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Comparative Study of Bandwidth Improvement Techniques of Micro Strip Patch Antennas

Archana B. Naval*, Prof. D. K. Shedge
Department of Electronics Engineering, All India Shri Shivaji Memorial Society's
Institute of Information Technology, Pune,
Maharashtra, India

Abstract— Now a day's rapidly increasing the use of wireless communication devices. This wireless communication devices supports many applications which require broad bandwidth; like mobile phones supports for many applications that requires higher bandwidth. In this paper a review of different types of bandwidth improvement techniques of micro strip patch antenna

Keywords— Micro strip patch antenna, Bandwidth improvement, stacked antenna, suspended antenna ,multi resonator antenna.

I. INTRODUCTION

Micro strip patch antenna is easy to manufacture, by etching the metal of one side of the substrate where other side of the substrate metal layer acts as a ground . Micro strip patch antenna is widely used due to light weight, low profile, small size, can be easily integrating with electronic circuits. Due to this nature of the antenna used for many applications like GPS requires up to 7.6 % B.W., WLAN, military , PCS requires 7.5% B.W. and so many applications. The main drawback of the micro strip patch antenna is the limited bandwidth. To overcome this limitation number of different techniques are used [1].

The Bandwidth improvement in the micro strip patch antenna increases with increase in substrate thickness h or decreasing dielectric constant of substrate, but practically there is a limit to increase 'h' ,if increases due to surface wave propagation antenna performance get reduced. So that in the following section Bandwidth improvement has been take place using different techniques like different shapes of the patches, stacked configuration, multi resonator antenna, multilayer configuration , different thickness of substrate, suspended configuration, different feeding techniques[2].

II. BANDWIDTH IMPROVEMENT TECHNIQUES USED IN MICRO STRIP PATCH ANTENNA

A .Different shapes of patches for bandwidth improvement:

In this configuration the two separate patches are embedded on a single layer structure. The embedded patches offers a two band micro strip patch antenna. In this antenna keep constant resonance frequency of one patch and varying resonance frequency of other patch, then more enhancement of bandwidth take place up to 21%[3].

By modifying the shape of the antenna ,E shape patch producing two parallel slots in rectangular patch. The E shaped micro strip patch antenna with a probe feeding achieves 300 MHz bandwidth [2]. The following fig. shows the swastik shapes of antenna. This antenna resonates at tri band and improves B.W. up to 20%.

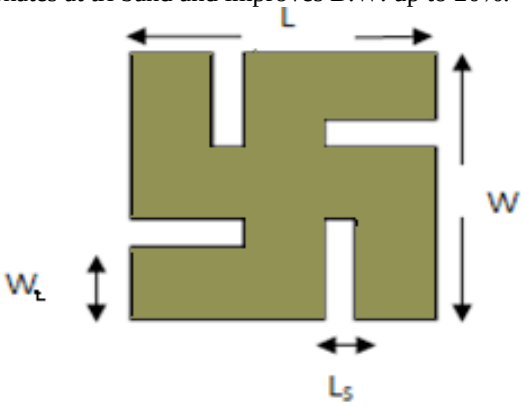

Fig.1.Swastik shape patch antenna [4]

B. Bandwidth Improvement using Multi resonator Configuration:

In the multiresonator configuration of the antenna multiple resonator patches are placed near to each other and one feed is used in only in single patch. All other patches are parasitically coupled with each other. Another type of multiresonator patches are directly connected using micro strip line[1].

In this configuration a rectangular patch surrounded by a other rectangular patch, is used to resonant two modes. The antenna tune at 2.3 GHz with bandwidth of 36% and a 5.5 GHz with a bandwidth of 17%[5].

This type of configuration increases the Bandwidth, but space required for this antenna is more.

C. Bandwidth improvement using stacked antenna configuration:

In stacked antenna multiple resonator patches are stacked on each other using substrate .In this stacked antenna that resonates at multiple frequency ,so that can be able to use multiple applications. Means instead of using multiple antennas for different applications one stacked antenna design for that multiple frequencies.

In this configuration three patches are stacked each other and achieves operating frequency bands for GPS L1(1.575GHz),L2(1.227 GHz),L3(1.176)GHz and achieves the Bandwidths 2%,1.5%,1.7% respectively. In this antenna the I slot on middle patch and slit cut on upper and lower patches tack place for bandwidth improvement.[7].

