U19EC046 | TLEM | LAB 6

AIM

Design 5 element & 6 element yagi uda antenna for 575 MHz and plot the 2D & 3D plot of directivity and find out front to back ratio, HPBW and FNBW

Software Used

ANSOF

THEORY

A Yagi-Uda antenna was seen on top of almost every house during the past decades. The parasitic elements and the dipole together form this Yagi-Uda antenna

Construction Yagi-Uda Antenna:

A Yagi-Uda antenna was seen on top of almost every house during the past decades. The parasitic elements and the dipole together form this Yagi-Uda antenna

The figure shows a Yagi-Uda antenna. It is seen that there are many directors placed to increase the directivity of the antenna. The feeder is the folded dipole. The reflector is the lengthy element, which is at the end of the structure. The figure depicts a clear form of the Yagi Uda antenna. The center rod like structure on which the elements are mounted is called as boom. The element to which a thick black head is connected is the driven element to which the transmission line is connected internally, through that black stud. The single element present at the back of the driven element is the reflector, which reflects all the energy towards the direction of the radiation pattern. The other elements, before the driven element, are the directors, which direct the beam towards the desired angle.

CALCULATIONS

f=575MHz.

$\lambda = c/f = (3 \times 108) / (575 \times 106) = 521.74$ mm.

Length of Activator $0.47 \times \lambda = 0.245$ m.

Length of Reflector = $0.498 \times \lambda = 0.260$ m

Length of Deflector = $0.404 \times \lambda = 0.211$ m

Distance between Activator and Reflector = $0.498 \times \lambda = 0.260$ m

Distance between Activator and Deflector = $0.15 \times \lambda = 0.15$ m

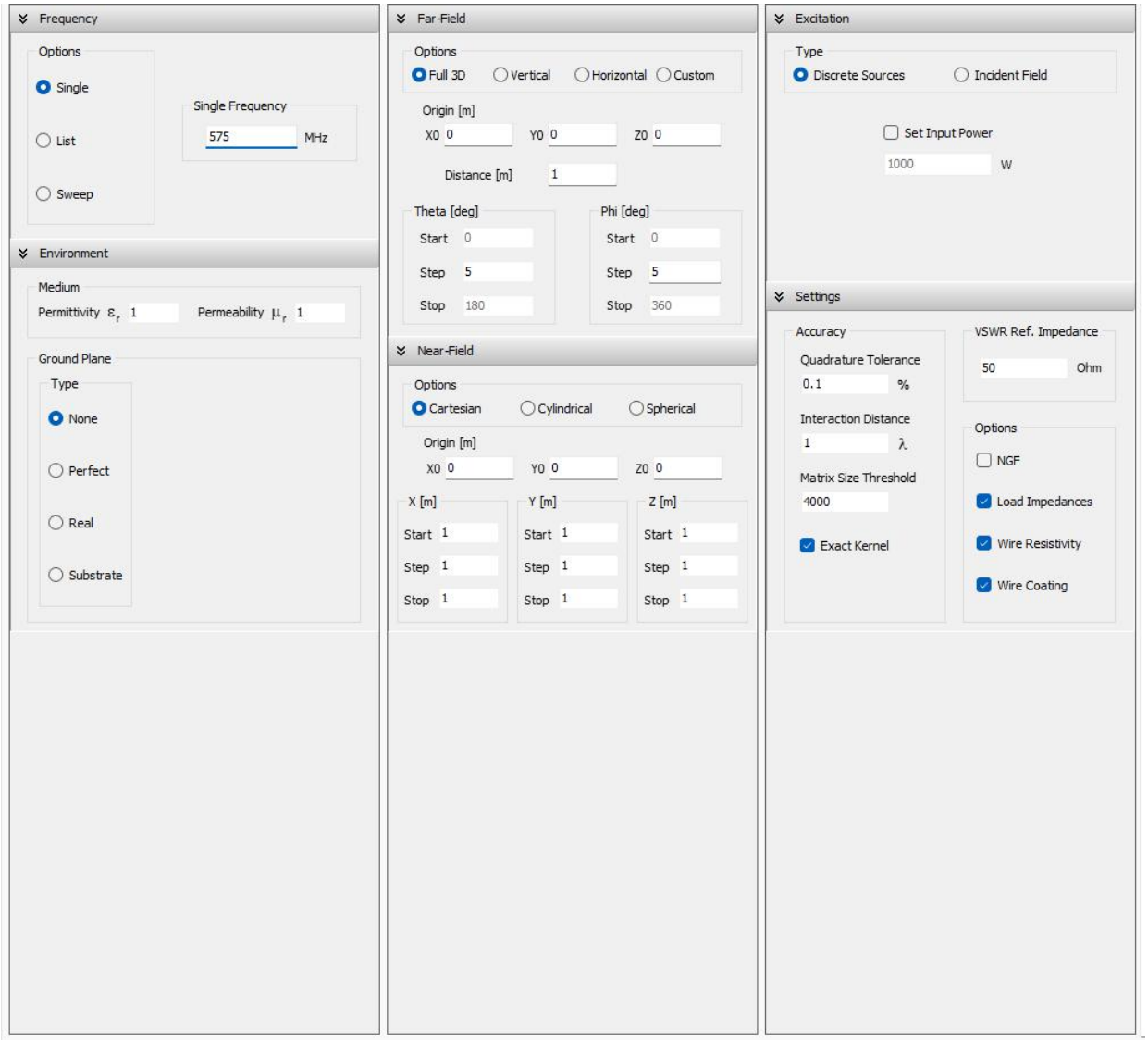
Distance between Deflector and Deflector = $0.34 \times \lambda = 0.178$ m

