Study of Wideband & Narrowband Antenna

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Abstract- Various papers on different configurations of wideband and narrow band antenna have been studied and thereby the different antenna parameters have been verified.

Keywords- Broad band, wide beam, circular polarization, conducting wall, micro strip antenna, Wide-Band, Omni directional radiation pattern smart grid, Wi MAX, very wide bandwidth, wireless applications.

I. INTRODUCTION

Circular polarization antennas are needed due to their insensitivity to ionospheric polarization rotation. Besides, for terminals to receive satellite signals, a wide radiation beam is extremely needed. Micro strip antenna has been widely used due to its small size, lightweight, low profile, low cost and easy to conform. Agile reconfigurable antennas for future communication systems have attracted researchers around the globe. Antenna's characteristics such as frequency, radiation pattern and polarization are reconfigured to attain the demands for agile radios. A lot of researches focus on frequency reconfiguration as future communication systems such as cognitive radio needs an antenna that can do spectrum sensing and communication. Research trend nowadays combine both wide and narrow band antennas to achieve concise, small and less complex front end cognitive radio systems. The wideband antenna is suggested to be used for spectrum sensing while an agile narrow antenna is used for communication. The agile wideband /scanned narrow band antenna are used for spectrum sensing and communication. Research trend nowadays combine both wide and narrow band antennas to achieve concise, small and less complex front end cognitive radio systems. In reconfigurable frequency antennas development, recently a reconfigurable wide-band to agile narrow frequencies, using a printed log periodic dipole array antenna, was introduced. A wideband slotted multifunctional reconfigurable frequency antenna for WLAN, WIMAX, UWB and UMTS has been proposed in ,a frequency reconfigurable antenna, consisting of two structures; one is an ultra-wide band (UWB) and other is a frequency reconfigurable triangle shape antenna, is proposed for cognitive radio communication.

Micro strip antennas have been widely used in many modern communication systems, because of its robustness, planar profile, and low cost. Most of these antennas operate at their fundamental mode, which gives a broadside beam. Micro strip antenna operating at the higher order mode has dual symmetric radiation beams. Micro strip antennas consist of a very thin metallic strip (patch) on a grounded substrate found extensive applications in different fields due to their attractive features. These antennas are low profile, light weight, compact and conformable structure and easy to fabricate. These antennas have drawn attentions of scientific community over the past decades several reconfigurable have been designed for cognitive radio applications. An effective method for doing this is to use physical alteration of the antenna parts via a rotational motion to achieve the reconfigurable characteristics. An alternative method is to combine the wideband antenna and narrowband antenna together and to connect to the narrow and wideband antennas via a shorting pin. Antennas used in ultra wide band (UWB) systems have been extensively studied in the recent years. Ultra-wide band antennas have already been used in areas such as satellite communication, remote sensing, ultra wide band radar and so on. Currently, the wireless area network (WLAN) in the 2.4-GHz (2.4-2.485 GHz) and 5-GHz (5.l5-5.875 GHz) bands is the most popular networks for accessing the internet the antenna for an AP not only requires dual-band operation but also needs to have an appropriate radiation profile in both bands, namely similar gain, wide beam width, and high front-to-back ratio. Wireless communications continues to enjoy exponential growth in Industrial, Scientific, and Medical (ISM) band. The future generation wireless networks require systems with broad-band capabilities in various environments to satisfy several applications as smart grid, personal communications, home, car, and office networking. Circular polarization (CP) is commonly adopted in GPS and other satellite communications due to the phenomenon of Faraday rotation when signals travel through the ionosphere. The circularly-polarized wave can be realized by exciting two linearly polarized modes. These two modes should be with 90 degree phase difference, equal amplitude, and orthogonal to each other in polarization. There are many types of antenna that can carry out the CP wave, such as spiral. But the micro strip antennas would be our first choice as it has the advantages of low-profile, lightweight and low cost. In this paper we will design a GPS micro strip antenna that perform wide-band CP radiation. Such antenna can be actualized using a single feed or dual feeds. The single feed CP antenna is simple in structure and easy to fabricate, while the bandwidth is rather too narrow. Therefore in this letter dual feeds are adopted to realize the wide-band CP antenna for dual-band GPS applications. The proposed antenna consists of a orbicular micro strip patch, a substrate of feeding network and a circular patch above. And orbicular patch antenna fed by two coaxial is considered as the base structure. The feeding network was designed and combined with the antenna. The proposed CP antenna can be designed by adjusting the dimensions of the inner and the outer radius of the orbicular patch to determine the operating frequency. Then the parameters of the branch line directional coupler can be fine tuned to achieve the required frequency with good impedance matching. Ultra-wide band (UWB) impulse technologies are being used increasingly for high-speed RF wireless communication, high power RF jamming and high-resolution impulse radar systems. The UWB operation

