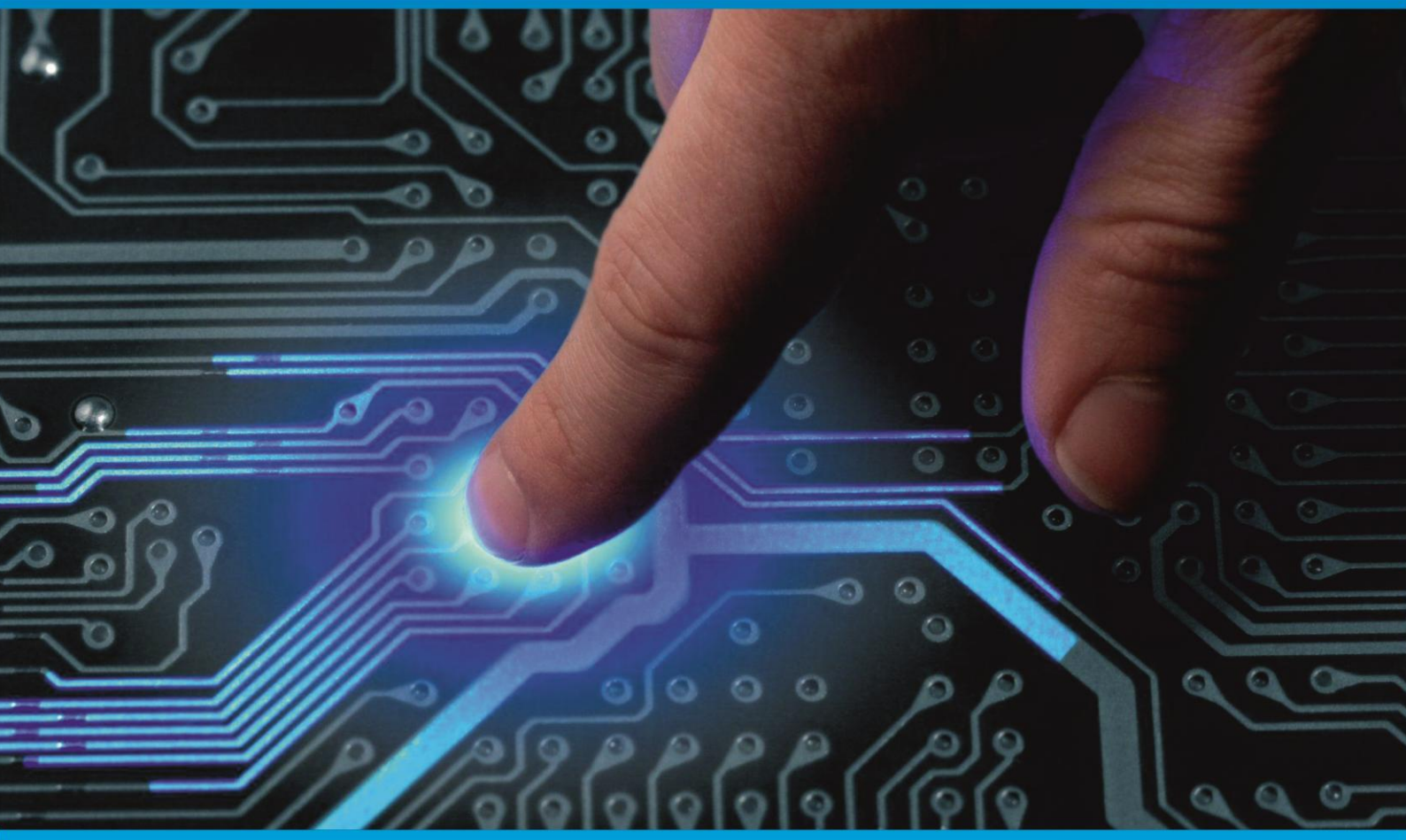
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 8, Issue 10, October 2020

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.488

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488 |

|| Volume 8, Issue 10, October 2020 ||

Review of Microstrip Patch Antenna for LTE Satellite 5G Application at K band

Archana Kushwaha[1], Prof. Braj Bihari Soni[2]

M.Tech Scholar, Dept. of ECE., NRI Institute of Information Science and Technology, Bhopal, India[1]

Assistant Professor, Dept. of ECE., NRI Institute of Information Science and Technology, Bhopal, India[2]

ABSTRACT: Now a days microstrip patch antenna is using in all satellite band applications. The K band is used for satellite communications, astronomical observations, and radars. Radars in this frequency range provide short range, high resolution and high throughput. The development in communication systems requires the development of low cost, minimal weight and low profile antennas that are capable of maintaining high performance over a wide spectrum of frequencies. This technological trend has focused much effort into the design of a microstrip patch antenna. This paper reviews about the various research works on 18 to 26 GHz frequency range bandwidth of millimeter wave antenna structures. The necessary parameters, challenges and application are also discussed.