PROCEDURE

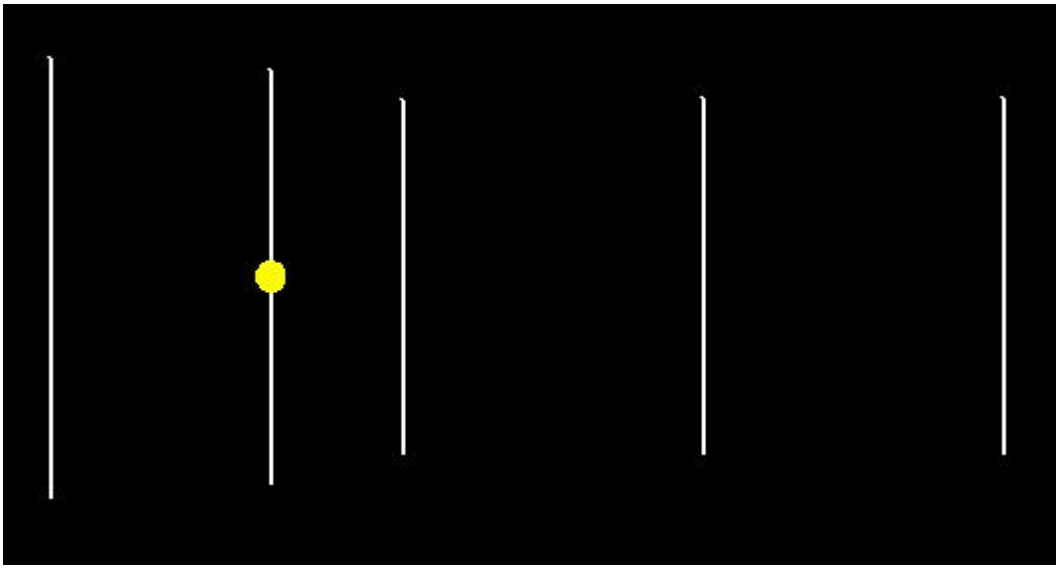
1. Configure the frequency of the antenna as 575MHz and set the preferences as shown in below figure.
2. Construct an Activator from the draw tab and set the coordinates based on above calculated length. Now, draw one Reflector and three Deflector based on above calculated lengths and distances.
3. Select the number of segments as 9, and set the cross-section as 5m.
4. Add the source to the centre of Activator and simulate, using the Run All command.
5. Observe the current plots and the Directive plots and Power Distribution Plots to draw the conclusions.

