International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 5, July-August 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

A Review on Beam Steering Techniques in Reconfigurable Microstrip Patch

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ABSTRACT

Modern Communication of 4G and 5G Wi-Fi wireless communication networks requires compact sized low profiled antennas with planar easy mounting structure , without difficulty integrable and low fabrication cost antennas have become exceedingly essential part of any communication block. The fast increasing needs for high-data-rate wi-fi communication transceivers like smartphone handsets, web modem, and various communicating devices require excessive signal-to-noise ratio (S/N). Therefore, their antennas want to possess enhanced beam and steerable radiation patterns. In this context, the beam-steerable antennas have become quite famous in the cutting-edge fashion of antenna propagation. Reconfigurable Antennas (beam steerable antennas) permit enhanced alerts for each transmission and reception from and to the preferred directions. Beam guidance technique reduces interference, saves power, increases attain and directivity of the microstrip antenna. In this paper we discuss the beam guidance principle in antenna theory, benefits of the beam steerable antennas and comparison inside a variety of beam guidance techniques.

KEYWORDS: *Microstrip Antennas, Beam Steerable Antennas, electromagnetic beam theory*

How to cite this paper: Osaf Baig | Shailendra Singh Pawar "A Review on Beam Steering Techniques in Reconfigurable Microstrip Patch" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-5, August 2020, pp.598-601, URL: www.ijtsrd.com/papers/ijtsrd31899.pdf

IJTSRD31899

INTRODUCTION

An antenna which is designed to transmit and receive electromagnetic waves alongside with the conversion of electric signal to electromagnetic waves and vice-versa is termed as antenna. Antenna performs a lead function in wi-fi communication system. Moreover, it moreover has the property of reversibility which ability it can work every as transmitter and receiver. In Wireless communication a small antenna affords an unidirectional radiation pattern to work for speedy distances. Planar antennas have immensely received popularity due to the the increasing demand for smaller and low profiled antennas nowadays. Design procedure of steerable antenna includes the investigation of microstrip antenna, electromagnetic beam theory, and the beam steering techniques. Pattern reconfigurable antennas or (beam steerable antennas) are essential for a wide variety of applications in electronic and microwave engineering such as telecommunication and radar. They mitigate interference via channelling the antennas radiation to the direction of interest. Several techniques have been used to put into effect beam guidance over the years, most of which achieves guidance at the fee of antenna performance. Beam practise technique offers the capability to differentiate between the liked warning signs and interference symptoms (jammers) and supress them.

ELECTROMAGNETIC BEAM THEORY

The time duration beam forming refers to the process of combining signals from an array of factors to structure a especially directional beam of radiation. It is moreover used to precisely align the phases of an incoming signal from different factors of an array to form a well-defined beam in a specific direction. This is achieved through imposing a time extend on each element's signal. It originated from spatial filters that have been designed to structure pencil beams (i.e., particularly directional radiation patterns) to receive indicators from a specific location and attenuate interference from distinctive locations It has determined severa applications in Radar, Sonar, wi-fi communications, acoustics, and biomedicine. Adaptive beam forming is used to detect and estimate the signal-of-interest at the output of a sensor array with the aid of ability of conceivable of most dependable (e.g., least-squares) spatial filtering and interference rejection.

