Design and Fabrication of Dual-Band Patch Antennas

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Microstrip Antenna (MSA)

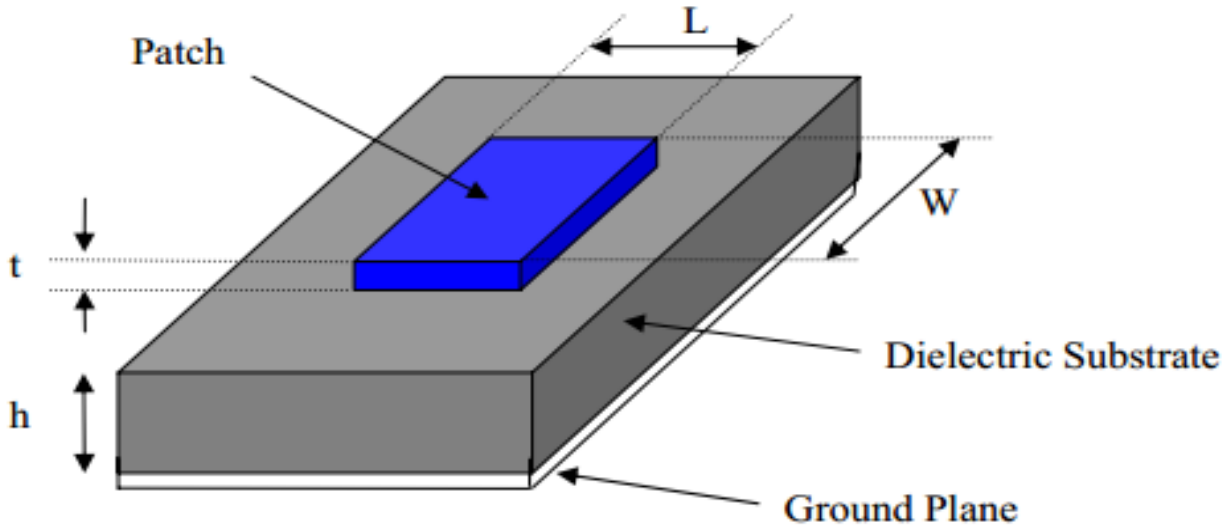


Figure 1 – Microstrip Antenna [1]

Pros-

- **Light weight & Lower Size**
- **Low Cost**
- **Capable of dual and triple frequency operation.**

Cons-

- **Narrow bandwidth**
- **Low efficiency**
- **Low Gain**

1. Adopted from A CPW-fed Rectangular Patch Antenna for WLAN/WiMAX Applications

Dual Band MSA

- Single MSA supporting two frequencies.

Application

- Multiple Frequency requirement in mobile phones. Eg. GSM(900/1800 MHz), Wi-Fi (2.4/5 GHz), LTE(2.3GHz)
- Cognitive Radio

Coplanar Waveguide Feed

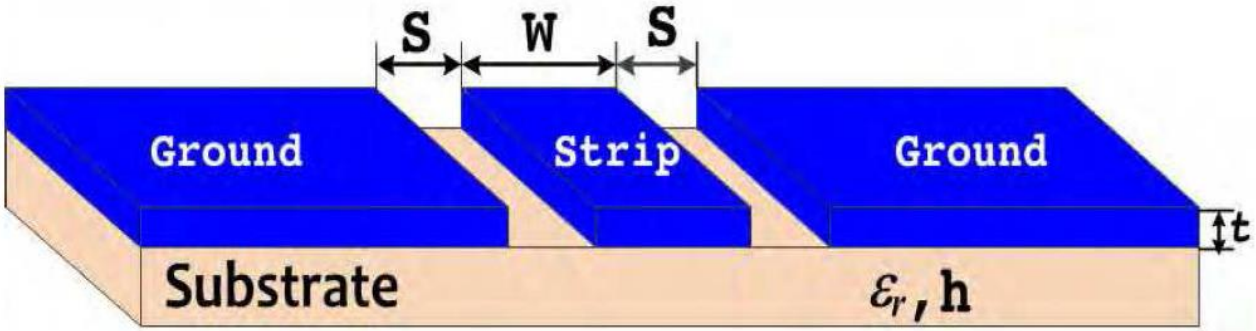


Figure 2 – Coplanar Waveguide Feed [2]

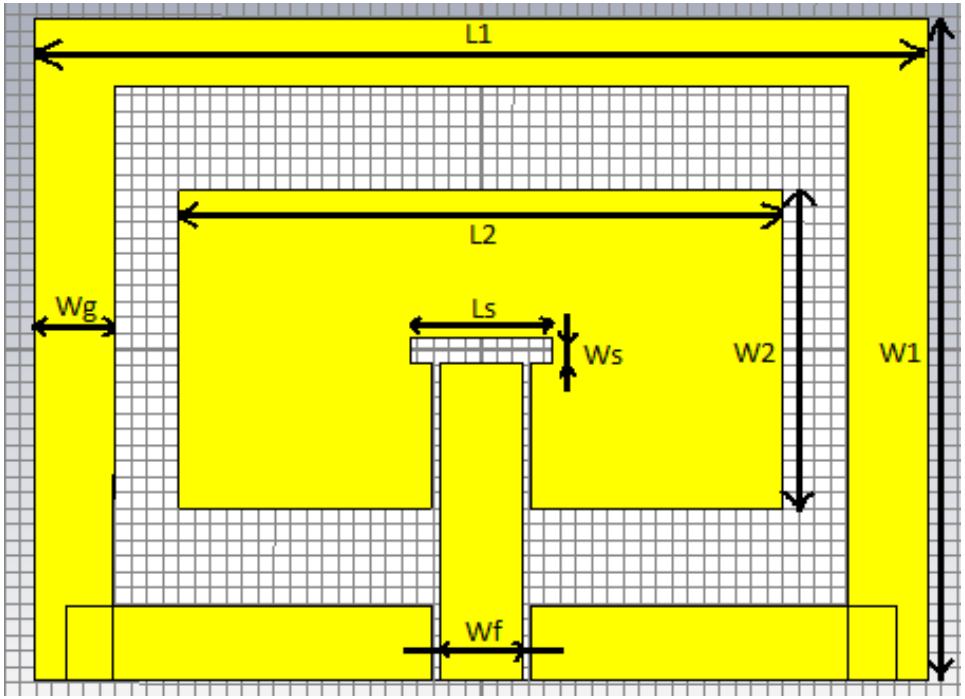
Advantages

- Easy Impedance matching
- Planer Structure
- Low radiation/dispersion losses
- Easy integration in MMICs

2. Adopted from CPW-Fed Antennas for Wifi and Wimax

Antenna Design

- Dual Frequency operation : 2.4GHz , 4.2GHz
  - Substrate FR4 with ε_r =4.3
  - Feed – CPW



Parameters:

L1 = 5.62cm , W1 = 4.16cm , Wg = 0.423cm

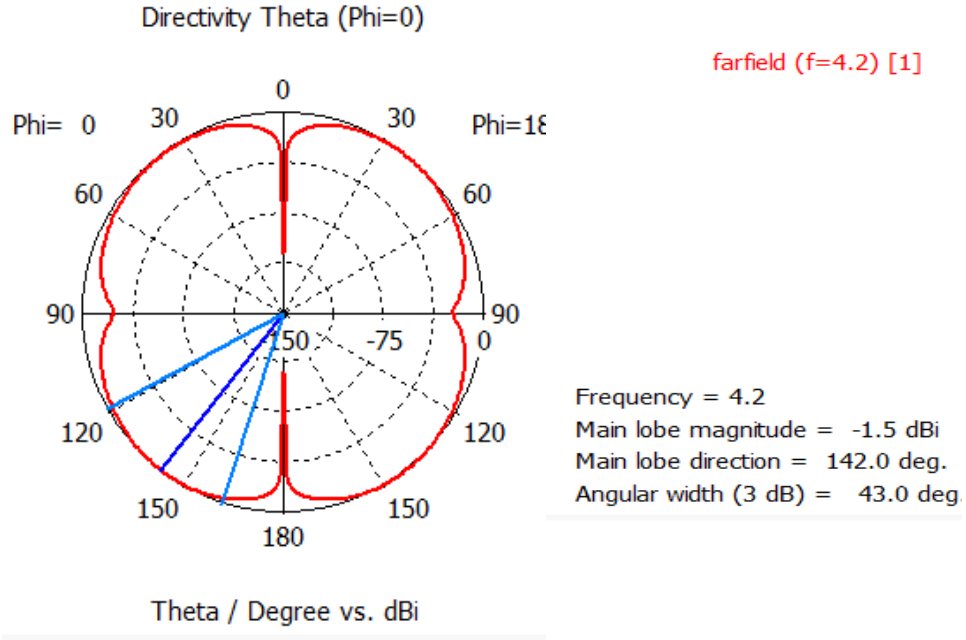
L2 = 3.8cm , W2= 2cm

Ls = 0.9cm , Ws = 0.18cm

Wf = 0.5cm

Antenna Fabrication

Results (Radiation Pattern)



