Effect of variation in parameters of Stub on performance of Fractal antenna

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Abstract: Fractal antenna is widely used antenna in present scenario particularly for wide band applications. Stub is used for impedance matching of antenna and it can also be used for getting better performance in fractal antenna. Through this paper, author is introducing effect of variation in different parameters like length, width & position of stub on performance of fractal antenna.Results coming from this study will be helpful for further designs of fractal antenna for various applications.

Introduction: Introducing stub for achieving good matching of impedance is a widely used technique in design of antenna. Different shapes of stubs are also experimented for achieving required results[1]. Fractal antenna is an advanced version of microstrip patch antenna and effect of changing parameters of patch on its performance is widely studied[2].Stub is also used for achieving compact wideband microstrip antennas. Tuning of stub results in wide bandwidth [3].High gain antenna using FR4 substrate is developed.7 shaped stub is created. Equivalent Inductor & capacitor is introduced in antenna element. It works for multi resonant frequencies [4]. Patch is seperated from stub in some of the work. Y shaped stub is created and good gain is achieved in this work[5]. Such kind of experimentation with stub is performed on microstrip patch antenna. Author has developed patch antenna with fractal sectional technique & stub is introduced in this patch. Effect of changing parameters of stub on antenna performance is studied.

Antenna Geometry with stub parameter variation:

A patch antenna is initially created with width 1.4mm. This antenna is then added with stub of length 1.7mm & width 0.7 mm.Feed is created of length 5.5mm.Defected ground structure is also created for this antenna. Original

structure of antenna can be seen in figure 1.Length of stub is varied from 1.7

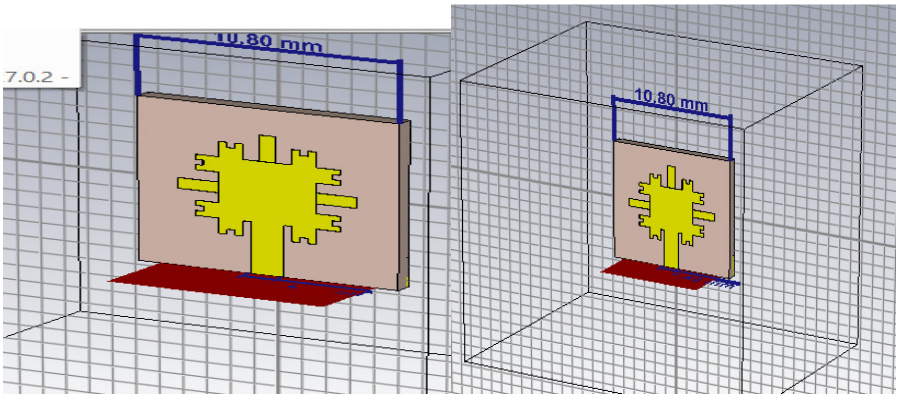

Fig 1 Original fractal antenna

Fig.2 Increase in length of stub

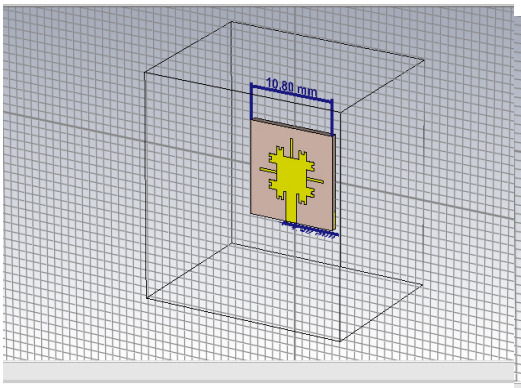

Fig 3 Change in width of stub

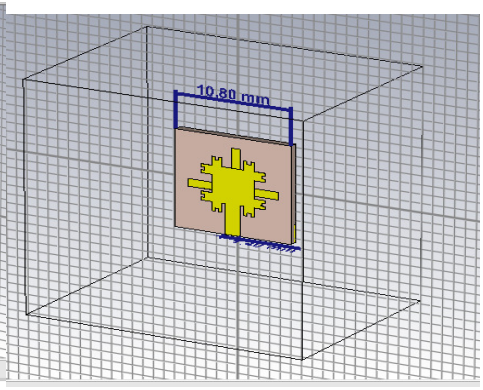

Fig 4 Change in position of stub

mm to 2mm, 2.2 mm & 2.4mm. Width of stub is also varied in same way. It is also increased from 0.7 mm to 1 mm and result is observed.This structure with change in width of stub can be observed in fig.3 Lastly, position of the stub is varied & from center point, it is taken nearer to corners of antenna.It can be seen in fig 4.

Simulation Results

With original fractal antenna, S11 is below -10 db for band from 8 GHz to around 17 Ghz with resonance obtained at around 15 GHz.

