VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY (VNIT), NAGPUR

RF Microwave Engineering (ECL404)

Project Report

Submitted by :
Kethavath Uday Kiran(BT20ECE056)
Kolte Yadnesh Rajesh(BT20ECE057)
Kontham Anand kumar(BT20ECE058)
Semester 6

Submitted to :
Dr. Joydeep Sengupta
(Course Instructor)
Department of Electronics and Communication Engineering,
VNIT Nagpur

Title: Design and Simulate Sidelobe-Reduced and Gain- Enhanced Square Patch Antennas With Adjustable Beamwidth under TM03 Mode Operation.

Software: 1) CST studio suite 2018 version

Abstract: A patch antenna is a type of antenna with a low profile, which can be mounted on a surface. A patch of metal, mounted over a larger sheet of metal called a ground plane.

Patch antennas cost low and can be easily fabricated and integrated. Even the performance of it is better and it can operate at Microwave frequencies.

Square patch antennas to increase their efficiency there are many techniques and we are interested Operation of higher modes of a patch antenna. By reducing the sidelobes level. We are using slot loaded technique for that operating under TM03 mode to reduce the SLL enhance the gain and adjust beamwidth.

Here By introducing slots into patch, We can say that in SLL E-plane of a TM03 mode patch antenna can be effectively reduced by reshaping the current distribution in y-direction, Also the beamwidth in the H-plane can be freely regulated with different distributions of current density in the x-direction.

- We are introducing the center slot of length ls2 and side slots of length ls1/2.
- Then with a coaxial feed and then stimulating from frequencies.

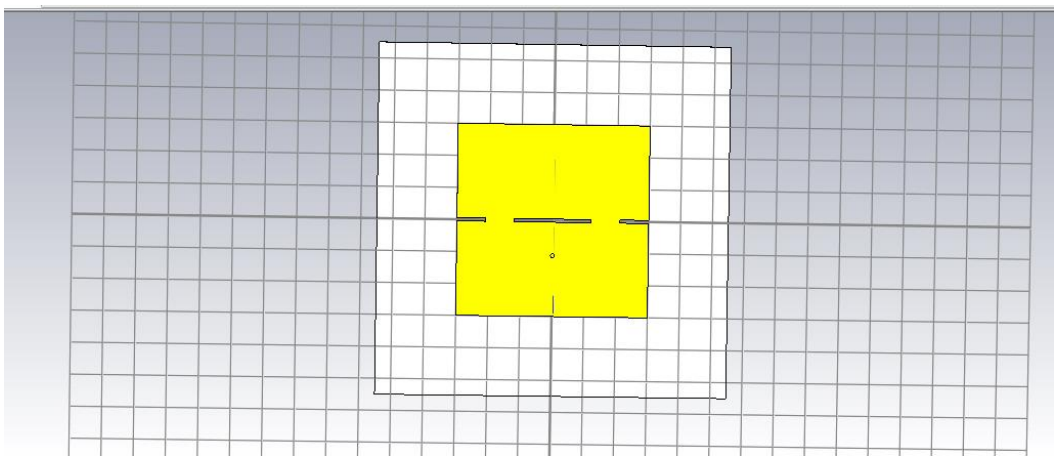

Figure 1: Antenna as modeled in CST: front view(patch)

3D | Schematic | ...\farfield (f=4.2)

Parameter List

Name	Expression	Value	Description	Type
hs	1.575	1.575		Undefined
mt	0.035	0.035		Undefined
w	60	60		Undefined
width	1	1		Undefined
ls2	24	24		Undefined
ls1	18	18		Undefined