provides critical advantages, such as improved detection, ranging and target resolution performances. (UWB) GPR system that transmits short time impulse signal is used to benefit from both low and high frequencies [2]. For the best UWB performance, the transmitter and receiver (T/R) antennas should have flat and high directive gain, narrow beam ,low side and back lobes over the operational frequency band; to attain the largest dynamic range, best focused illumination area, lowest T/R coupling, reduced ringing and uniformly shaped impulse radiation

II. DIFFERENT TECHNIQUES USED

A. Ultra wideband antenna is integrated with a micro strip slot antenna operating in ultra wideband (.98 to 12 GHz.) and narrowband from 2 to 4 GHz. Also Narrow/Ultra wide band antenna operating at 8.2GHz to 9.4GHz and 3.1GHz to 10.6GHz respectively is also implemented. The use of omni-directional wideband antenna and directional agile narrow antenna for the first system and agile wideband / scanned narrow band antenna for the second system are widely been explored. The wideband antenna is suggested to be used for spectrum sensing while an agile narrow antenna is used for communication. The agile wideband scanned narrow band antenna are used for spectrum sensing and communication.

B. Wide band phased array antenna is implemented to scan in the range of +-45 degree in wideband. With the variation of the operation frequency of the array antennas, the electrical size of the space between the elements will be changed, and the coupling between the elements and the scanning scope and electrical performance of the elements will be different.

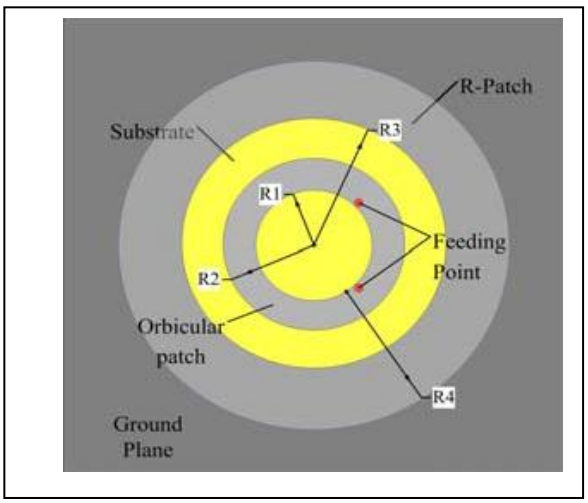
C. Wideband Circularly polarized micro strip antenna is implemented for global positioning systems at 1575 hz band wide beam circular polarization micro strip antenna with bandwidth from 3.46 GHz to 4.36 GHz. There are many types of antenna that can carry out the CP wave, such as spiral. But the micro strip Antennas would be our first choice as it has the advantages of low-profile, lightweight and low-cost. In this paper we will design a GPS micro strip antenna that perform wide-band CP radiation. Such antenna can be actualized using a single feed or dual feeds. The single-feed CP antenna is simple in structure and easy to fabricate, while the bandwidth is rather to narrow. Therefore in this letter dual feeds are adopted to realize the wide-band CP antenna for dual-band GPS applications. The circularly polarized wave can be realized by exciting two linearly polarized modes. These two modes should be with 90 □ phase difference, equal amplitude, and orthogonal to each other in polarization design a GPS micro strip antenna that perform wide-band CP radiation. Such antenna can be actualized using a single feed or dual feeds.

