Review of UWB Monopole Antenna With BOW-Tie Structure

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Abstract*-A UWB (ultra wideband) antenna are gaining prominence and becoming very attractive in communication system. A compact triple multi- band slotted bow tie patch antenna is design to meet requirement of the multiple operating frequency. This antenna has simple structure generated by ethching slots of different lengths in a bow type patch. The length of each bent monopole is determine under the quarter wavelength resonance condition. The bow type patch treated as a broad band impedance matching structure. A triple band bow-tie monopole antenna for WLAN/WiMAX/LTE application with the bands of 2.4-2.7 GHz,3.4-3.7 GHz,and 5.2-5.8 GHz. The antenna is fabricated on a 0.8 mm-thick FR4 substrate*

Keywords-Microstrip patch antenna, UWB antenna, CPW Feeding Technique, ISM band.

I. INTRODUCTION

The main aim of designing monopole antenna is to improve bandwidth requirement. The CPW-fed monopole antenna is of bow-tie structure. By tunning the angle of different slots of antenna results the change in the bandwidth of the antenna. Angle is use to tunning of the frequency and its directly proportional to the bandwidth of the antenna. Each operating frequency of a ultrawide band monopole antenna can be design independently.

In traditional planer monopole antenna, the bandwidth can be increase by widening the width of antenna therefore if the bandwidth of each band needs to be fine-tuned, it can be adjust by the width of the corresponding bent monopole. the band width of proposed bent monopole is larger than that of a single monopole for the same operating frequency hence the bow-tie patch near the CPW feeding point acts as a broad band matching structure.

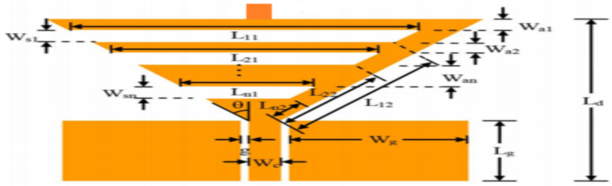


Fig.1 CPW-fed UWB monopole antenna with bow-tie structure

In high-performance aircraft, spacecraft, satellite, and missile applications, where size, weight, cost, performance, ease of installation, and aerodynamic profile are constraints, low-profile antennas may be required.. To meet these requirements, microstrip antennas can be used. These antennas are low profile, conformable to planar and non planar surfaces, antennas are used in commercial as well as government application purpose simple and inexpensive to manufacture using printed-circuit technology, mechanically robust when mounted on rigid surfaces, compatible with MMIC designs, and when the particular patch shape and mode are selected, they are very versatile in terms of resonant frequency, polarization, pattern, and impedance. In addition, by adding loads between the patch and the ground plane, such as pins and varactor diodes, adaptive elements with variable resonant frequency, impedance, polarization, and pattern can be designed Major operational disadvantages of microstrip antennas are their low efficiency, low power, high Q (sometimes in excess of 100), poor polarization purity, poor scan performance, spurious feed radiation and very narrow frequency bandwidth, which is typically only a fraction of a percent or at most a few percent. In some applications, such as in government security systems, narrow bandwidths are desirable. However, there are methods, such as increasing the height of the substrate, that can be used to extend the efficiency (to as large as 90 percent if surface waves are not included) and bandwidth (up to about 35 percent) . However, as the height increases, surface waves are introduced which usually are not desirable because they extract power from the total available for direct radiation(space waves). The surface waves travel within the substrate and they are scattered at bends and surface

II. SYSTEM SPECIFICATION

The range of Microstrip antennas is from 2 to 6 GHz.
*Radiation Pattern

This type of antenna is low profile antenna. antenna radiates in various direction. We say that antenna has directivity which express in dbi. radiation pattern tells the variation of the power radiated by an antenna. if the antenna radiate in particular direction then it is omnidirectional this type of antenna are the actual antenna and come into practice.

