Literature Study of Different Properties of Antenna

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Abstract— The size of the antenna depends the different uses. The use define different properties of the antenna, how an antenna will perform. The patch antenna is one of the best antenna which can be used for different frequency range & bandwidth. The gain & directivity will decide effectiveness of the antenna. To reduce the antenna size, notches are developed. The antenna losses & polarization will decide how the antenna is capable for the long distance communication.
Key words: MSA, PCB, GAIN

I. INTRODUCTION

The patch can be explain in different manner i.e. compact rectangular patch antenna projected by Tan, B.[1] for Ku-band frequency 7 GHz BW for application of the far field having gain of the 18 dB structure having truncated ground. Wen, Y.et al. [2] proposed endfire antenna with multiport feeding with five layers of structures. Antenna is having 7.4 dBi gain at ±800 xy-plane. Rectangular patch antenna for broadband application is designed by Mutiara, A B et al. [3] at frequency 2.4GHz with gain 11dB for impedance matching 50Ω. One more information is given by Kalambe, N. et al. [4] for in slot antenna of frequency 3.1-10.6GHz,gain 56dB,beamwidth 70degree -90degree to use for review for ultra-wideband frequency. A projection by Nath, S. [5] et al. at frequency 10.65 GHz for TM10 mode, with gain is 8 to 9dB for easy to integrate with accompanying electronics 3D in structure for field anechoic chamber. One of other initiated by Cakir, G. et al. [6] patch antenna array antenna of frequency 1.8GHz, 35degree to 60 degree beamwidth with finite difference time domain, operating resonance frequency 7.5 GHz for cellular wireless communication system.

A. Bandwidth

The bandwidth depends on the overall effectiveness of the antenna through a range of frequencies, so all parameters must be understood to fully characterize the bandwidth capabilities of an antenna. In other words bandwidth is typically defined by measuring a characteristic such as SWR or radiated power over the frequency range of interest. To improves the impedance bandwidth for wireless and mobile communication, Yang,X. M. et al. [7] proposed a microtrip patch antenna by embedded line array ,77.7-42 MHz bandwidth, works at TM10 dominant mode at 3.5GHz frequency ,-10dB impedance bandwidth. For WLAN/WPAN applications Karnfelt, C. [8] designed antenna with two array having directivity of 13.4 & 14.1 dBi having BW of 1.5 GHB. Two array antenna have been designed by Dejean , G.R.,[9] with band width 7% , gain 13.0 and 15.6 dBi respectively which is having efficiency above to 89 % used in WLAN application. For proximity fed gap coupled half with E-shape antenna have been designed by Deshmukh, A. A. et al. [10] a rectangular patch antenna with bandwidth of 350 MHz having gain of 7dBi in 800 to 1200MHz.Circular polarized antenna have been designed for wireless applications patch antenna array of 1.92 to 2.51 GHz frequency developed by Gu, H. [11], having efficiency of 47 % to 61 % for wireless combination. Sanchez , L.I.,[12] investigated microstrip patch antenna to improve the gain which can be used in Wireless Communication, the impedance band width considered is 14 dB & 8 dB respectively within the 2nd & 3rd harmonics. Wideband multi U-slotted for WLAN, WiMAX and wireless communication Rao, J. C. et al. [13] proposed antenna of frequency 4.2 GHz, impedance bandwidth of 110% and VSWR ≤ 1.02.

B. Gain

Gain of Antenna is the ratio of the power generated by the antenna from a substantially source on the antenna's beam axis to the power produced by a speculative lossless identical antenna, which is equally sensitive to signals from all directions. Generally this ratio is given in decibel, and these units are represented in decibel isotropic (dBi). For the various tuning and wireless application Yeap, S.B. et al. [14] given antenna with improved design within 2.4 GHz frequency & reduced dielectric loss, which provide gain of 2.4 -2.7 dB. For frequency selection Liang, J. et al. [15] regarded a mushroom type electromagnetic band gap structure tunable metamaterial integrated patch antenna at 1.86GHz at on state and 2.52GHz at off state, efficiency at on state 38.7% and off state 55.2%, maximum gain 2.2dBi from simulation and 1.1dBi from measurement for "on" state and 4.40dBi from simulation and 3.2dBi from measurement for the "off" state to tune. The proposal of MSA to achieve better gain was given by Khidre, A. et al. [16] proposed microstrip antenna, which have achieved peak gain value is 8.1 dBic with 2.4 dB gain at 2.45 GHZ, B.W is 2%, axial ratio level is below 3 dB in 2.38 – 2.63 GHz and efficiency varies from 83% to 57% for low orbit vehicular satellites, aircrafts, tracking terminals and remote-sensing receiving systems applications. Cross polarization suppression is considered by Guha, D. et al. [17] who proposed microstrip patch antenna, for cross polarization suppression, value by 5 to 8 db with XP (cross polarized) level of -20 db for mobile wireless equipment application. Another approach was given by Choi,W. et al [18] , considered dielectric substrate layer patch slot array antenna to enhance the gain range up to 4 dBi at 12 GHz frequency the impedance bandwidth for VSWR<2, above 11% and a wide impedance bandwidth of over 17% to increase the narrow bandwidth for high permittivity.

