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Theory Subject- Waveguide & Antenna
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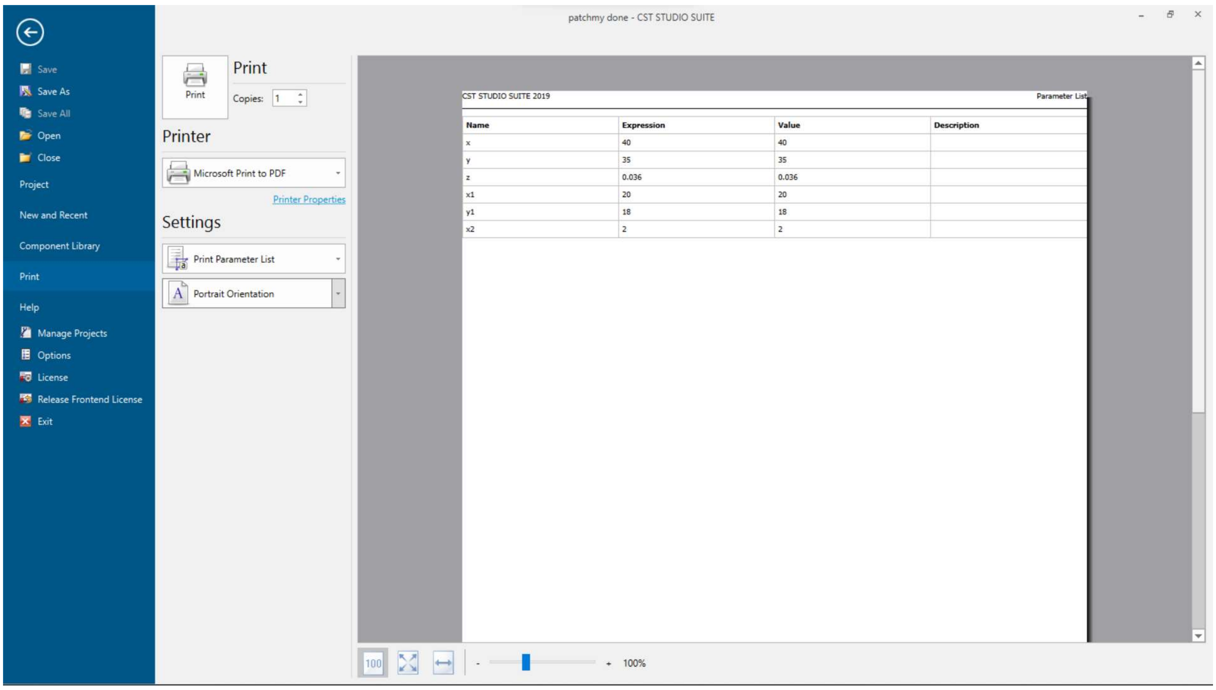
Microscript Patch Antenna Report for 7 GHz Frequency

Mobile phone, receiver and other communication device also nano technology devices are growing fastly, So it needs to be improve communication system. Atinna is having most important roll in that side.
In this report i have described our microstrip patch antenna for 7 ghz frequency.

There are some works in the literature about the antennas around 7 GHz. One of them uses impedance matching method in order to increase the bandwidth at different frequencies.