(a) 5 Element yagi uda antenna

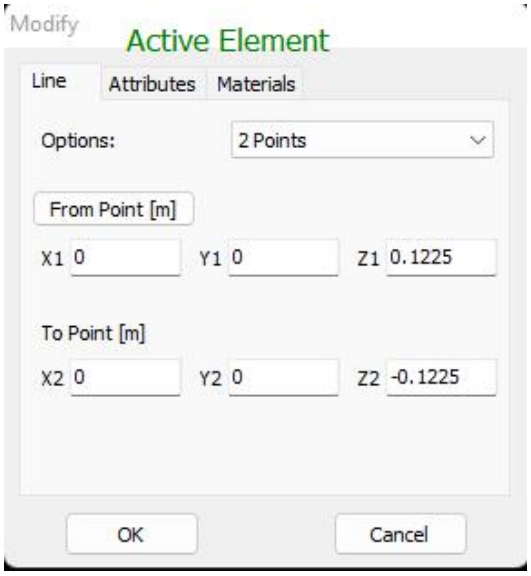
i. Configuration

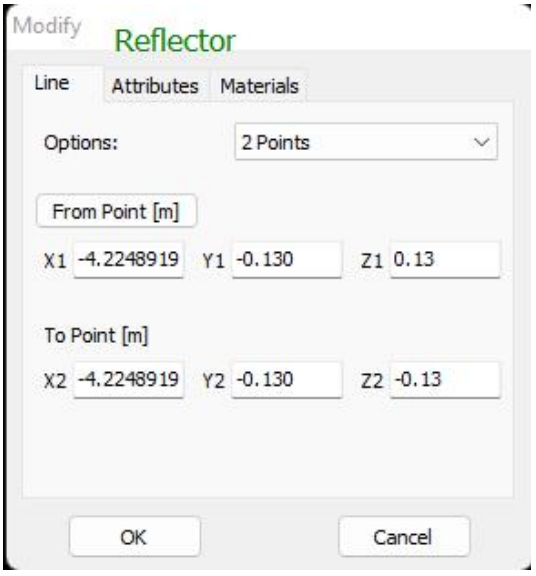


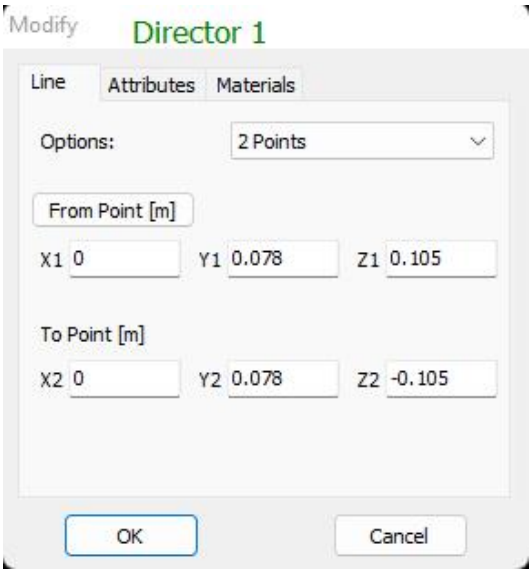
ii. Circuit diagram

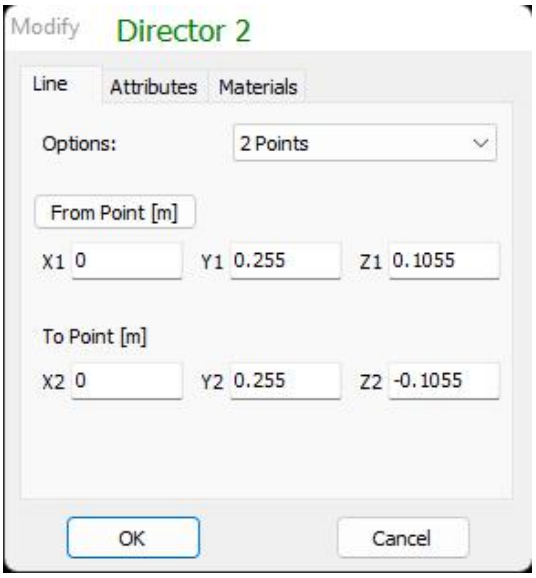


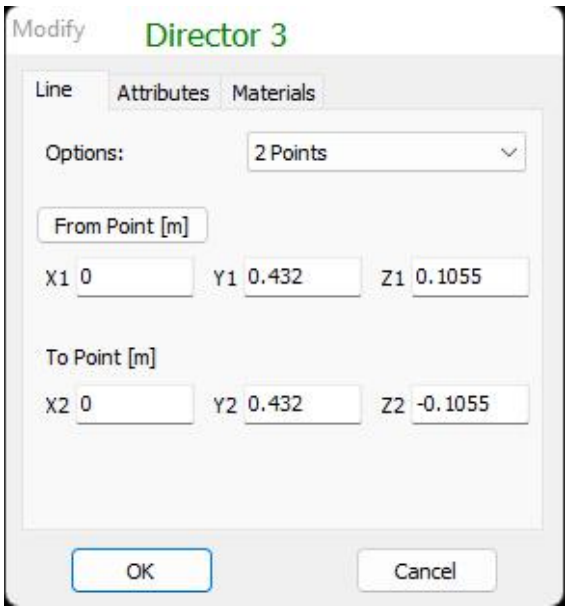