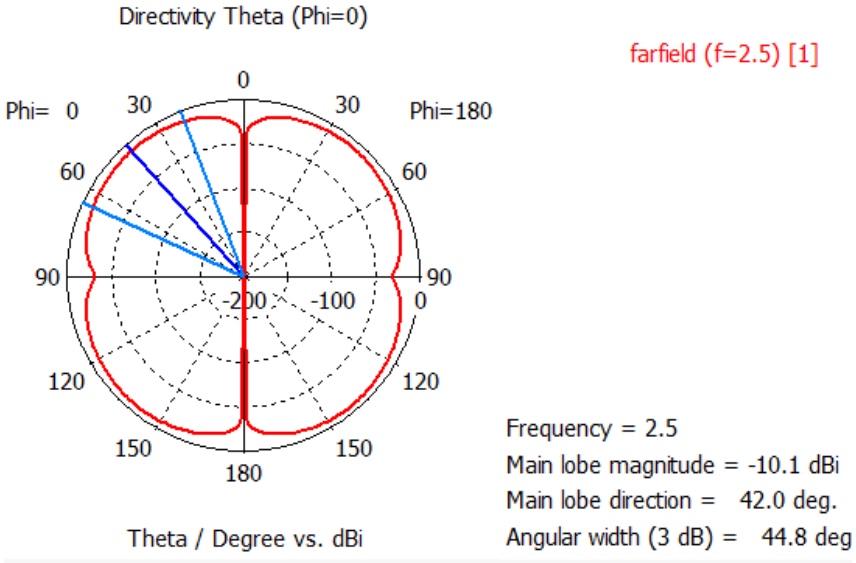


Figure 3 – H Plane Radiation Pattern

Results (Radiation Pattern)

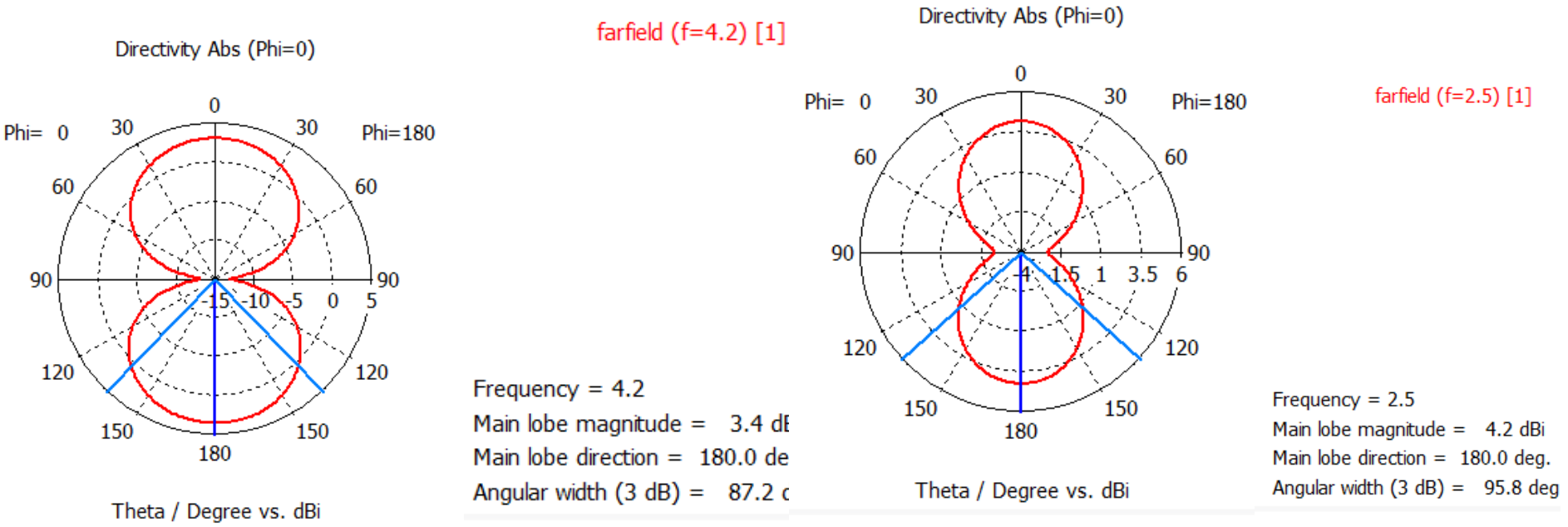


Figure 4 – E Plane Radiation Pattern

Results (S11)

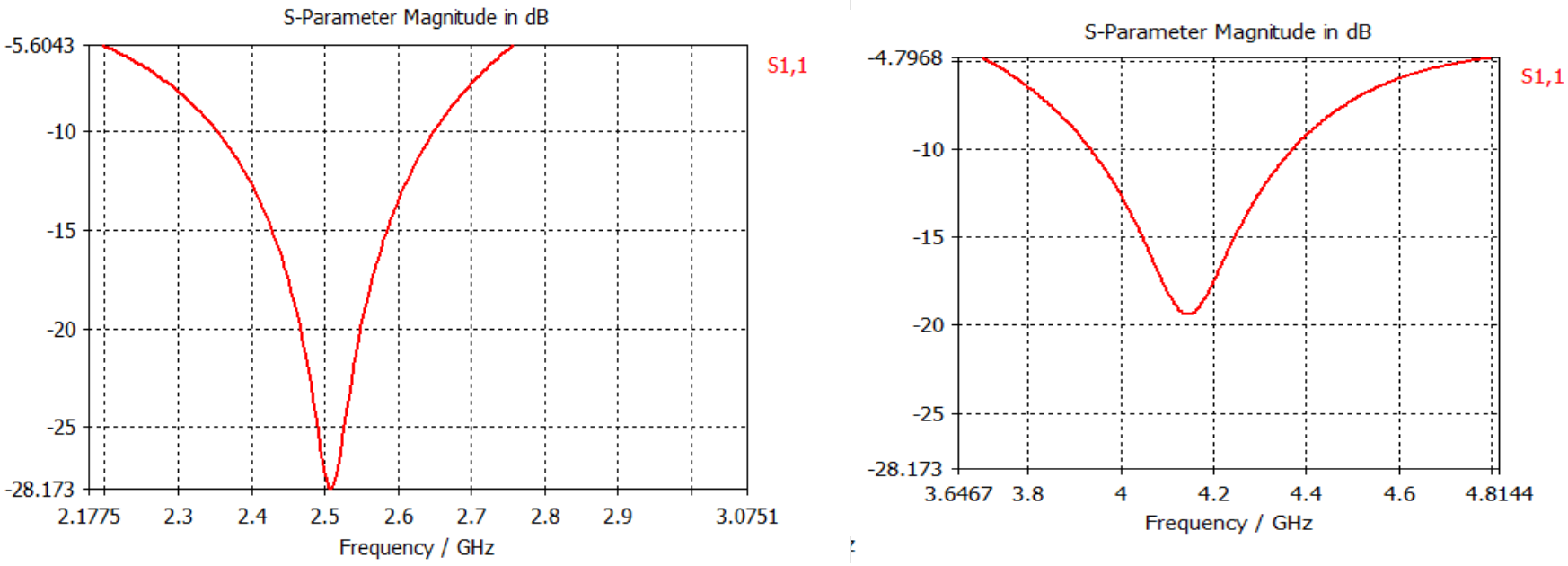


Figure 5 – Frequency Vs. Return Loss (S11)

