

# A Double-Printed Trapezoidal Patch Dipole Antenna for UWB

Jillala Veeresh, Mangu Pavani

**Abstract**— In this paper, a novel double-printed trapezoidal patch dipole antenna compatible for UWB functions with band-notched attribute is offered and investigated. The band-notched attribute is finished with the aid of inserting T-form slots on the trapezoidal radiating patches. The impedance characteristic, radiation patterns and the switch function are studied. Experimental results exhibit that the proposed antenna covers the complete UWB band (three.110.6 GHz) at the same time it has a notched band for the IEEE 802.11a frequency band (5.155.825 GHz). Measured time delay, transmission traits and Time area traits point out that the proposed antenna satisfies the requirement of the current wireless communications techniques.

**Index Terms**— dipole antenna, impedance, UWB, radiation pattern .

## I. INTRODUCTION

With the progress of wideband wireless conversation techniques, more than a few varieties of extremely huge band (UWB[2]) antennas had been studied greatly and various possible designs of extremely-wideband antennas are steadily growing [1]. It's a well-known fact that planar dipole antennas reward particularly attractive aspects such as easy structure, compact size, low fee, omni-directional character, and many others. Because of these fascinating traits, many dipole antennas are studied broadly [5-7].

Due to the fact that the 5.155.825 GHz frequency band allocated for wireless local area network (WLAN) programs can interfere with the UWB communications programs, a band-notched filter in UWB methods is imperative. In comparison with including a filter to expand the complexity of the UWB procedure, utilising a UWB antenna having frequency band-notched function is the really useful alternative. More than a few Planar antennas with band-notched performance were proposed for UWB purposes [8]. In this article, we advocate a novel double-printed trapezoidal patch dipole antenna having a frequency band-notched function for UWB[3-5] communication. The band-notched attribute is acquired by way of inserting

T-form slots on the radiators. The band-width and the notched frequency band can also be adjusted with the aid of changing the antenna parameters. Important points of the design and experimental results are awarded and discussed in the following sections.

## II. LITERATURE SURVEY

The first antennas were inbuilt 1888 by German man of science Heinrich Rudolph Hertz in his pioneering experiments to prove the existence of magnetic force waves foretold by the idea of James Clerk Maxwell. Hertz placed dipole antennas at the put concentration of parabolic reflectors for each transmission and receiving.

The origin of the word antenna relative to wireless equipment is attributed to Italian radio pioneer Marconi. In 1895, whereas testing early radio equipment within the Swiss Alps at Salvan, European country within the mountain peak region, electrical engineer experimented with long wire "aerials". He used a two.5 meter vertical pole, with a wire hooked up to the highest running right down to the transmitter, as a divergent and receiving aerial part.

Microstrip antenna was 1st introduced within the early Nineteen Fifties .However this idea had to attend for regarding twenty years to be realised once the event of computer circuit board (PCB) technology within the Seventies. Since then microstrip antennas are the foremost common kinds of antennas with wide selection of benefits of low profile, light-weight weight, easy fabrication and integration with microwave monolithic integrated circuits (MMIC).

The most ordinarily used microstrip antenna could be a rectangular patch. The oblong patch antenna is just about a half wavelength long section of rectangular microstrip line. once air is that the antenna substrate, the length of the oblong microstrip antenna is just about half of a free-space wavelength. Because the antenna is loaded with a nonconductor as its substrate, the length of the antenna decreases because the relative nonconductor constant of the substrate will increase. The resonant length of the antenna is slightly shorter attributable to the extended electrical "fringing fields" that increase the electrical length of the antenna slightly. Associate early model of the microstrip antenna could be a section of microstrip line with equivalent masses on either finish to represent the radiation loss.

*Manuscript received Sept , 2015.*

*J.Veeresh, Department of ECE, K.L.R College of Engineering and Technology Khammam, India, Mobile No:+91-8187059657.*

*M.Pavani, Department of ECE, K.L.R College of Engineering and Technology Khammam, India, Mobile No: +91-9603246837.*

### III. DESIGN ANALYSIS

The design of the structure relies on the theoretical calculations mentioned within the previous chapter. The planning is finished in 2 simulation soft wares specifically Central Time (COMPUTER SIMULATION TECHNOLOGY) and HFSS (HIGH FREQUENCY STRUCTURE SIMULATOR). Central Time and HFSS are unit magnetism simulators employed in the planning and analysis of high frequency (HF) devices like antennas, filters, couplers, plate like and multi-layer structures and SI and EMC effects.

