

# Design a Microstrip Patch Antenna for 3G and ISM Application

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**Abstract:** - A novel structure of planar antenna has been designed for 3<sup>rd</sup> Generation (3G) and ISM (industrial, scientific and medical) band Applications and simulated using HFSS simulation software. Dual band of resonance frequency obtained by this antenna. The simulated 10 dB impedance bandwidth of the designed antenna is 260 MHz and 350 GHz at resonance frequency of 1.88 GHz and 2.33 GHz respectively. Required gain is presented at desired resonance frequency.

**Keywords:** - Micro-strip Transmission Line, 3rd Generation, ISM (industrial, scientific and medical) band.

## I. INTRODUCTION

Microstrip patch antennas are a class of the planar antenna which have been research and developed extensively in the last three decades. They have become favourite among antenna designers and have been used in many applications in wireless communication systems [1]. Patch antennas play a very significant role in today's world of wireless communication systems. Micro strip patch antennas are attractive due to their light weight, easy fabrication and low cost [2]. These antennas can be integrated with printed strip-line feed networks and active devices. This is a relatively new area of antenna engineering. The radiation properties of micro strip structures have been known since the mid 1950s [3]. The application of this type of antennas started in early 1970s when conformal antennas were required for missiles. Rectangular and circular micro strip resonant patches have been used extensively in a variety of array configurations. As conventional antennas are often bulky and costly part of an electronic system, micro strip antennas are light weight and low cost based on photolithographic technology seen as an engineering breakthrough [2-3].

It is a new generation of mobile communication, which can combine wireless communications and the Internet and other multimedia communications. 3G standard wireless network must be able to support different data transfer speeds. For instance, it can support at least 2Mbps, 384kbps and 144kbps transmission speed respectively in the environment of indoor, outdoor, and driving [4].

It also supports efficient transport of voice, data, image, multimedia, etc, with its strong system capacity [5]. The

industrial, scientific and medical (ISM) radio bands were originally reserved internationally for the use of RF electromagnetic fields for industrial, scientific and medical purposes other than communications. ISM band (Industrial, Scientific and Medical band) A part of the radio spectrum that can be used by anybody without a license in most countries. In the U.S., the 902-928 MHz, 2.4 GHz and 5.7-5.8 GHz bands were initially used for machines that emitted radio frequencies, such as RF welders, industrial heaters and microwave ovens, but not for radio communications.

## II. DESIGN CONSIDERATIONS

In the design of this type of antennas, the width 'W' and Length 'L' of the patch of the antenna plays a crucial role in determining the resonant frequency of the system. The starting values of these parameters are calculated by using the equations given in [9-10] for the substrate height (h), dielectric constant ( $\epsilon_r$ ) and for the lower frequency. Fig 1 Show the structure of the antenna for 3G and ISM band applications. The antenna consists of rectangular aperture with width 'W' and length 'L' and rectangular patch with height 'H'. In this study, a dielectric substrate with thickness of 7 mm with a relative permittivity of 2.1 (Teflon) is chosen as substrate. The feed is designed for 50  $\Omega$  characteristic impedance with fixed 4.5 mm feed line widths and 0.05 mm ground gap. By properly adjusting the dimension of the antenna and feeding structure the impedance matching of the proposed antenna is improved that produces wider impedance bandwidth with satisfactory radiation pattern. The wide bandwidth and impedance matching with reduced size of the antenna is achieved by the different surface magnetic currents of the structure [7-8].

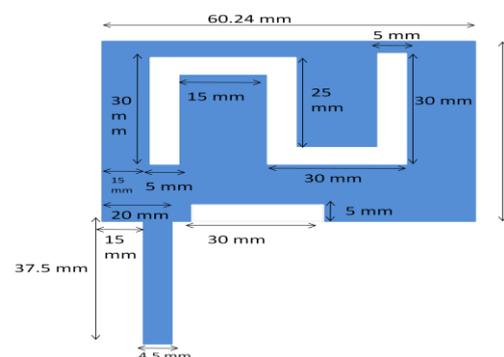


Fig.1 Geometry and configuration of 3G antenna.

Fig.2 shows the geometry and configuration of 3G and ISM band applications. The design parameters are L=45.01 mm, W=60.24 mm, H=0.05mm, h=7mm.

For getting the perfect frequency band of the antenna we cut the patch of the antenna as per the Fig.1. Here the dimensions of the cut are mention in the figure.