*Antenna Gain

Power transmitted in the direction of peak radiation to that of an isotropic source. It is also said the function of angle. The gain of antenna must be in positive.it is measure in dB.if the gain of the antenna is negative then the power is reflected back and antenna will not radiate. If the antenna gain is 0 then antenna is short and it will not radiate radiation.

*Polarisation

The plane in which electric field varies is called polarization. Vertical antenna receives and emits vertically polarized waves and horizontal antenna emits and receives horizontal polarized waves.

*Bandwidth

It is the range of the frequency with in a particular band for example, if the radiates at 2.4GHz to 2.6GHz then the bandwidth of a given band is 200MHz. Bandwidth is inversely proportional to gain.as the bandwidth increases gain of the antenna is decreases.

*Antenna Feeding

There are various feeding technique use in microstrip patch antenna. for bow-tie structure antenna microstrip line fed patch is use. there are 4 types of feeding technique probe feed patch, microstrip fed line patch and inset microstrip line fed patch, aperture couple feed patch.

Antenna Description

The main design goal is to achieve a monopole type antenna to meet the overall size and operational bandwidth requirement. The CPW-fed multi band monopole antenna is modified using bow-tie structure. The bandwidth of a bow-tie antenna is directly proportional to included angle and control the band width by tunning the angle. Horizontal slots of different length are etched to create bent monopole with different frequencies. Each operating frequency of a multiband antenna can be design independently.

In traditional planer monopole antenna, the bandwidth can be increase by widening the width of antenna therefore if the bandwidth of each band needs to be fine-tuned, it can be adjust by the width of the corresponding bent monopole. the band width of proposed bent monopole is larger than that of a single monopole for the same operating frequency hence the bow-tie patch near the CPW feeding point acts as a broad band matching structure.

III. FEEDING METHODS

Contacting Feed:- In this method, the patch is directly fed with RF power using the contacting element such as microstrip line or coaxial line. The most commonly used contacting fed methods are Microstrip Feed and Co-Axial Feed

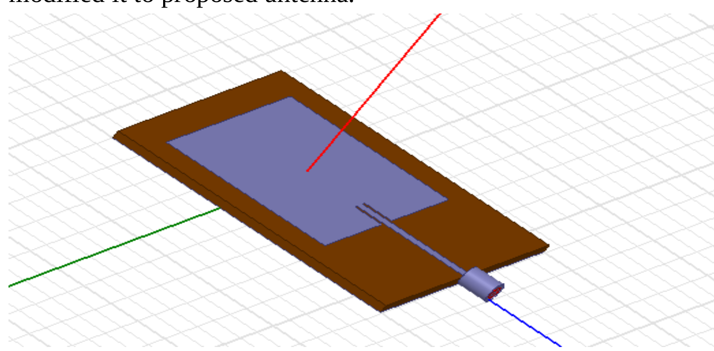
Non-Contacting Feed:- In this method, the patch is not directly fed with the RF power but instead power is transferred to the path from the feed line through electromagnetic coupling. The most commonly used noncontacting feed methods are Aperture Coupled feed and Proximity Coupled Feed.

There are many configurations that can be used to feed microstrip antennas.

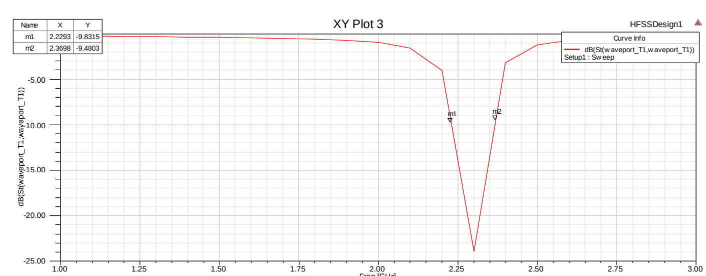
IV. EXAMPLE OF SIMPLE RECTANGULAR ANTENNA

Step 01:

To study the basic antenna simulation on HFSS we start with the basic rectangular patch antenna and further we modified it to proposed antenna.



