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A 9 Slots dual band Microstrip Patch Antenna for Wireless Applications

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Abstract: A 9 Slots dual band microstrip patch antenna is presented in this paper .The antenna resonates at 5.27 GHz and 7.61 GHz frequencies. The antenna is fed with coaxial feed giving bandwidths of 11.87%& 11.22%and VSWR of the both bands is less than 1.09.The proposed antenna can be used for WLAN (Wireless Local Area Networks) applications.

Keywords: Impedance bandwidth, Microstrip patch antenna, Return loss, VSWR

1. INTRODUCTION

Microstrip patch antennas are widely implemented in many applications, especially in wireless communication [1]. This is due to attractive features such as low profile, lightweight, conformal shaping, low cost, high efficiency, simplicity of manufacture and easy integration to circuits. However, the major disadvantage of the microstrip patch antenna is its inherently narrow impedance bandwidth. Wireless communication have been developed widely and rapidly, which leads to a great demand in designing low-profile antennas, especially for WLAN and WiMAX applications. Wireless local area network (WLAN) and WiMAX technology is most rapidly growing area in the modern wireless communication. This gives users the mobility to move around within abroad coverage area and still be connected to the network[2-4].There are numerous and well- known methods to increase the bandwidth of antennas, including increase of the substrate thickness, the use of a low dielectric substrate and feeding techniques [5-7]. Hence, we need an antenna which offers a low profile, wider bandwidth and high gain. The feeding technique used is coaxial feed technique as it can be placed at any place in the patch.

The proposed 9 slots dual band microstrip patch antenna is suitable for WLAN applications. The proposed antenna resonates in the frequency range of 5.27 GHz and 7.61 GHz with bandwidths of 11.87% & 11.22% respectively and VSWR of the both bands is less than 1.09. The proposed antenna is fed by coaxial feeding and gives return loss approximately -29 dB for both bands. These slot antenna design structures have improved dual-band responses for wireless communications [8-9].

2. PROPOSED SLOT ANTENNA DESIGN

The proposed antenna has dual bands that are used for wireless communications such as WLAN applications. The reason for having more slots in designed antenna is for getting good return loss and VSWR .The geometry of the designed antenna is shown in Figure 1.

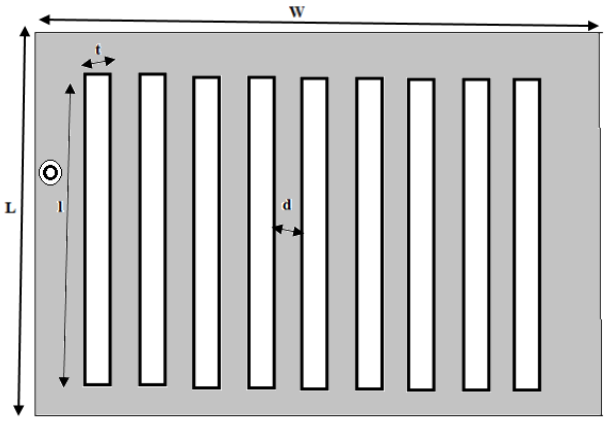

Figure 1. Geometry of the Proposed Antenna

In the proposed antenna all the 9 slots are used and equally spaced on the patch. The material FR4 is used as substrate with dimensions 80x120x3.4 (mm^3) and its dielectric constant value is ϵ_r=4.4.The antenna is resonates at5.27 GHz and7.61 GHz. The antenna is provided with coaxial feed with suitable inner and outer conductor diameters. The feed position is centered at left side of the patch. The feeding technique used is coaxial feed as it can be placed at any position in the patch. The dimensions of the patch and the slots are shown in the Table 1.

Table1: Dimensions of the 9 slots microstrip patch antenna

Parameter & Symbol	Dimensions(mm)
Patch length(L)	80
Patch width(w)	120
Slot length(l)	60
Slot thickness(t)	5
Slot distance(d)	5
Feed Inner conductor radius(r)	1.2
Feed Outer conductor radius(R)	2.5

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3. RESULTS AND DISCUSSIONS

The important results obtained using the proposed antenna are discussed in this section.

