An Analytical Review on Broadband Antennas and Recent Advances

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Abstract: With advancement in technology, need of high speed communication is required. Thus antenna should adjust to increasing demands of more effective and increased data rate of communication system. Therefore from past few decades enhancing the bandwidth of antennas and gain are the topic of interest for research purpose. The advancement of broadband system in wireless communication area has insistence design of antennas that can function properly over a higher frequency range. Broadband antennas are referred to as the antennas having wide bandwidth. Slots introduced in the basic microstrip antennas increases the bandwidth of the antenna by modifying the surface current distribution. This paper presents a survey of broadband antennas and advancement in this field.

***Index Terms* -** Broadband antennas; microstrip antennas; stacked; C band.

1. INTRODUCTION

For transmitting and receiving waves the metallic device which is used is called as an antenna or in other words between the free space and transmission line or waveguide the transitional circuit used is antenna. The antenna emits the energy as electromagnetic waves from current which are supplied by the radio transmitter to antenna terminal during transmission [1]. Antenna is the array of conductors electrically connected to transmitter and receiver. For receiving and transmitting radio waves in horizontal direction or in all directions the antenna can be designed. An antenna consists of horns, parabolic reflectors or parasitic elements that are used to align the waves into a desired radiation pattern or in beam. A German physicist Heinrich Hertz during the late 1880s has designed the early antenna for proving the presence of electromagnetic waves as depicted by James Clark Maxwell. For both transmission and reception Hertz put the dipole antennas at the focal distance of reflectors, which were parabolic in shape. In wireless system antenna is used to increase energy in few directions and supress in additional. Therefore, along with a probing device antenna should also serve as a directing device. Antenna is most analytic device for the wireless communication. The overall system execution can be enhanced if the design of antenna is good. As eyeglasses are necessary for the human for clear vision similarly an antenna is also required for the communication system. Microstrip antennas are the simplest form of antennas and come under the category of low profile antennas. On a ground plane a metal patch is mounted and a dielectric material is present in between. Microstrip antennas are having low radiations and are compact in size. These antennas are suitable for 100 MHz frequency operations. The radiation intensity is considred in direction normal to emitting element of antenna, in properly designed microstrip antenna. The length of antenna L is tipically one-half wavelength long dpending on the dielectric constant of substrate. The higher efficency is obtained at low values of dielectric constant. To reduce the undesired propagation modes at the conductor edge another important parameter is considered which is the height, h of the substrate, it is important in terms of efficiency and bandwidth. The rectangular geometry of the Microstrip antenna is most widely used. Conventional patch shapes are rectangular, circular, annular-ring etc. Coaxial feed, aperture coupled feed microstrip feed are the basic feeding techniques that are used in microstrip antenna. The microstrip antennas provide the major advantages of being flimsy, smaller volume, consistent configuration, low manufacturing prices and simplicity in bulk manufacturing. Linear and circular polarizations are possible, dual frequency antennas can be easily realized. The main drawback of these microstrip antennas is that they produce limited bandwidth, generally lower than 5%. The small profile benefits of microstrip antennas were especially appealing for faster moving vehicles like airplanes, rockets and space crafts. There are major advancements in the field of microstrip antennas that incorporate multiband and dual band methods, circular polarization of antennas method, broad banding methods and reduction in size.

2. CHARACTERISTICS OF MICROSTRIP PATCH ANTENNA

Multiple features are provided by microstrip antennas. They are common to the basic geometry of antenna irrespective of the shapes of patch.

a) In an antenna there exists infinite resonant modes; the resonance frequency of these modes depends upon size and shape of patch, relative permittivity of substrate and thickness of substrate.

$$f_{mn} = \frac{k_{mn}c}{2\pi\sqrt{\epsilon_r}} \quad \text{……….} (1)$$

b) The dominant modes having strongest radiation along the broadside are (1,0) or (0,1) modes. Every mode has its own radiation. By employing two modes the circular polarization can be obtained.

c) Microstrip antennas dimensions sometimes increases due to the fringing fields at edge of the antenna. Effective factors are taken into consideration in order to obtain the effective dimension of antenna.