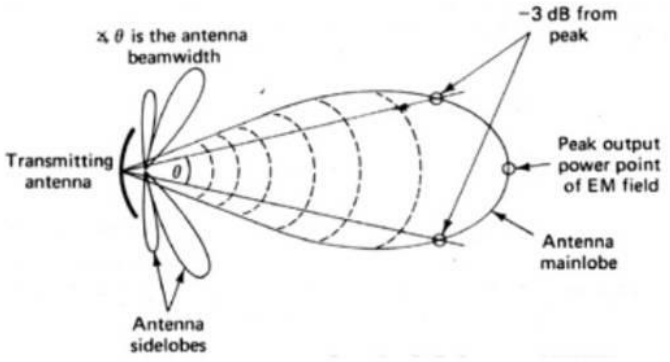


Fig.1 Structure of Electromagnetic beam

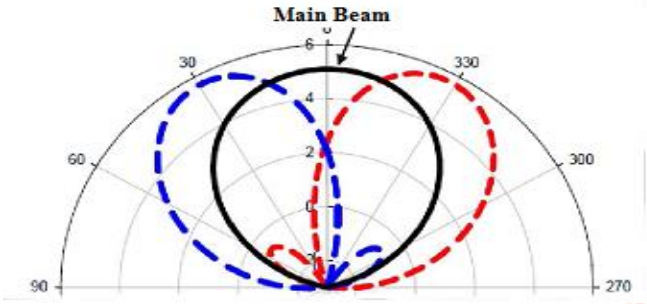


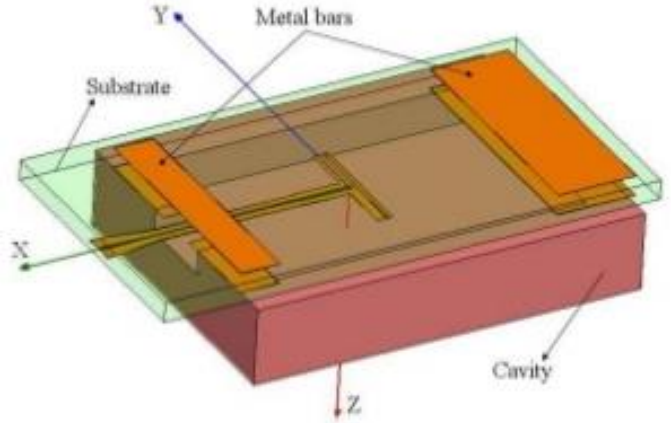
Fig.2 Steered Beam Radiation Antenna Pattern

REVIEW OF LITERATURE SURVEY

The increasing requirement of smaller and low profile antenna in wi-fi communication has led to the reputation of microstrip patch antenna .This antenna has vast applications in army application and commercial area. Design of Geometry of Microstrip antenna can be of arbitrary nature. Beam steerage technique includes the mechanism of changing the direction of most important lobe of a radiation sample of an antenna. Beam steerage affords each constructive and destructive interference so as to steer the beams in favored direction. As per our investigation Beam steerage antenna are used to steer It focuses the transmit strength toward the preferred direction. We have investigated various strategies for achieving beam steerability in a Planar antenna:

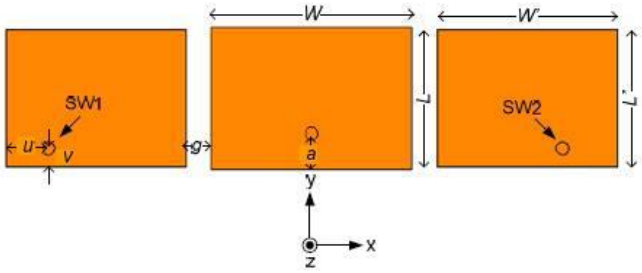
A. HIGHER REFRACTIVE SUPERSTRATES

A immoderate Refractive superstrate is used above the radiator to patch to achieve the control on radiating wave .The directivity and collect of the MSA is manipulated with the aid of ability of a variety of the superstrate parameter. Through full-wave simulations, the imperative beam of the antenna is established to deflect in the plane alongside with the superstrate movement. When the superstrate is displaced alongside the E-plane, the critical beam is tilted in the E-plane and no tilt in the H-plane is observed. If the superstrate is moved in every E- and H- planes, i.e., when completely quarter of the antenna is covered with the superstrate, the beam is validated to deflect in every of the principle planes of the antenna. Higher point of view of deflection/phase shift can be placed the use of immoderate refractive index superstrate. In this discover out about the fundamental beam of the antenna is experimentally decided to deflect at increased angles as the refractive index of the superstrate is increased. It affords a novel mechanism to control and manipulate accumulate and beam direction of microstrip antenna, frequently the radiated beam is deflected in E-plane and H- plane alongside with the characteristic of the superstrate in xy plane .It used to be as soon as positioned that the predominant beam of the antenna is deflected in the direction of the part of the patch that is covered partly and moreover depends upon upon the refractive index of the superstrate is reduced to 33 tiers which indicates increased directivity.



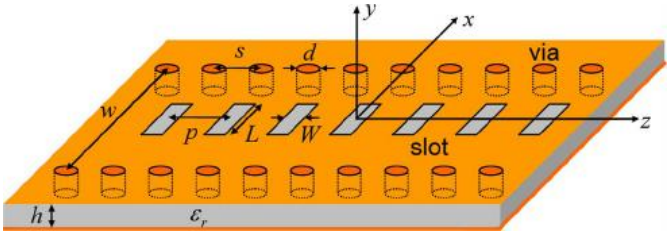
B. PARASITIC ARRAY

Beam titling is realized using parasitic element in the antenna structure that may be placed at the same layer or above to the radiator patch layer. Number of parasitic used varies from design to design, but the main thing is the parasitic elements are activated or deactivated using shorting pins referred as switch and in some design PIN diode is used as switch along with via. An antenna is capable in maintaining a minimum gain of 4 dBi from angle -53 degrees to angle +53 degrees and the parameters like the spacing between driven element and the parameters like the spacing between pushed issue and parasitic factor and the size of the parasitic issue influences the potential tilt attitude.