D. Wideband U slot micro strip antenna operating in the frequency range of 5.18 to 5.8 GHz and improving directivity .Two radiation beams off broadside are obtained by operating the patch antenna at the higher order mode instead of the fundamental mode, which radiates a broadside beam. Broadening the antenna bandwidth is achieved by using the U-slot technique. Microstrip antennas have been widely used in modern communication systems, because of its robustness, planar profile, and low cost. Most of these antennas operate at their fundamental mode, which gives a broadside beam. Micro strip antenna operating at the higher order mode has dual symmetric radiation beams. It is well known that the major drawback of a micro strip antenna is its narrow bandwidth (3%). One of the popular techniques for broadening the patch antenna bandwidth is to incorporate a U-slot on its surface as proposed.

E. Ultra wideband millimeter wave stack patch antenna achieving high efficiency > 90% and high gain of 6 to 8 db. Antenna is fabricated on silicon and takes advantage of cavity etching and BCB membranes fabrication process of an UWB 60-GHz antenna based on silicon micromachining and BCB (BenzoCycloButene) embranes to achieve high efficiency and large band performances the use of membranes to reduce the effective permittivity around the radiating elements in order to reduce the effective permittivity below the top patch, a 280- μm cavity was etched in the cap.

F. Implementation of wide band antenna for smart grid applications with a frequency bandwidth of 40% and gain of 3 to 4db The antenna design and simulation was carried out using ANSYS' HFSS software which is the industry-standard simulation tool for 3-D full-wave electromagnetic field simulation. The paper presents a novel compact low profile wide bandwidth micro strip antenna. The total size of the antenna is 20mm x 10mm x 2mm. This new design offers a wide fractional frequency bandwidth of about 40% with a gain from 3dB-4.3dB over the frequency band (5GHz – 7.5GHz).

G. Using ultra wideband dipole antenna operating at 1.75 to 40 GHz. It is shown that the



proposed antenna works well in 1.7GHz-40GHz frequency range and the main direction of the radiation pattern keeps stable during the whole frequency range. The H plane demonstrates an excellent omni-directional pattern The

structure of the ultra-wide band circular disk monopole antenna is shown in Fig.1. The structure is composed of two parts: a ground plane and a metal circular disk which is perpendicular to the ground plane. Both of them are involved in the radiation. To analyze the performance of the antenna, the following antenna structure parameters are chosen: the diameter of the circular disk d_1 equals to 42mm, the diameter of the ground plane d_2 equals to d_1, the height of the feed gap h equals to 0.3mm, the thickness of the metal disk and ground plane is 0.2mm.The structure is composed of two parts: a ground plane and a metal circular disk which is perpendicular to the ground plane. Both of them are involved in the radiation.

H. A Dual-band Wide-beam width WLAN Access Point Antenna with similar gain and wide beam width in both the 2.4- and 5-GHz WLAN bands. This paper describes a dual-band printed dipole antenna that has nearly identical radiation patterns with similar gain and wide beam width in both the 2.4- and 5-GHz WLAN bands. The proposed design employs two techniques to improve the radiation pattern. These techniques are the use of an angle dipole and vertical copper plates arranged on the ground plane for improvement in the radiation pattern of lower and upper bands, respectively

I. Ultra Wide Band TEM Horn Antenna for Ground Penetrating Radar (GPR) is used and Broad band wide beam circular polarization micro strip antenna with bandwidth from 3.46 GHz to 4.36 GHz. Since TEM horn is a kind of travelling wave antenna, its structure can be considered as combination of micro-strip transmission line segments, which are characterized by their local geometrical and constitutional structure parameters. The staircase modeling is used for the analysis. In this work, different design forms of TEM horn antenna such as, dielectric loaded, Vivaldi shaped and array versions were surveyed for UWB GPR systems.

J. To improve the performance of antenna the operating frequency of the array antenna is varied and the electrical performance and the coupling between the elements will be different. Various techniques have been explored to develop small size antenna. One of the techniques is achieved by using shorting wall Another technique is the shortening of the ground plane for bandwidth enhancement and size reduction. Design has a ground plane and a metal circular disk which is kept perpendicular to the ground plane giving omnidirectional characteristics. Rotational motion is used for the physical alteration of the antenna and further the narrowband and the wideband antenna are combined and connected via a shorting pin. It is the integration of ultra-wide band antenna with a micro strip slot antenna.