d) Feed in antenna plays a vital role in input impedance of antenna. The impedance is high as the feed is close to the edge of the patch; decrements as feed moves interior to patch. The feed inductance at resonance can be minimised by using a thin substrate. If the feed location is chosen properly than feed line resistance could be matched to the resonant resistance. If matching is proper than the voltage standing wave ratio is approximately equal to unity. Further, when frequency deviates from the resonance the standing wave ratio increases.

e) The impedance bandwidth of the antenna is directly proportional to thickness of substrate and is inversely proportional to relative permittivity of the substrate. Higher level of radiations from feed could be obtained by using a lower permittivity substrate. With the increase in the substrate thickness above 0.005 λ_0, the antenna cannot be matched with the feed line.
Therefore, the basic microstrip antenna bandwidth is constraint up to 5%. Thus the broad banding of microstrip antenna is latest research topic of interest.

3. BROADBAND ANTENNAS

Antenna should adjust to increasing demands of more effective and increased data rate of communication system. Therefore, from past few decades enhancing the bandwidth of antennas and gain are the topic of interest for research purpose. For gain enhancement antenna arrays is the latest research area. The advancement of broadband system in wireless communication area has insistence design of antennas that can function properly over a higher frequency range. Broadband antennas are referred to as the antennas having wide bandwidth. The term broadband" is a comparative calculation of bandwidth. Bandwidth can be calculates as:

$$B = \frac{f_u - f_l}{f_c} \times 100 \quad \text{……… (2)}$$

Where f_u, f_l, f_c are upper Frequency, lower frequency and centre frequency. The bandwidth is expressed as the percentage using the above equation of narrow band antennas.

$$B = \frac{f_u}{f_l} \quad \text{………… (3)}$$

In term of the ratio of the higher and lower frequency the bandwidth for wide band antenna can be expressed by above equation. Over an octave when the pattern of antenna does not change remarkably then it is classified as broadband antenna. Thus the broadband antenna definition depends upon the particular antenna. Broadband antenna normally requires shapes that remains similar in dimensions, however alternatively utilize materials with clean boundaries. Clean physical systems tend to provide patterns and enter impedance that still exchange easily with frequency. This easy concept could be very crucial in designing broadband antenna. Various types of antennas come under broadband antennas:

- Travelling wave antenna
- Helical antenna
- Biconical antenna
- Frequency-independent antenna
- Log-periodic antennas
- Yagi antenna
- Corner reflector
- Patch antenna
- Directional antennas

4. TECHNIQUES TO ACHIEVE BROADBAND

The needs of the wireless communication system are not able to be met by the basic microstrip antenna design since it is primarily narrowband. However the bandwidth of antenna can be enhanced simply by using the lossy substrate, but one has to compromise with the efficiency of the antenna. Many new techniques and methods are developed in order to increase the bandwidth of antenna without compromising with efficiency. Various methods that are developed in order to obtain the wider bandwidth are based on these principles:
a) The overall broader bandwidth is obtained by addition of slot or either the parasitic elements; due to which additional resonances are introduced.
b) By using the thicker substrate having low relative permittivity.
c) The most basic slot design is U slot, the slot is cut in patch, various types of slots can be used namely H, F, E, L etc. The inductance instigated by the probe/feed is equilibrized by the slot. These types of designs are single patch designs and have a single substrate. The drawback of this type of design is high cross polarization at the end of frequency bands in H-plane. Up to 25% of the bandwidths can be obtained.
d) Another similar design as the slot design is the L-shaped fed design. The middle of the coaxial feed/probe is bent into an L shape. This design also introduces resonance frequencies, 30% of the bandwidth can be obtained by using this design.
e) Aperture coupled designs are also used to obtain the higher bandwidth; the patch is fed across an aperture by a microstrip line. About 25% bandwidth can be achieved by making the slot to resonate near the resonance frequency of the patch but not same as that of patch. The resonant slot however has high back lobe radiations.
f) Another method for broadband antennas is by using the stacked patches or multilayer structure. In stacked patches the bottom is fed through an aperture through microstrip line. 50% of bandwidth can be achieved by this design but the overall antenna is thick because of multiple layers.