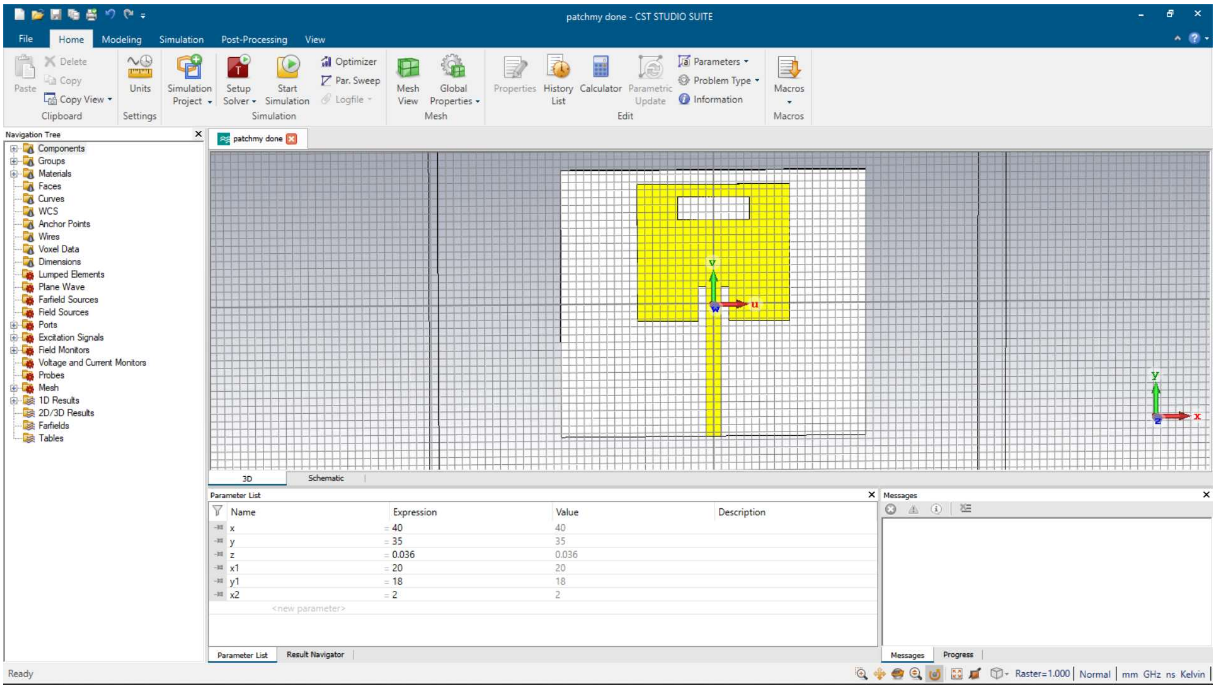
Component name -
a.Copper metal for antenna(base, patch ant script).
b.Substrate Fr-4(lossy).
c.Software - CST (Computer Simulation Technology).

Parameter list is given below.

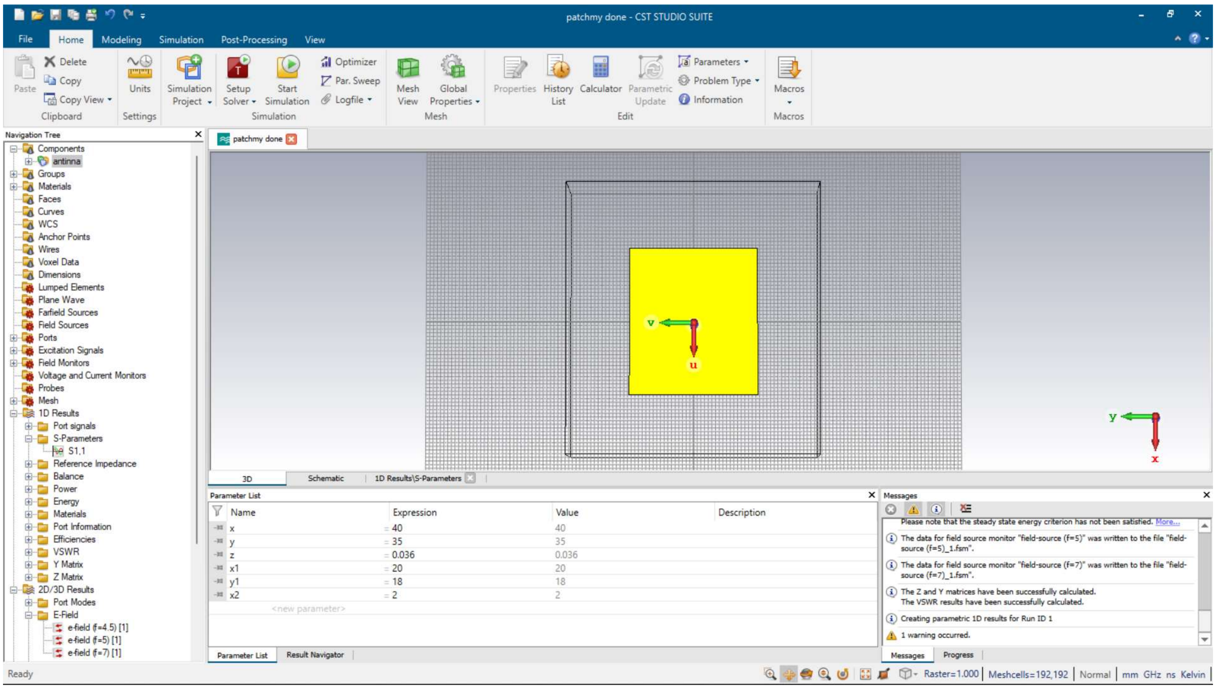


Name	Expression	Value	Description
x	40	40	
y	35	35	
z	0.036	0.036	
x1	20	20	
y1	18	18	
x2	2	2	

Image of Antenna is shown below -



Img - 1 upper side of antinna



Img - 2 back side of antinna(bottom face of antenna)

A middle space having substrate.

