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Band width Enhancement of Co-axial Feed Rectangular Microstrip Patch Antenna

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Abstract

The rectangular micro strip patch antennas are attracting the attention of antenna designers from past few years, because of its low profile, light weight, compact. In spite of merits it also suffers with some draw backs like narrow band width, surface wave interference. Present paper we are proposing that the designer takes some precautions while designing radiating element can enhance the operating band width. Here I concentrated on width of rectangular patch, whose dimensions should maintain higher than length will enhance operating band width. Present concept was designed in Ansoft HFSS Software. Radiating element is excited by co-axial feed. Operating at 2.0369GHz. Simulated results were presented in comparatively.

1. Introduction

The patch antennas are widely used in wireless communication application because of its light weight, easy to fabricate etc., out of all designs rectangular patch antennas are popularly used. The structure of rectangular patch antenna consists dielectric substrate backed optically planar ground plane, radiating element on other side of substrate which is prepared with conducting materials. Present paper basic antenna parameters are considered which were altered in comparison with other. The enhancement in the operating band width was observed. Rectangular patch antenna can be effectively analyzed using transmission line model and cavity model. In present paper I adopted transmission line for design and analysis.

2. Di-Electric Material

While selecting the substrate or dielectric material cost of material, dielectric constant, loss tangent are the parameters need to be considered. Present project I considered Roger RT/duriod 5880 with permittivity 2.2 and loss tangent 0.0009

3.Design Specifications

Three essential parameters need to be considered while designing rectangular microstrip patch antenna. 1. Operating Frequency 2. Dielectric Constant 3.Height of Substrate. Present project all these parameters were kept un altered concentrated only width of patch.

Rectangular Patch Width

$$W = \frac{c}{2 f_o \sqrt{\frac{(\varepsilon_r + 1)}{2}}}$$

Effective dielectric constant

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-\frac{1}{2}}$$

Effective length

$$L_{eff} = \frac{c}{2 f_o \sqrt{\varepsilon_{reff}}}$$

Length extension

$$\Delta L = 0.412h\frac{\left(\varepsilon_{reff} + 0.3\right)\left(\frac{W}{h} + 0.264\right)}{\left(\varepsilon_{reff} - 0.258\right)\left(\frac{W}{h} + 0.8\right)}$$

Actual Length of patch

$$L = L_{eff} - 2\Delta L$$

Ground plane dimensions

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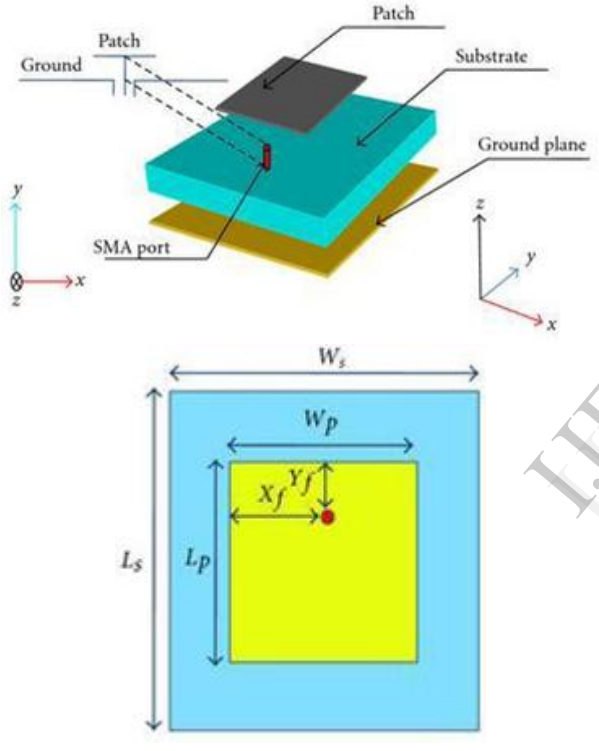
$$L_g = 6h + L$$

$$W_g = 6h + W$$

4. Feed Method:

The co-axial feed method is adopted for present project. Here outer conductor of co-axial probe is connected to ground plane, inner conductor is extends through dielectric and soldered to patch. Inner conductor transferes power from strip line to microstrip antenna from slot in ground plane. Position of feed is also effect the radiation characteristics, in order to have best matching with input impedance the feed is applied at 0mm, 9.2mm along XY plane.

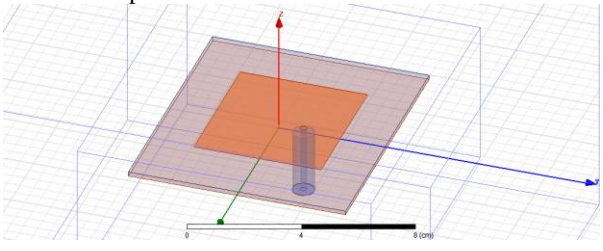


5. Numerical Design:

The initial length and width of radiating element is 47.5mm and 52.5mm respectively considered for operating frequency 2.0369GHz. the width of patch is increased in steps of 0.25mm proportional change of band width is observed and presented. second and following pages should begin 1.0 inch (2.54 cm) from the top edge. On all pages, the bottom margin should be 1-1/8 inches (2.86 cm) from the bottom edge of the page for 8.5 x 11-inch paper; for A4 paper, approximately 1-5/8 inches (4.13 cm) from the bottom edge of the page.

6. Simulation Setup:

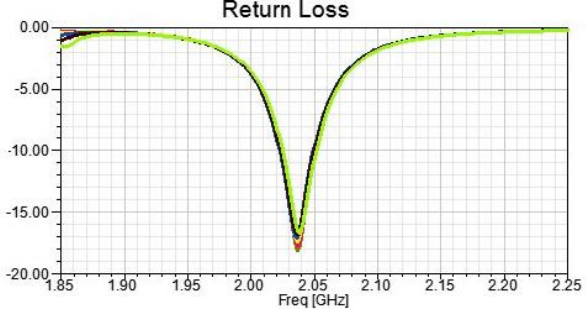
By the availability latest simulation software, now a days it become very easy to implement our ideas or proposals insisted of real time implementation. Present project work of coaxial feed rectangular patch antenna was designed with above given specification in Ansoft HFSS software. And results of return loss and band width were presented.



7. Results & Discussion

Return loss

This is important to calculate the input and out put of signal source, because if load is mismatched the whole power is not delivered to load there is a return of power that is called loss since this loss is returned hence is called return loss. -20log|□| where □ is reflection coefficient. The response of magnitude of S11 verses frequency curve clearly explains return loss. Here band width is calculated from return loss plot, where the band width of antenna can be defined as the range of frequencies over which the return loss is greater than -9.5dB (-9.5dB corresponds to VSWR of 2 which is an acceptable figure)



By care ful absorving the return loss curve, we can see merged return loss curves. There is an increment in the operating band width as the patch width is increasing and also simultaniously the return loss value is decreasing which indicates maximum amount of power is applied at input is transferred to out.

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Patch Width (mm)	Band Width (MHz)	Return Loss (dB)
52.5	26.6	-16.8242
52.75	27.2	-17.0219
53	27.5	-17.4091
53.25	27.8	-17.7691
5.35	27.9	-18.1061

8.Conclusion

Wherever After analysing the results one thing we can conclude that the operating band width is enhanced to some extent when we considered the width of rectangular patch is higher than its length.

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