Figure 1: Top view of the antenna with circular polarization.

K. Circular polarization is used which is produced by exciting two linearly polarized modes of antenna with 90 degree phase difference, equal amplitude and orthogonal to each other . Circular polarization antennas are needed due to their insensitivity to ionospheric polarization rotation

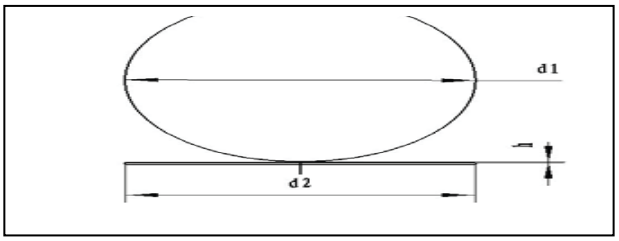


Figure 2: side view of the antenna

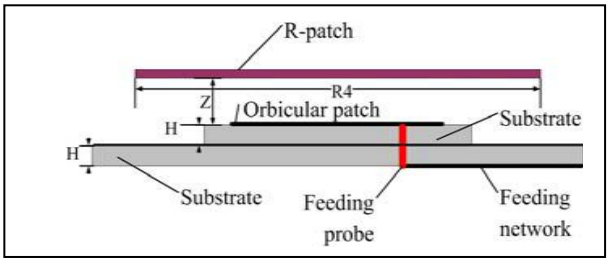


Figure 3: Side view of the antenna with circular Polarization.

L. Cavity etching and silicon micromachining technique fabricating the antenna on benzo cyclo butane (BCB) membranes is also used.

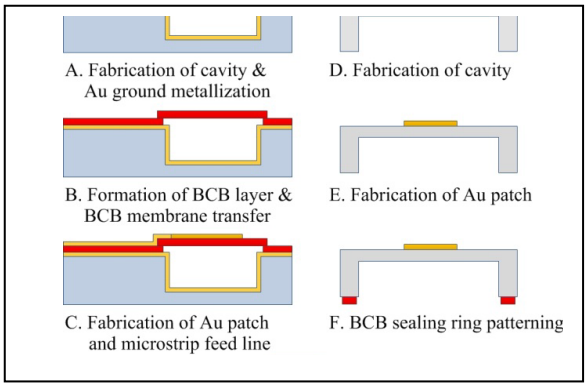


Figure 4: Example of a figure caption.

M. The antenna for an AP not only requires dual-band operation but also needs to have an appropriate proposed design. It employs two techniques to improve the radiation pattern. These techniques are the use of an angled dipole and vertical copper plates arranged on the ground plane for improvement in the radiation pattern of lower and upper bands, respectively radiation profile in both bands, namely similar gain, wide beamwidth.

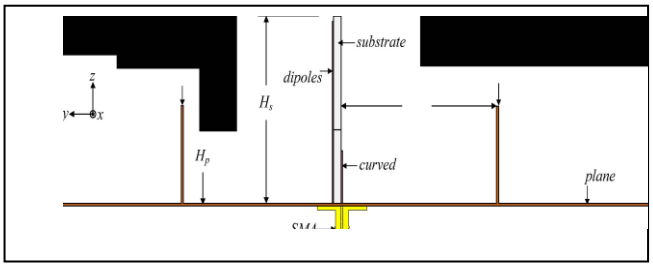


Figure 5: Example of a figure caption.

N. One of the popular techniques for broadening the patch antenna bandwidth is to incorporate a U-slot on its surface. They have the ability to confine the power in certain directions instead of scattering the power everywhere. As a result of less power loss toward unwanted directions, the

multipath and interference effects are reduced

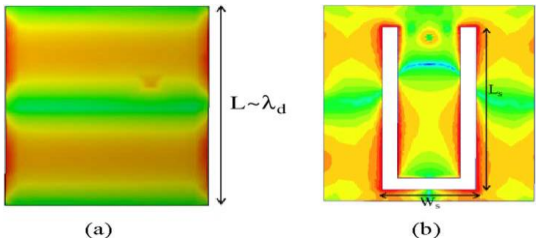


Figure 6. Example of a figure caption.