Return loss

Return loss is the ratio of power reflected to the power delivered expressed in negative logarithmic db. The return loss should be as low as possible for maximum power delivery in microstrip antennas. The return loss plot of the designed antenna is shown in figure 2.

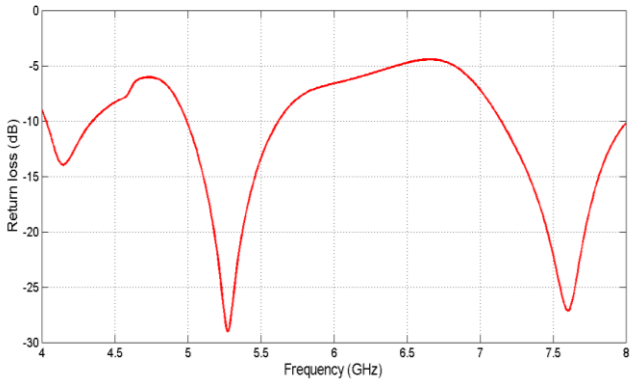

Figure 2. Return Loss Plot of the Proposed Antenna

For this proposed antenna dual bands are achieved. For the first band the bandwidth is measured between the frequencies from 4.99 GHz to 5.62GHz which is 11.87% and similarly the bandwidth of the second band is measured between the frequencies from 7.15 GHz to 8.0 GHz which is 11.22 % as observed from Figure 2.

VSWR

The VSWR is a measure of the impedance mismatch between the antenna and the transmission line connected to it. Higher the VSWR, greater is the mismatch between antenna and feed line. The plot between VSWR and frequency of the proposed antenna is shown in Figure 3. The VSWR for proposed antenna is observed to be $\leq$ 1.09 which is close to unity.

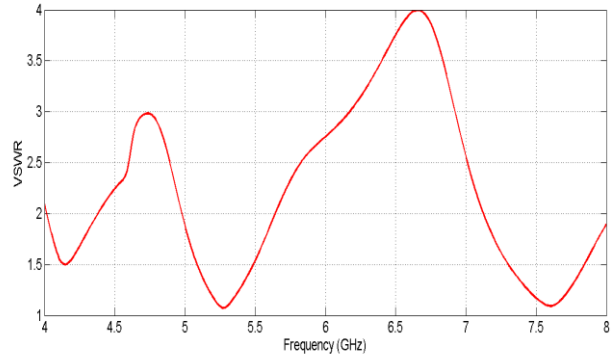

Figure 3. VSWR Plot of the Proposed Antenna

Radiation Pattern

Radiation pattern is the graphical representation and it shows the variation of power radiated by the antenna as a function of the direction away from the antenna. The radiation characteristics of the designed antenna is represented by the 2D radiation pattern at $\emptyset=0^0$,$\emptyset=90^0$.

The *E*-plane radiation patterns of both bands are shown in Figure 4 & Figure 5. i.e. at $\emptyset = 0^0$.

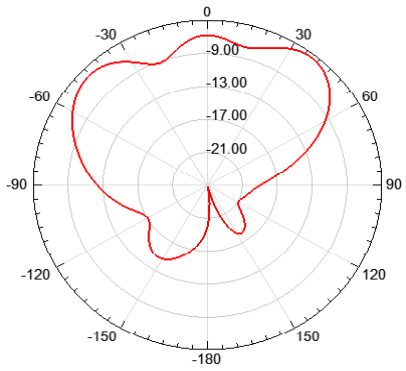

Figure 4. Radiation Pattern at 5.27 GHz for $\emptyset = \mathbf{0^0}$

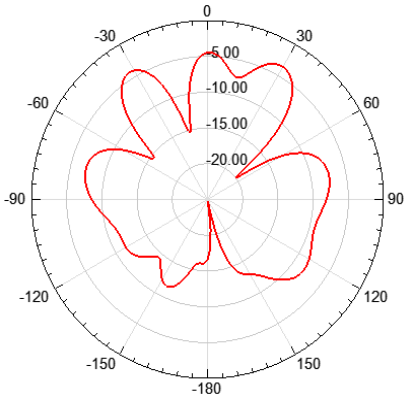

Figure 5. Radiation Pattern at 7.61 GHz for $\emptyset = \mathbf{0^0}$

The *H*-plane radiation patterns of both bands are shown in Figure 6 & Figure 7.i.e. at $\emptyset = 90^0$.