Experimental Result

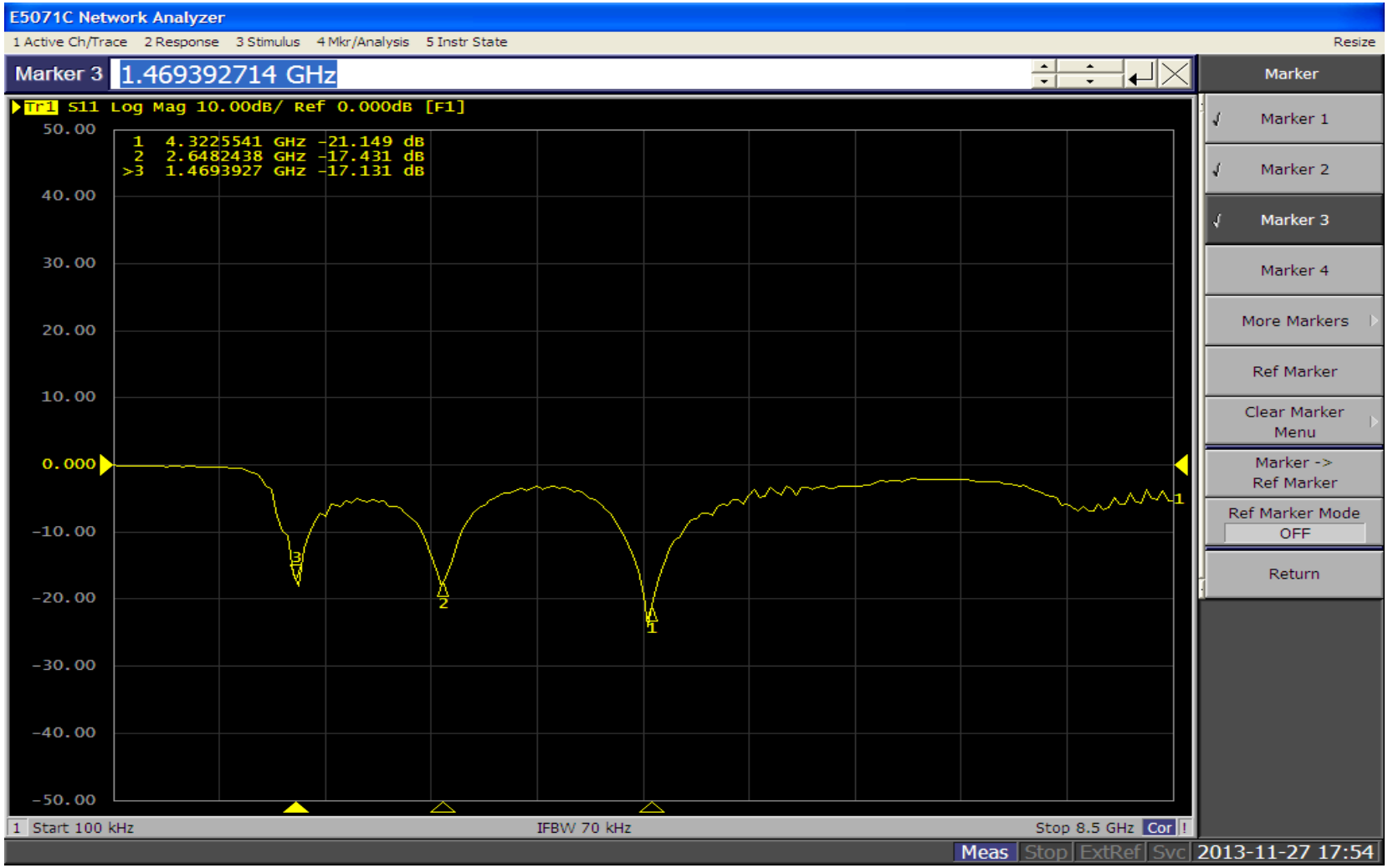


Figure 6 – Frequency Vs. Return Loss (S11)

