Monopole:

```
n =377;
Io = 5;
r = 20;
lambda = 0.3;
k =(2*pi) / lambda;
etta = 377;
theta = 0.1:0.01:pi;
L =lambda/4;
Elambda = 1j * n * Io * exp(-1j * k * r) * (1 / (2 * pi * r)) *
((cos(k * L * cos(theta) / 2)- cos(k * L / 2)) ./ sin(theta));
figure;
polar(theta, abs(Elambda), 'b*');
hold on;
legend('Monopole Elambda');
hold off;
```

Dipole:

```
n =377;
Io = 5;
r = 20;
lambda = 0.3;
k =(2*pi) / lambda;
etta = 377;
theta = 0.1:0.01:2*pi;
L =lambda/2;
Elambda = 1j * n * Io * exp(-1j * k * r) * (1 / (2 * pi * r)) * ...
((cos(k * L * cos(theta) / 2)- cos(k * L / 2)) ./ sin(theta));
figure;
polar(theta, abs(Elambda), 'r*');
hold on;
legend('Elambda');
hold off;
```

Two element:

```
clc;
clear all;
close all;
c =3e8;
f = 2e9;
lambda = c / f;
d =lambda / 2;
E0 = 1;
phi = 0:0.01:2*pi;
alpha_values = [0, pi/4, pi/2, pi];
figure;
for i = 1:length(alpha_values)
alpha = alpha_values(i);
E =2*E0*cos((pi * d / lambda) * cos(phi)) + alpha;
E_normalized = abs(E) / max(abs(E));
subplot(2, 2, i);
polar(phi, E_normalized);
title(['Radiation Pattern with \alpha = ', num2str(alpha)]);
end
sgtitle('Radiation Patterns for 2-Element Array Antenna');
```

Nele end fire:

```
clc;
clear all;
close all;
c =3e8;
f = 2.6e9;
lambda = c / f;
d =lambda / 2;
E0 = 1;
alpha = 0;
K=2*pi / lambda;
theta = 0:0.01:2*pi;
figure;
for N = 3:6
psi = K * d * sin(theta) + alpha;
E =(sin(N * psi / 2)) ./ (N * psi / 2);
E(psi == 0) = 1;
subplot(2, 2, N- 2); % For N = 3, 4, 5, 6
polarplot(theta, abs(E) * E0);
title(['N=', num2str(N)]);
ax = gca;
ax.ThetaTick = 0:30:360;
ax.ThetaTickLabel = {'0°', '30°', '60°', '90°', '120°', '150°', '180°', '210°', '240°',
'270°', '300°',
'330°'};
end
sgtitle('Radiation Patterns of End-Fire Array Antenna for 4G Airtel');
```

BINOMIAL

```
clc;
clear all;
close all hidden;
f = 24e9;
N=8;
lambda = (3e8) / f;
d =lambda / 2;
k =2*pi / lambda;
theta = 0:0.01:2*pi;
U=k*d*cos(theta);
A=[0 0 0 0 0;
1 0 0 0 0;
1 1 0 0 0;
3 1 0 0 0;
3 4 1 0 0;
10 5 1 0 0;
10 15 6 1 0;
35 21 7 1 0;
35 56 28 8 1;
126 84 36 9 1];
AF =0;
if mod(N, 2) == 0
for n = 1:5
AF =AF+A(N,n) * cos(((2*n-1)/2) * U);
end
else
error('Please enter an even number of elements (N) for the binomial array.');
end
W=abs(AF);
if max(W) > 0
w=W/max(W);
else
w=W;
end
figure;
polar(theta, w);
title('Normalized E-field of Array Antenna in Linear Scale');
afdb = 20 * log10(W);
afplot = (afdb + abs(afdb)) / 2;
figure;
polar(theta, afplot);
title('Non-Normalized Polar Pattern of the Array in dB Scale');
HPBW=(1.06 / (N- 1)^0.5) * (180 / pi);
Do =1.77 * (N)^0.5;
Do_db = 10 * log10(5.5972);
disp('Results:');
disp(['HPBW: ', num2str(HPBW), ' degrees']);
disp(['Directivity (Do): ', num2str(Do), ' linear']);
disp(['Directivity (Do) in dB: ', num2str(Do_db), ' dB']);
```

N ELE BROAD FIRE

```
clc;
clear all;
close all;
c =3e8;
f = 2e9;
lambda = c / f;
d =lambda / 2;
E0 = 1;
phi = 0:0.01:2*pi;
alpha_values = [0, pi/4, pi/2, pi];
figure;
for i = 1:length(alpha_values)
alpha = alpha_values(i);
E =2*E0*cos((pi * d / lambda) * cos(phi)) + alpha;
E_normalized = abs(E) / max(abs(E));
subplot(2, 2, i);
polar(phi, E_normalized);
title(['Radiation Pattern with \alpha = ', num2str(alpha)]);
end
sgtitle('Radiation Patterns for 2-Element Array Antenna');
```