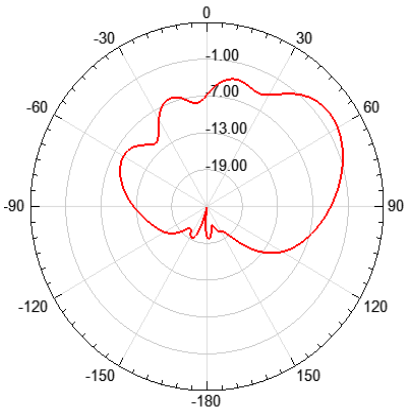

Figure 6. Radiation Pattern at 5.27 GHz for $\emptyset = \mathbf{90^0}$.

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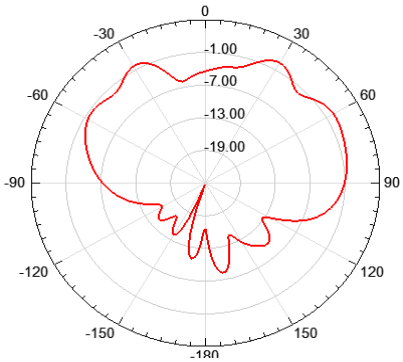

Figure 7. Radiation Pattern at 7.61 GHz for $\emptyset = 90^0$.

4. CONCLUSION

A 9 Slots dual band microstrip patch antenna is designed to improve the bandwidth for wireless communications. The antenna resonates in the frequency ranges of 5.27 GHz and 7.61 GHz with bandwidths of 11.87% & 11.22%. The antenna is fed with coaxial feeding and VSWR of the both bands is less than 1.09 is obtained from designed antenna. It is suitable WLAN applications.

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REFERENCES

1. C. A. Balanis, "*Antenna Theory Analysis and Design"*, 2nd edition: John Wiley & Sons, Inc., 1997.
2. Lin Dang, Zhen Ya Lei, Yong Jun Xie, Gao Li Ning, and Jun Fan, *"A Compact Microstrip Slot Triple-Band Antenna for WLAN/WiMAXApplications"*, IEEE Antennas and Wireless Propagation Letters, Vol.9.2010.
3. T. Wang, Y. Z. Yin, J. Yang, Y.L. Zhang, and J.J. Xie, *"CompactTriple-Band Antenna Using Defected Ground Structure for WLAN/WIMAX Applications"*, Progress In Electromagnetics Research Letters,Vol. 35,164, 2012.
4. C.R. Byra Reddy, N.C. Easwar Reddy and C.S. Sridhar, *"A Compact Triple Band Rectangular Microstrip Slot antenna for WLAN/WIMAX applications"*, Journal of Theoretical and Applied Information Technology, October 2011.
5. Priti Salunke, Rajeshvari Purohit, and Guruprasad Burshe,"*Linearly Polarised Microstrip Antenna for WLAN Applications"*,978-1-4244-5118-0/11/$26.00 ©2011 IEEE.
6. Sami S. S. Abuhalima, Esmat A.F. Abdallah & Darwish A. E. Mohamed *"Ultrawideband Elliptical Microstrip Antenna Using Different Taper Lines for Feeding"* Proceedings of the 11th WSEAS International Conference on COMMUNICATIONS, July 26-28, 2007.
7. Sudipta Das, Partha P. Sarkar, and Santosh K. Chowdhury*"Design and Analysis of a Compact Triple Band Slotted Microstrip Antenna with Modified Ground Plane for Wireless Communication Applications"*, Progress In Electromagnetics Research B, Vol. 60, 215-225, 2014.
8. Ren, W., *"Compact dual-band slot antenna for 2.4/5 GHz WLAN applications,"* Progress In Electromagnetics Research B, PIER B, Vol. 8, 319-327, 2008.
9. Wang, C.-J., and S.-W. Chang *"Studies on dual-band multi-slot antennas,"* Progress In Electromagnetics Research, PIER, 83, 293-306, 2008.

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