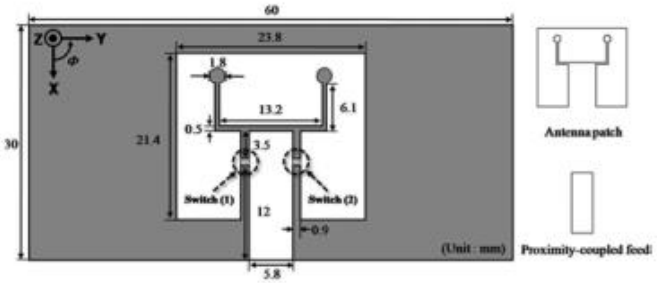
C. LEAKY WAVE ANTENNAS

A microstrip leaky-wave antenna (MLWA) is designed for regular frequency beam steering. The integral beam direction of this antenna is controlled with the resource of changing the periodic reactive loading of a microstrip line. This reactive loading is provided thru a set of periodic patches closely coupled to the stubs in the microstrip line. These patches can be selectively connected to the ground the use of PIN diodes. Each periodic patch is connected to ground with by means of the use of through a switch or PIN diode Controlling the switching states cause steering of the most important beam at regular frequency. The designed reconfigurable antenna can steer vital from forty stages to sixty 4 stages at 6.2 GHz.



D. SWITCHING PIN DIODES

Beam guidance in microstrip antenna can be realized the usage of artificial switches in between the fed and the radiator patch. The steerage attitude or direction of the major is controlled with the aid of one of a kind states of the artificial switch. A single beam-steering broadband microstrip antenna. used to be designed, fabricated and measured. The proposed broadband antenna can function beam practise with the aid of capability of switching p-i-n diodes connecting stubs to a partial ground Plane with running frequency in between 2.8-4.8 GHz It is nicely ideal for fundamental signal application.



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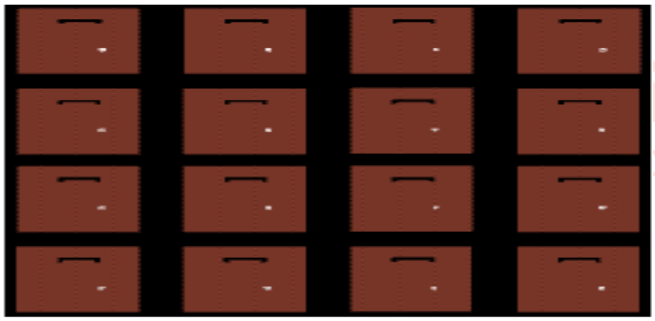
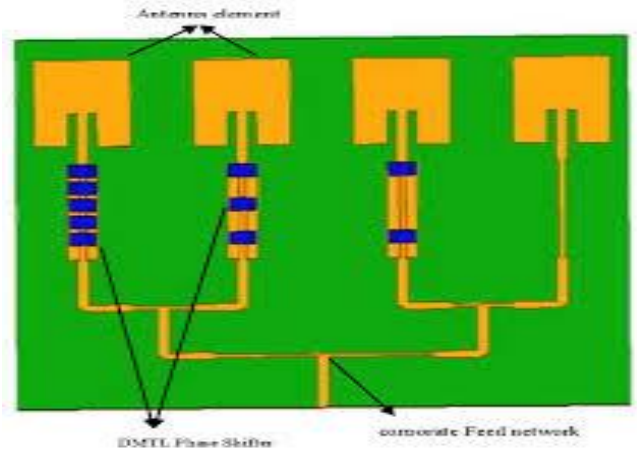
E. PHASED ANTENNA ARRAYS

Beam guidance realized the use of the array structure of the antenna thing that can also be two × 2, four × 4, eight × eight or greater dimensions. The beam guidance operation is carried out through changing the segment of the feeding sign aspect used in the antenna structure. A Ka-Band slot coupled microstrip fed patch antenna and its application to 4 X 4 antenna array of microstrip antenna has been designed and examined This designed structure is in a position to provide 15.6 dBi. and 23 p.c of impedance band width. A PET controlled Phase shifter is built-in to produce beam steerage with most 30 degrees.



F. PHASE SHIFTERS

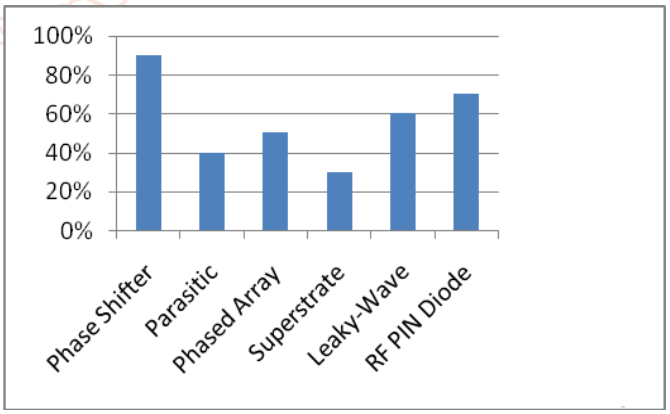
Beam guidance the use of section shifter is every other efficient technique for beam steering. The beam guidance attitude is relies upon upon the phase. delay. The section prolong is achieved the usage of segment shifter community the use of switch, meanderline or any different methods. The required steerage perspective can be realized the use of switch, meanderline or any different techniques The required steering attitude can be realized by means of the use of specific section lengthen provided with the aid of the section shift network.