Figure 3: parameter list

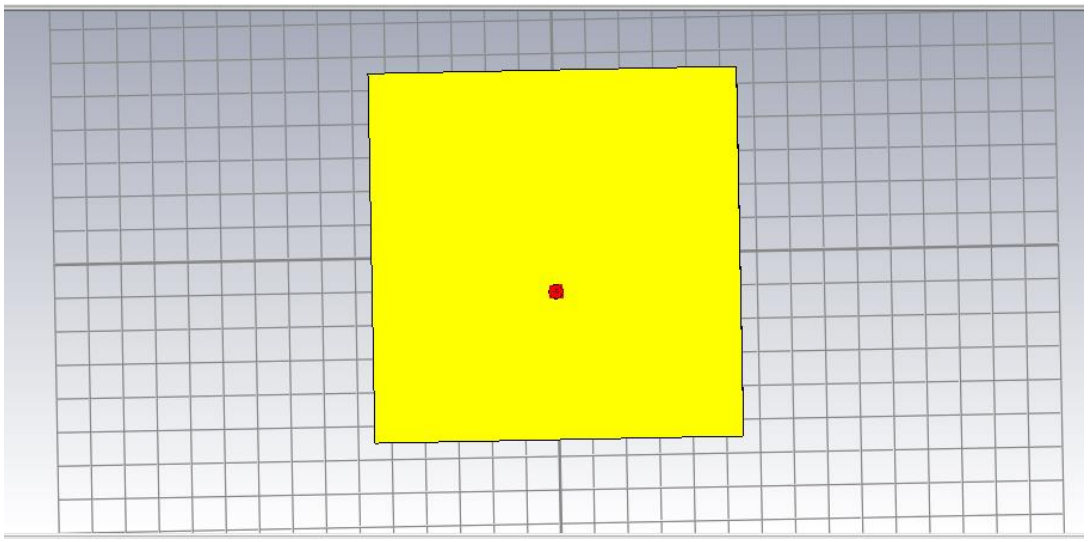

Figure 2: back view(ground)

Results and Discussion: 1) After analysis and designing this square patch antenna to reduce the side lobes by introducing the slots into the patch antenna we did reduce the side lobes also achieved good antenna efficiency. we suppressed the side lobes by reshaping the current distribution on patch in both directions.

For low SLL and high directivity dimensions are like ls1 = 0.3*W and ls2 = 0.4*W.

Here the resonant frequency is observed to be at 4.672 GHz and S11 parameter is -29.934 dB.

Stimulated values:

Directivity = 6.5 dB

Gain = 4.37 dB

Emax = 26.69 dB

Hmax = -43.19 dB

Simulation results:

