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APPLICATIONS OF MICROSTRIP PATCH ANTENNA : AN OVERVIEW

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ABSTRACT:-

The study of microstrip patch antennas has created nice progress in recent years. Compared with standard antennas, microstrip patch antennas have additional blessings and higher prospects. They're lighter in weight, low volume, low cost, low profile, smaller in dimension and simple fabrication and conformity. Moreover, the microstrip patch antennas will give twin and circular polarizations, dual-frequency operation, frequency nimbleness, broad band-width, feedline flexibility, beam scanning omnidirectional patterning. During this paper, the microstrip antenna, varieties of microstrip antenna, feeding techniques and application of microstrip patch antenna with their advantage and downsides over standard microwave antennas have been discussed.

KEYWORDS : Microstrip Antenna (MSA), Microstrip patch antenna (MPA), Feeding techniques.

INTRODUCTION :-

Microstrip antennas have numerous benefits over conventional microwave antenna and consequently are extensively utilized in plenty of sensible programme. Microstrip antennas in its most effective configuration are demonstrated in fig.1.It consists of a radiating patch on one facet of dielectric substrate ($\epsilon_r \leq 10$), which has a floor plane on specific component.

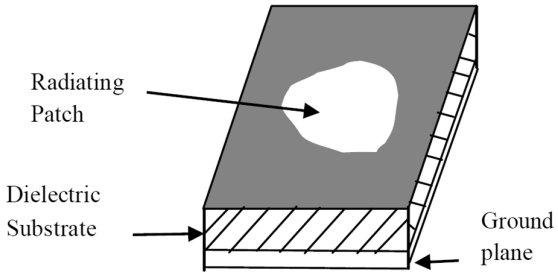
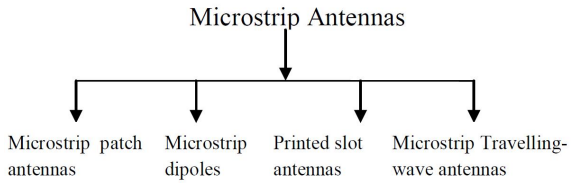


Fig 1: Microstrip antenna configuration

Microstrip antennas are characterised through a bigger variety of physical parameters than traditional microwave antennas. They can be designed to have many geometrical shapes and dimensions [2]. Microstrip antennas have been divided into four categories:



MICROSTRIP PATCH ANTENNA

A microstrip patch antenna (MPA) consists of a conducting patch of any planar or nonplanar with one facet of a material substrate with a ground plane on alternative facet. It is a well resonant antenna for slim-band microwave wireless hyperlinks that want hemispherical insurance. Because of its planar configuration and simple integration with microstrip technology, the microstrip patch associate degreetenna has been heavily studied and is usually used as parts for an array. An oversized variety of microstrip patch

antennas are studied thus far. Associate degree thorough list of the geometries in conjunction with their salient options is offered [1]. The oblong and circular patches square measure the fundamental and most ordinarily used microstrip antennas. These patches square measure used for the only and therefore the most tight applications. Rectangular geometries square measure dissociable in nature and their analysis is additionally straightforward. The circular patch antenna has the advantage of their radiation diagram being interchangeable. An oblong microstrip patch antenna in its simplest type is shown in Figure-2 .

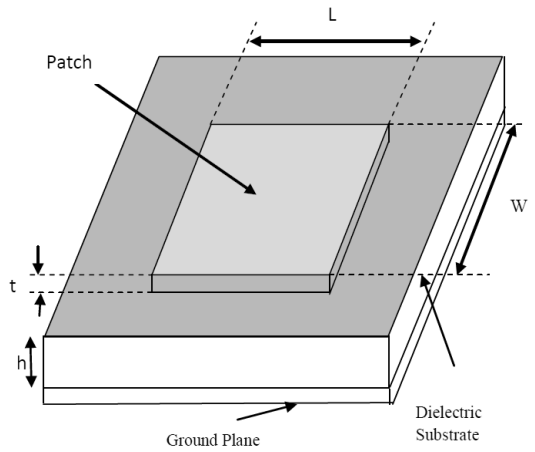


Fig 2: Structure of rectangular microstrip patch antenna

The characteristics of microstrip patch antennas, microstrip slot antennas and printed dipole antennas are compared in table 1.

