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A Survey On Patch Antenna Arrays With Improved Bandwidth,Coverage And Gain For 5g Wireless Applications

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Abstract
Microstrip antennas are widely equipped in laptops,mobiles and other portable devices in modern wireless communication, due to their advantages like small size, light weight, low cost and easy integration with planar structures. The research evolution in microstrip antennas required for portable wireless communication system applications is advancing day by day. So, it becomes very essential to notice the research and improvements happening in the area of microstrip antennas for the specific applications. The main objective of this paper is to discuss antenna arrays for mobile applications at the 5G frequency band. This paper initially presents various mm-Wave antenna arrays. Then, it reports capacitively coupled patch antenna arrays with 360 degree coverage and high gain. Finally, this paper helps to explore and design suitable microstrip antenna arrays at the 5G frequency band for the required application.

Keywords: *5G antenna, patch antenna. Capacitive coupling, mm-Wave, HFSS, antenna array.*

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I. INTRODUCTION

Due to the shortage of frequency spectrum below 6 GHz bands and the demand for higher data rate, higher frequencies, e.g., the millimeter-wave (mm-Wave) frequency bands, have been suggested as candidates for future 5G smartphone applications, as the considerably larger bandwidth could be exploited to increase the capacity and enable the users to experience several-gigabits-per-second data rates . When we shift from the cellular carrier frequencies used presently up toward the mm-Wave band new problems are introduced that need careful consideration. Free-space path loss is increased when higher frequencies are employed. To combat the increased path loss at mm-Wave frequencies a high gain narrow beam radiation pattern commonly referred to as beamforming, synthesized by an array consisting of multiple antenna elements with optimized spacing is a solution. Communication is mostly line of sight at mm-Wave frequencies. Hence,communication links can be disrupted if line of sight is not maintained. By varying the phase shift associated with each antenna element, thereby steering the overall radiation pattern of the array this can be get rid of.

Recently, many researches are focused on developing mm-Wave arrays at 28 GHz for 5G mobile phone applications. We study the lots of papers and journals , from that we made analysis and literature survey is made on following references.

II. ANALYSIS OF REFERENCES

1. “Dipole array for mm-Wave mobile applications”:
In this paper, an attempt was made to design a 1 × 4 array using curved dipole antenna elements to achieve high bandwidth. But the achieved gain was around 8 dBi which did not come out to be sufficient for practical applications.stream operating temperature of 280^{o}C – 300^{o}C and decreased at 320^{o}C – 360^{o}C. While n-tridecylbenzene and n-tetradecylbenzene decreased at 280^{o}C – 300^{o}C and increased at 320^{o}C – 360^{o}C.

2. "A switchable 3-D-coverage-phased array antenna package for 5G mobile terminals":
A probe-fed patch antenna is used as an antenna element and 3D array configuration was proposed in this paper. The array was capable of covering 270◦ in the azimuth plane. But the bandwidth of the patch antenna was too narrow.

3."A high gain steerable millimeter-wave antenna array for 5G smartphone applications":

PIFA antenna with a wide bandwidth and defected ground structure was proposed. But the design had back radiation due to the defected ground structure. It was observed that an antenna design to achieve a large bandwidth, high gain, small size and wide beam width simultaneously is a challenging task.

4."Multi-layer 5G mobile phone antenna for multi-user MIMO communications":
To obtain a 2 GHz bandwidth around 28 GHz off-center dipole elements were used. However, the feeding mechanism was complicated and the design had multiple layers.

5."Millimeter-wave open ended SIW antenna with wide beamcoverage":
A bandwidth of 3.9 GHz using substrate integrated waveguide (SIW) technology, a wide beam antenna design was implemented. However, it achieved a low gain.

6."SIW multibeam array for 5G mobile devices":
To generate fixed beams , an SIW based slot antenna was integrated with SIW power dividers and phase shifters based on Butler matrix principle. It covered the frequency band of 26-30 GHz and achieved a bandwidth of 4 GHz. However, the overall size of the system was 72 mm × 27.4 mm × 0.54 mm which almost occupied a quarter of the mobile phone's area and proved too large for practical implementation.

III. CONCLUSION

From all above reports and papers we understand that to achieve a large bandwidth, high gain, small size and wide beam width simultaneously is a challenging task. Our main focus is a capacitive fed patch antenna element and used this antenna element for a new array configuration for wide coverage.

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