O. Ultra-wide band (UWB) impulse technologies are being used increasingly for high-speed RF wireless communication, high power RF jamming and high-resolution impulse radar systems.

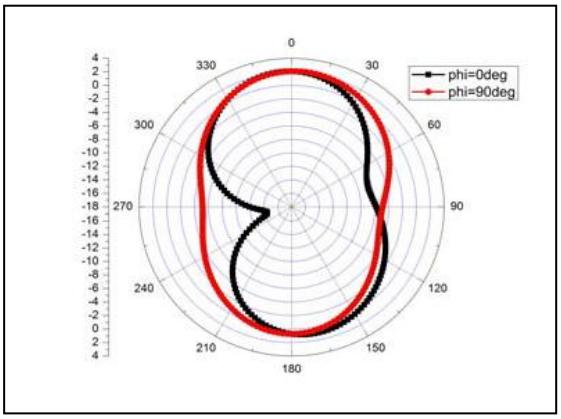


Figure 7: Radiation pattern of circularly polarized Micro strip antenna.

III. COMPARISION OF TECHNIQUES

THE DIFFERENT TECHNIQUES ARE ABBREVIATED AS UNDER:

1. Circular polarization technique.
2. Cavity etching and silicon micromachining technique.
3. Rotational motion of antenna technique.
4. Ultra wide band angled dipole antenna technique.
5. Wideband U slot micro strip antenna technique.
6. Variation of the operating frequency technique.
7. Dual band access point antenna technique.

Integrating the wideband and narrowband antenna with the variation of operating frequency among the above mentioned techniques the wideband phased array antenna provides the of best scanning range. The ultra wideband antenna fabricated on silicon with cavity etching provides the highest efficiency among all the different techniques used for the improvement of antenna parameters. Further it provides an improvement in the overall gain of the antenna by 6 to 8 db. Further wideband U slot micro strip antenna provides the broadening of the antenna bandwidth and the overall improvement in the directivity of the antenna. Ultra band dipole antenna and circularly polarized antenna provides the best Omni directional radiation pattern. Also the techniques such as angled dipole and vertical copper plates on ground plane are used for the further improvement of the radiation pattern of the antenna.

Also the antenna operated in the dual TEM mode is used for ground penetrating radar (GPR) applications. The circularly polarized microstrip antennas are the one providing the highest gain and efficiency. Also the best operating frequency bands, directivity and the antenna radiation pattern. Circular polarization antennas are needed due to their insensitivity to ionospheric polarization rotation. A dual-feed wide-band circularly polarized micro strip antenna is presented with an orbicular patch for GPS use requiring approximately 20 MHz at 1227 MHz and 1575 MHz each is considered as the one providing best results for improvement of antenna parameters. Also further improvements could be done by using antenna substrates with higher dielectric constants in order to reduce the size a broad band wide beam circular polarization micro strip antenna The configuration of the antenna is simple and easy to fabricate compared with conventional micro strip antenna, the radiation beam is broadened obviously. Further research on circularly polarized wideband micro strip antenna is required as it gives the best performance and overall improvement of antenna parameters

III. CONCLUSION AND FUTURE WORK

Circular polarization antennas are needed due to their insensitivity to ionospheric polarization rotation. A dual-feed wide-band circularly polarized micros trip antenna is presented with an orbicular patch for GPS use requiring approximately 20 MHz at 1227 MHz and 1575 MHz each is considered as the one providing best results for improvement of antenna parameters. Also further improvements could be done by using antenna substrates with higher dielectric constants in order to reduce the size a broad band wide beam circular polarization micro strip antenna. The configuration of the antenna is simple and easy to fabricate compared with conventional micro strip antenna, the radiation beam is broadened obviously. Further research on circularly polarized wideband micro strip antenna is required as it gives the best performance and overall improvement of antenna parameters.

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