In another configuration by varying the patch dimensions in stacked antenna bandwidth improvement tack place up to 45% [8].

In this configuration of the stacked antenna fed by coaxial feed and by changing substrate and its thickness due this configuration up to 15 % of the bandwidth get improved at 2.4GHz frequency [9].The following fig. Shows the configuration of the stacked antenna.

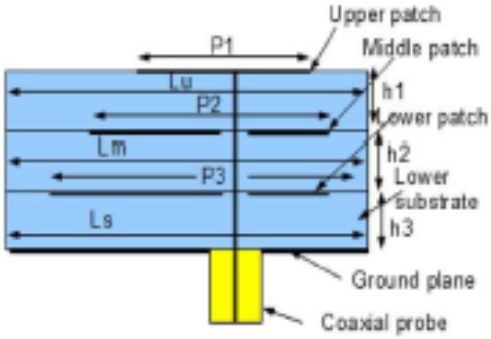

Fig.2.Stacked Antenna[7]

D. Bandwidth improvement using suspended antenna configuration

To improve the Bandwidth of antenna increase ' h' and decrease 'εr'. This effect can be realized by using suspended nature of the antenna .In this configuration patch is fabricated at one side of the dielectric substrate and it is suspended in air with air gap 'Δ'.

Suspended E-shape Micro strip antenna was designed. Due to the air gap between substrate and ground plane of 11mm, bandwidth of 12.1% is obtained, then adding capacivaly feeding antenna achieves high bandwidth up to 23.1% [10].

In this suspended hexagonal antenna with coaxial feed obtain the circular polarization and antenna is designed for 915 MHz frequency. due to suspended nature that improves up to 70MHz bandwidth[11].

In this suspended antenna weight of the antenna get reduced due to the air gap.

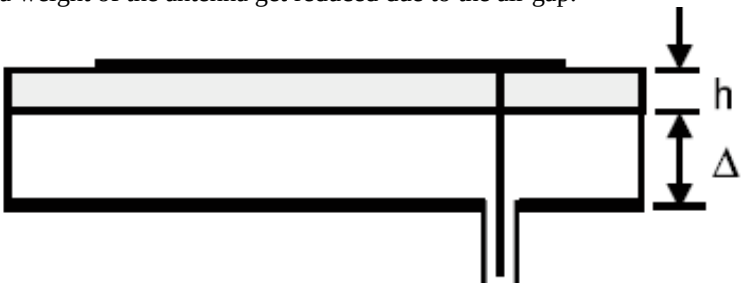

Fig.3. Suspended Antenna[6]

III. TABLES FOR THE COMPARATIVE ANALYSES OF BANDWIDTH IMPROVEMENT TECHNIQUES

Sr. No.	Bandwidth improvement Techniques	Configurations	Remarks
1	Modified Shape of Patch	Embedded two patches on a single layer[3]	The Bandwidth achieves up to 21 %
		Swastick shaped triband antenna [4]	Impedance bandwidth improves up to 20 %.
		E –shaped patch [2]	Yielded bandwidth up to 230 MHz

2	Multi resonator Technique	Two rectangular patches are placed near to each other[5]	Tune at 2.3GHz with 36% Bandwidth & 5.5 GHz with 17% Bandwidth obtained.
3	Stacked Multilayered Technique	Single feed stacked antenna [7]	Tune at L1,L2,L3 bands for GPS and achieves 2 %,1.5%,1.7%bandwidth improvement respectively.
		Micro strip stacked square patch antenna[9]	Tune at 2.4 GHz obtained 15 % Bandwidth improvement
		Stacked antenna [8]	45 % bandwidth improvement tack place.
4	Suspended multilayered Techniques	Slotted hexagonal suspended antenna[11]	320 MHz band width is obtained.
		Suspended hexagonal antenna[10]	Tune at 2.26GHz-2.83GHz obtained 23.1% bandwidth improvement.

IV. CONCLUSTION

After the extensive literature survey ,it has been found that the bandwidth improvement is an important area of research in microwave communication. So many techniques has been reported by researchers for improvement of bandwidth have been revised in this paper. The principle used, advantages, disadvantages of this methods has been described out of this techniques the multilayered ,stacked and suspended techniques provides maximum bandwidth improvement.

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