#### 3.1 style Simulator –CST Studio Suite

CST - theoretical account Technology Ag (CST) could be a German software package company with headquarters in Darmstadt. The most product of Central Time is Central Time STUDIO SUITE, that contains numerous modules dedicated to specific application areas. There are unit modules for microwave & RF applications, summarized in Central Time MICROWAVE STUDIO, low frequency (CST EM STUDIO), PCBs and packages (CST PCB STUDIO), cable harnesses (CST CABLE STUDIO), temperature and mechanical stress (CST MPHYSICS STUDIO) and for the simulation of the interaction of charged particles and magnetism fields (CST PARTICLE STUDIO). All modules are unit integrated with a system gate machine (CST style STUDIO).

In our design we tend to use CST MICROWAVE STUDIO (CST MWS). CST MICROWAVE STUDIO® (CST MWS) may be a specialist tool for the 3D EM simulation of high frequency elements. CST MWS' alone performance makes it an initial alternative in technology leading R&D departments. CST MWS permits the quick and correct analysis of high frequency (HF) devices like antennas, filters, couplers, planar and multi-layer structures and SI and EMC effects. Exceptionally user friendly, CST MWS quickly provides an associate degree insight into the EM behavior of high frequency styles.

#### 3.2 Design Process in CST

For coming up with the desired form in CST MICROWAVE STUDIO (CST MWS), the following steps are followed.

1. Open CST STUDIO SUITE and so click on CST MICROWAVE STUDIO (CST MWS).
2. Because the needed style is planar, choose planar form from the essential shapes given.
3. Choose brick form and assign X, Y and Z co-ordinates thereto per the look. This can be the bottom plane. X & Y co-ordinates denote the length and breadth of the

bottom plane severally. Z denotes the thickness. Choose the fabric as PEC (Perfect electric).

4. Then choose solid two and assign X1, Y1 co-ordinates thereto same as that of the bottom
5. Plane. Z2 is varied. This is the dielectric substrate RT DUROID 5880. The thickness (Z2) of dielectric substrate is varied in our style and simulation results are measured.
6. Then choose solid three and co-ordinates thereto. This is the patch.
7. Choose solid and assign X4, Y4 co-ordinates thereto. These square measure the cut breadth and cut depth of the antenna. Cut it from solid three. We get a cut-shape piece (Boolean subtract).
8. Choose another solid and assign X5, Y5 co-ordinates. These square measure the strip patch length and strip patch breadth severally. Add it to solid three (Boolean add).
9. This completes the look of the structure. Then head to fast begin guide and assign frequencies, boundary conditions, waveguide ports etc needed as per the look.
10. Begin the transient convergent thinker and see the simulation results.
11. Return loss (S11) and VSWR square measure calculated for various substrate thickness (Z2) and simulation results are measured and noted down.

#### 3.3 Design Simulator –HFSS

HFSS may be an industrial finite part methodology convergent thinker for magnetic attraction structures from Analysis. The descriptor originally stood for top frequency structural machine. It's one amongst many industrial tools used for antenna style, and therefore the style of complicated RF electronic circuit components as well as filters, transmission lines, and packaging. It had been originally developed by prof Zoltan Cendes and his students at Carnegie Mellon University.

HFSS is that the industry-standard simulation tool for 3D full-wave magnetic attraction field simulation. HFSS provides E- and H-fields, currents, S-parameters and close to and much radiated field results. Intrinsic to the success of HFSS as an associate degree engineering style tool is its machine-controlled answer method wherever users square measure solely needed to specify pure mathematics, material properties and therefore the desired output. From here HFSS can mechanically generate an associate degree applicable, economical and correct mesh for determination of the matter.

#### 3.4 Design Process in HFSS

1. Open HFSS software package.

2. Choose insert HFSS style and draw rectangle1 .This is ground plane. All x,y and z dimensions square measure unbroken in mil.
3. Then draw box1 that is nonconductor with thickness .Assign x,y and z co-ordinates.
4. Then draw rectangle2 that is patch. Assign x,y and z co-ordinates.
5. Then draw parallelogram3 with completely different centre and cypher it from rectangle two. Assign x,y and z co-ordinates.
6. Draw rectangle4 and assign x,y and z co-ordinates. This offers the strip path length and strip path breadth.

7. Then draw box2 that is that the radiation box. Choose wave guide port and provides excitation.
8. Begin the convergent thinker and see the simulation results. The substrate thickness is varied and simulations square measure allotted for various substrate thickness