ANTENNA DESIGN

Designing For designing of a microstrip patch antenna, we have to select the resonant frequency and a dielectric medium for which antenna is to be designed. The parameters to be calculated are as under. Width (W): The width of the patch is calculated using the following equation.

$$W=\frac{C0}{2fr}\sqrt{\frac{2}{\varepsilon r+1}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where, W = Width of the patch, f r = Frequency of operation, $C0$= Speed of light, εr = Dielectric constant of substrate

Effective dielectric constant ($\mathcal{E}eff$): The effective dielectric constant value of a patch is an important parameter in the designing procedure of a microstrip patch antenna. The radiations travelling from the patch towards the ground pass through air and some through the substrate (called as fringing). Both the air and the substrates have different dielectric values, therefore in order to account this we find the value of effective dielectric constant. The value of the effective dielectric constant ($\mathcal{E}eff$) is calculated using the following equation

$$\mathcal{E}eff = \frac{\mathcal{E}r+1}{2} + \frac{\mathcal{E}r-1}{2}\left[1 + 12\,\frac{h}{w}\right]^{-0.5} \text{...............} \; (2)$$

Length: Due to fringing, electrically the size of the antenna is increased by an amount of (ΔL). Therefore, the actual increase in length (ΔL) of the patch is to be calculated using the following equation.

$$\frac{\Delta L}{h} = 0.412 \frac{(\mathcal{E}eff+0.3)\left(\frac{w}{h}+0.264\right)}{(\mathcal{E}eff-0.258)\left(\frac{w}{h}+0.8\right)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where ‘h’= height of the substrate The length (L) of the patch is now to be calculated using the below mentioned equation.

$$L = \frac{1}{2fr\sqrt{\mathcal{E}eff\ \mu_0\varepsilon_0}} - 2\Delta L \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Length (Lg) and width (Wg) of ground plane: Now the dimensions of a patch are known. The length and width of a substrate is equal to that of the ground plane. The length of a ground plane (Lg) and the width of a ground plane (Wg) are calculated using the following equations.

Lg = 6h + L .... (5)

Wg = 6h + W ....(6)

<u>Antenna far field - </u> the far field of an antenna is generally considered to be the region where the outgoing wavefront is planer and the antenna radiation pattern has a polar variation and is independent of the distance from the antenna.

Far field images - shown below.