Rectangular patch antenna

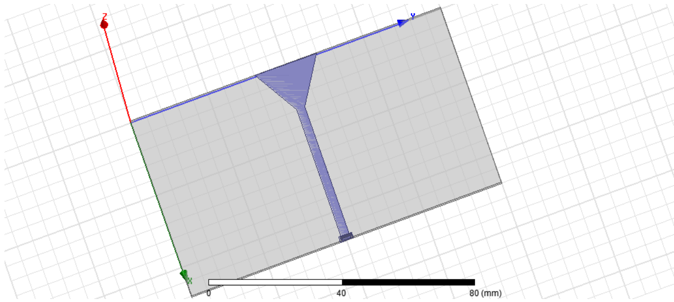


S11 parameter

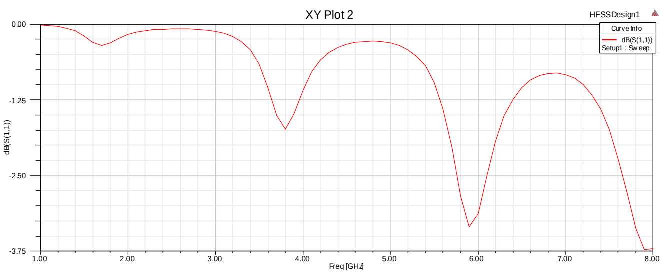
We observe that the antenna is operating at a frequency of 2.4GHz and having band of 140MHz. the gain of the antenna is 5dB.

V.EXAMPLE OF MONOPOLE ANTENNA

Step 2:



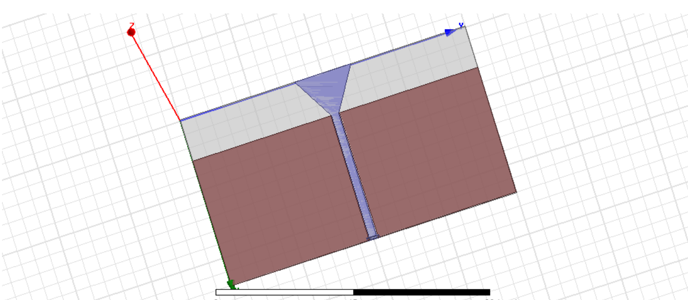
This is second step of designing monopole bow tie antenna having bow tie shape connected to the feed line. We construct the bow tie structure using polyline.



S11 parameter .

Example of Bow-tie shape patch antenna:

This is the simple design of monopole bow-tie antenna. further we will improve the design of the antenna to operate for triple band. Now below there some results ,dimensions of this antenna



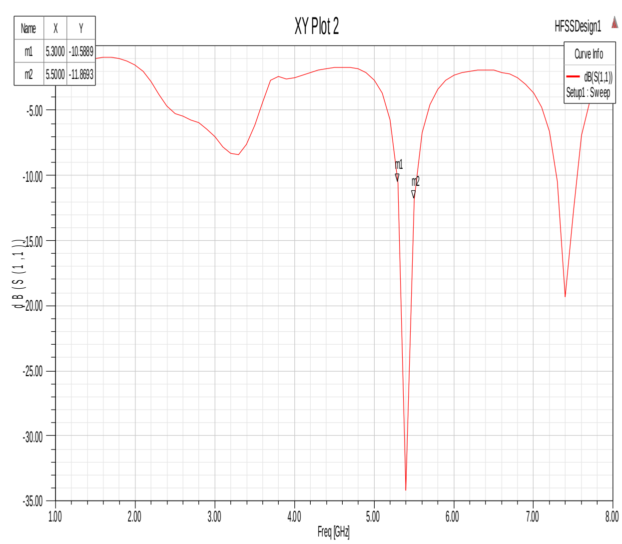
The proposed antenna is operating at a frequency of 5.5GHz and having bandwidth of 200MHz. reflection coeffient of the proposed antenna is -34dB.Bow-tie monopole antenna has better bandwidth than dipole antenna. bow –tie antenna has lower VSWR than dipole .lower the VSWR power get reflected .the proposed antenna is simulated on hfss. Lumped port is used to designed the antenna. Driven model is used as a solution type in hfss. the size of a substrate of a proposed antenna is 60×100mm and the thickness is 0.8mm.