#### IV. SIMULATION AND RESULTS

##### 4.1 Structure in CST/HFSS:

The Figure 4.1 shows the structure in CST/HFSS

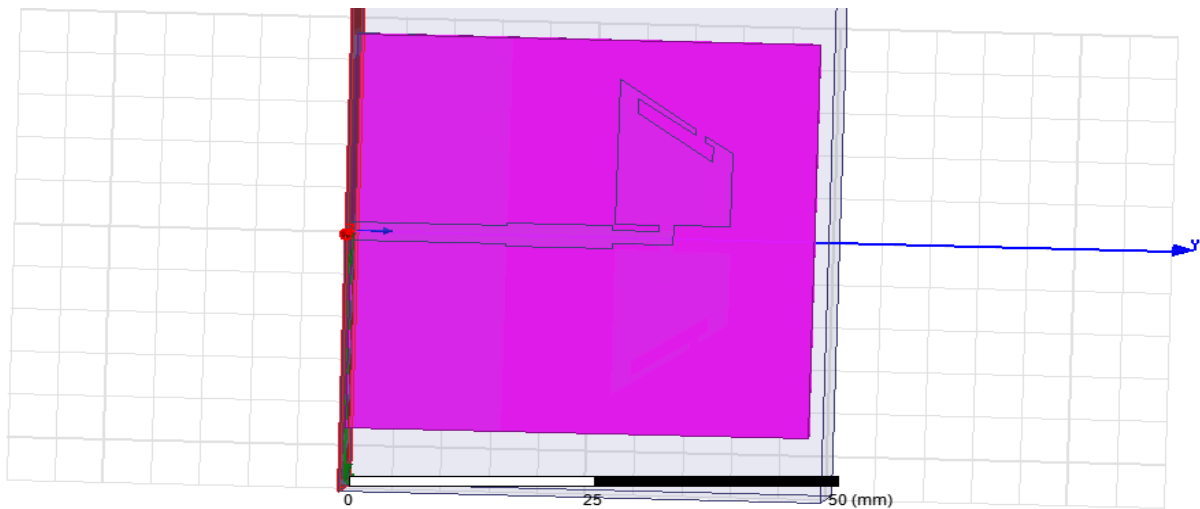


Fig 4.1 Structure in CST/HFSS

##### 4.2 Results in CST/HFSS

The results in CST/HFSS shown in the Figure 4.2, S11 parameters shown in the Figure 4.2 (a) radiation pattern shown in the Figure 4.2 (b) shows that the simulated

radiation patterns of *E*-plane and *H*-plane at 3.6 and 11 GHz respectively. It is observed that the radiation pattern of *E*-plane and *H*-plane at 3 and 6 GHz are approximately omni-directional while those at 11 GHz are a little worse.