Table-1

Sr. No.	Characteristics	Microstrip Patch Antenna	Microstrip Slot Antenna	Printed Diopole antenna
1.	Profile	Thin	Thin	Thin
2.	Fabrication	Very easy	Easy	Easy
3.	Polarization	Both linear and circular	Both linear and circular	Linear
4.	Dual-Frequency operation	Possible	Possible	Possible
5.	Shape flexibility	Any shape	Mostly rectangular and circular shapes	Rectangulatar and triangular
6.	Spurious radiation	Exists	Exists	Exists
7.	Bandwidth	2-50%	5-30%	-30%

FEEDING TECHNIQUES

A feedline is employed to excite for radiation by direct or indirect contact. There are various techniques of feeding and four most well-known techniques are- concentric probe feed, microstrip line, aperture coupling and proximity coupling [2]. Coaxial probe feeding is feeding technique within which the inner conductor of the concentric is hooked up to the radiation patch of the antenna whereas the outer conductor is connected to the bottom plane. Blessings of concentric feeding are straightforward of fabrication; simple to match, low spurious radiation and its disadvantages is slim information measure, troublesome to model especially for thick substrate.

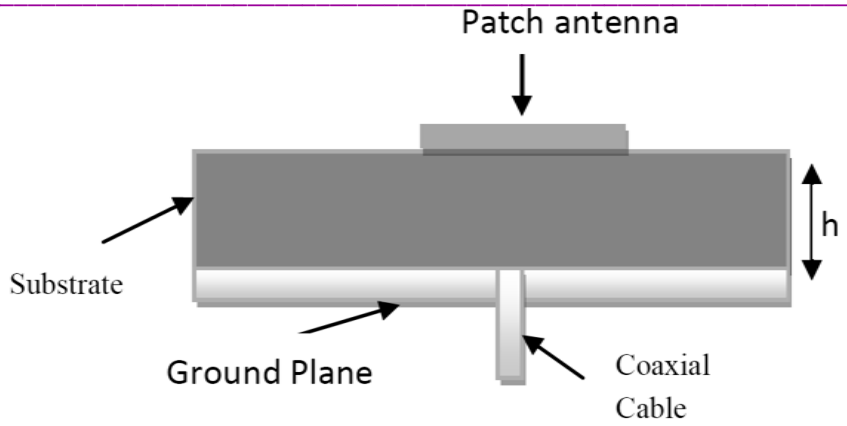


Fig 3: Coaxial probe feed patch antenna

Microstrip line feed is one of the easier methods to fabricate as it is a just conducting strip connecting to the patch and therefore can be considered as extension of patch. It is simple to model and easy to match by controlling the inset position. However the disadvantage of this method is that as substrate thickness increases, surface wave and spurious feed radiation increases which limit the bandwidth.

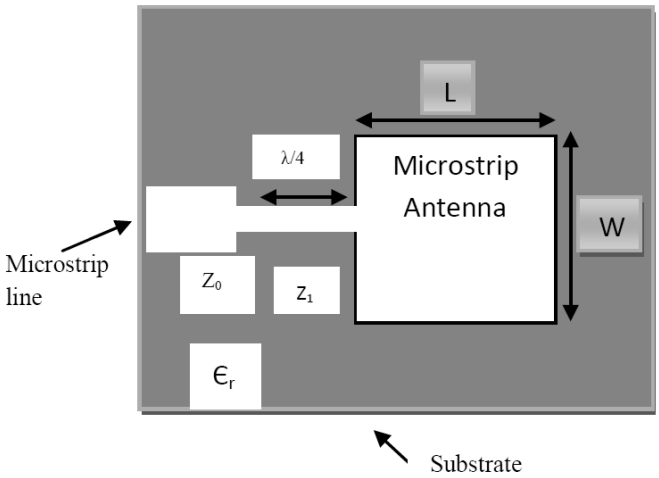


Fig 4: Microstrip line feed patch antenna

Aperture coupled feed include two totally different substrate separated by a ground plane. On rock bottom aspect of lower substrate there's a microstrip feed line whose energy is coupled to the patch through a slot on the bottom plane separating two substrates[3]. This arrangement permits freelance improvement of the feed mechanism and also the diverging component. Ordinarily prime substrate uses a thick low stuff constant substrate whereas for rock bottom substrate, it's the high stuff substrate [4-5].The bottom plane that is within the middle, isolates the feed from radiation component and minimizes interference of spurious radiation for pattern formation and polarization purity. Benefits are freelance improvement of feed mechanism component.