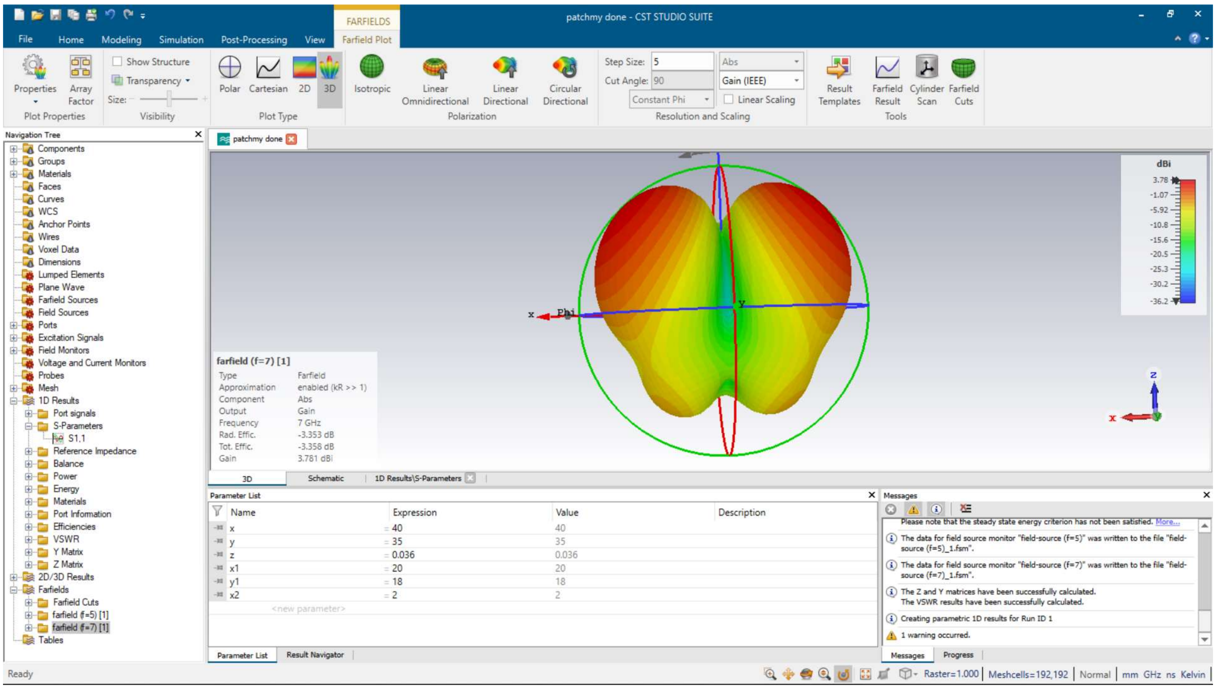


Image-3(a)

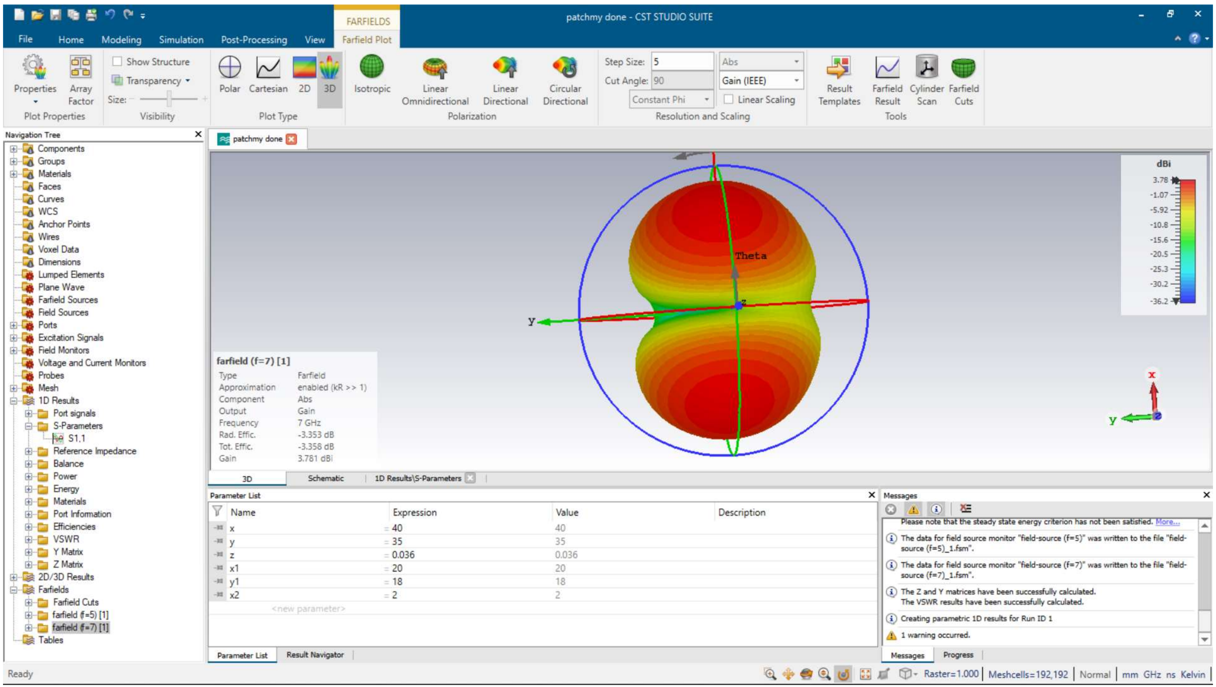


Image-3(b)