##### 4.2.1 S-Parameters:

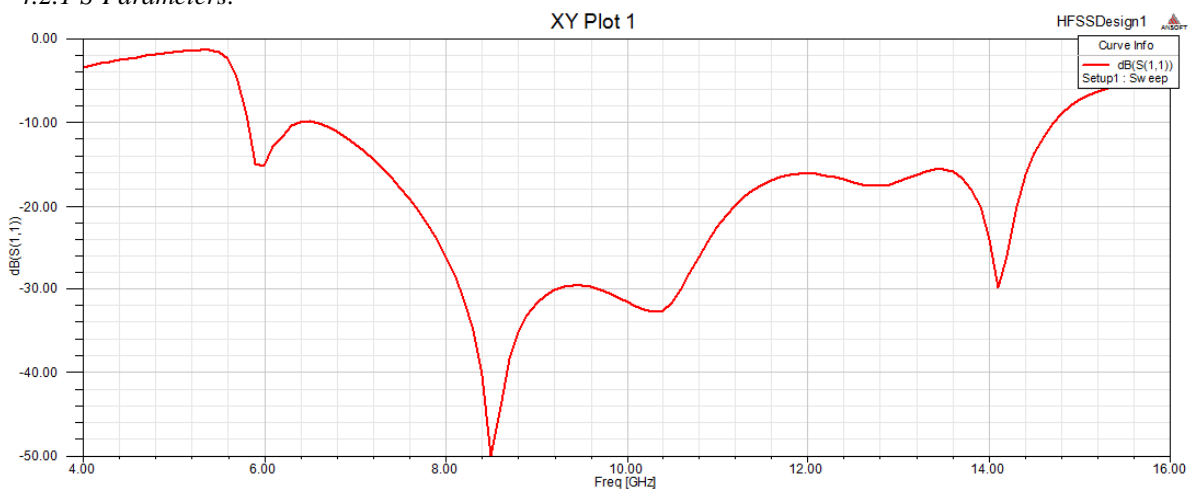


Fig 4.2.(a) S-Parameters

## 5.2.2 Radiation Pattern :

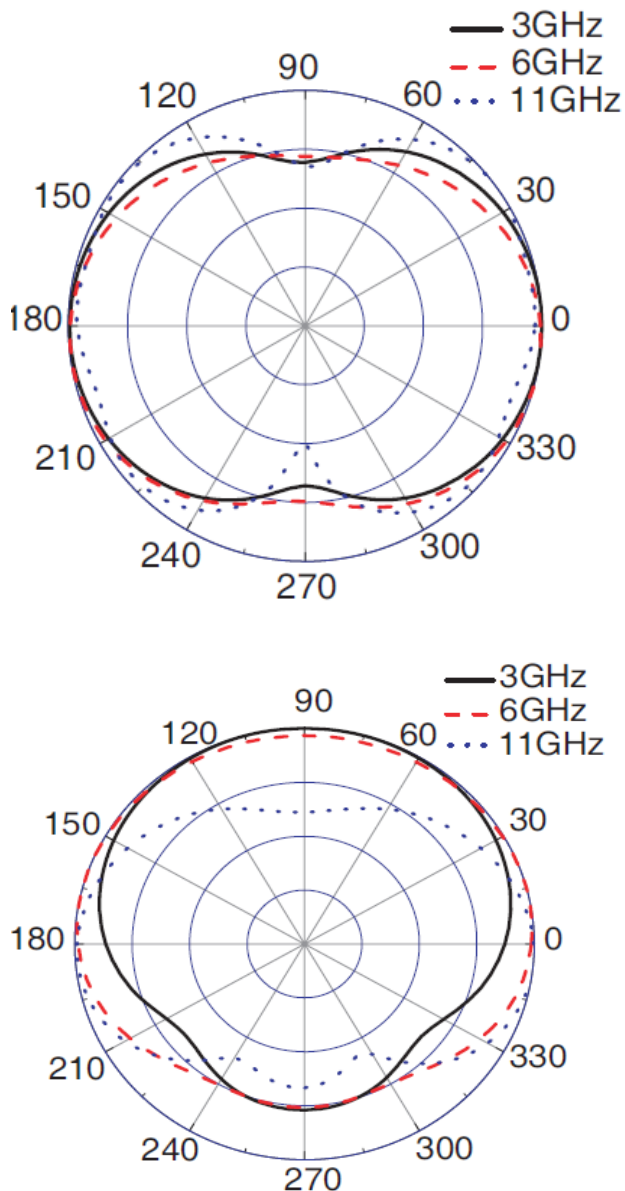


Fig 4.2.(b) Radiation Pattern

## V. CONCLUSION

A new antenna style of 2 parallel dipoles is conferred for broadband wireless communication and phased array applications. The projected antenna style is characterised by high pattern stability, which results in important improvement within the usable information measure over all similar designs. The antenna provides a good usable information measure of eighty four. The one part antenna produces endfire radiation diagram with high front-to-back magnitude relation, low cross polarization level, wide beamwidth, and high gain, and these characteristics area unit increased additional by victimization the modified two-element arrays. The antenna is great candidate for many applications in wireless communications and phased arrays.

## REFERENCES

- [1] Chen, Z.-N., \UWB antennas: Design and application," 2007 6th International Conference on Information, Communications & Signal Processing, 1{5, Dec. 10{13, 2007.
- [2] Yildirim, B.-S., A.-C. Bedri, R. Gemma, and J. Luis, \Integrated bluetooth and UWB antenna," IEEE Antennas and Wireless Propagation Letters, Vol. 8, 149{152, 2009.
- [3] Ojaroudi, M., C. Ghobadi, and J. Nourinia, \Small square monopole antenna with inverted T-shaped notch in the ground plane for UWB application," IEEE Antenna and Wireless Propagation Letters, Vol. 8, 728{731, 2009.
- [4] Guo, L., S. Wang, X. Chen, and C. Parini, \A small printed quasi-self-complementary antenna for ultra wideband systems," IEEE Antenna and Wireless Propagation Letters, Vol. 8, 554{557, 2009.
- [5] Eldek, A. A., \Design of double dipole antenna with enhanced usable bandwidth for wideband phased array applications," Progress In Electromagnetics Research, PIER 59, 2006.
- [6] Ling, J., S.-X. Gong, B. Lu, H.-W. Yuan, W.-T. Wang, and S. Liu, \A microstrip printed dipole antenna with UC-EBG ground for RCS reduction," Journal of Electromagnetic Waves and Applications, Vol. 23, No. 5{6, 607{616, 2009.
- [7] Dissanayake, T., M.-R. Yuce, and C. Ho, \Design and evaluation of a compact antenna for implant-to-air UWB communication," IEEE Antenna and Wireless Propagation Letters, Vol. 8, 153{156, 2009.
- [8] Jang, J.-W. and H.-Y. Hwang, \An improved band-rejection UWB antenna with resonant patches and a slot," IEEE Antenna and Wireless Propagation Letters, Vol. 8, 299{302, 2009.
- [9] Choi, N., C. Jung, J. Byun, F. J. Harackiewicz, M.-J. Park, Y.S. Chung, T. Kim, and B. Lee, \Compact UWB antenna with I-shaped band-notch parasitic element for laptop applications," IEEE Antenna and Wireless Propagation Letters, Vol. 8, 580{582, 2009.