

EE 305 Project Report

Group 14

Project Title: Design a microstrip patch antenna using coaxial feeding in Ansys HFSS software radiating at 3 GHz.

The parameters on which the performance of a microstrip antenna depends are the operation frequency, the thickness of the substrate, the dielectric constant of the substrate, and the feed/excitation location. The feed location is crucial for coaxial-fed antennas as it determines the voltage reflection coefficient and the gain. If the feed is correctly impedance matched then the performance is good.

For our design, we used the following formulas and their respective values. Some slight modifications were made to values obtained to account for non-idealities and better results

Parameters chosen by us-

- Height of substrate: 3 mm
- Frequency of operation: 3 GHz
- Substrate Material: FR4-Epoxy, $\epsilon_r = 4.4$

Parameters Calculated:

- For locating the feed point

$$X_f = \frac{L}{\sqrt[2]{\epsilon_{eff}}}$$

$$Y_f = \frac{w}{2}$$

- The values thus obtained were:

$$\epsilon_{eff} = 5.217$$

$$\text{Patch Width} = 30.2\text{mm}$$

$$\text{Patch Length} = 21.8\text{mm}$$

$$\text{Substate Width} = 48.2\text{mm}$$

$$\text{Substrate Length} = 40.5\text{mm}$$

$$\text{Feed location X} = 0\text{mm}$$

$$\text{Feed location Y} = -4.7\text{mm}$$

$$\text{Resultant Return Loss: } -34.43469 \text{ dB}$$

$$w = \frac{c}{2f_0} \sqrt{\frac{2}{\epsilon_r + 1}}$$

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

$$L_{eff} = \frac{c}{2f_0 \sqrt{\epsilon_{eff}}}$$

$$\Delta L = 0.412h \frac{(\epsilon_{eff} + 0.3)(\frac{w}{h} + 0.264)}{(\epsilon_{eff} - 0.258)(\frac{w}{h} + 0.8)}$$

$$\epsilon_{eff} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} [1 + 12 \frac{h}{w}]^{-\frac{1}{2}}$$

Where,

W = width of the patch antenna

L = length of the patch antenna

f_0 = resonance frequency

c = speed of light

ϵ_r = dielectric constant of the substrate

L_{eff} = effective length

ΔL = length extension

h = thickness of the substrate

ϵ_{eff} = effective dielectric constant of the substrate