iii. Element lengths



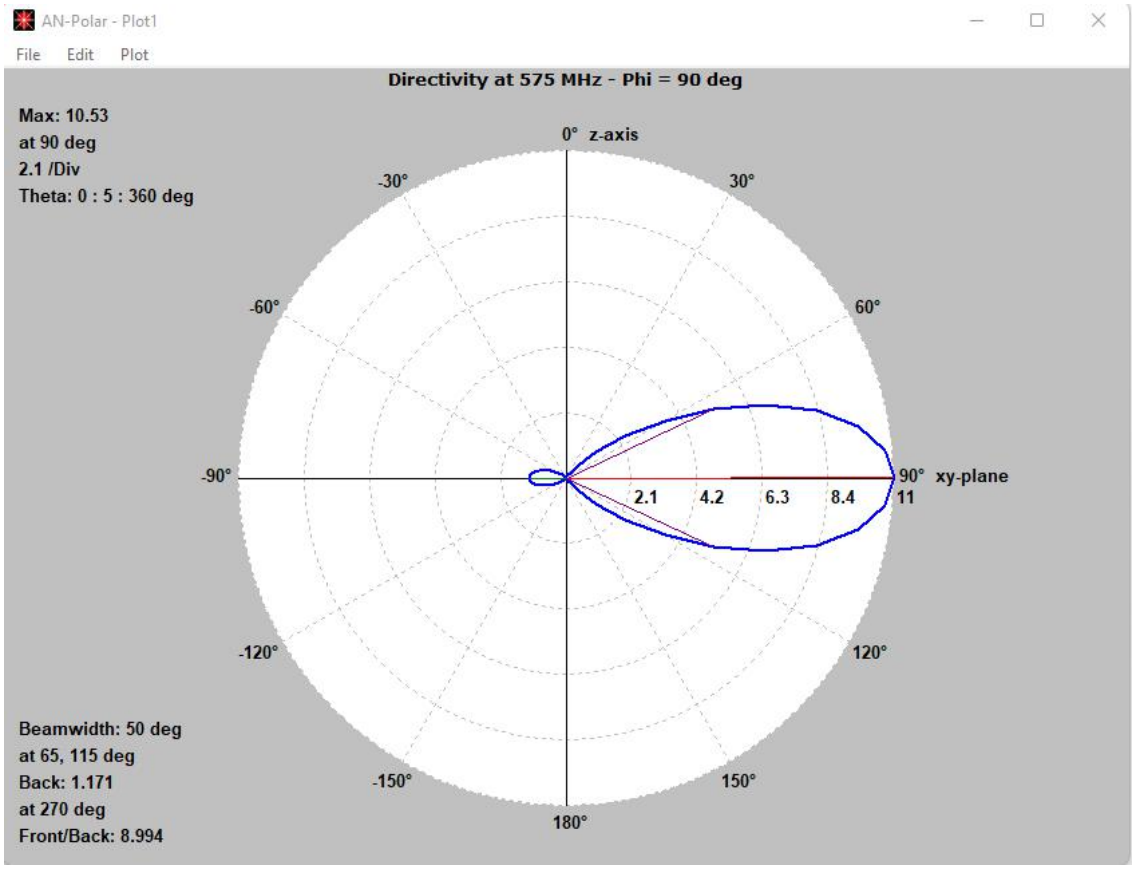




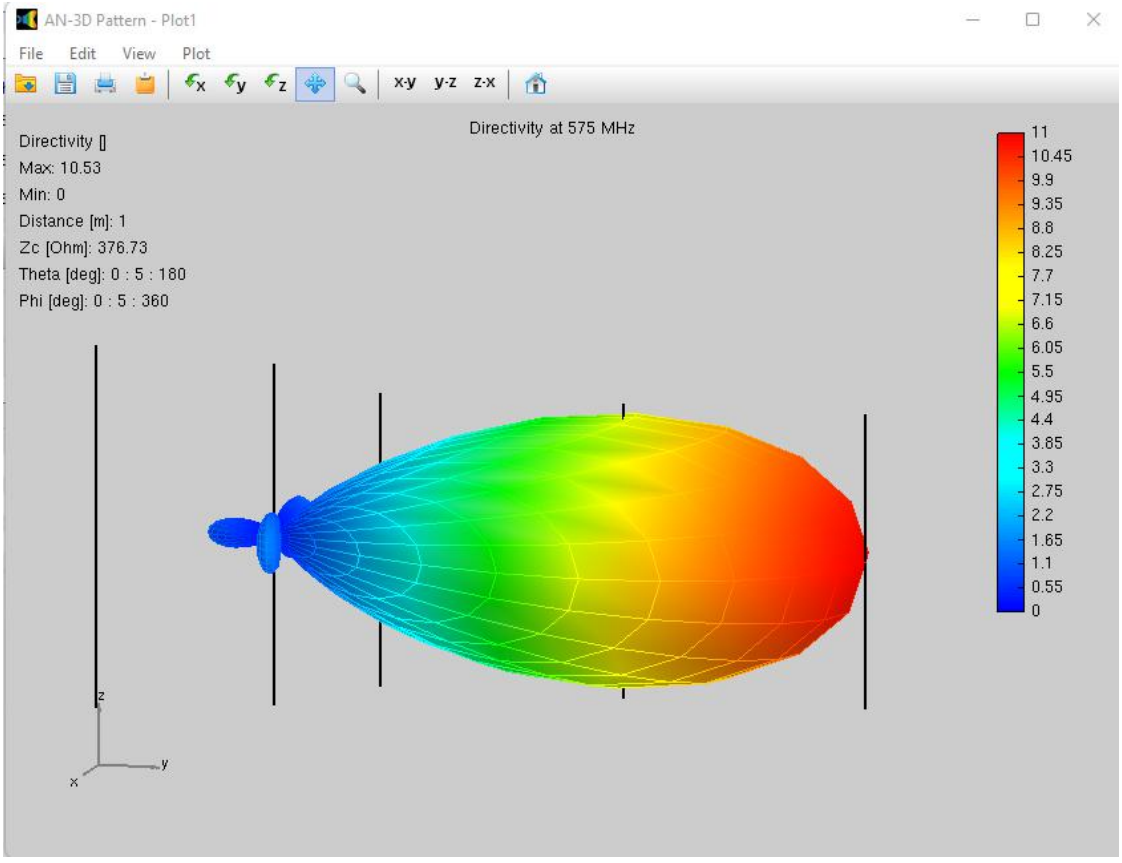




iv. 2-D Plot of Directivity at θ = 90 degree and ϕ = 90 degree

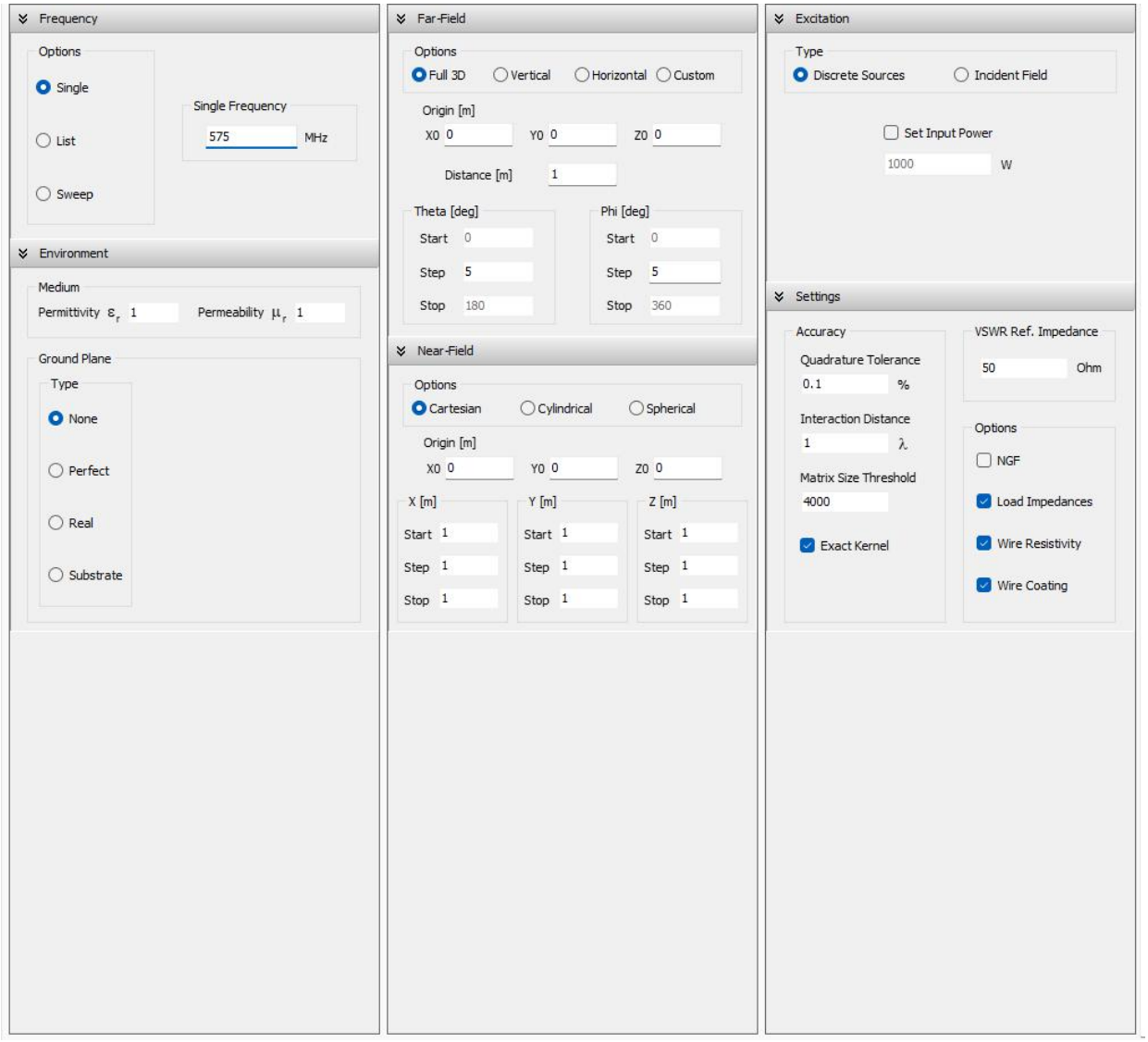


v. 3-D Plot of Directivity



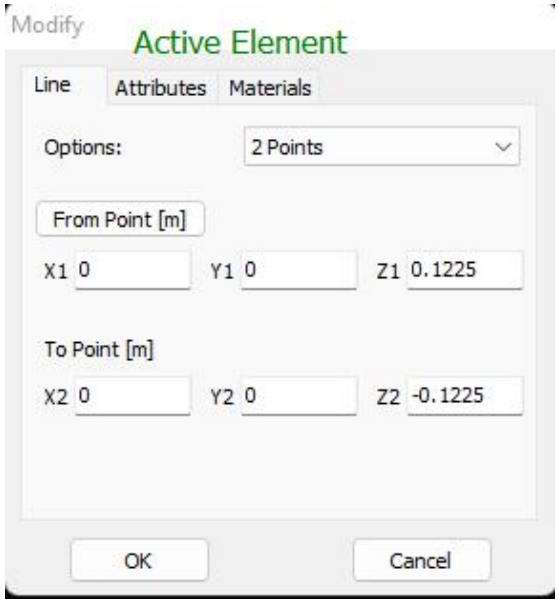