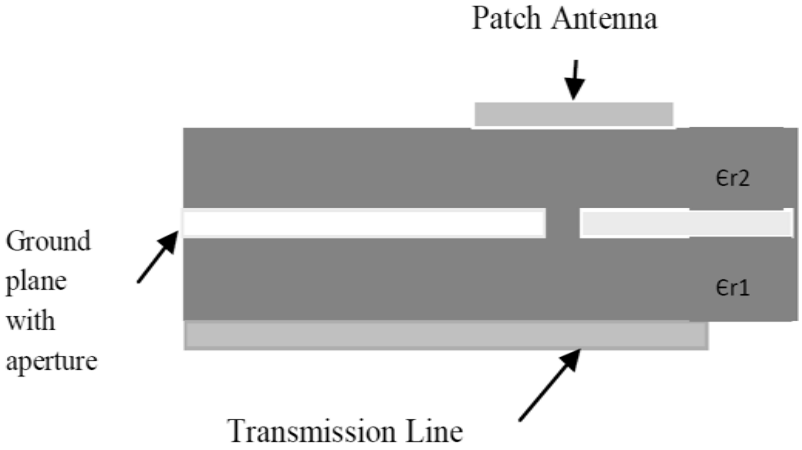


Fig 5: Aperture coupled feed patch antenna

Proximity coupling has the largest bandwidth, has low spurious radiation. However fabrication is difficult. Length of feeding slab and width-to-length ratio of patch is used to control the match. Its coupling mechanism is capacitive in nature.

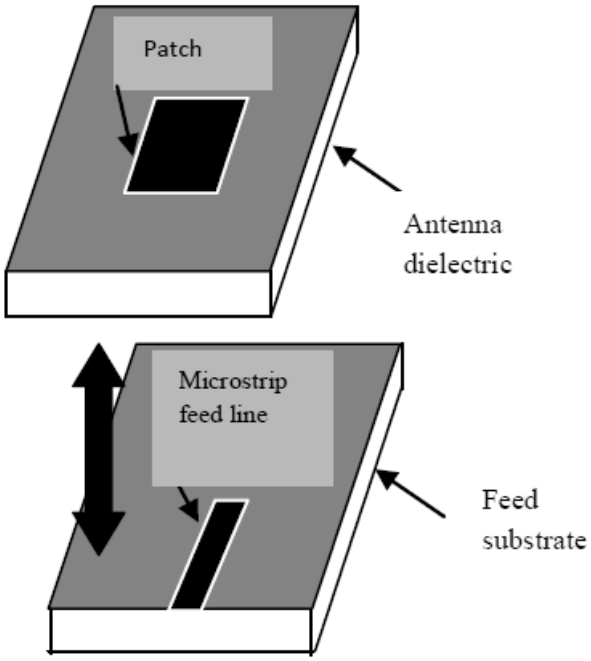


Fig 6: Proximity coupled microstrip patch antenna

The major disadvantage of this feeding technique is that it is difficult to fabricate because of the two dielectric layers that need proper alignment. Also, there is increase in overall thickness of the antenna.
In the wide range of antenna models there are different structures of Microstrip antennas, but on the whole we have four basic parts in the antenna [6]:

They are:
- The patch
- Dielectric Substrate
- Ground Plane

- Feed Line

Applications

The Microstrip patch antennas square measure renowned for their performance and their study style, fabrication and their extent usage. The benefits of this Microstrip patch antenna square measure to beat their de-merits like straightforward to style, lightweight etc., the applications square measure within the numerous fields like within the medical applications, satellites and after all even within the military systems rather like within the rockets, aircrafts missiles etc. The usage of the Microstrip antennas square measure spreading wide altogether the fields and areas and currently they're booming within the business aspects. Thanks to their low price of the substrate material and also the fabrication. Thanks to the increasing usage of the patch antennas within the big selection. This might take over the usage of the traditional antennas for the utmost applications. Microstrip patch antenna has many applications. A number of these applications square measure mentioned as below:

Mobile and satellite communication application:

Cell communication wishes tiny, low-price, low profile antennas. Microstrip patch antenna meets all wishes and numerous varieties of microstrip antennas are designed for use in cellular communication systems. Simply in case of satellite conversation circularly polarized radiation patterns square degree wanted and may be realised victimisation both square or round patch with one or two feed factors.

Global Positioning System applications:

These days microstrip patch antennas with substrate having excessive permittivity sintered material are used for worldwide positioning gadget. Those antennas are circularly polarized, very compact and pretty costly due to its positioning. It is predicted that hundreds of thousands of gps receivers will be used by the general population for land cars, plane and maritime vessels to discover their position correctly

Radio Frequency Identification (RFID):

RFID uses in different areas like mobile communication, logistics, manufacturing, transportation and health care [2]. RFID system generally uses frequencies between 30 Hz and 5.8 GHz depending on its applications. Basically RFID system is a tag or transponder and a transceiver or reader.

Worldwide Interoperability for Microwave Access (WiMax):

The IEEE 802.16 standard is known as Wimax. It can attain upto 30 mile radius theoretically and facts rate 70 Mbps. Mpa generates three resonant modes at 2.7, 3.3 and 5.Three GHz and may, therefore, be used in Wimax compliant communication equipment.

Radar Application:

Radar may be used for detecting moving objectives including people and vehicles. It demands a low profile, mild weight antenna subsystem, the microstrip antennas are a super choice. The fabrication generation based on photolithography allows the bulk manufacturing of microstrip antenna with repeatable performance at a decrease cost in a lesser time frame compared to the traditional antennas.[7-9]

Telemedicine Application:

In telemedicine utility antenna is operating at 2.45 GHz. Wearable microstrip antenna is suitable for Wi-fi frame place network (WBAN). The proposed antenna performed a better advantage and the front to return ratio as compared to the other antennas, similarly to the semi directional radiation sample that is favored over the omni-directional pattern to triumph over needless radiation to the person's frame and satisfies the requirement for on-body and stale-body applications. A antenna having advantage of 6.7 dB and a F/B ratio of 11.7 dB and resonates at 2.45GHz is appropriate for telemedicine applications.[7-9]

Medicinal applications of patch:

The specific design of the aforesaid antenna is used for the treatment of malignant tumors. The microwave energy is stated to be the simplest manner of inducing hyperthermia. The design of the unique radiator that is for use for this reason ought to posses mild weight, easy in handling and to be rugged. Most effective the patch radiator fulfils those necessities. The initial designs for the microstrip radiator for inducing hyperthermia became primarily based on the printed dipoles and annular jewelry which had been designed on S-band. And afterward the design became based on the round microstrip disk at L-band. There is a easy operation that is going on with the tool, coupled microstrip lines are separated with a flexible separation which is used to measure the temperature inside the human body.

5. Advantage and Disadvantage

Microstrip patch antenna has several advantages over conventional microwave antenna with one similarity of frequency range from 100 MHz to 100 GHz same in both type. The various advantage and disadvantage are given in table 2.

Table -2

Sr. No.	Advantage	Disadvantage
1.	Low weight	Low efficiency
2.	Low profile	Low gain
3.	Thin profile	Large ohmic loss in the feed structure of arrays
4.	Required no cavity backing	Low power handling capacity
5.	Linear and circulation polarization	Excitation of surface waves
6.	Capable of dual and triple frequency operation	Polarization purity is difficult to achieve
7.	Feed lines and matching network can be fabricated simultaneously	Complex feed structures require high performance arrays

5. CONCLUSION

A theoretical survey on microstrip patch antenna is supplied on this paper. particular microstrip patch antenna may be designed for every utility and merits are compared with traditional microwave antenna.

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