VSWR and Smith Chart

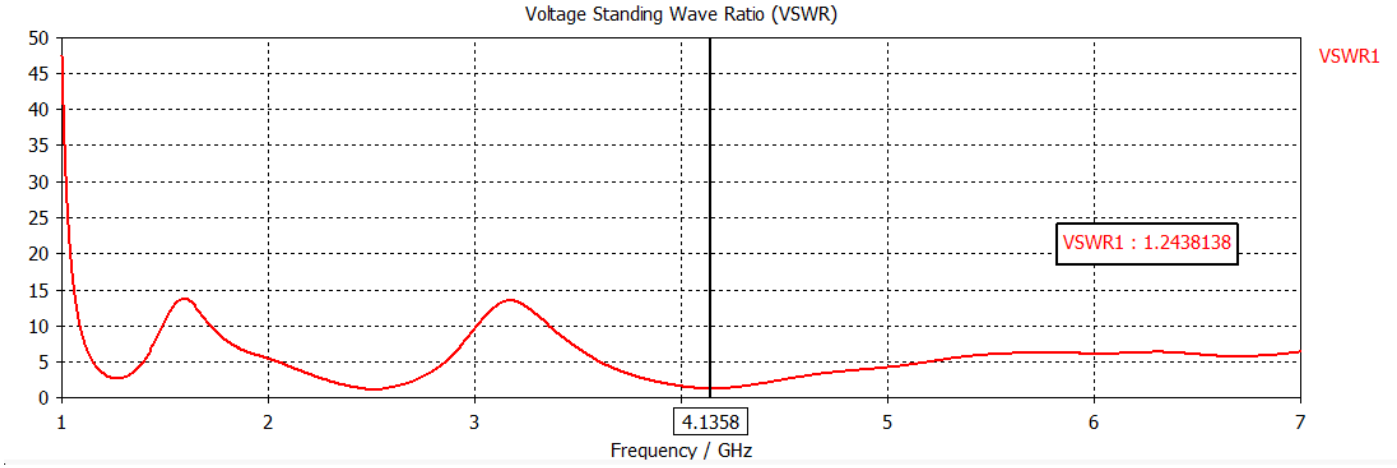


Figure 7 – Frequency Vs. VSWR

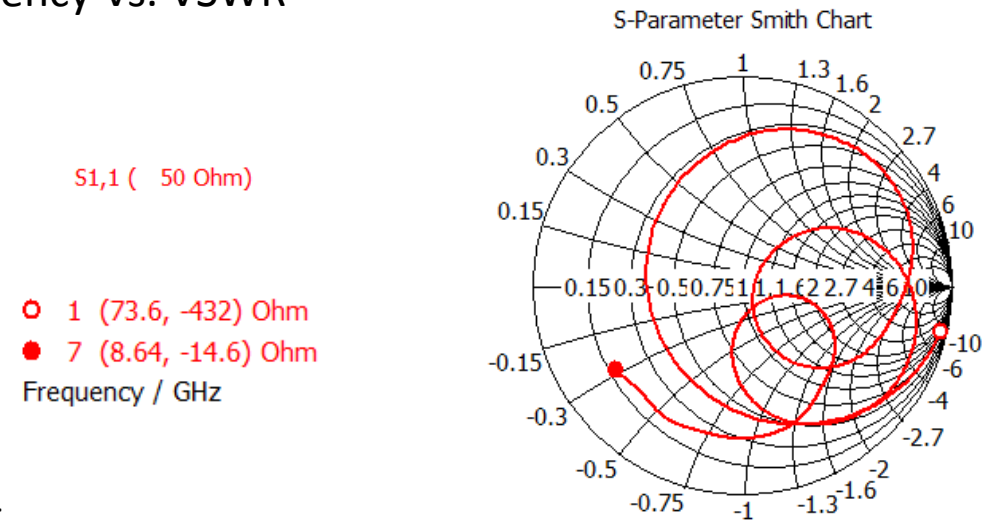
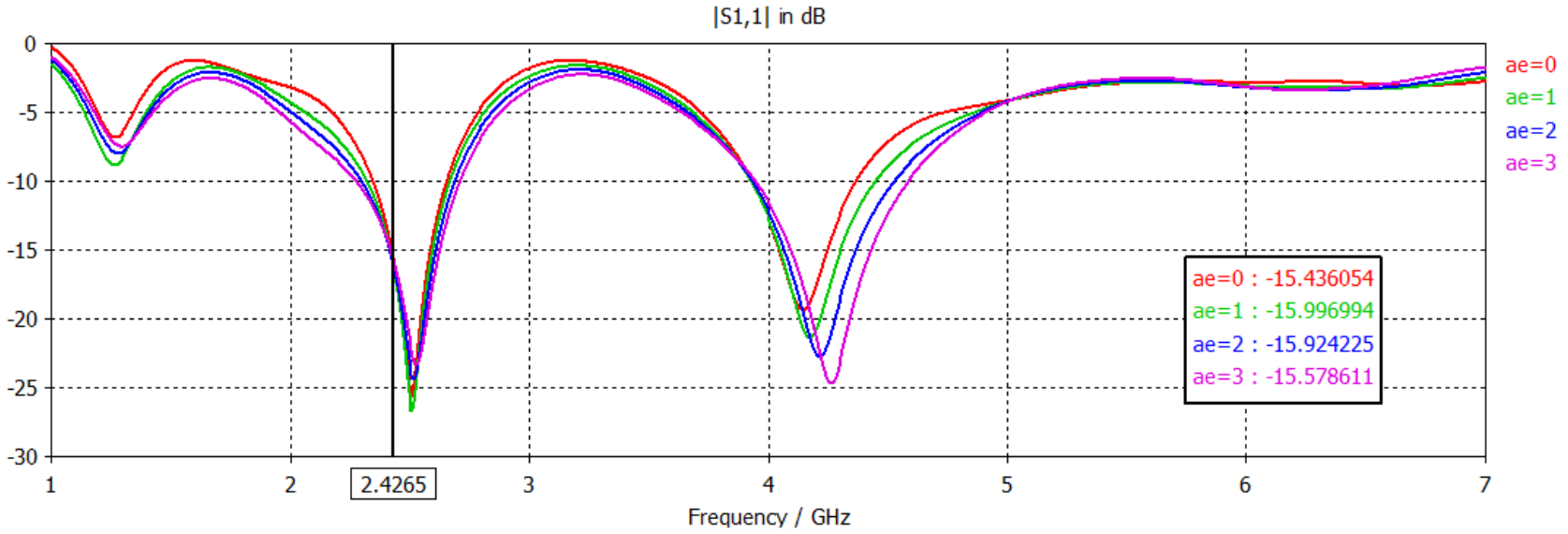
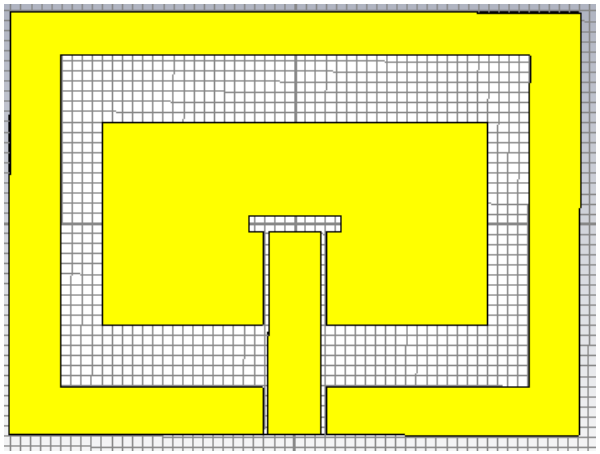
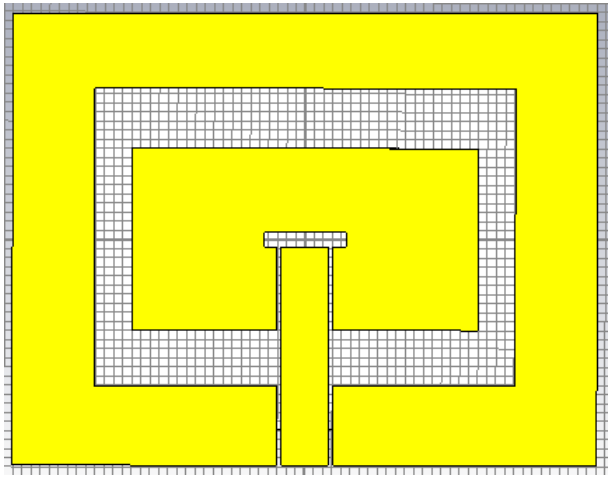


Figure 8 – Smit Chart

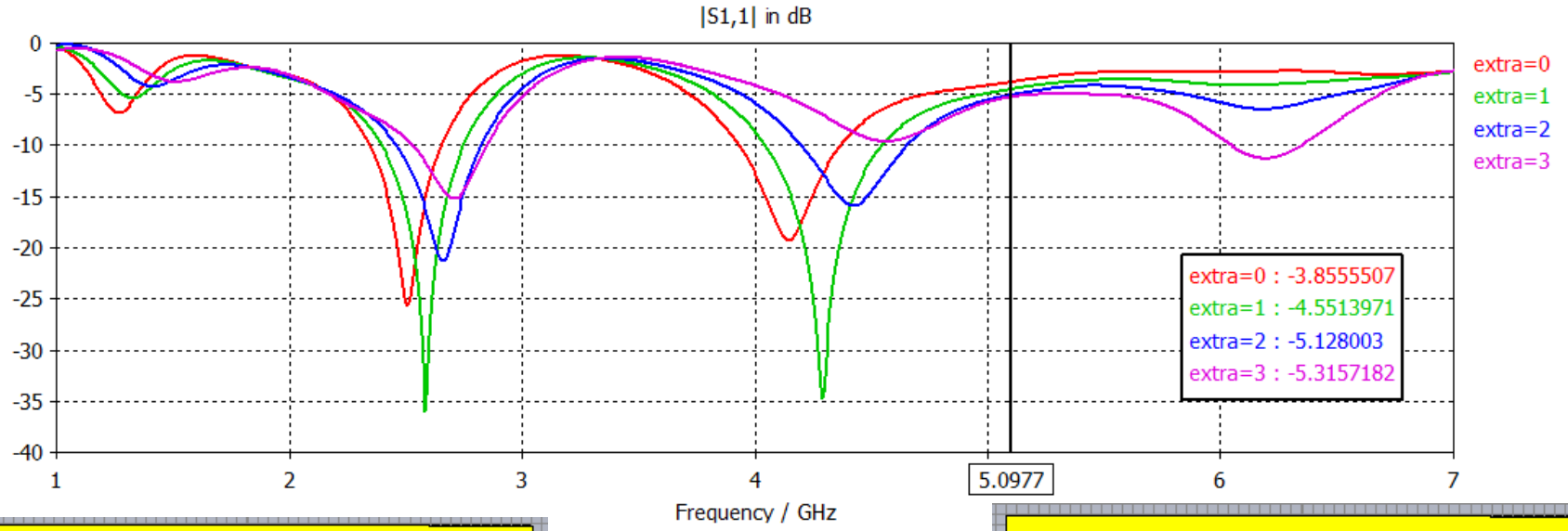
Effect of Variation of Ground Plane Width (L1 and W1)