(b) 6 Element yagi uda antenna

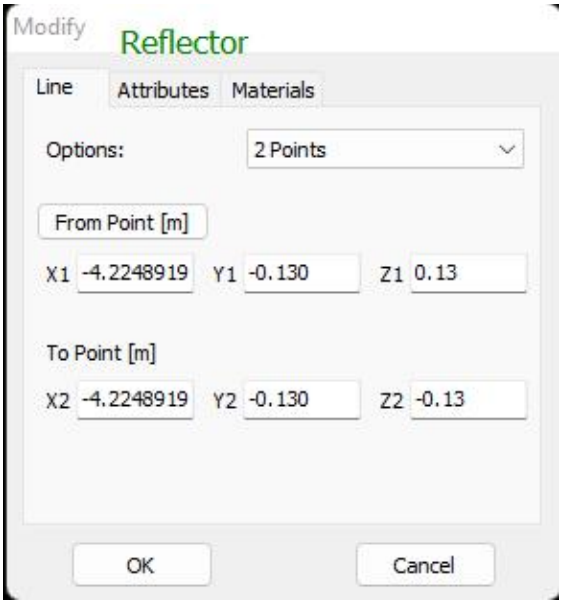
vi. Configuration

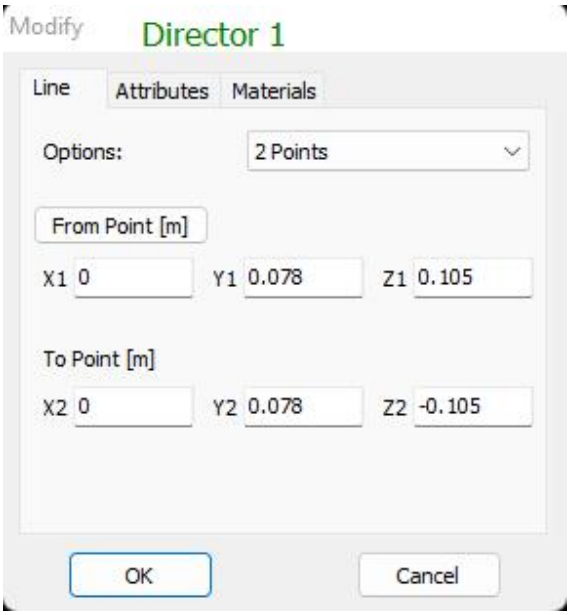


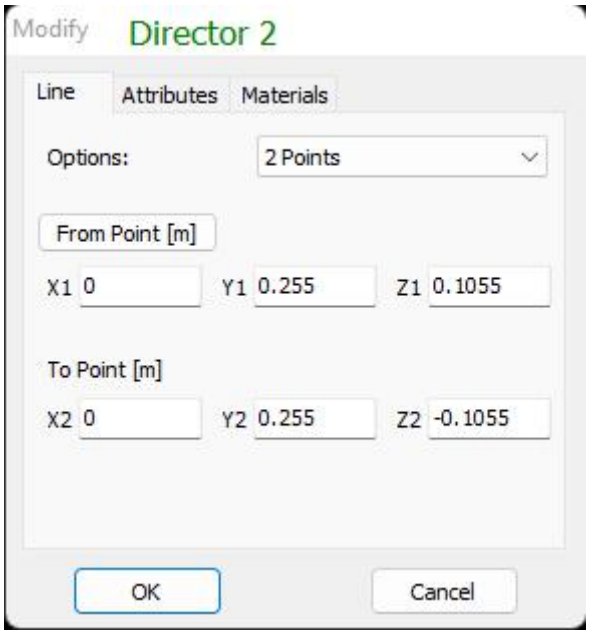
vii. Circuit diagram

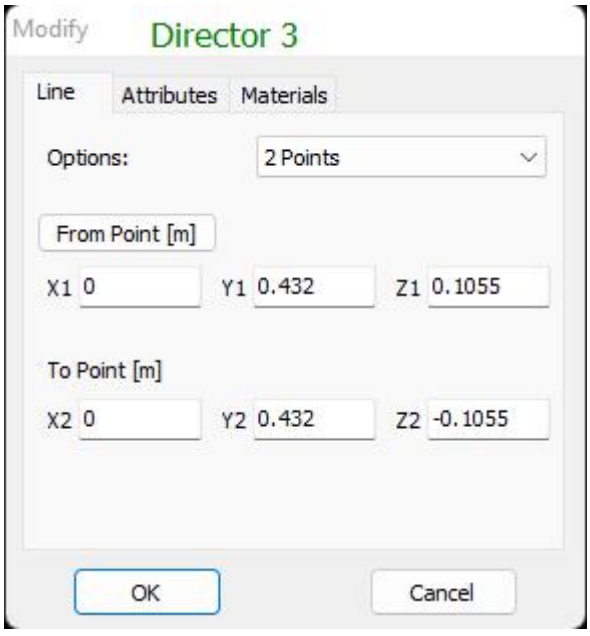
viii. Element lengths

