

ECEN 452 Lab 10 Activity

Patch Antenna

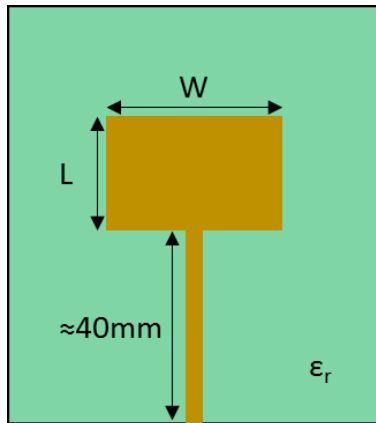
For this lab you will design a patch antenna with an impedance matching network. First, you will calculate the dimensions of the patch and cut it out of copper tape. Then, you will measure the input impedance of the patch at the 15 mm reference plane. Lastly, you will design and implement either a quarter wave transformer or single-stub matching network and re-measure the impedance to show that it is matched. Use the following parameters for your design:

$$f = 3 \text{ GHz}$$

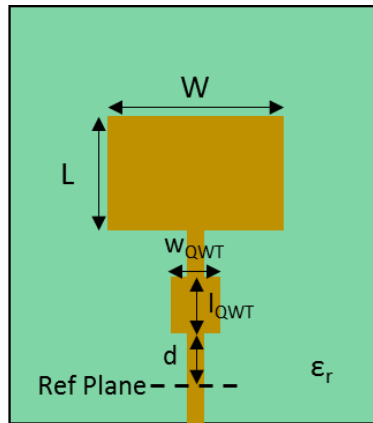
$$\epsilon_r = 4.1$$

$$h = 1.5748 \text{ mm}$$

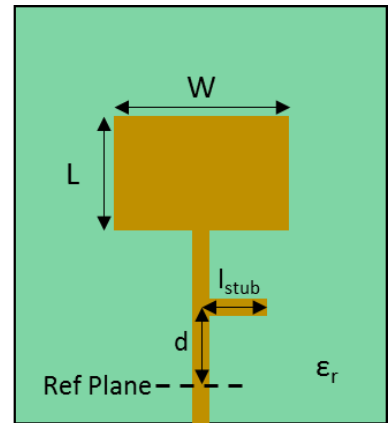
$$Z_0 = 50 \Omega$$



Patch Antenna w/ Feed Line



Patch Antenna w/ QWT



Patch Antenna w/ Single Stub

Task 1: Calculate the dimensions of the patch (L and W) using the equations below. Implement this patch with a 50 Ω feed line using copper tape. Obtain a measurement of the impedance and VSWR of this design.

$$W = \frac{c}{2f} \sqrt{\frac{2}{\epsilon_r + 1}}$$

$$\epsilon_{eff} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left[1 + 12 \frac{h}{W} \right]^{-1/2}$$

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

$$L = \frac{c}{2f\sqrt{\epsilon_{eff}}} - 2\Delta L$$

Task 2: Design and implement a matching network for your antenna. You may choose either a quarter wave transformer or a single-stub matching network. Keep in mind that your impedance measurement is taken at a reference plane 15 mm from the edge of the substrate. You will need to rotate **towards the load** on the Smith chart when designing your matching network. Measure the impedance and VSWR of your patch antenna with the matching network.