KEYWORDS: K-band, Microstrip, Antenna, Radar, Satellite, Array.

I. INTRODUCTION

In late years there is a requirement for increasingly smaller antennas because of quick abatement in size of individual specialized gadgets. As specialized gadgets become littler because of more prominent reconciliation of electronics, the antenna turns into an essentially bigger piece of the general bundle volume. These outcomes in an interest for comparative decreases in antenna size. Furthermore, low profile antenna structures are likewise significant for fixed remote application. The microstrip antennas utilized in a wide range of uses from correspondence frameworks to satellite and biomedical applications. So as to improve examination and execution expectation, the patch is commonly square, rectangular, circular, triangular, curved or some other normal shape. The IEEE K band is a segment of the radio range in the microwave range of frequencies from 18 to 27 gigahertz (GHz). The range of frequencies in the focal point of the K band somewhere in the range of 18 and 26.5 GHz is consumed by water fume in the climate because of its reverberation top at 22.24 GHz, 1.35 cm. Subsequently these frequencies experience high air constriction and can't be utilized for long separation applications. Consequently the first K band has been part into three bands, Ka band, K-band, and Ku band as point by point underneath. The meteorological radars having attributes most appropriate for barometrical perception and examination transmit electromagnetic heartbeats in the 3–10 GHz recurrence range (10–3 cm frequency, individually). Basically, they are intended for distinguishing and mapping regions of precipitation, estimating their force and movement, and their sort. Feathered creatures, creepy crawlies subterranean insect the fierce variances can likewise deliver utilizing wind data with Doppler radar. Their power examples can uncover the area of environmental limits that are demonstrative of regions of low level assembly where tempests may start or create.

Higher frequencies (35 and 94 GHz) are utilized to identify littler hydrometeors, for example, cloud, mist, sprinkle, day off light precipitation are getting pervasive in the examination network. These frequencies are commonly not utilized in operational anticipating for precipitation identification or general climate observation as a result of unnecessary constriction of the radar signal by the mediating medium and their moderately short range, especially, in Doppler mode.

At lower frequencies (915-1440 MHz, ~400-440 MHz and ~50MHz), radars are fit for recognizing varieties in the refractive record of clear air, and they are utilized for wind profiling. In spite of the fact that they may distinguish precipitation, their examining capacities are restricted by the size and sort of the antenna that for the most part point in the vertical.

The returned signal from the transmitted heartbeat experiencing any objective, called a reverberation, has an adequacy, a stage and a polarization. Most operational radars overall are as yet constrained to examination of the plentifulness include that is identified with the size conveyance and quantities of particles in the (beat) volume lit up by the radar beam. The sufficiency is utilized to decide the reflectivity factor (Z) to appraise the mass of precipitation per unit volume or the power of precipitation using exact relations. An essential application is therefore to distinguish, guide and gauge the precipitation at ground level immediately, about persistently and over huge territories.

Doppler radars have the capacity of deciding the stage contrast between the transmitted and got beat and is a proportion of the mean spiral speed of the particles. This is the reflectivity weighted normal of the spiral segments of the relocation speeds of the hydrometeors inside the beat volume. The Doppler range width is an estimation of the

spatial changeability of the Doppler speeds and gives a proportion of the breeze shear and disturbance. For all intents and purposes all presently monetarily accessible climate radars have Doppler ability. A significant component of Doppler is the capacity to sift through echoes because of ground focuses in the sign handling.