Feed line: Feed line is one of the important component of antenna structure given below in fig. Coplanar waveguide structure is becoming popular feed line for antenna. The coplanar waveguide was proposed by C.P.WEN in 1969. A coplanar waveguide structure consist of median metallic strip of deposited on surface of dielectric surface slab with two narrow slits ground electrodes running adjacent and parallel to strip on same surface. This transmission line is uniplanar in construction , which implies that all conductors are on same slide of substrate.

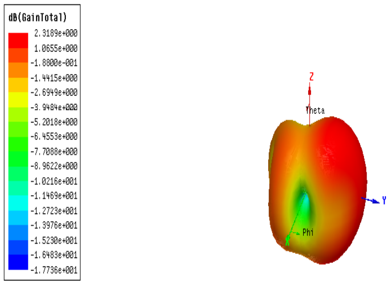
Etching a slot and feed line on same substrate eliminates the diagram problem needed in other wide band feeding techniques such as aperture coupled and proximity feed.

Antenna using CPW feed line have many attractive features including low radiation lossless dispersion, easy integration for monolithic micro wave circuits(MMICs) and simple configuration with single metallic layer. CPW feed slot antenna have modified shape reflector have been proposed. By shaping the reflector, noticeable enhancement in both bandwidth and radiation pattern is provide unidirectional antenna can be achieved by radiating antenna.

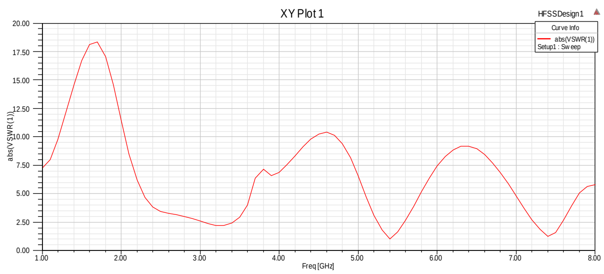
Possibility of covering some standardized Wi-Fi and Wi-Max frequency band while cling to class of simply structured and component antenna. The return loss characteristics of CPW feed bowtie antenna at 50 Ohms impedance matching.



Gain of proposed antenna for frequency of 5.5GHz

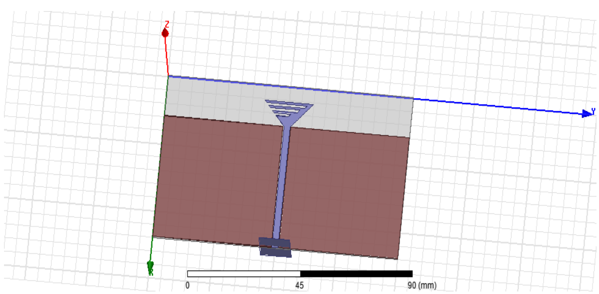


VSWR vs Frequency

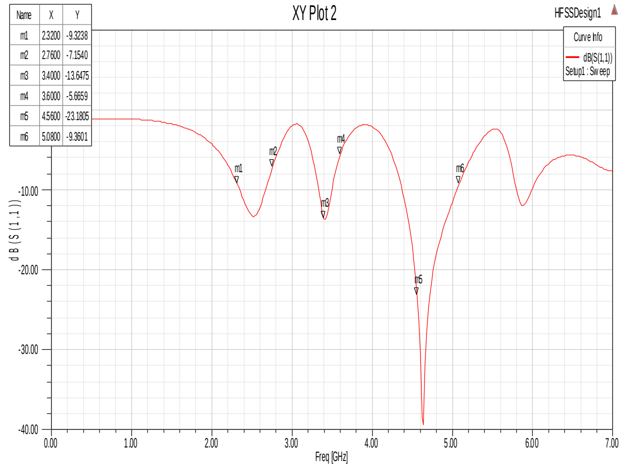


Example of bow tie antenna with antenna

Step 4:

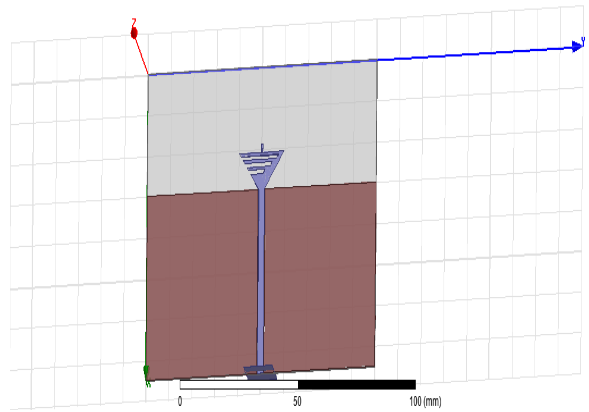


This proposed antenna has 3 bent monopole and operating at 3 different frequencies of 2.5GHz ,3.5GHz, and 5.5GHz.this antenna is the improvement in the previous antenna for better gain and bandwidth.

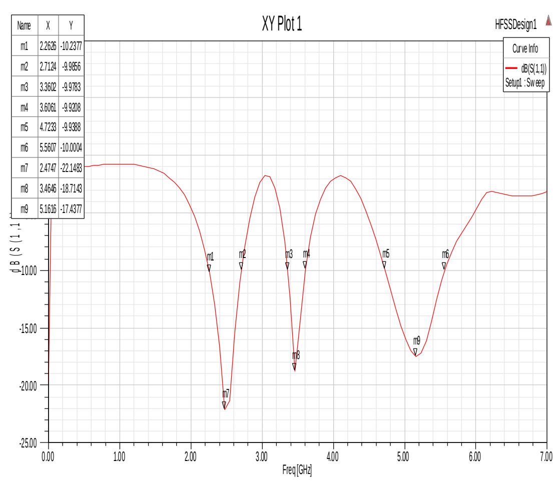


S11 parameter

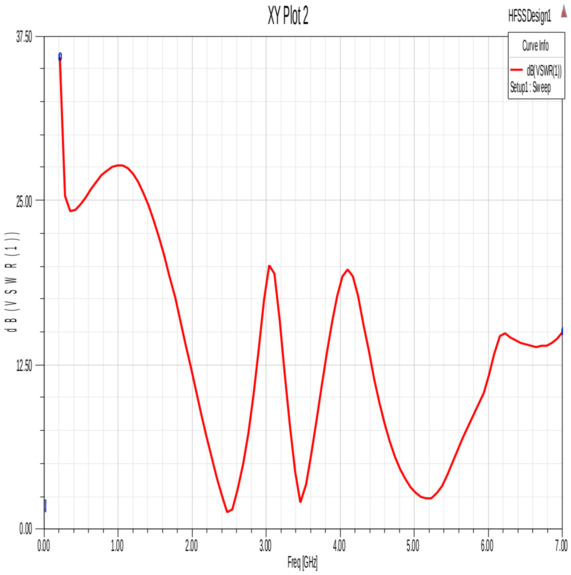
Step 5:



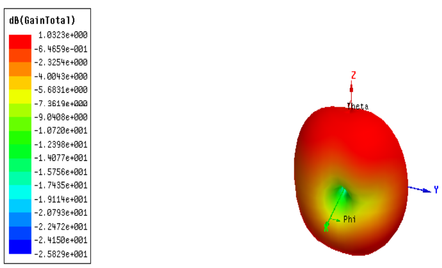
The proposed antenna is the improvent in previous antenna. In this proposed antenna we add a rectangular stob to improved bandwidth at 3.5GHz