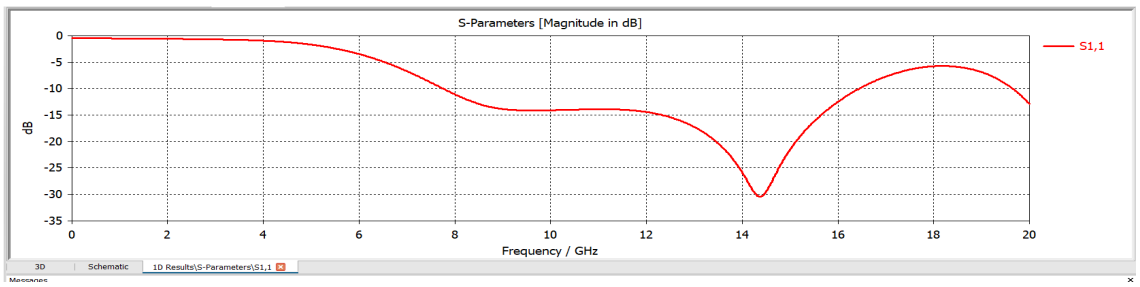

Fig 5 Simulated result of Original fractal antenna

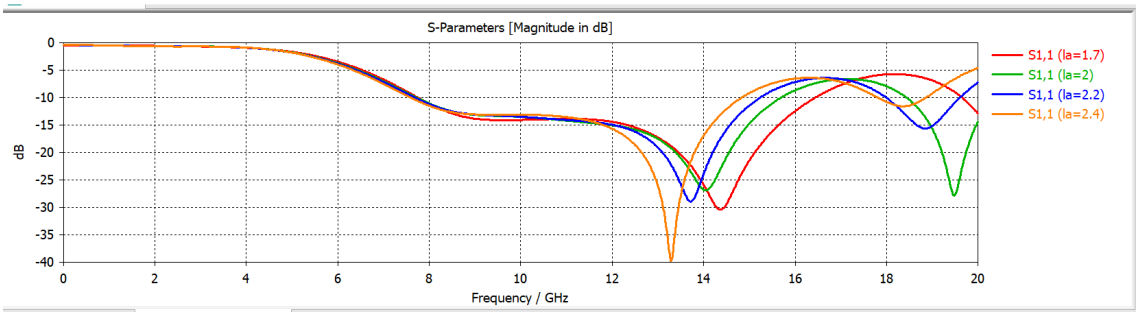

Fig 6 Effect of change in length of stub on S11

This resonant frequency reduces with increase in length of stub. This effect can be observed in fig 6. For stub length 2mm resonance frequency is reduced to 14 GHz. It is further reduced down to between 12GHz & 14GHz.Change in width of stub is leading to generation of another resonant frequency at around 19GHz which can be seen in fig 7. Change in position of stub is also changing overall band from 8GHz to 17GHz to around 8GHz to 15GHz.It can be seen fig 8.

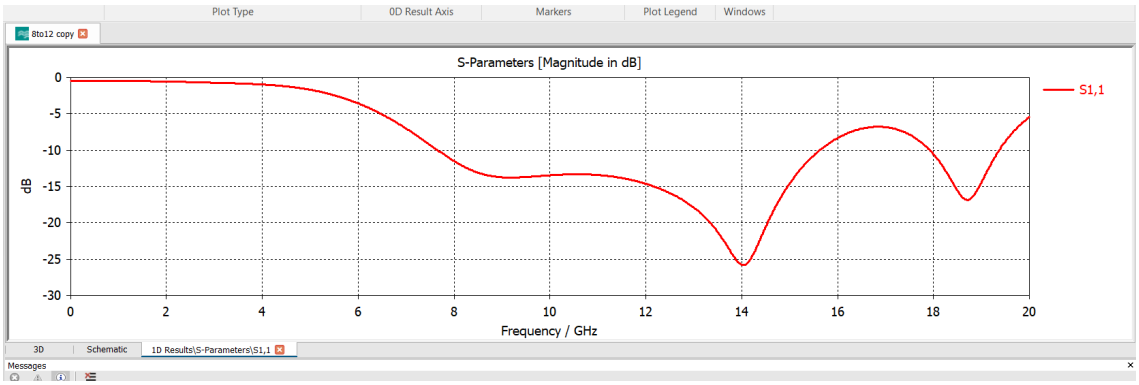

Fig 7 Effect of change in width of stub on S11

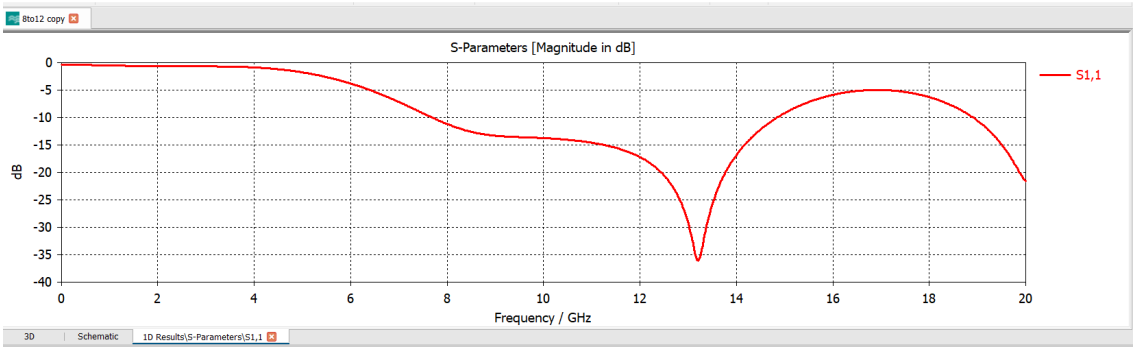

Fig 8 Effect of change in position of stub on performance of antenna

Conclusion: From the presented experimentation, it can be observed that addition of stub to fractal antenna is having wide impact on its performance.Bandwidth of antenna can be changed by variation in parameters of stub. Resonant frequency of antenna can also be changed by variation in width, length & position of antenna and new resonant frequencies can also be obtained. This result will be helpful for designing of further fractal antennas for various applications.