The present age of radars have polarization capacity. Operationally, beats are transmitted at the same time with level and vertical polarizations. Previously, the beats were transmitted in succession yet required a powerful polarization switch that was inclined to disappointment. Two beneficiaries (physical or virtual) are utilized to gauge the flat and vertical segments of the brought signal back. The principle benefits are improved information quality through the capacity to distinguish attributes of the objective (winged creatures, bugs, precipitation and its sort, mess). For estimate applications, the double polarization ability can distinguish hail and the downpour snow limit. Furthermore, high precipitation rates influence the event and vertical period of the transmitted and got beats. This can be abused for precipitation estimation even with halfway blocked beams or uncalibrated power adjustment.

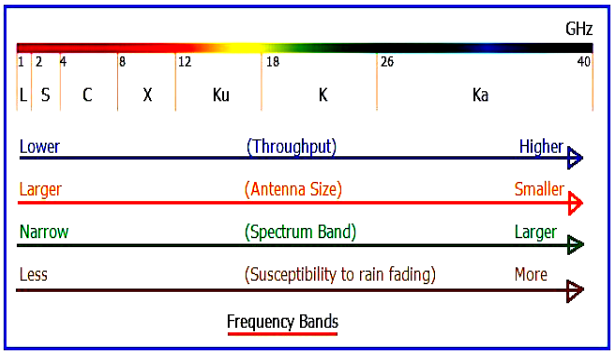


Figure 1: Antenna ssatellite frequency band

II. RELATED WORK

H. Jin et al.,[1] A micro-strip antenna array with low side-lobe is intended for 24GHz radar sensors right now. The proposed microstrip antenna array is taken care of by an arrangement feed organize which can decrease obstruction of feed organize and acknowledge scaling down of antenna on premise of fulfilling necessity of every component of antenna array energized by the inconsistent abundancy. This work will detail plan of feed organize and the separation structure to enhance radiation example of the antenna array. The reproduction results show the side-lobe level of the antenna array is - 26.5dB.

Z. Al-Dulaimi et al.,[2] Right now, monopole antenna array based fractal geometry is proposed for MIMO applications. The antenna structure is developed from a customary monopole antenna appended to a fractal patch on a FR4 substrate. A numerical investigation is applied dependent on a Finite Integral Technique (FIT) of CST Microwave Studio (CSTMWS) plans to describe the antenna execution as far as S-parameters and radiation patters. It is discovered that the proposed antenna gives a magnificent coordinating, | S 11 |<;- 10dB, at 3.78GHz and 8.24GHz. In any case, it is discovered that the proposed antenna shows a broadside radiation design rather than omni directional radiation as in conventional monopole. Such accomplishment is credited with the impact the fractal geometry expansion. At last the greatest common coupling between the antenna components inside a separation of 0.4A is discovered roar - 30dB at the two bands of interest.

M. Candid, et al.,[3] This work presents the plan of a linearly enraptured electronically reconfigurable transmit array in K-band for beam controlling applications. The transmit array is a linear arrangement of five unit cells. Every unit cell gives a ceaseless stage tuning range of 360° which has been affirmed with numerical and test results. The unit cells are shaped of various single layers of RF-overlay with varactor stacked patches as tunable components and a space for opening coupling. The layers are isolated by metal sheets gave openings. The transmitarray is intended for a beam controlling range of ±30 ° which has been effectively exhibited at 24GHz.

R. Tiwari et al.,[4] A research on Antenna design and simulation is a emerging area among researchers. Antenna is a basic element for wireless communication. There are various shapes and types of antenna, which uses in different application. Now a day's Microstrip patch antenna is very useful in advance electronics devices applications. This work focused on study based various types of microstrip antenna. Return loss, VSWR, bandwidth, resonant frequency and gain is key parameters to judge antenna performance. Good value of return loss is less than -10dB. Considerable range of VSWR is 1-2. CST microwave studio is a advance software to design and simulation of all types of antenna, filter etc.

S. Lan et al.,[5] Right now, new millimeter-wave transmitting/getting antenna module for bioradar sensors was proposed. This antenna was planned working at 24 GHz for remote contactless assessment of the human life form adjustment to physical and mental pressure. This module was separated into two sections, the two of which were actualized by a microstrip array antenna sub-module. The feed systems were additionally streamlined for impedance

coordinating to dispose of the sign self-blending. This module had an element of 56×64 mm2, which made it simple to introduce on the rooftops over the beds to screen the heart development movement and breath design changeability of consumed patients or individuals in stress. The reproduction results indicated its great execution in bioradar applications.