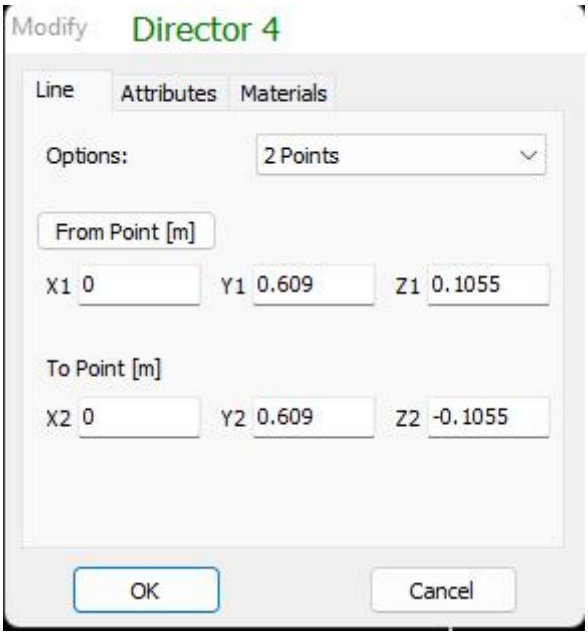

Modify
Active Element
Line
Attributes
Materials
Options:
2 Points
From Point [m]
X1 0
Y1 0
Z1 0.1225
To Point [m]
X2 0
Y2 0
Z2 -0.1225
OK
Cancel


Modify
Reflector
Line
Attributes
Materials
Options:
2 Points
From Point [m]