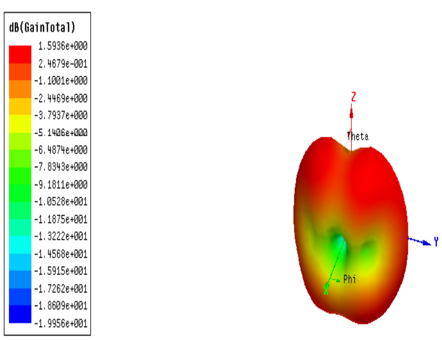
S11 parameter



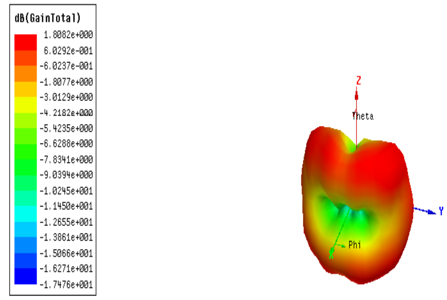
VSWR



Gain for 2.5GHz



Gain for 3.5GHz



Gain for 5.5GHz

Calculation Table:

Sr. No.	Parameters	Description
1	L11 L21 Ln1	16.5mm 12mm 5.3mm
2	Wa1 Wa2 Wa3	0.75mm 0.75mm 0.75mm
3	Ws1 Ws2 Wsn	0.9mm 0.9mm 0.9mm
4	Wg	48.75mm
5	Wc	2.5mm
6	Wd	100mm
7	G	0.3mm

Advantages:

- Ease of manufacturing.
- It has very low fabrication cost.
- Microstrip patch antenna are efficient radiators.
- It has support both circular and linear polarization.
- Easy in integration with microwave integration circuits.
- Low weight.
- Low profile.
- Required no cavity backing.
- Capable of dual and triple frequency operation.

Review:

In [1] UWB antenna is design using FR4 substrate having thickness 1.6mm. The antenna is uniplaner printed couple fed technique operated in two band 2.5 and 5.5Ghz .

In [2] a Triple band monopole antenna is designed using FR4 substrate having thickness of 1.6mm.The shape of patch is U type . It is operated in 2.4 GHz -5.2GHz.

In [3] a dual band antenna with compact radiator having shape of E and L is designed using FR4 substrate operates at 2.5GHz and 5.5GHz frequency..

In [4] a triple band antenna is designed using FR4 substrate having inverted L shaped operated at 2.3,3.53 and 5.5 GHz.

In [5] triple band antenna having dual sleeves inside the ground plane is designed using FR4 substrate and operates at2.38-2.85GHz, 3.35-4.30GHz and 5.12-5.85GHz .

In [6] compact triple band antenna of two U shape slots to remove unwanted frequency for Bluetooth ranging from 2.28 GHz to 2.9 GHz, WiMAX ranging from 3.3 GHz to 3.85 GHz and wireless local area network (WLAN) ranging from 4.72 GHz to 6.4 GHz.

In[7] Novel cpw feed planer monopole antenna of a pentagonal radiating patch with two bent slots. antenna can be good omnidirectional obtained so that three operating bands covering 2.14–2.85, 3.29–4.08, and 5.02–6.09 GHz can be achieved.

In[8] Penta band omnidirectional slot antenna having columnar structure operates in penta band for DCS, PCS, UMTS, 2.5-GHz, and 3.5-GHz WiMAX bands.

VI. CONCLUSION

The design of high gain 5.4GHz patch antenna for wifi application have been shown. and deployed on a 1.6mm thick FR4 Epoxy dielectric substrate has the gain of 2.31dB at 2.35GHz of resonant frequency with the bandwidth response of 130MHz ranges from the frequency of 5.31GHz - 5.55GHz.

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