5. STACKED PATCHES

Stacked patches were instigated for broadband design. In stacked patch design multiple layers are used in which bottom is fed whereas the upper conducting portion/patch is parasitic in nature. The broadband characteristics are achieved due to the higher coupling between the two resonances of conducting patches. This multilayer design can also be implemented for having dual frequency operations. The dual band response is obtained as in coaxial fed case the middle conductor passes by a hole and is attached directly to the upper patch due to which coupling is not strong between the resonances of the two patches. The first experimental effects of such design have been said by way of Long and Walton. Two stacked round patches had been pictureetched on separate substrates and aligned so that their centres have been along the equal line. The sizes of the discs and their spacing have been varied and the consequent antenna traits were measured. It is clear that the technique of using stacked patches for twin band operation may be extended to multi bands by means of honestly stacking patches in multilayers.

6. LITERATURE REVIEW

Broadband antennas are basically frequency independent antennas; they have been studied for several decades. Typical broadband antennas include spiral antenna, complementary antennas and log-periodic antennas. New technologies like system on package and system in chip that are based on LTCC, GaAs, Si and other substrate. For such rising technology, planar antennas and antennas in bundle are most desirable solution for significant dense machine. However, broader antennas needed by using those rising systems cannot be applied using basic antenna structures like log-periodic antenna or either spiral antenna. Hence, there is a need of new antennas structures and layout approach must be put forward to attain wider bandwidth operations with dense size. Moreover, unique radio structures can additionally possess special specs that can utilize distinct antennas and arrays to satisfy system necessities.

The literature review gives the brief discussion about the latest advancements in the field of broadband antenna designs and trouble introduced for designing broadband antennas or broadband radio wire exhibited for C band correspondence.

G. bubost et al. [2] allocates a comprehensive exploratory research of Microstrip antenna. A broad-folded dipole flat in shape and is collateral to and at small distance from reflector plane is proposed and studied. For different applications the bandwidth obtained by the designed antenna is sufficient despite having smaller thickness. The maximum linear isotropic gain of 7.5 dB at 2000 MHz is obtained. This shows that losses are below than 0.5 dB.

Amit A. Deshmukh et al. [3] proposed the E shaped microstrip antenna having three unequal length rectangular slots. The resulting antenna has broader bandwidth due to the rectangular slots present. Along with the fundamental TM10 mode and orthogonal higher orders TM11, TM02 the slots reduces the resonance frequencies of these modes. This results in 450MHz of bandwidth, which is more as obtained by the U-shaped slot antenna. The antenna provides a gain of 8dBi.

Amit A. Deshmukh et al. [4] proposed the resonant length formulation for C-shape patch at higher order mode. A step width open circuit stub loaded C-shape microstrip antenna is proposed. The comparison of the C-shape patch is carried out with the fundamental rectangular patch. The stub introduced alters surface current distribution of second order mode and reduces the resonant frequency of TM20, TM10, TM01 and TM30 modes. This results in broadside radiation pattern at each frequency and broadband and multiband responses. The incremental bandwidth of 4% around 32MHz is obtained at lower frequencies and 2% at multiband frequencies is obtained.

Amit A. Deshmukh and Girish Kumar [5] comparison of different stacked configurations of C-shaped microstrip antenna is carried out. The stacked configurations that are carried out are C-shaped microstrip antenna with two C; H and ring microstrip have been studied. C-formed with an H ring or hoop microstrip gives biggest bandwidth from other configurations having a better cross polarization level. However the C-fashioned with two C offers smallest cross polarization stage.

Mubarak Sani Ellis et al. [6] presents a structure of new compact circularly polarized slot antenna which is fed by the Microstrip feed line. For acquiring desired results of operation of compact polarized a horizontal stub is introduced from the ground plane towards centre of wide slot and then wide slot is fed with a Microstrip feed line which is positioned to side of wide slot, underneath the introduced stub. Both the metallic stub and feed line are perpendicular to each other. A fractional impedance bandwidth of 90.2% from 3.5 to 9.25 GHz and a fractional AR bandwidth of 40% from 4.6 to 6.9 GHz are attained. This is useful for wireless applications in the C-band.