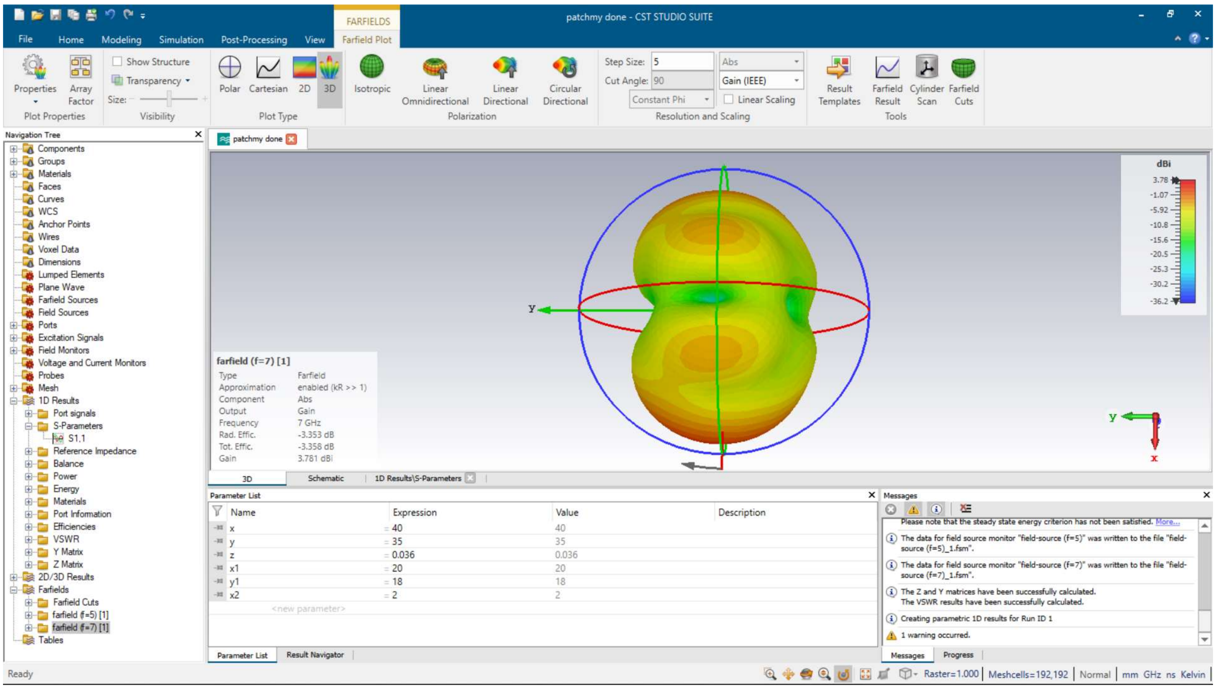


Image-3(c)