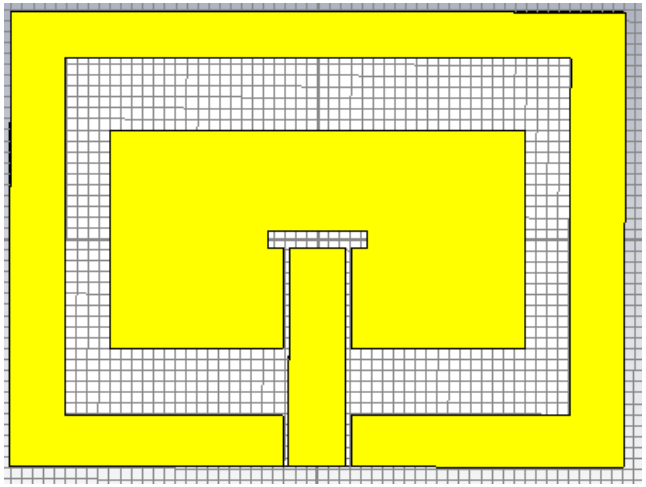


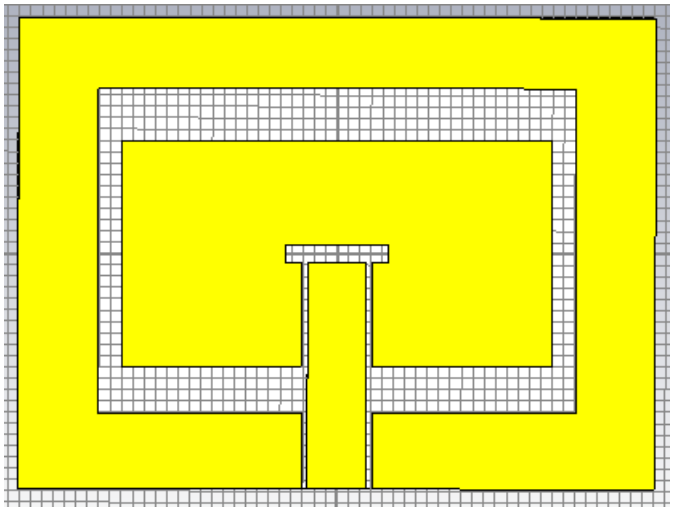




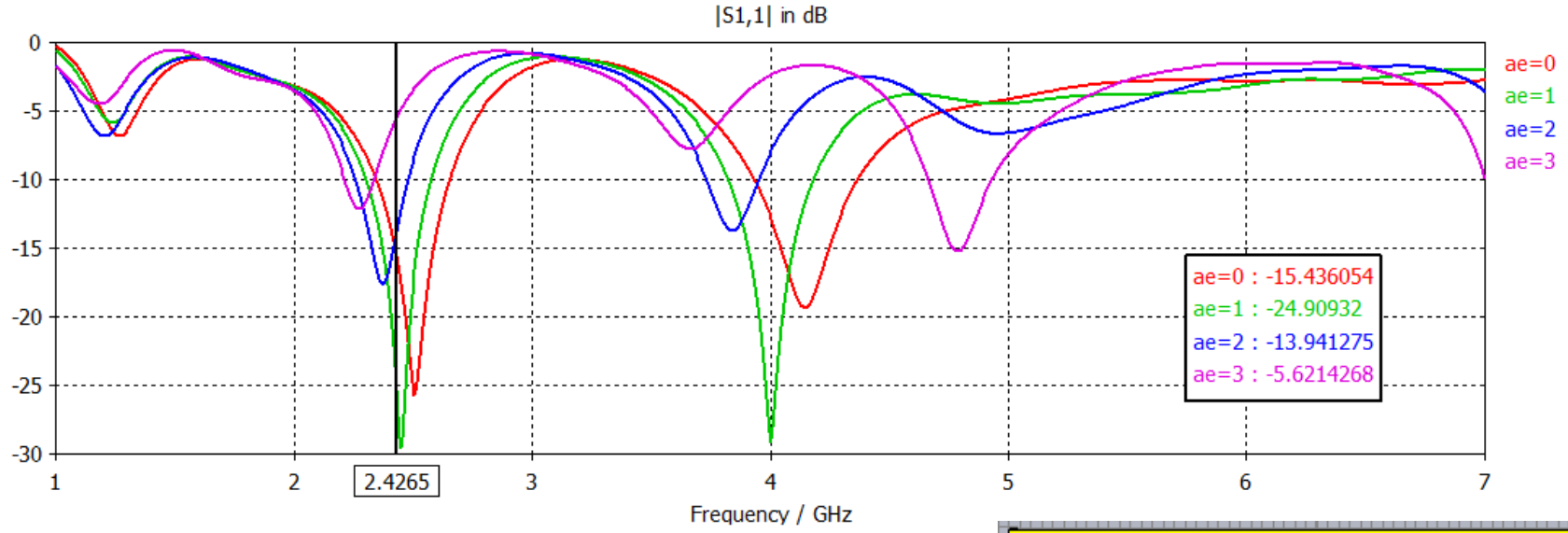
Effect of Variation of separation between central patch and ground plane

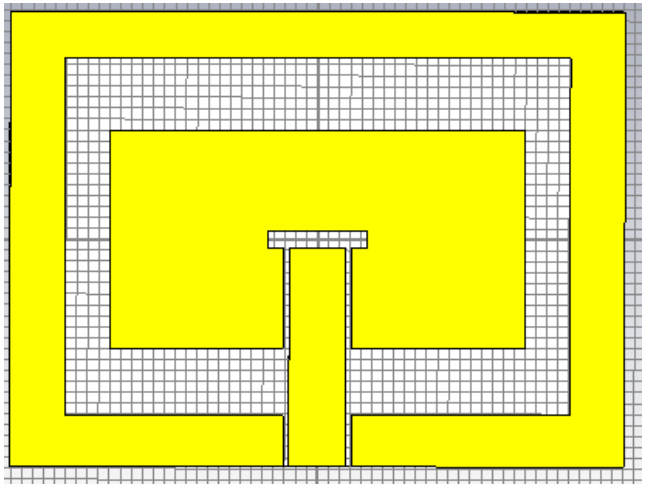


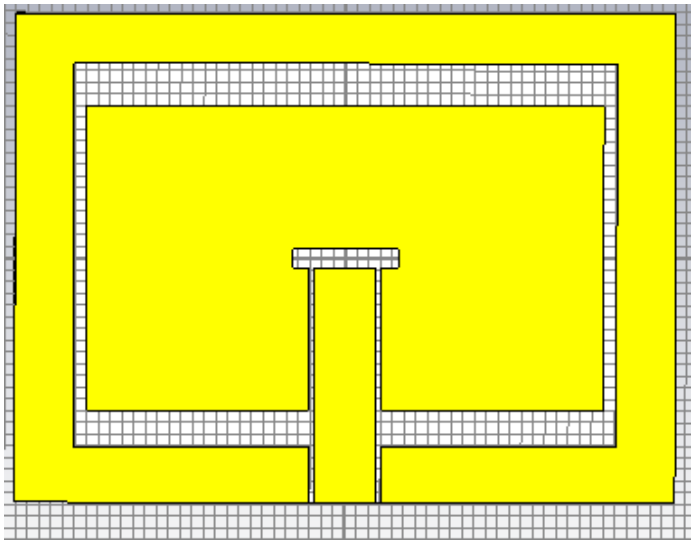




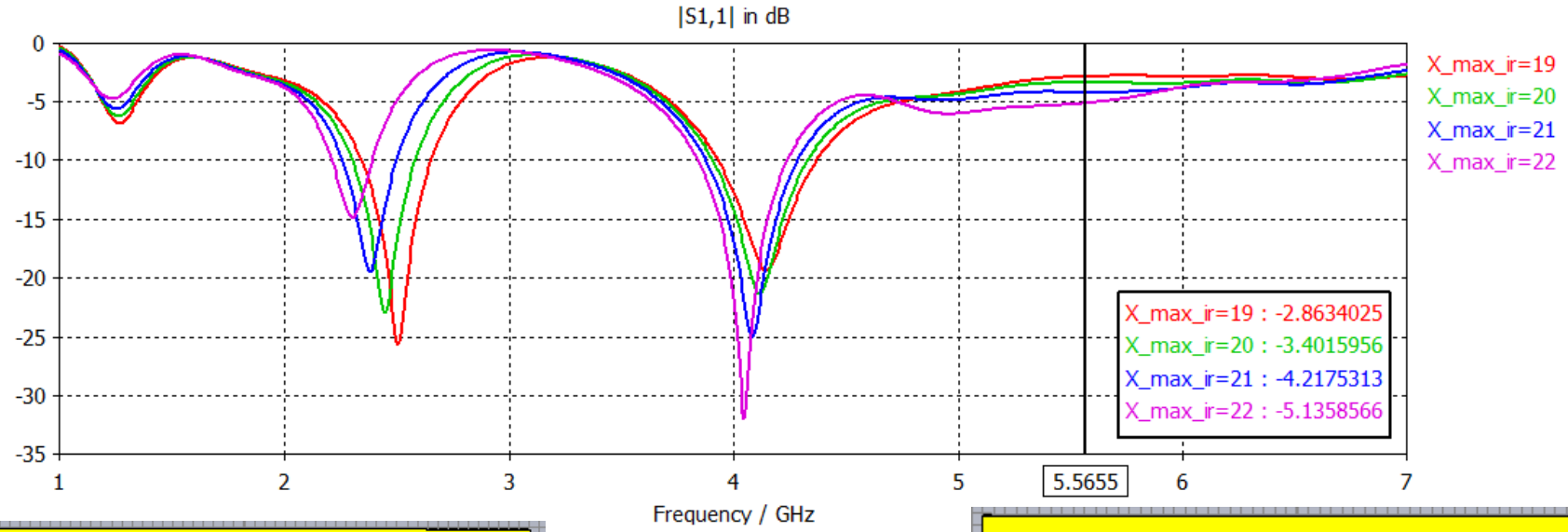
Variation of length and width of central patch (L2 and W2)