Amit A. Deshmukha et al. [7] proposes a configuration of 120^0 sectored microstrip slot antenna. The sectored patch antenna provides a higher frequency of operation with proximity fed design. The resonant length formulation at fundamental mode is used in sectored antenna. Compared with the circular patch the sectored patch provides a bandwidth of 1200MHz, about 59% and broader radiation pattern. The peak gain of 9dBi is obtained. At a frequency band of 1000MHz the proposed formulation design of 120^0 sectored antenna yields 600 MHz of bandwidth.

D de Haaij et al. [8] introduced a broadband Microstrip antenna for enhancing the bandwidth. To obtain the required results as open circuited and short circuited stub a parallel resonant circuit to the feed structure is attached. At the feed point impedance matching is also used to enhance bandwidth without disturbing radiation detail. Antenna is operated at 1.8 GHz frequency. When matching circuit is not used then the measured bandwidth is approx. 3.2 % (1.774 – 1.832 GHz) and whilst matching circuit is used then the measured bandwidth is approx. 6.9 % (1.730 – 1.854 GHz).

Md. Mehedi Hasani et al. [9] a meta-atom with a new mirror shape chiral for C-band is presented. The meta-atom is developed by an electric inductive-capacitive resonator. Simulation is carried out for the analysis of the meta-atom. The designed structure of meta-atom shows the left handed characteristics at 7.61 GHz. Designed structure is fabricated for the validation of the results and the structure provides a broader bandwidth of 5.14 GHz from 4.0 to 9.14 GHz that covers the major portion of the C-band.

Dong-Ya Cheng et al. [10] proposes a new high gain and dual-band waveguide slot cut antenna. The antenna is designed by combining a folded plate and a double-layer metal structure with four apertures on its top floor. Gain of antenna is obtained up to 11.9 dB at 12.7 GHz, 12.1dB at 15 GHz in comparison to single aperture flat antenna. Measured and simulated outcomes shows that introduced antenna with resonant cavity provide higher impedance matching with increment in gain of 5.2 dB and 6 dB respectively at the desired frequencies.

Praveen Chaurasia et al. [11] introduce a low profile planar multiband slot antenna designed for multiple applications. Antenna designed resonates for seven frequency bands with centre frequencies as 2.54 GHz, 3.48 GHz, 4.02 GHz, 4.34 GHz, 5.1 GHz, 5.54 GHz and 6.24 GHz. In two frequency bands from 3.42 to 3.68 GHz and 6.2 to 6.94 GHz antenna shows the circular polarization. The proposed antenna is useful for PAN, RADAR system, scalable OFDMA, Bluetooth, mobile Wi-MAX and WLAN applications.

Mohammad Fazaelifar et al. [12] using a new broadband cell, a single layer wideband reflect array antenna is proposed. The given antenna design consists of two parts, circular patch and a ring with some additional stubs. They are affixed to patch and rings in consistent manner. For achieving constant phase response between 11GHz to 20GHz to enhance reflect array antenna bandwidth proportions of ring, stubs and radiating element is optimized. The gain achieved is 23.40 dB after fabrication of antenna.

Amandeep Singh et al. [13] for improving execution properties of Microstrip receiving wire a Sierpinski fractal radio wire structure improvement is proposed by using the molecule warm enhancement and bend fitting technique. By changing the diverse plan parameters of the structure receiving wire the streamlining and fitting bend is gotten. The plan parameters for the transfer speed improvement of the proposed structure are gotten utilizing the down to earth swarm streamlining procedure. Bend fitting based streamlining upgrades the data transfer capacity to more noteworthy degrees.

L.F. Sanchez et al. [14] the proposed arrangements with featuring the comfort of utilizing electromagnetic recreation programming as an option in contrast to conventional scale model estimations when managing the plan of HF radio wires. Medium and low band receiving wires were structured specially appointed for this. The deliberate information was contrasted and the outcomes got utilizing the reproductions. The utilization of the reproduction code for the structuring of the HF receiving wires gives more exact outcomes than the utilization of scale models.