C. Directivity

Directivity is given by the radiated power density of the transmitting antenna radiates in the direction of its strongest radiation between the power density radiated by a perfect isotropic antenna radiate the same total power. A large Quality factor for better directivity to improve bandwidth in mobile satellite, mobile and personal communication. New dual MSA which consist of the two different groups have been designed by Masri, T. et al. [19] which radiates in two operation 2.4 GHz & 5.8 GHz. The incorporated EBG (Electromagnetic band gap) structure diminishes the grating lobe. Dual band antenna planned by Zhu, X. et al.[20] ,frequency 2.45-5.8 GHz,bandwidth 115-928 MHz,gain1.37-4.37dBi for diverse wireless communication. For the broadband applications Campos, J.L.M et al. [21] projected parallel plate patch antenna of frequency 12.4GHz, gain 27dBi. Another gain enhance 2.9 dB by Boutayeb, H. et al.[22] investigated patch antenna of frequency 2.6 GHz,return loss -9dB for using a cylindrical electromagnetic crystal substrate of compact, conformal wireless communication. A suitable Slotted E-Shaped Patch Antenna have been designed by Modani, U.S. et al. [23] used for the wideband operation for the 5-6 GHz with the return loss 5.15 – 5.85 GHz for WiMAX and WLAN applications have faster data rates. Rajendran, J. et al. [24] made a square patch antenna of frequency 1.147GHz, gain 5dB narrow bandwidth 0.9% and efficiency 65% .Which can be used for the circular polarization. The applications of this antenna is in RFID based antenna designed by Abbak, M. et al.[25] provided patch antenna array of frequency 867MHz,directivity of 9.5 dB, bandwidth 15MHz and return loss 20dB and 30dB. The simulation of the microstrip square patch antenna (MSA) which is capable in beamforming technique by Jayanthi, K.M.A et al. [26] provide that the range of 1.8-2.4 GHz frequency, reference centre frequency 1.85 GHz, gain 15 dB with 58% high directivity compare with conventional patches. Various size of antenna is having different impact on the basic antenna parameter. The smaller antenna is having an edge on larger antenna due use at various places and also having different uses.

D. Size Reduction

For small frequencies in MHz range, the size of the antennas becomes large which is difficult in handling. A lot of techniques were developed for smaller size; also there are a no. of method is developed to reduce the size as dielectric material with high permittivity with using impedance loading, increasing the electrical properties including length of antenna by optimizing its shape utilization of mathematically calculated position of notches on the patch antenna. To reduce and enhance bandwidth of satellite communication, Ahmed, K. T. et al.[27] suggested patch antenna of frequency 3-5.5 GHz, resonance at 4 GHz, bandwidth 1.6 GHz. Hameed, A et al. [28] generated result for the antenna of frequency 2.4GHz, gain 2.4 dBi and directivity 4.61 dBi for the size reduction in wireless communication. Patch antenna with Ceramic substrate of high permittivity Kula, J.S. et al. [29] proposed bandwidth of 9 %, with frequency 1-3 GHz, return loss -6.5dB, for smaller size in the GSM band. Reduced size patch antenna with frequency 3.06 GHz Chen, W.J. et al. [30] suggested multimaterial & multiscale feature, which used surface integral equation & volume surface integral equation. Two orthogonal excitation is used with TM01 mode for GPS automated application, Alboni, E. et al. [31] given a small profile CP patch antenna, largest gain is 3.8db on 1570 MHz frequency but ceramic patch maximum gain is 5.2dB.The component of radiation pattern is almost omnidirectional for some nulls in radiation pattern Sreekrishna, R. et al. [32] developed a conformal wideband antenna of frequency spectrum 1.3 GHz-2.5 GHz, size reduction by about 60% in comparison of simple patch antenna.