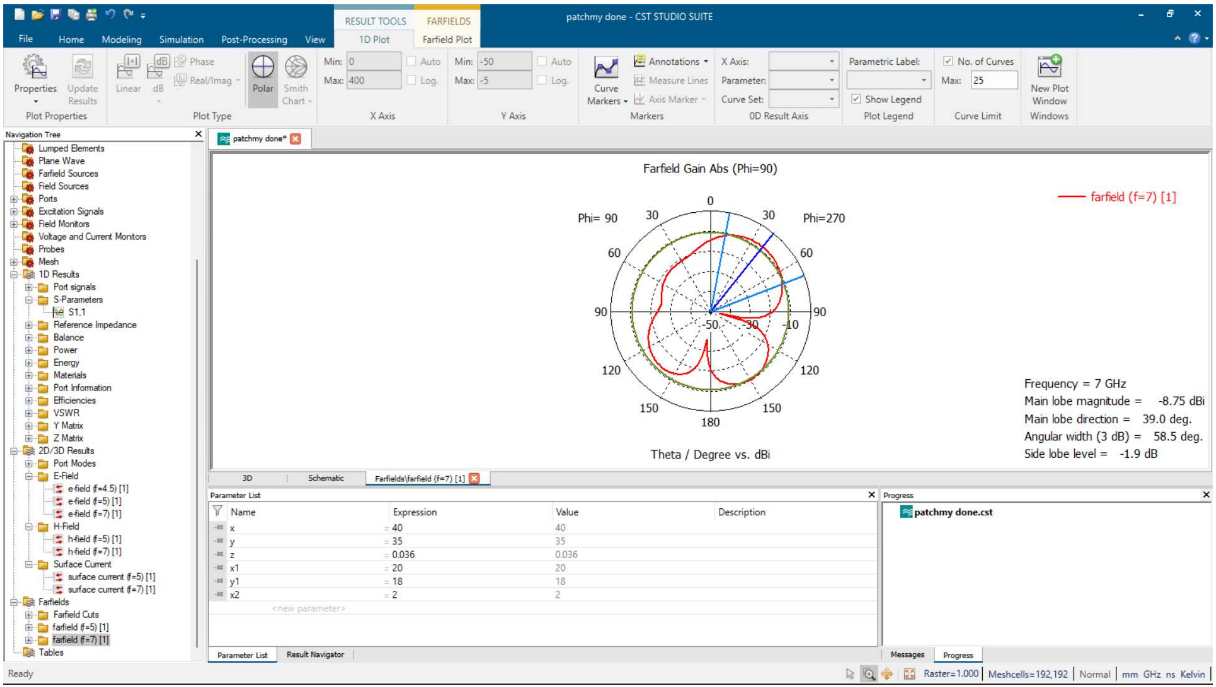


Image-3(d)

Various type of field images is shown below.