Arvind Kumar et al. [15] for broadband applications the structure of low-profile cavity sponsored roundabout fix radio wire is proposed. A planar depression supported fix is acknowledged utilizing the substrate incorporated waveguide based hole and nourishing instrument. Underneath the regular roundabout fix utilizing a rectangular SIW-based depression gives a wide impedance data transmission. The proposed radio wire works for 2.31GHz from 9.09 to 11.40 GHz and pivotal proportion transmission capacity of 2.7% from 10.30 to 10.57 GHz. The reception apparatus gives the pinnacle increase of 6.6 dBi and displays unidirectional radiation attributes. The proposed structure can be stretched out to cluster plan.

Amit A. Deshmukh, Shefali Pawar et al. [16] proposed F-molded different spaces cut receiving wire for broadband double captivated reaction. With reference to the crucial TM10 mode the different rectangular openings in fix tunes the impedance and reverberation recurrence at second request TM20 mode. This gives the transfer speed of in excess of 500 MHz (>40%). The variable polarization data transfer capacity can be acquired by the stub length and the closeness feed position. One structure of tunable polarization BW is given in which BW proportion of 65 to 35% crosswise over polarizations ended up changed to 51 to 49%. The proposed reduced design recommends broadside radiation design all through the BW with broadside advantage of over 5 dBi.

Zhenya Li et al. [17] proposed a CPW nourished ultra wideband opening receiving wire with broadband double round polarization. To accomplish both right-hand roundabout polarization and left hand round polarization at a similar recurrence band two CPW sustained ports are presented. From the surface current circulation the roundabout polarization instrument is dissected. The data transmission of the double CP receiving wire is from 1.9 to 14.3 GHz, and 3dB pivotal proportion transfer speed is from 1.9 to 5.9 GHz. Port detachments is superior to 15 dB inside the AR data transfer capacity and the addition is above 3dB.

Satyadeep Das et al. [18] meta-material based resounding depression broadband receiving wire with high addition working at C-band is proposed. A barrel shaped dielectric resonator receiving wire is utilized as the source feed for the meta-material Superstrate to energize the resounding depression radio wire. Meta-material involves the counterfeit attractive transmitter and square fix on either side of the lossy business dielectric material. Over a total band going from 4 to 9.1 GHz a data transfer capacity improvement of 72.72% and high addition of 22.4 dBi is accomplished because of the nearness of AMC. AMC expands the directivity of the reception apparatus.

Garima, D. Bhatnagar et al. [19] on a glass epoxy FR-4 substrate the radiation execution of a concentric round fix receiving wire having a jewel shape space for C-band is proposed. The presentation is contrasted and regular round fix reception apparatus having indistinguishable sweep. The improvement of the points and side lengths of precious stone opening is done to get upgraded data transfer capacity (16.93%). The addition of the proposed radio wire expanded possibly when contrasted with the ordinary round fix receiving wire. It reverberates at a solitary recurrence and offers 1.12 GHz of transmission capacity and is reasonable for C-band activity in space.

Chih-Wei Hsiao et al. [20] proposed broadband ±45° double spellbound base station radio wire energized by a square circle structure. The working groups of the proposed structure are in LTE2300/LTE2500/C-Band/5G 3300MHz-3600MHz. The proposed reception apparatus includes two Microstrip lines, two sets of coplanar symmetrical dipoles, two metallic barrels, square circle shape structure and a reflector. The dipole and metal barrels are associated with the reflector though the square circle is associated by Microstrip line is electromagnetically coupled to sustain the dipoles. Impedance transmission capacity of 55.88% is acquired by the reception apparatus by $S_{11} < -10$dB. Stable radio wire increase differing from 5.01dBi to 8.58dBi is acquired.

Shailendra Kumar Dhakad et al. [21] proposed hexagonal fix Microstrip reception apparatus structure for X band, Ku band and C band applications. A more noteworthy data transmission of 14.617 GHz is acquired and the radio wire works for all frequencies from 3.68 to 18.297 GHz. When contrasted with the basic fix receiving wire the data transfer capacity improvement of 504% is seen in proposed radio wire. Reception apparatus can be utilized in satellite correspondence, climate gauging and radar. 82% of the radiation force is gotten by the proposed receiving wire with high directivity.