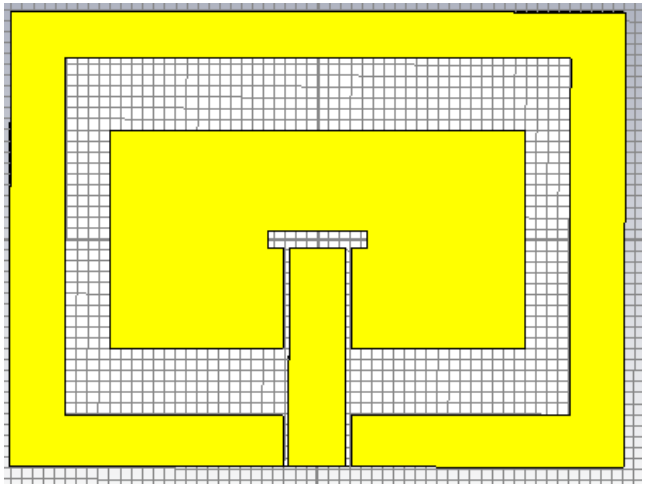


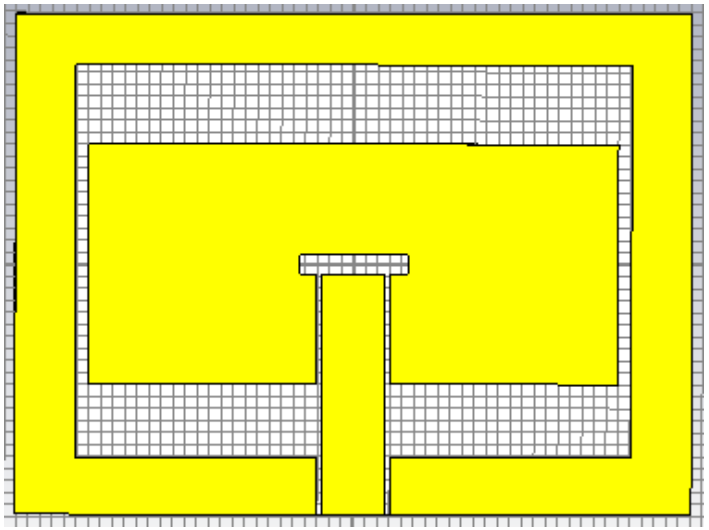




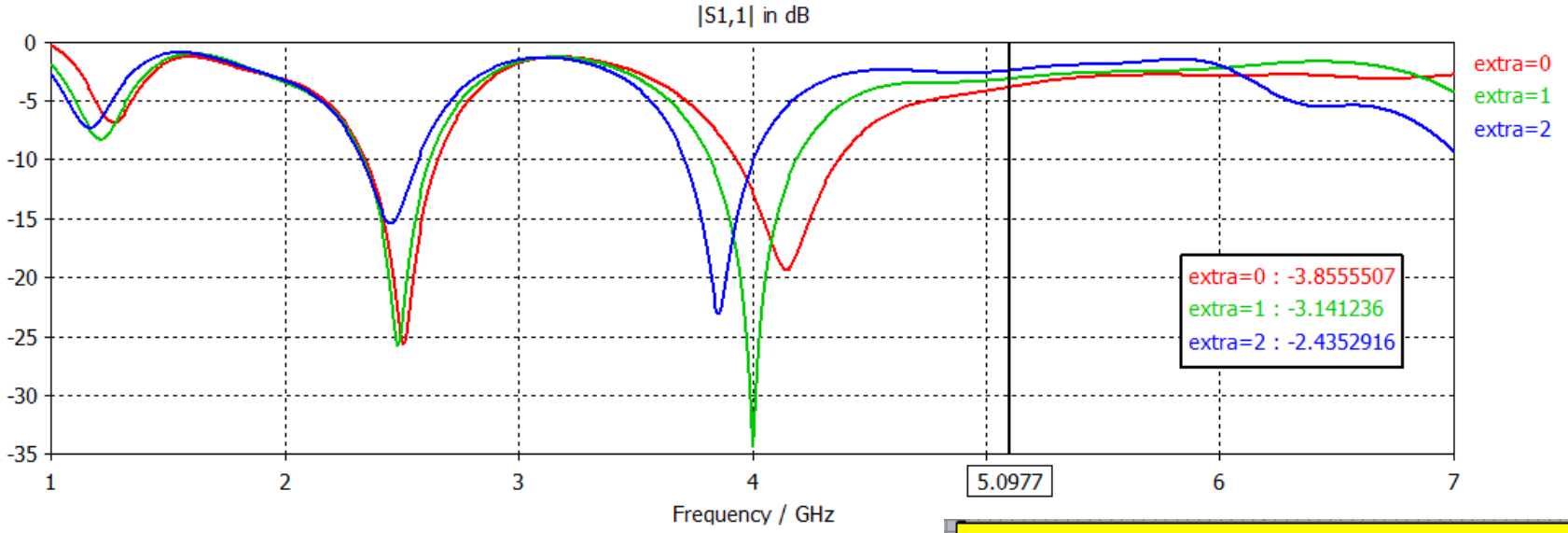
Variation of length of central patch (L2)