X1 -4.2248919
Y1 -0.130
Z1 0.13
To Point [m]
X2 -4.2248919
Y2 -0.130
Z2 -0.13
OK
Cancel

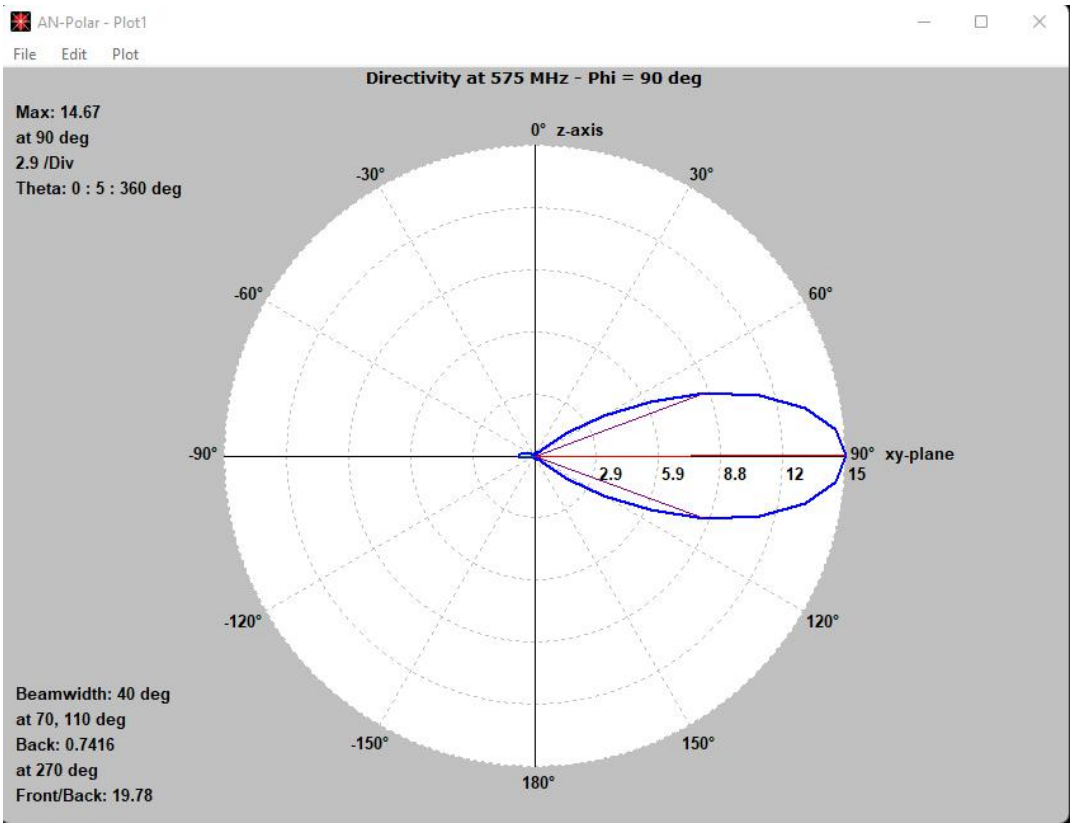

Modify
Director 1
Line
Attributes
Materials
Options:
2 Points
From Point [m]
X1 0
Y1 0.078
Z1 0.105
To Point [m]
X2 0
Y2 0.078
Z2 -0.105
OK
Cancel