Mohamed Abdelwahab et al. [22] proposed a broadband Microstrip radio wire configuration to cover X-band focused at 10GHz, C band focused at 6GHz and Ku band focused at 14 GHz. A twofold layered rectangular fix receiving wire is proposed to get wide data transmission and high addition. Two openings are cut in the metal ground plane, and lower layer is scratched by rectangular Microstrip fix. The second layer goes about as the pit back, fix as an exciter and the openings as a radiator. The upgraded transmission capacity of 89% is accomplished when contrasted with the traditional Microstrip reception apparatus. High productivity up to 0.9 and improved acknowledged increase up to 11dB is gotten.

V.P. Sarin et al. [23] proposed a broadband strip sustained printed Microstrip reception apparatus. To accomplish the impedance coordinating for higher request modes notwithstanding the current resonances the opened broadband Microstrip radio wire is nourished by a strip feed line. The proposed reception apparatus gives 74% of transmission capacity from 4.35GHz to 9.5GHz and a normal increase of 4.09dBi is acquired that is reasonable for wideband imaging applications.

N. Fhafhiem et al. [24] propose the broadband waveguide high increase receiving wire nourished by utilizing the Microstrip radio wire at 2.33 to 5.24 GHz. To improve the order gain a sustaining system of broadband fix reception apparatus with the bloom shape is joined with rectangular waveguide receiving wire. High increase and wideband execution are accomplished with addition up to 8.79 dB. The deliberate and mimicked broadband receiving wire data transfer capacities are 76.88% for S11< 10dB. Ease materials like aluminium and FR4 are utilized for the creation of the proposed reception apparatus.

Ubaid Ullah et al. [25] present a basic sustaining strategy for energizing the symmetrical parts in wide-space radio wire. To energize the major even and vertical parts of the roundabout polarization, a rectangular section molded parasitic strip is put at the open end of the straight Microstrip line. The proposed system—when utilized related to the unbalanced geometry of coplanar waveguide and a distended stub from the beginning takes into account keeping up the hub proportion inside a wide range in C band. The proposed structure includes a 62% impedance transfer speed inside scope of 3.6 to 6.85 GHz and hub proportion data transfer capacity of 49% from 3.6 to 5.93 GHz. The application zone of the proposed receiving antenna incorporates a few WLAN and WiMAX groups.

Jingli Guo et al. [26] discussed a smaller wideband sickle moon-shape fix pair reception apparatus. The two fix sets are having inverse stage feed. The antenna of size about 54.5× 22×20 mm3 is developed and tried thinking about the coupling between the two fixes in structure. The outcomes demonstrated antenna gives about 87% data transfer capacity extending from 2.6 to 6GHz. Reflection coefficient of the reception apparatus is under 9dBi.

Lorenzo Mattioni et al. [27] paper depicts a multifunction HF-stacked radio wire for broadband maritime correspondences dependent on each floor wave and close vertical pervasiveness sky waves. The radio wire, meant as bi collapsed monopole, is planned by another stacking technique which maintains a strategic distance from the utilization of convoluted outer systems. Numerical reproductions and estimations on a scaled model have appeared energizing capacities are obtained by method for the utilization of only four or five stacking circuits.

Rania Elsharkawy et al. [28] proposed reflect exhibit antenna working at 28 GHz with polarization autonomous attributes. Unit cell contains three round rings upgraded to get direct stage qualities with change in the unit cell measure. The proposed exhibit made out of 400 unit cells of variable size. So as to mirror the wave in heading typical to reflect exhibit surface the unit cells are orchestrated in a square shape gap. Proposed configuration gives an addition of around 25 dB and a productivity of 58% at 28 GHz.

M.M. Ali et al. [29] A minimized rectangular with half of hover cut-out Microstrip fix reception apparatus for C-band is proposed. The reception apparatus is nourished by 50 ohm Microstrip transmission line and has measurements 22 mm × 20 mm × 1.5 mm. The FR-4 substrate with dielectric consistent of 4.4 and 1.5mm of thickness is utilized. The re-enactment results of the receiving wire demonstrate that the proposed reception apparatus is an incredible possibility for over the top speed remote LAN at 4.25 GHz to 7.32 GHz assortment. The radio wire has an impedance data transmission of 72.24% (3.07 GHz). Hence this sort of reception apparatus is useful for WLANs just as C band utility. Increase of 5.07 dB is gotten.