Yipan Zhou et al.,[6] Right now, omni-directional round and hollow patch array antenna utilizing liquid crystal polymer (LCP) innovation is planned, the proposed antenna is made out of 8 linear sub-arrays took care of by three-arrange T-intersection power divider organize, and each sub-array contains 5 arrangement took care of rectangular microstrip patches. Examinations among estimated and mimicked results confirm that the round and hollow patch array antenna accomplishes a 10dB return misfortune somewhere in the range of 23.45GHz and 24.29GHz and the deliberate addition at 24GHz is 6.9dB, likewise the proposed antenna plays out a decent omni-directional example in H-plane at 24GHz.

P. M. Anju et al.,[7]A millimeter wave antenna utilizing Half Mode Substrate Integrated Waveguide (HMSIW) is introduced. Thin rectangular patch is utilized as transmitting component took care of by the open finish of the HMSIW. Reenactment results are introduced for antenna array planned on Alumina substrate for 24GHz and 60GHz band.

Xu Feng, et al.,[8] A K-band micro-strip array twofold antenna applied in 24GHz car accident cautioning radar is introduced right now. The twofold antenna comprises of two individual 14×6 components arrays which both are put on ROGERS RT5880 substrate with 0.254 mm thickness, one for the transmitter (TX) and one for the collector (RX). The consequences of reproduction show that the twofold antenna has increase of 26.5dB and productivity of 60%, the -10dB bandwidth is 1GHz from 23.6GHz to 24.6GHz, three-decibel beam width in azimuth is 6° and in height is 18°, the sub lobe concealment in azimuth is better than - 20dB and in rise is better than - 15dB. The confinement between two antennas array is better than - 32dB.

Therefore the review of literature informs us various research works on antenna design and analysis for LTE satellite 5G application.

Researchers design micro-strip antenna array with low side-lobe is designed for 24GHz radar sensors. The simulation results show the side-lobe level of the antenna array is -26.5dB. Monopole antenna array based fractal geometry is proposed for MIMO applications. The antenna elements within a distance of 0.4A are found bellow -30dB at the two bands of interest. The design of a linearly polarized electronically reconfigurable transmit array in K-band for beam steering. The transmit array is designed for a beam steering range of ±30 ° which demonstrated at 24GHz. A planar dual-polarized patch antenna array with vertical beam forming capability. The novelties and the potential of this dual-polarized antenna array are discussed in detail. A new millimeter-wave transmitting/receiving antenna module for bioradar sensors. Module had a dimension of 56×64 mm2, which made it easy to install on the roofs above the beds to monitor. An omni-directional cylindrical patch array antenna using LCP technology is designed. The cylindrical patch array antenna a 10dB return loss between 23.45GHz and 24.29GHz and 24GHz is 6.9dB. A millimeter wave antenna using Half Mode Substrate Integrated Waveguide. Antenna array designed on Alumina substrate for 24GHz and 60GHz band. A K-band micro-strip array double-antenna applied in 24GHz automotive collision warning radar. The double-antenna has gain of 26.5dB and efficiency of 60%.

III. CHALLENGES AND APPLICATIONS

A. Challenges

- Microstrip antennas are relatively inexpensive to manufacture and design because of the simple 2-dimensional physical geometry.
- They are usually employed at UHF and higher frequencies because the size of the antenna is directly tied to the wavelength at the resonant frequency.
- A single patch antenna provides a maximum directive gain of around 6-9 dBi. It is relatively easy to print an array of patches on a single (large) substrate using lithographic techniques. An advantage inherent to patch antennas is the ability to have polarization diversity.
- Patch antennas can easily be designed to have vertical, horizontal, right hand circular (RHCP) or left hand circular (LHCP) polarizations, using multiple feed points, or a single feed point with asymmetric patch structures.[4] This unique property allows patch antennas to be used in many types of communications links that may have varied requirements.

B. Applications

- The Microstrip patch antennas are well known for their performance and their robust design, fabrication and their extent usage.
- The advantages of this Microstrip patch antenna are to overcome their de-merits such as easy to design, light weight etc.,

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488 |

|| Volume 8, Issue 10, October 2020 ||

- The applications are in the various fields such as in the medical applications, satellites and of course even in the military systems just like in the rockets, aircrafts missiles etc.
- The usage of the Microstrip antennas is spreading widely in all the fields and areas and now they are booming in the commercial aspects due to their low cost of the substrate material and the fabrication.
- It is also expected that due to the increasing usage of the patch antennas in the wide range this could take over the usage of the conventional antennas for the maximum applications.