E. Losses

Losses are related to antenna in terms of the return loss in comparison to the insertion loss. It is considered from the reflection of the discontinuous boundary. The incident power & reflected power are the basic parameter of the return loss measured in decibel. The insertion loss in decibel (db) is determined by power received with respect to insertion. A compact multiband monopole antenna for WLAN/WiMAX applications designed by Song, Z.N. et al. [33] which covers these three bands 2.32 to 2.84, 3.39 to 4.34 and also 5.11 to 5.91GHz that for WLAN and WiMAX applications respectively, this antenna is available with the narrow impedance bandwidth. 2.32 to 2.84, 3.39 to 4.34 and 5.11 to 5.91 GHz that for WLAN and WiMAX applications accordingly. A square circular & cross shaped patch antenna proposed by the Poongodi, C. et al. [34], which is having different shapes on RO4003C substrate having gain of -16 dB, directivity of 6, 6.211 ,6.2229 dB at 920MHz for various shapes used for the RFID application. The mutual coupling effect introduced between the array elements for orthogonal method Khodaee, M. et al. [35] antenna of return loss -10dB, also aperture coupled frequency 9.5GHz, and bandwidth (BW) 21%. Dual band frequency Patch antenna of 50 Hz and 3.2GHz developed by Rajhi, A. et al [36], it would function in second and third generation mobile communication systems.

F. Polarization

The electric field component of the wave exists in different manner as linear, circular & elliptical. The different configurations in wave are known as polarization. The linear wave is the wave in which there is no electrical field component in two orthogonal directions. In circular polarization electric field is having equal magnitude with 900 of phase shift. Elliptical polarization is having electric field in fixed plane with intersection. A dual band microstrip patch antenna is proposed by Hasan, N. et al. [37] , two slot are created at 450 & 1350 in X shape with circular polarization given bandwidth of 170 Mhz. The comparison of rectangular and truncated rectangular patch for Ku-band (10.7-12.75GHz) is proposed by Aung, K.S. et al. [38] compared the different antenna for the circular polarization for the S11 mode, these antenna will be used in satellite communication which will resonate at the 11.6 Ghz with return loss less than -10 db. The circular polarized antenna with the four slit suggest that there will be 40% reduction in the antenna size, Benjwal, P. et al. [39] developed a circular polarized antenna for the decreasing the operating center frequency with active loading for the band width enhancement. Microstrip Antenna with wideband offset stacked is proposed by Sarin, V. et al. [40] for the gain improvement for low cross polarization with gain of 15 dB also having peak gain of 8.07 dBi, it is capable to use for the broadband application in co-polarization patterns. E-shaped patch slot with dual polarized is given by Guo, Y. et al. [41] for frequency 2.5 GHz-2.7 GHz with gain of 6.8-6.4dBi.Exploration of the dual polarized antenna is completed by Wang, Y. et al. [42] given antenna for frequency 1.69-2.21 GHz, impedance band width 520 MHz, & also having gains 6.1 ± 0.4 dBi & 7.56 ± 0.55 dBi for vertical & horizontal respectively can be used for the radar communication. Dual polarized antenna by Deng, C. et al.[43] with having frequency range 4.83 to 5.02 GHz , &

bandwidth 290 MHz to 470 MHz also having gain of 4.1-5.3dB for omnidirectional radiation used in broadband wireless communication. A circular polarization (CP) with broadband application, Wu, J. et al. [44] given patch antenna of frequency 2.32-2.95 GHz, axial ratio <3dB & gain 8 dBi . Circular polarized antenna for Wi-max by Shekhawat, S. et al. [45] developed square patch antenna of 3.10 GHz to 3.55GHz, bandwidth 3.6% to 7.2%.

II. CONCLUSION

The observation from above is that polarization is having vital roles for the stage shift. For the direct polarization it can be seen that there is good result yet circular polarization can give difference with superior to anything straight. Satellite correspondence can be adopted circular polarization. This is specially required to the polarization of the direct transmission radio waves for the various concepts as Faraday rotations in ionosphere. Geometry positon of the satellite changes with the changing position of the earth. Circular polarization is capable to deal with these peculiarities and keep signal constant. For the remote communications large bandwidth required with the broadband application. Gain is also enhanced with impedance bandwidth but there is decrement in the gain for the enhancement of the bandwidth for the modern communication systems. Antenna gain is factor between the ideal antennas to the practical receiving antenna. Directivity is factor of the antenna which measures the degree to which the radiation emitted is concentrated in a single direction of the satellite cell. For the reducing the microstrip antenna size dielectric substrate of high permittivity is applied which is having electrical properties capable to increase the electrical length of the antenna. Resonance & data transmission is having good model for this. Losses are the factor developed by the power loss by the reflection due to the discontinuous boundary.

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