Modify
Director 2
Line
Attributes
Materials
Options:
2 Points
From Point [m]
X1 0
Y1 0.255
Z1 0.1055
To Point [m]
X2 0
Y2 0.255
Z2 -0.1055
OK
Cancel

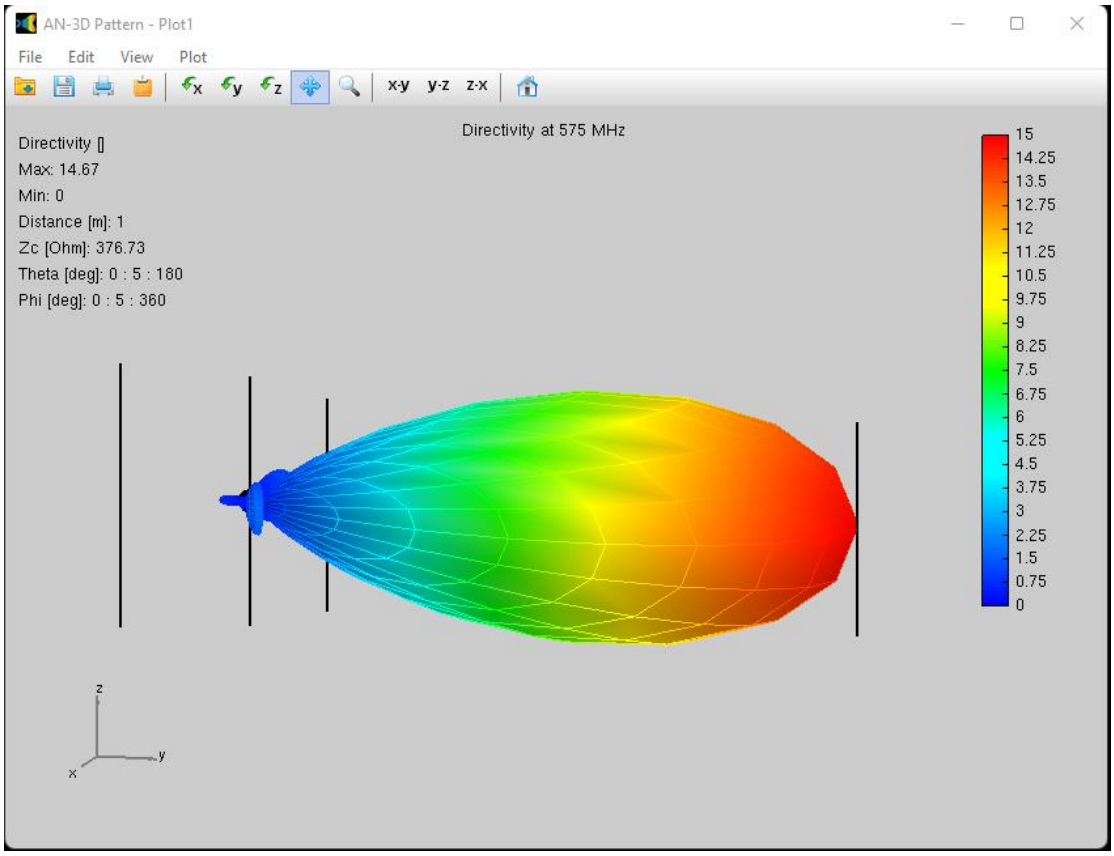

Modify
Director 3
Line
Attributes
Materials
Options:
2 Points
From Point [m]
X1 0
Y1 0.432
Z1 0.1055
To Point [m]
X2 0
Y2 0.432
Z2 -0.1055
OK
Cancel


Modify
Director 4
Line
Attributes
Materials
Options:
2 Points
From Point [m]
X1 0
Y1 0.609
Z1 0.1055
To Point [m]
X2 0
Y2 0.609
Z2 -0.1055
OK
Cancel

ix. 2-D Plot of Directivity at θ = 90 degree and ϕ = 90 degree



x. 3-D Plot of Directivity



CALCULATIONS

From observation plots:

1. 5 Element Yagi – Uda Antenna

HPBW = 50 degree.

Front/Back = 8.994.

FPBW = 2.25 * HPBW = 2.25 x 50 = 112.5 degree.

2. 6 Element Yagi – Uda Antenna

HPBW = 40 degree.

Front/Back = 19.78

FPBW = 2.25 * HPBW = 2.25 x 40 = 90 degree.

CONCLUSION

In this practical we have implemented five and six element Yagi Uda antenna at 575MHz using ANSOF, and also plotted it directivity. It was found that the directivity gain of six element Yagi antenna (14.67) was higher than the five element Yagi uda antenna (10.53). Also, the beamwidth of six element yagi uda antenna (40 deg) is smaller than the Five element antenna (50 deg)