V. P. Sarin et al. [30] Discussed about broadband printed microstrip reception apparatus having pass polarization organize > 15db with cutting edge advantage inside the whole recurrence band is given. Statute of stacking is executed on a strip stacked opened broadband fix antenna for boosting the addition without influencing the broadband impedance coordinating attributes and counterbalancing the situation of the upper fix energizes a lower reverberation which supplements the data transfer capacity further. The antenna has a component of $42\times55\times4.8mm^3$ when imprinted on a substrate of dielectric steady 4.2 and has a 2:1 VSWR transfer speed of 34.9%. The antenna shows a pinnacle addition of 8.07 dBi and a decent front to back proportion superior to anything 12 dB is watched all through the whole working band.

Manisha Gupta et al. [31] proposed a privilege calculated isosceles triangular Microstrip antenna. The state of the fix component in reception apparatus is triangular and the ground plane is abandoned. For improve the presentation of antenna variety happens in feed hole, cut size and in breaking the fix. The proposed reception apparatus works at 8.8 GHz recurrence. The antenna accomplished pinnacle addition of 6.310 dB and 728 MHz of data transmission. The proposed reception apparatus configuration is utilized for ultra wideband applications in X band.

Weiwen Li et al. [32] proposes a dual-polarized printed slot antenna is constructed by inserting the open-end slot into the coplanar waveguide centre conductor of T-shaped slot. In order to verify the antenna performance, an antenna prototype was fabricated. The working bandwidth of about 10.5% is obtained. In operating frequency band, the isolation between two ports is higher than 27dB. However, higher port isolation can be achieved by using other feeding technique.

Abhishek Kandwal et. al [33] proposed a Coupled C-band stacked antenna using different dielectric constant substrates for communication systems is proposed. The antenna operates in C-band resonating at two different frequencies. Two different substrates FR4 and Mica are used in this antenna structure. The stacked antenna design is fed coaxially at the central patch keeping the other three patches as parasitic patches. The antenna is optimized to obtain an impedance bandwidth of about 8% and 7% in the two bands respectively with a peak gain of 9.5 dBi and side lobe level of 12.2 dB at the resonant frequency.

Wangyu Sun et al. [34] depicts a Broadband and low-profile microstrip antenna using strip-slot hybrid structure to enhance the bandwidth up to 41% within a height of $0.06\lambda_0$. The proposed antenna consists of four strips, which are separated by three narrow slots. By controlling the dimensions of the strips and the slots, dual modes, i.e., TM10 mode and antiphase TM20 mode are excited and coupled to increase the operating bandwidth. The strip-slot hybrid structure can be excited with optimized impedance matching using an aperture-coupled Y-shaped feeding microstrip line. A prototype of the proposed antenna is constructed and tested. Experimental results show an impedance bandwidth of 41% for the reflection coefficient less than−10 dB.

A comprehensive survey of the broadband antennas and the advancement in the fields of broadband antennas is given. The hexagonal patch microstrip antenna provides better results and can be operated in X band and Ku band along with C band communication. Moreover slot antennas are used for enhancing the bandwidth of the microstrip antenna. Different shapes namely U, E, F, L etc. with varying lengths are considered and different feeding techniques are used such as microstrip feed, probe feeding and proximity coupling for obtaining better results but at the cost of reduced gain due to high cross polarization in H plane at high frequency.

7. CONCLUSION

In this paper a general insight of the microstrip antennas and its advancement in revolutionary and flexible antennas has been given. When dealing with antennas the broad-banding of microstrip antenna is the major concern for wireless communication system. Various methods are discussed regarding the broadband antennas, namely the addition of the slots. Slots introduced in the patch increases the bandwidth of the antenna by modifying the surface current distribution. The latest advancement for achieving higher bandwidth using the microstrip antenna is by using the stacked patches structure. In stacked patch design multiple layers are used in which bottom is fed whereas the upper conducting portion/patch is parasitic in nature. A greater amount of the bandwidth can be achieved by using the stacked patch structure. While the advances of the last three decades have been impressive, many challenges remain. In broad-banding, the efficient methods developed all result in increased volume, which somewhat mitigate the low profile advantage of microstrip patch antennas.

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