### III.SIMULATION RESULTS

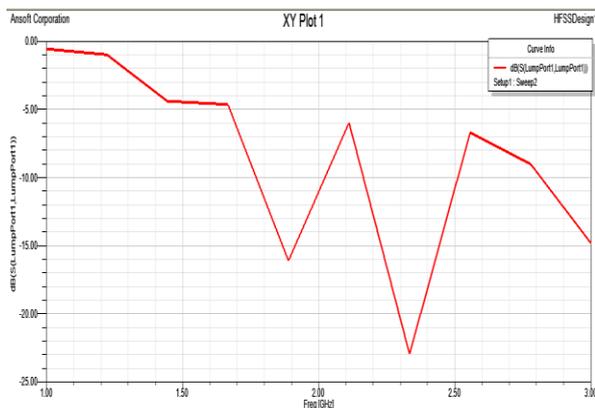


Fig. 2 Return Loss vs. frequency of 3G and ISM band antenna.

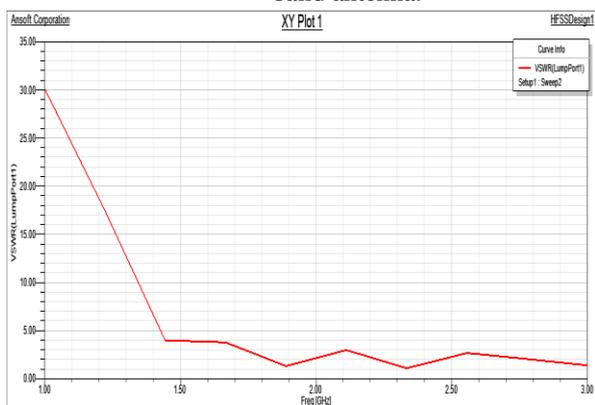


Fig. 3 VSWR vs. frequency of 3G and ISM antenna.

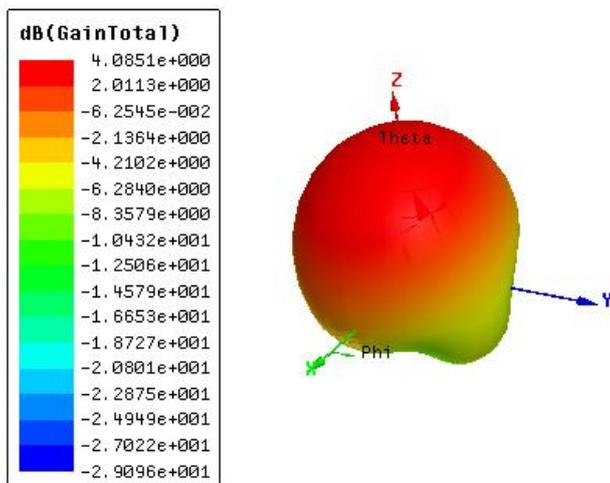


Fig. 4 Simulated E-plane and H-plane radiation patterns.

### IV. CONCLUSION

Simulated results shows that the proposed antenna can be work on the frequency range from 1.76 GHz to 2.02 GHz (lower resonance band) and 2.16GHz to 2.51GHz (upper resonance band) having 3G and ISM band applications. Gain is also getting sufficient for the proposed design.

### REFERENCES

- [1] Kumar, G.and K. P. Ray,” Broadband Microstrip Antennas”, Attach House, Boston, 2003.
- [2] Wong, K. L., “Compact and Broadband Microstrip Antenna”, John Wiley & Sons, New York, 2002.
- [3] Juha Korhonen, “Introduction to 3G mobile communications”, John Wiley and Sons.
- [4] Tomi T. Ahonen, Joe Barrett, “Services for UMTS: creating killer applications in 3G”, Aristech House.
- [5] Syed A. Ahson, “HSDPA/HSUPA Handbook”, CRC library.
- [6] Bader Al-Manthari and Hossam Hassanein, “Packet Scheduling in 3.5G High-Speed Downlink Packet Access Networks: Breadth and Depth”, University of Guelph.
- [7] Qian shouyi, mei chengcai, “3G applications in colleges”, Department of Information Engineering, Zhejiang Industry & Trade Vocational College, Wenzhou 325003, China.
- [8] D Ralph and I Bonner, “3G and beyond - the applications generation,”.
- [9] J.D.krauss,”Antenna for all application”, 3<sup>rd</sup> addition. TMH publication. 1995.
- [10] C. A. Balanis, “Antenna Theory: Analysis and Design, 2nd Edition”, pp. 722 – 752, John Wiley and Sons, Inc., 1997.