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Analysis of microstrip patch antenna

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Abstract
The study of microstrip patch antennas have more advantages and better prospects. They are lighter in weight, low volume, low cost, low profile, smaller in dimension and ease of fabrication and conformity. Moreover, the microstrip patch antennas can provide dual and circular polarizations, dual-frequency operation, frequency agility, broad band-width, feedline flexibility, beam scanning omnidirectional patterning. In this paper we discuss the microstrip antenna, types of microstrip antenna, feeding techniques and their advantage and disadvantages over conventional microwave antennas.

Keywords: microstrip antenna (MSA), microstrip patch antenna (MPA), feeding techniques.

1. Introduction
Antenna is a transducer designed to transmit or receive electromagnetic waves. Microstrip antennas have several advantages over conventional microwave antenna and therefore are widely used in many practical applications. Microstrip antennas in its simplest configuration are shown in Fig1. It consists of a radiating patch on one side of dielectric substrate ($\epsilon_r \leq 10$), which has a ground plane on other side.

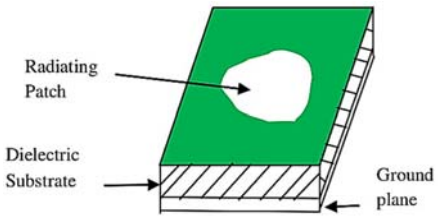
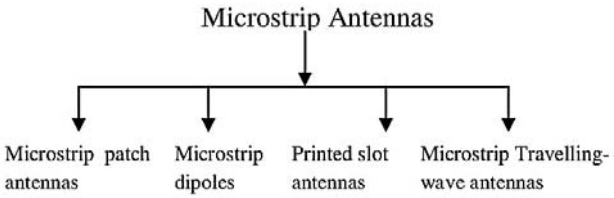


Fig 1: Microstrip antenna configuration

Microstrip antennas are characterized by a larger number of physical parameters than are conventional microwave antennas. They can be designed to have many geometrical shapes and dimensions [2]. All microstrip antennas can be divided into four basic catagories:



2. Microstrip Patch Antenna
A microstrip patch antenna (MPA) consists of a conducting patch of any planar or nonplanar geometry on one side of a dielectric substrate with a ground plane on other side. It is a popular printed resonant antenna for narrow-band microwave wireless links that require semi-hemispherical coverage. Due to its planar configuration and ease of integration with microstrip technology, the microstrip patch antenna has been heavily studied and is often used as elements for an array. A large number of microstrip patch antennas have been studied

to date. An exhaustive list of the geometries along with their salient features is available [1]. The rectangular and circular patches are the basic and most commonly used microstrip antennas. These patches are used for the simplest and the most demanding applications. Rectangular geometries are separable in nature and their analysis is also simple. The circular patch antenna has the advantage of their radiation pattern being symmetric. A rectangular microstrip patch antenna in its simplest form is shown in Figure 2.

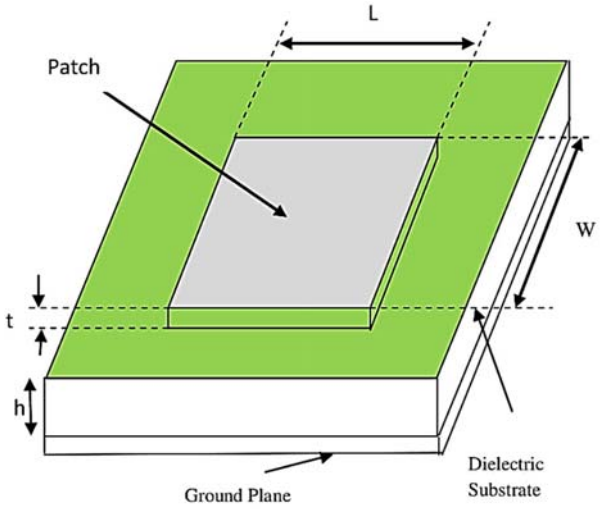


Fig 2: Structure of rectangular microstrip patch antenna

Table 1: The characteristics of microstrip patch antennas, microstrip sot antennas and printed dipole antennas are compared in

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	Rectangular and triangular
6.	Spurious radiation	Exists	Exists	Exists
7.	Bandwidth	2-50%	5-30%	-30%

3. Feeding Techniques

A feedline is used to excite to radiate by direct or indirect contact. There are many different techniques of feeding and four most popular techniques are coaxial probe feed, microstrip line, aperture coupling and proximity coupling [2]. Coaxial probe feeding is feeding method in which that the inner conductor of the coaxial is attached to the radiation patch of the antenna while the outer conductor is connected to the ground plane. Advantages of coaxial feeding is easy of fabrication, easy to match, low spurious radiation and its disadvantages is narrow bandwidth, Difficult to model specially for thick substrate.

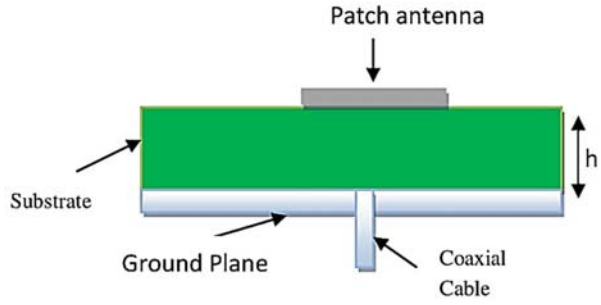


Fig 3: Coexial probe feed patch antenna

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 consider 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.