COMPARISION REPORT

TABLE I. COMPARATIVE ANALYSIS

S. No.	Analysis	
	Bean Steering Technique	Properties
1	Higher Refractive Superstrate	Less Complex, Medium Size, Medium Cost, High Insertion Loss.
2	Parasisitic Array	Less Complex, Frequency dependent Size, Low Cost, Low Insertion Loss.
3	Leaky Wave Antenna	Less Complex, Small Size, Medium Cost, Medium Insertion Loss.
4	Switiching PIN Diode	Medium Complex, Medium Size, Medium Cost, Medium Insertion Loss.
5	Phased Antenna Array	Medium Complex, Medium Size, Medium Cost, Low Insertion Loss.
6	Phase Shifter	Highly Complex, Large Size, High Cost, High Insertion Loss.



CONCLUSION

This paper intends to grant a quick discussion on the severa techniques that have been incorporated in the past, that presents a platform for achieving the principle of beam steerability in Planar antennas. It affords a clear cut thought on the range of beam steerability phenomenon employed in microstrip antennas and are compared primarily based on the discern of merit. Research in beam steerable antennas is producing a lot of interest as efforts are being made to enhance an most fabulous beam guidance reply at millimetre

wave frequency band for every point-to-point nand point-to-multipoint applications in Microwave and wi-fi Communication.

References

[1] M. Fallahpur, M. T. Ghasr and R. Zoughi, "Miniaturized Reconfigurable Multiband Antenna For Multiradio Wireless Communication," in IEEE Transactions on Antennas and Propagation,vol.62,no.12,pp.6049-6059,Dec 2014.

[2] Iyemeh Uchendu and James Kelly "Survey of Beam Steering Techniques Available for Millimeter Wave Applications" Progress In Electromagnetics Research B, Vol. 68, 35–54, 2016.

[3] Taeksoo Ji, Hargsoon Yoon, Member, K.Abraham, Vijay K. Varadan, "Ku-Band Antenna Array Feed Distribution Network With Ferroelectric Phase Shifters on Silicon" IEEE Transactions on microwave Theory and Techniques,Vol54,no.3,March 2016.

[4] M.Faisal Abedin,Student Member, IEEE, and Mohammod Ali, Senior Member, IEEE, 'Effects of EBG Reflection Phase profiles on the enter Impedance and Bandwidth of Ultrathin Directional Dipoles" IEEE transactions on antennas and propagation, Vol.53, no.11, November 2015.

[5] D. R. Jackson, and N. G. Alexopoulos, "Gain enhancement methods for printed circuit antennas," IEEE Trans. Antennas Propagation, vol. 33, no. 9, pp. 976-987, Sept. 1995.

[6] R. Mittra, Y. Li, and K. Yoo, "A comparative examine about of directivity enhancement of microstrip patch antenna with the utilization of three distinct superstrates", MOTL, Vol. 52, Issue no. 2, pp. 327-331, 2017.

[7] H. Attia, L. Yousefi, M. M. Bait-Suwailam, M. Said Boybay and O. M. Ramahi, "Analytical model for calculating the radiation vicinity of Microstrip antenna with artificial magnetic superstrates: Theory and Experiment,, "IEEE transactions on antennas and propagation,vol.59,issue no ,pp.1438-1445,2017.

[8] H. Griguer, M. Drissi, E. Marzolf, H. Lalj, and F. Riouch, " Design and characterization of a tunable DNG metamaterial superstrate for small beam practise antennas", proceeding of META'10, the 2nd International Conference on Metamaterials, Photonic Crystals and Plasmonics, pp. 255-259, Cairo, Egypt, February 2015.

[9] A. Foroozesh and L. Shafai, "Investigation into the effects of the patch sort fss superstrate on the high-gain cavity resonance antenna design", IEEE Transaction Antenna propagation, Vol. 58, Issue no. 2, pp. 258-270, 2018.

[10] R. Camblor, S. Ver Hoeye, G. Hotopan, C. Vazquez, M. Femandez, aF. Heras, "Design of A Submillimeter Microstrip Array for Beam Scanning Applications", IEEE Proceedings, 2020.

[11] Soliman, W. Swelam, A. Gomaa, and T. Taba, "Steerable Dual-Band Microstrip Antenna for 3G and 4G Wireless Communication Systems", conference Proceedings, ISBN: 978-1-4577-0048-4, pp.905-908, 2019.