IV. CONCLUSION

Microstrip patch antenna is using in all electronics devices for wireless communication. Array structure is advancement of MIMO and other type of antenna designs. This paper review about various research work based on mm wave microstip patch antenna for satellite k band wireless applications. Therefore it can be said that there are many challenges to design and performance improvement of k band antenna. K band antenna lies between 18 to 26 GHz so its bandwidth and other necessary parameter should be more improved. So that such antenna gives better performance in 5^{th} generation communications.

REFERENCES

[1] H. Jin, L. Zhu, X. Liu and G. Yang, "Design of a Microstrip Antenna Array with Low Side-Lobe for 24GHz Radar Sensors," 2018 International Conference on Microwave and Millimeter Wave Technology (ICMMT), Chengdu, 2018, pp. 1-3.

[2] Z. Al-Dulaimi, T. A. Elwi, D. C. Atilla and C. Aydin, "Design of Fractal Based Monopole Antenna Array with Ultra-Mutual Coupling Reduction for MIMO Applications," 2018 18th Mediterranean Microwave Symposium (MMS), Istanbul, 2018, pp. 39-42.

[3] M. Frank, R. Weigel and A. Koelpin, "A multilayer reconfigurable transmitarray in k-band for beam steering applications," 2017 International Conference on Electromagnetics in Advanced Applications (ICEAA), Verona, 2017, pp. 764-767.

[4] R. Tiwari, R. Sharma, and R. Dubey, “Microstrip Patch Antenna Array Design Anaylsis for 5G Communication Applications”, IJOSCIENCE, vol. 6, no. 5, pp. 1-5, May 2020. https://doi.org/10.24113/ijoscience.v6i5.287

[5] S. Lan, Y. Xu, H. Chu, J. Qiu, Z. He and A. Denisov, "A novel 24GHz microstrip array module design for bioradars," 2015 International Symposium on Antennas and Propagation (ISAP), Hobart, TAS, 2015, pp. 1-3.

[6] Yipan Zhou, Bing Liu, Fang Zhu, Dan Shen, Yawei Liu and Min Wang, "Omni-directional cylindrical patch array antenna using liquid crystal polymer technology," 2014 IEEE International Conference on Communiction Problem-solving, Beijing, 2014, pp. 269-272.

[7] P. M. Anju, A. O. Lindo, C. K. Aanandan, D. D. Krishna and P. R. Young, "Novel Millimeter-Wave Antenna Array Using Half Mode Substrate Integrated Waveguide (HMSIW)," 2012 International Conference on Advances in Computing and Communications, Cochin, Kerala, 2012, pp. 274-277.

[8] Xu Feng, Chen Xu and Wang Xin'an, "K-band micro-strip antenna array applied in anti-collision radar," 2010 IEEE 12th International Conference on Communication Technology, Nanjing, 2010, pp. 1240-1243.

[9] V. Cojocaru et al., "A 24GHz Low-Cost, Long-Range, Narrow-Band, Monopulse Radar Front End System for Automotive ACC Applications," 2007 IEEE/MTT-S International Microwave Symposium, Honolulu, HI, 2007, pp. 1327-1330

[10] V. Cojocaru, "A Medium Range Low-Cost Monopulse Radar System for Azimuth and Range Detection at 24GHz," 2006 IEEE Annual Wireless and Microwave Technology Conference, Clearwater Beach, FL, 2006, pp. 1-3.

[11] Chuang Wang, Rong Qian, Ming-hui Yang, Yun Sun, Jian-zhong Gu and Xiao-wei Sun, "A low cost 24-GHz FMCW radar for automobile application," 2005 European Microwave Conference, Paris, 2005, pp. 4 pp.-2086.

[12] L. Pierantoni, S. Lindenmeier, C. Ciandrini and T. Rozzi, "Efficient modelling of the near field coupling between phased array antennas," 33rd European Microwave Conference Proceedings (IEEE Cat. No.03EX723C), Munich, Germany, 2003, pp. 1389-1392 Vol.3.

INNO SPACE

SJIF Scientific Journal Impact Factor

Impact Factor:
7.488

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details