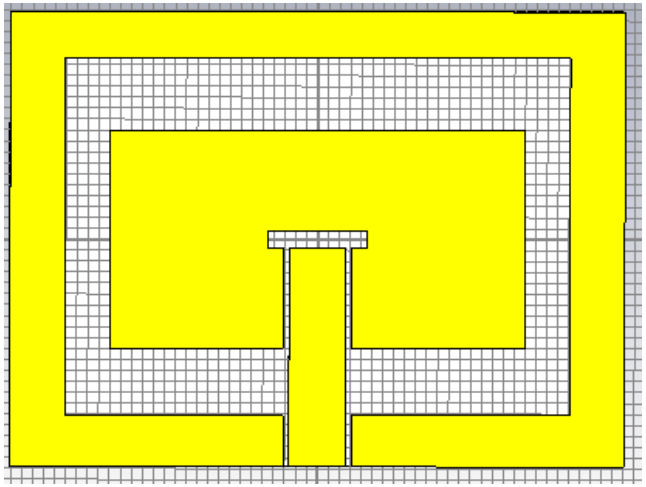


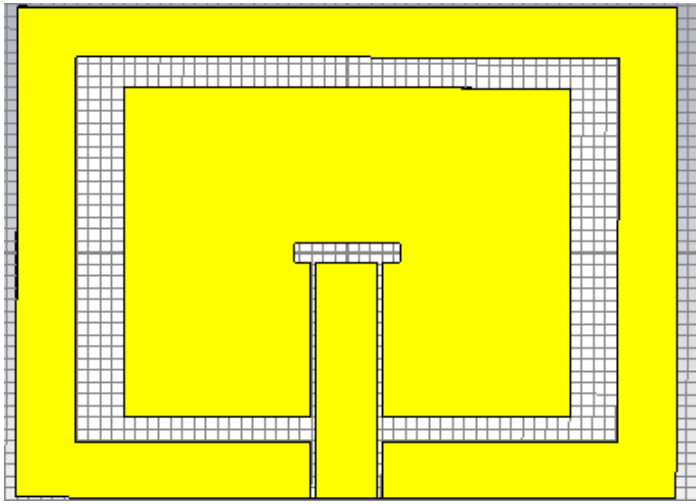




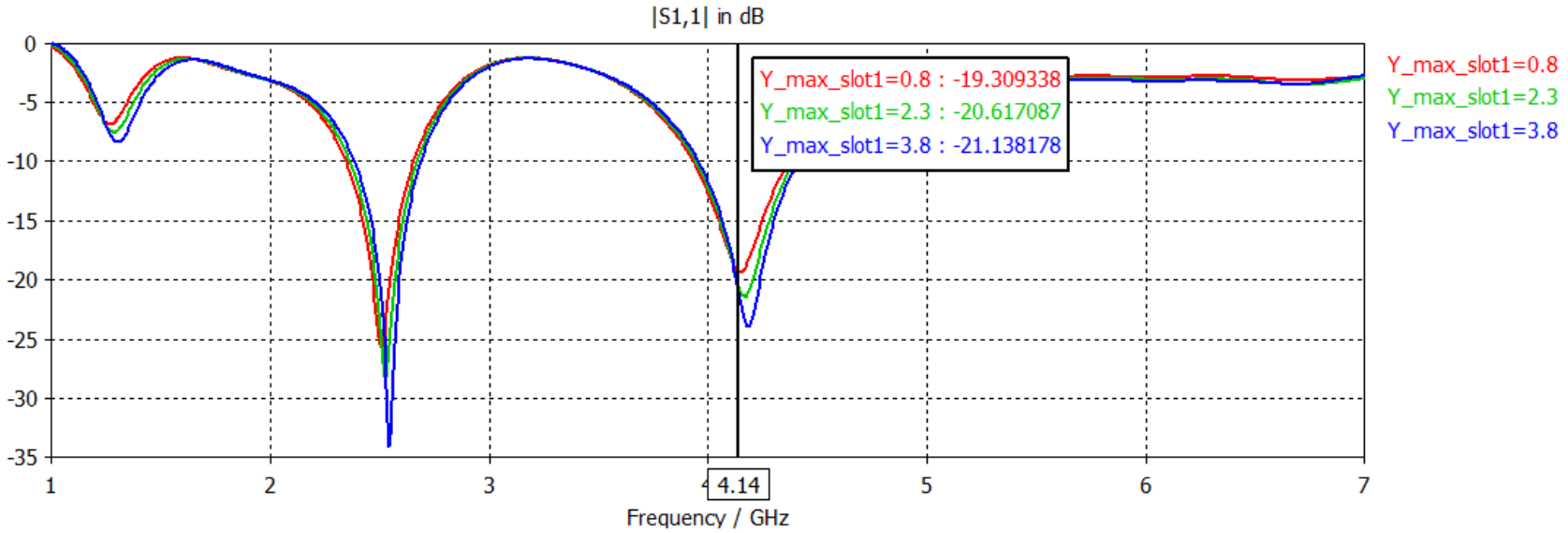
Variation of width of central patch (W2)

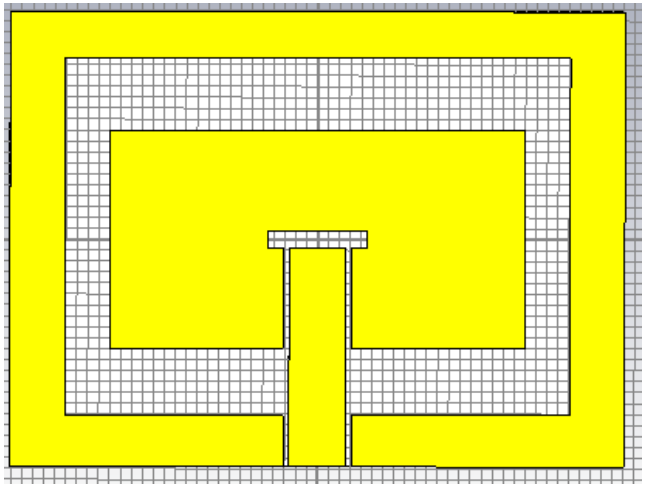


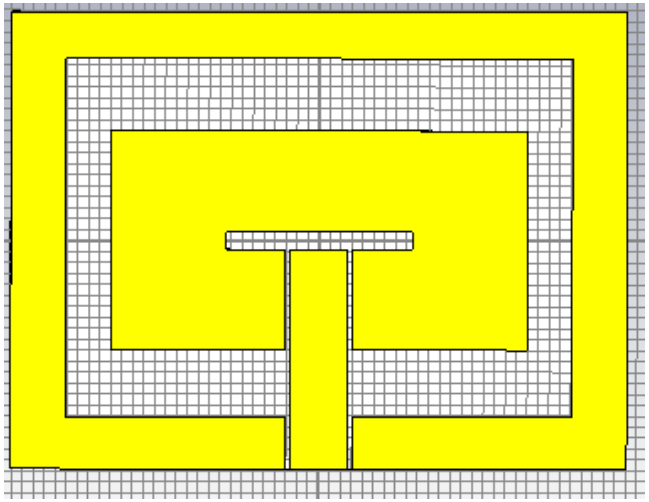




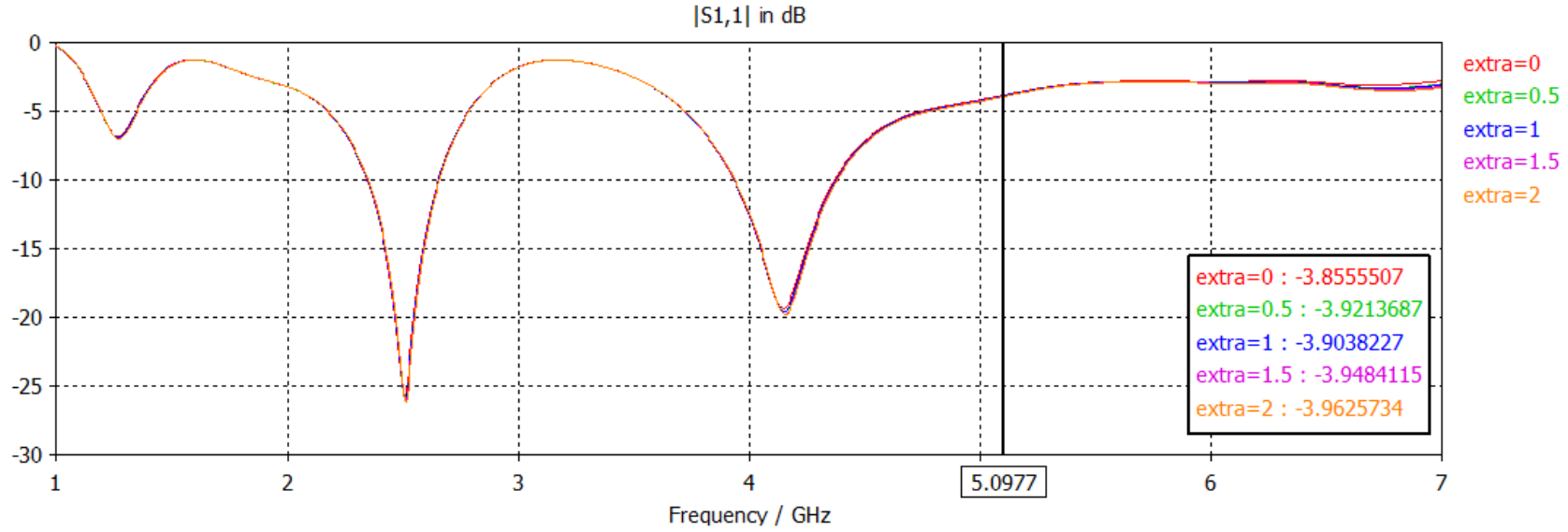
Variation of changing slot Length (Ls)