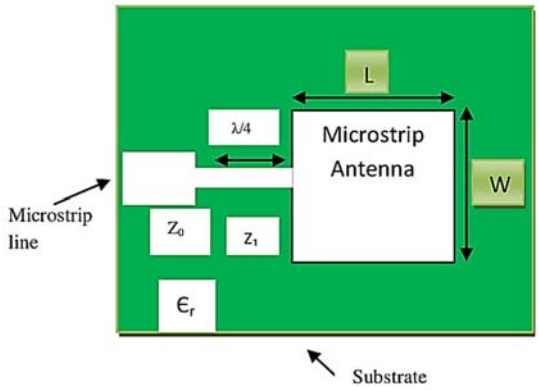


Fig 4: Microstrip line feed patch antenna

Aperture coupled feed consist of two different substrate separated by a ground plane. On the bottom side of lower substrate there is a microstrip feed line whose energy is coupled to the patch through a slot on the ground plane separating two substrates. This arrangement allows independent optimization of the feed mechanism and the radiating element. Normally top substrate uses a thick low dielectric constant substrate while for the bottom substrate; it is the high dielectric substrate. The ground plane, which is in the middle, isolates the feed from radiation element and minimizes interference of spurious radiation for pattern formation and polarization purity. Advantages is allows independent optimization of feed mechanism element.

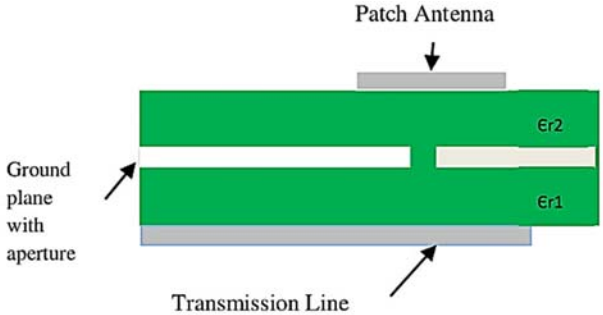


Fig 5: Aperture coupled feed patch antenna

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

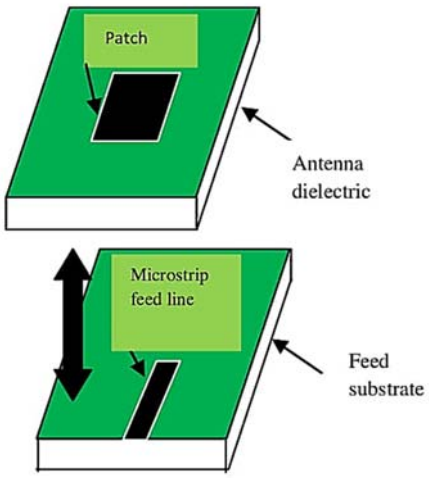


Fig 6: Proximity coupled microstrip patch antenna

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
- Ground Plane
- Dielectric Substrate
- Feed Line

4. 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 below.

The major Advantages

- Light weight and low volume.
- Low profile planar configuration which can be easily made conformal to host surface.
- Low fabrication cost, hence can be manufactured in large quantities.
- Supports both, linear as well as circular polarization.
- Can be easily integrated with microwave integrated circuits (MICs).
- Capable of dual and triple frequency operations.
- Mechanically robust when mounted on rigid surfaces.
- Feed lines and matching network can be fabricated simultaneously

Disadvantages such as

- Narrow bandwidth
- Low efficiency
- Low Gain
- Extraneous radiation from feeds and junctions
- Poor end fire radiator except tapered slot antennas
- Low power handling capacity.
- Surface wave excitation.
- Complex feed structures require high performance arrays

5. Conclusion

A theoretical survey on microstrip patch antenna is presented in this paper. Some effect of disadvantages can be minimized. Lower gain and low power handling capacity can be overcome through an array configuration. Some factors are involved in the selection of feeding technique. Particular microstrip patch antenna can be designed.

6. References

1. James j, Hall PS. (Eds), Handbook of microstrip antenna, Peter Peregrinus, London, UK 1989.
2. Ramesh Garg, Prakash Bartia, Inder Bahl, Apisak Ittipiboon, ‘’Microstrip Antenna Design Handbook’’, Artech House Inc. Norwood, MA 2001;1(68);253-316.
3. Wentworth M Stuart. Fundamentals of Electromagnetic with Engineering Applications, John Wiley & Sons, NJ, USA 2005, 442-445.
4. Kraus JD, Marhefka RJ. Antenna for all applications 3rd Ed., McGraw- Hill 2002.
5. Robert A. Sainati, CAD of Microstrip Antennas for Wireless Applications, Artech House Inc, Norwood, MA 1996.
6. Lo YT, Lee SW. editors, ‘’Antenna Handbook Theory, Applications & Design’’, Van Nostrand Rein Company, NY 1988.
7. Balanis CA. Antenna theory: analysis and design, 2nd ed., John Willey and & Son, Inc 1997.