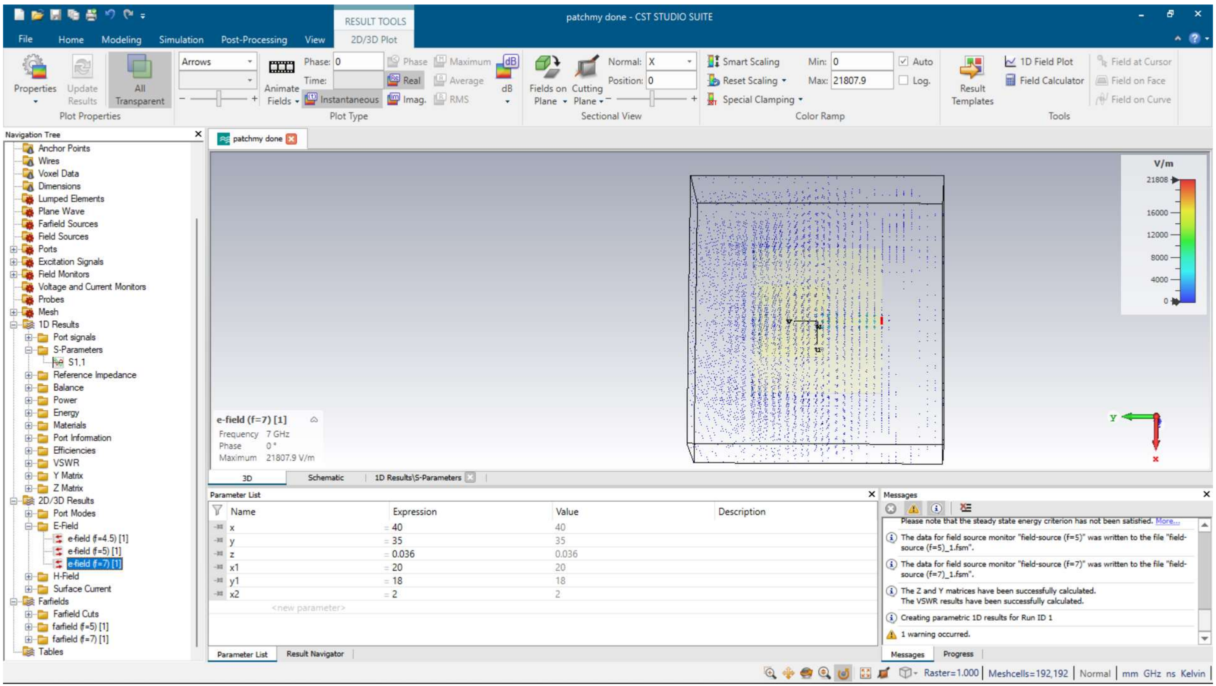


Image-4(a) E-Field

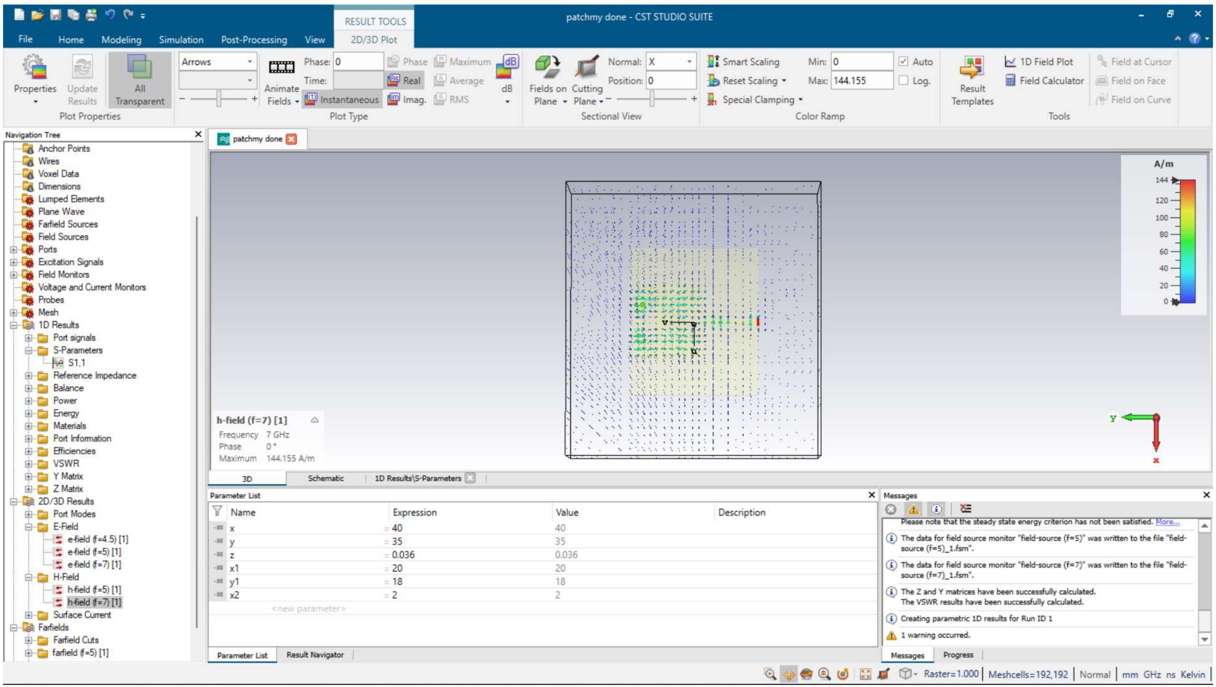


Image-4(b) H-Field

The surface current is also an important parameter for describing the antenna performance, surface current which is shown in the Fig. is describing the phenomenon of the dual band antenna performance. It can be observed in Fig. 6 that the maximum current at frequency 7.059 GHz is flowing in upper portion of the radiating patch and it flows incoming direction in feeding line while in case of frequency 10.94 GHz the maximum current flows lower portion of the radiating patch and the current flows upward direction in the feeding line of the antenna.