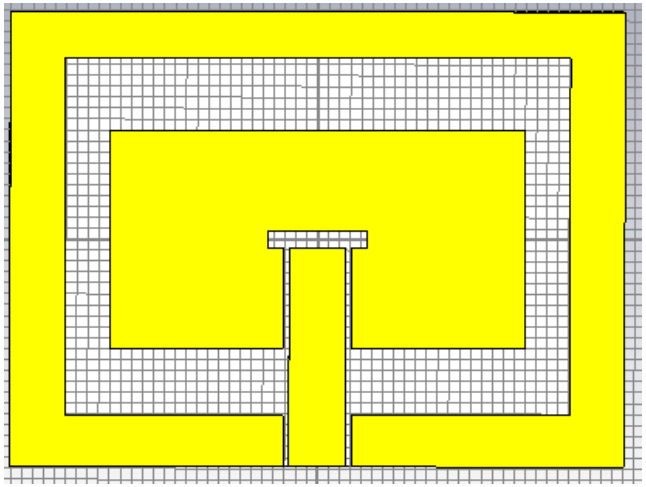


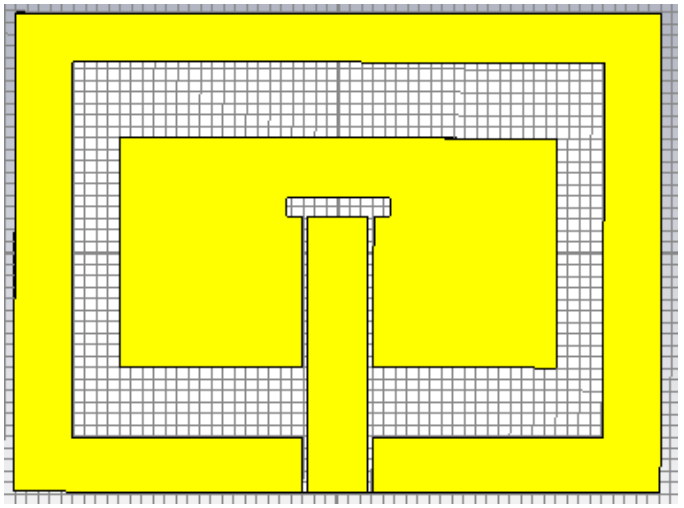




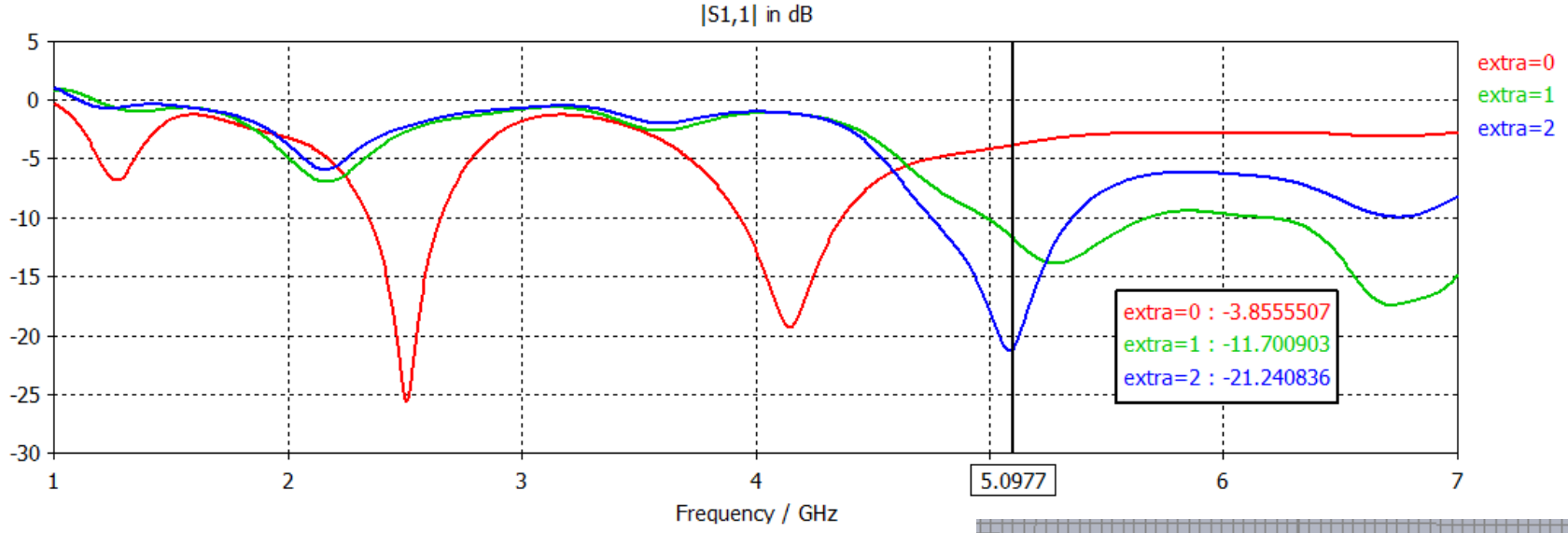
Variation of moving slot upwards

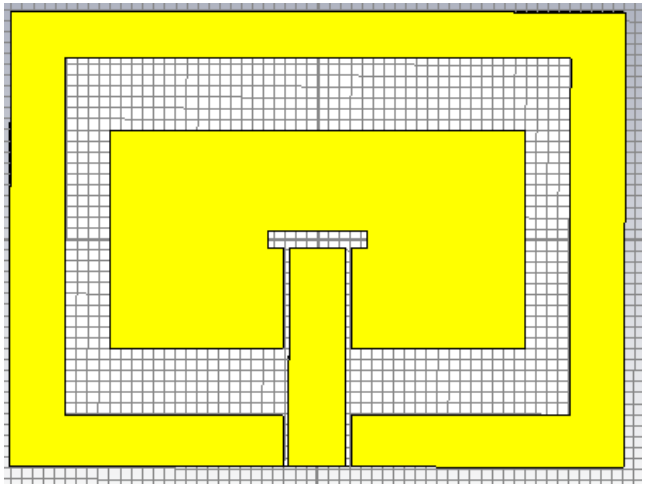


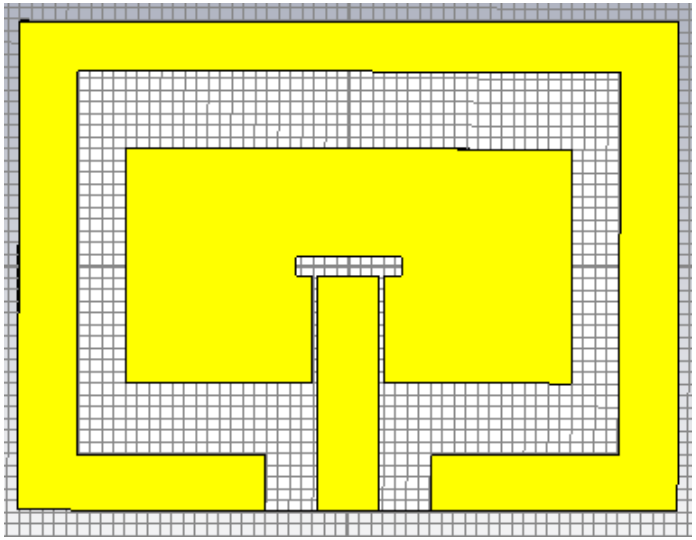




Variation of distance between ground plane and feed line







Inferences

- The two frequencies of operation do not depend on one single parameter
- In fabrication, an additional resonating frequency was observed
- This could be due to connector impurities or dimensional errors while cutting the substrate

References

- Ch. Sulakshana and D. Sriram Kumar, “A CPW-fed Rectangular Patch Antenna for WLAN/WiMAX Applications”, ACEEE International Journal on Communication, Vol 1, No. 2, July 2010.
- Sarawuth Chaimool and Prayoot Akkaraekthalin, “CPW-Fed Antennas for WiFi and WiMAX”, ACEEE International Journal on Communication, Vol 1, No. 2, July 2010.