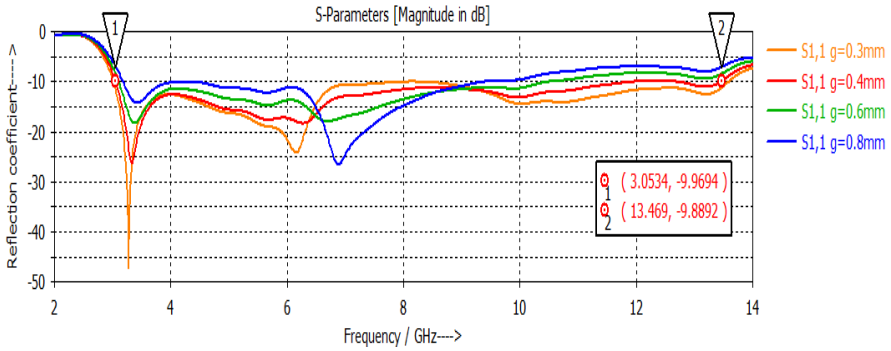

Figure.6 Effect of gap g over the reflection coefficient characteristics

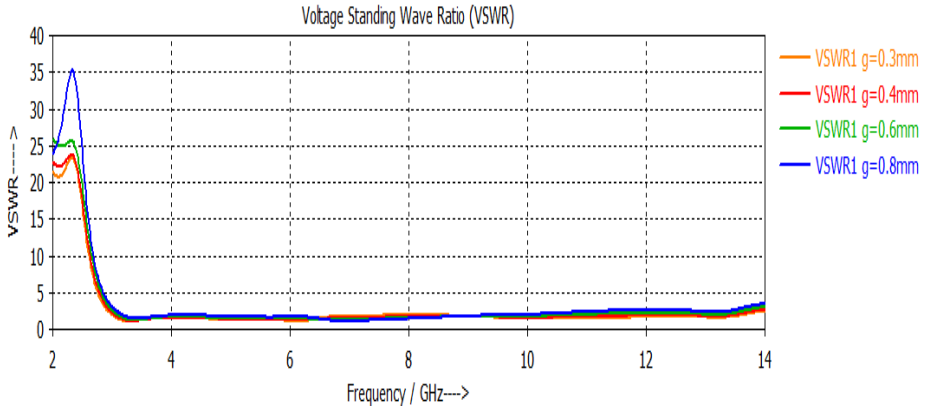

Figure 7 Effect of gap g over the VSWR

The simulated 3D radiation pattern of the compact coplanar wideband antenna is shown in figure.8 A nearly eight shaped pattern is obtained at frequency 3GHz, 6GHz, 9GHz and 12GHz shown in figure 8 (a), (b), (c), (d) respectively.

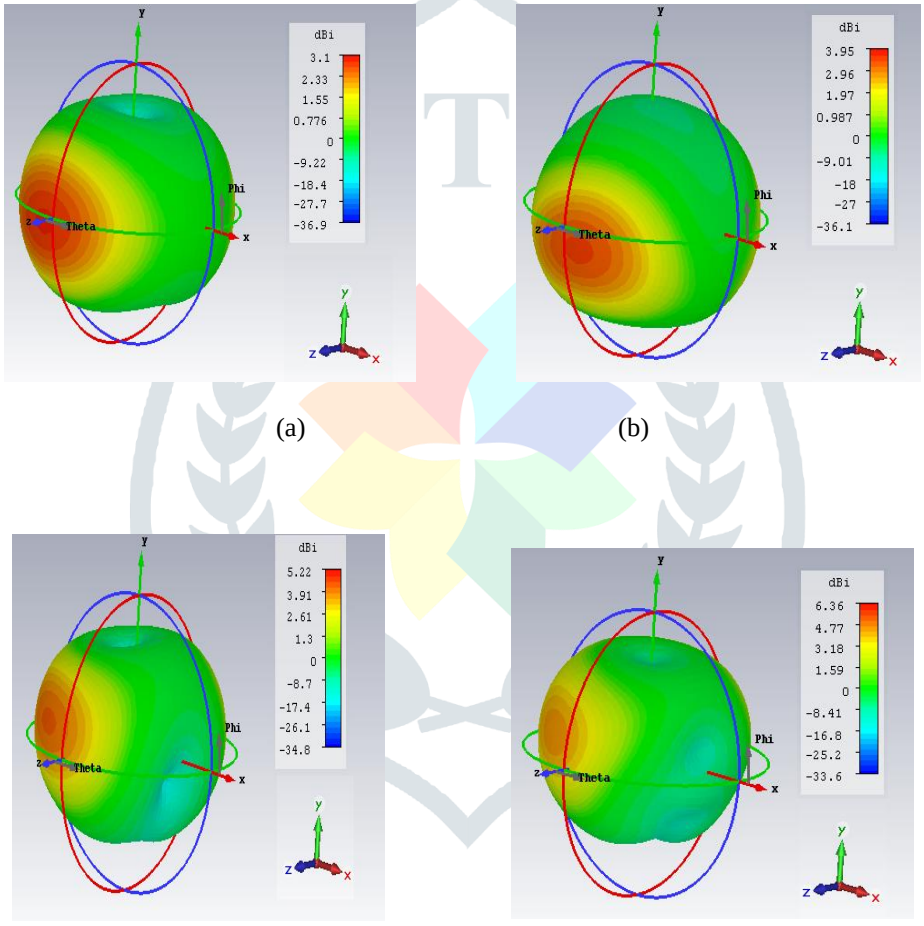

Figure 8 3D Radiation pattern of coplanar compact antenna at 3GHz (a), 6GHz (b), 9GHz(c) and 12GHz (d)

IV. CONCLUSION

In this letter presents the design of a compact size co-planar wideband Microstrip line feed square spanner shaped patch antenna for ultra-wideband applications. The proposed antenna system operates frequency range from 3.05-13.45 GHz frequencies for VSWR≤2. Compared with other microstrip patch antennas of high bandwidths this proposed geometry has the attractive features of low profile, smaller patch size and being simple to design is suitable to satisfy the challenging requirements of the modern wireless communication systems.

BIOGRAPHY

NAGARAJ HANCHINAMANI was born in Karnataka, India in 1988. He received the B.E Degree in Electronics and Communication engineering and the M.Tech degree in Digital Communication and Networking from the VTU, Belgaum in 2010 and 2012 respectively. He is received Ph.D. from JAIN University Bangalore in 2019. He is currently working as Senior Grade lecturer in Electronics & Communication engineering department at Government Polytechnic Bankapura, Haveri. His research interest is on Microwave communication, Antennas and Wireless communication, Includes Analysis and design of patch antenna for wireless communication.