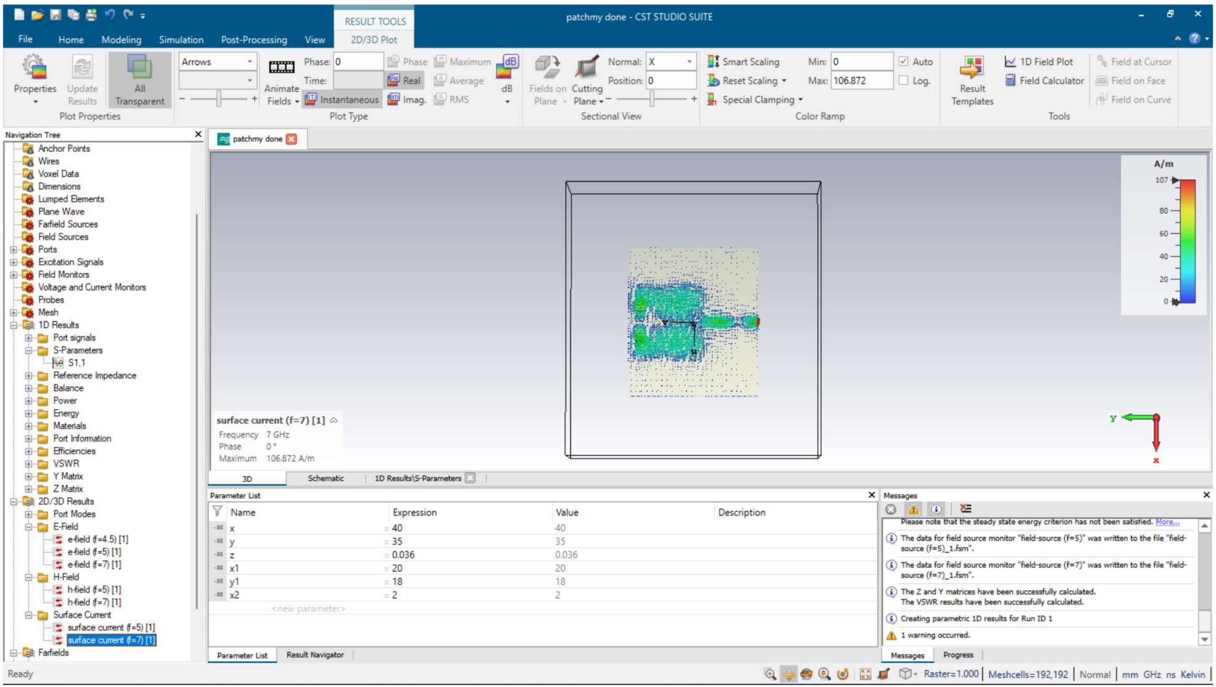


Image-4(c) Surface Current.

S-parameter -
A microstrip patch antenna for satellite application is proposed in the paper. The antenna has a frequency bandwidth of 0.3 GHz (6.8500 GHz-7.1500 GHz) centered

at 7 GHz with a return loss of-27.533 dB.

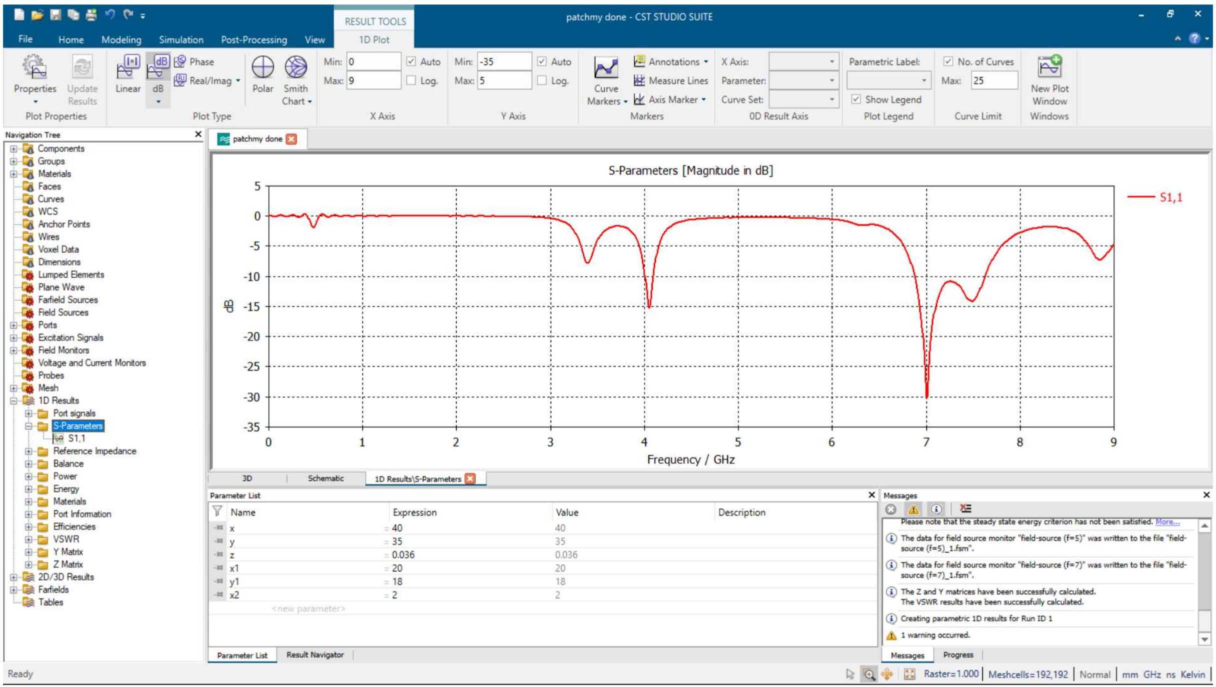


Image-5 S-parameter

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