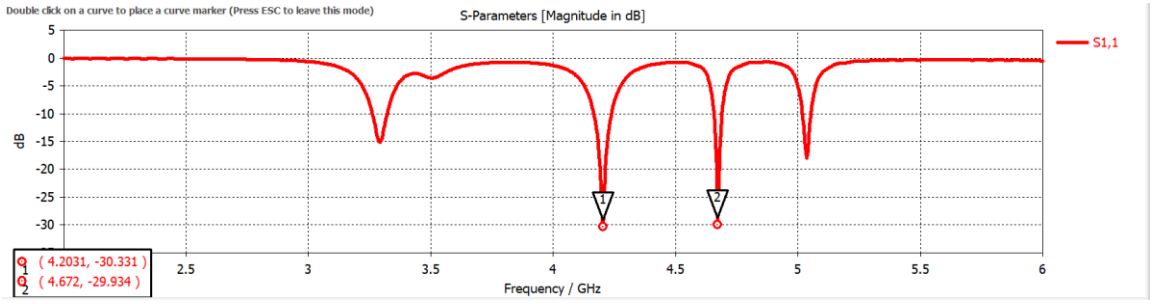

Figure 4: S parameters

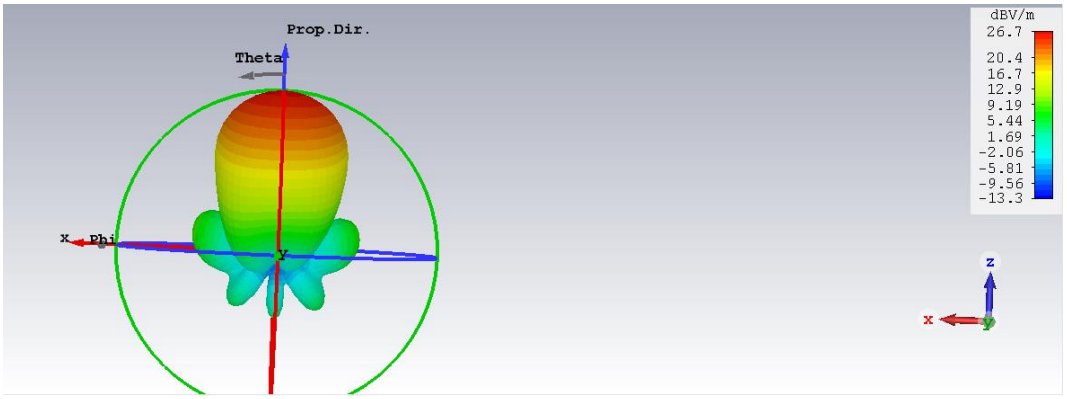

Figure 5: Farfield directivity in 3D

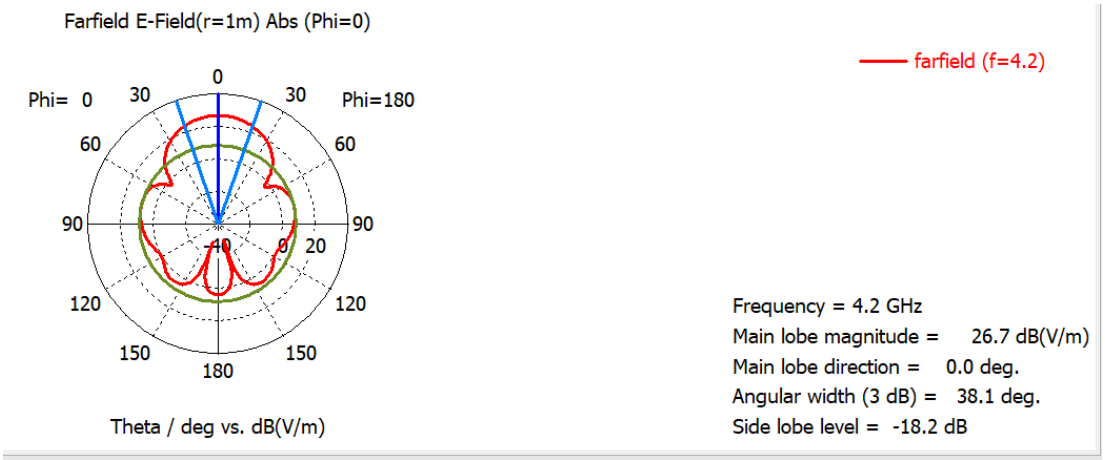

Figure 6: Directivity at phi=0deg

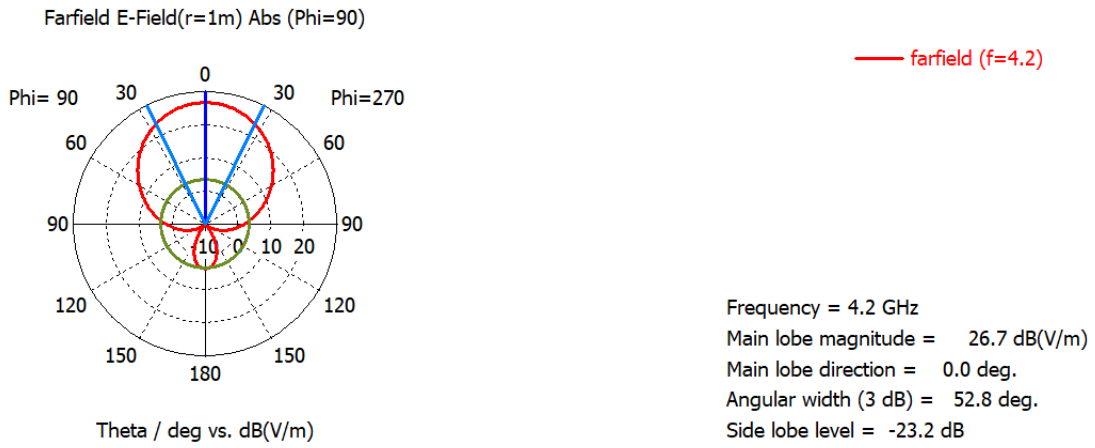

Figure 7: Directivity at phi=90deg

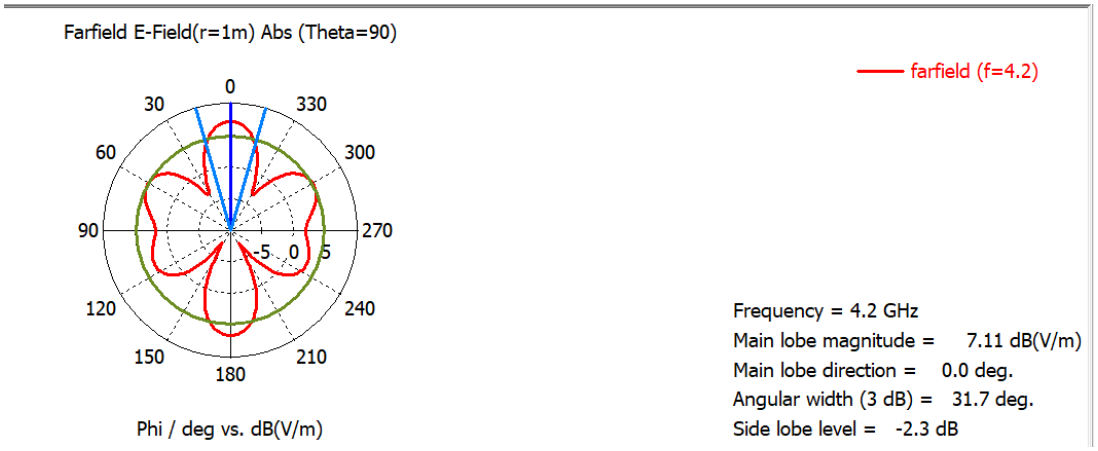

Figure 8: Directivity with respect to theta

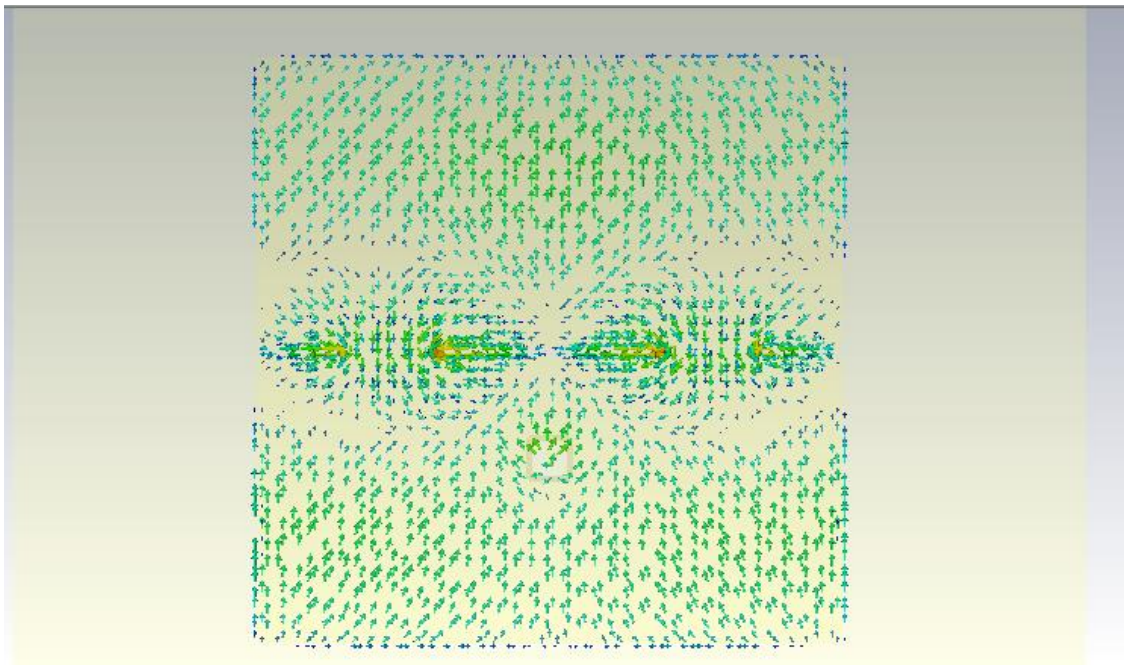

Figure 11: Surface current density

Conclusion:

The side lobes in the E-plane can be sufficiently suppressed and the beamwidth in H-plane can be freely adjusted by reshaping the current distribution on patch in the longitudinal and transverse directions respectively and by changing configurations of three transverse slots along the central line of patch. The SLL (sidelobe level) in the E-plane is substantially reduced.