Experiment No : 01

Experiment Name : To study the characteristics of a simple dipole λ/2 antenna.

Objective: To study the power gain of a simple dipole λ/2 antenna.

Theory: An antenna is defined as a usually metallic device (as a rod or wire) for radiating or receiving radio waves. In other word, an antenna is the transitional structure between free-space and a guiding device. The guiding device or transmission line may take the form of a coaxial line or a hollow pipe and is used to transport electromagnetic energy from the antenna to the receiver.

There are different types of antenna such as - wire antenna, aperture antenna, microstrip antenna, array antenna, dipole antenna etc.

The dipole antenna is cut and bent for effective radiation. The length of the total wire, which is being used as a dipole, equals half of the wavelength that is $l = \lambda/2$. Such an antenna is called as half-wave dipole antenna. This is the most widely used antenna because of its advantages

The range of frequency in which half wave dipole operates is around 3KHZ to 300 GHZ. It is mostly used in radio receivers.

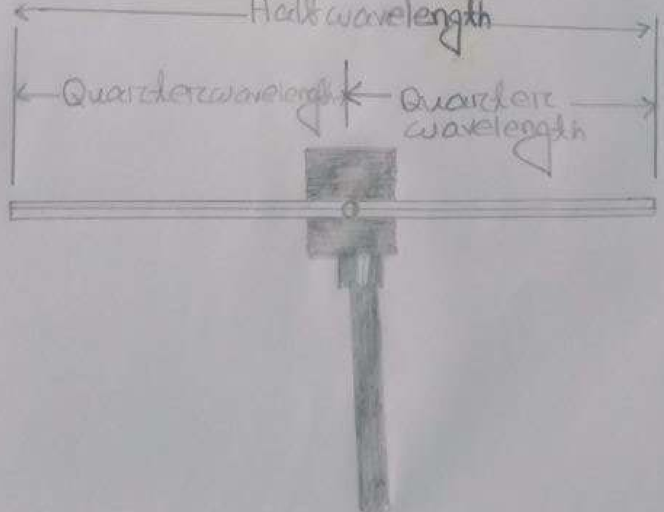

Figure: Half-wave Dipole antenna

$$\text{Gain}(G) = \frac{\text{Maximum radiation intensity from test}}{\text{Maximum radiation intensity from an antenna}}$$

Apparatus Required:

1. Main Unit
2. Antenna trainer
3. Transmitter
4. Receiver
5. RF detector
6. BNC connector
7. $\lambda/2$ Simple dipole antenna

Experimental Data Table:

Experimental data table for simple dipole λ/2 antenna.

Angle	Reading of antenna	Reading RF detector	Normalized power gain, $G = 20\log(\frac{N_i}{N})$ dB
0	100	65	-0.13
10	100	66	0
20	100	63	-0.40
30	100	61	-0.68
40	101	36.4	-5.17
50	101	30.4	-6.73
60	102	27.4	-7.64
70	102	28.4	-7.32
80	102	20	-10.37
90	102	12.3	-14.59
100	102	5.8	-21.12
110	102	5.10	-22.24
120	100	0.7	-39.49
130	110	3.9	-24.57
140	102	3.8	-24.80
150	102	14.0	-13.47
160	104	21.0	-9.95
170	102	34.5	-5.63
180	104	44.5	-3.42
190	101	10	-16.39

Angle	Reading of Antenna	Reading of RF Detector	Normalized power gain, $G = 20\log\left(\frac{N_i}{N}\right)$ dB
200	101	47.8	-2.80
210	102	44.0	-3.52
220	103	38	-4.80
230	102	33	-6.02
240	101	34	-5.76
250	101	32	-6.29
260	100	30	-6.84
270	100	40	-4.35
280	102	42	-3.93
290	102	46	-3.14
300	100	44	-3.52
310	101	48	-2.77
320	102	50	-2.41
330	101	55	-1.58
340	100	60	-0.83
350	100	61	-0.68
360	100	65	-0.13

Calculation:

From table we obtain the maximum reading from the RF detector is $N=66$ corresponding reading of N are

$N_i = N_1, N_2 \cdots N_n$

Let,

$N_1 = 65$

For normalized power gain $G = 20\log\left(\frac{N_i}{N}\right)$

$$= 20\log\left(\frac{65}{66}\right)$$

$$= -0.13$$

by this method all values should be calculated.

Result and Discussion:

From the experiment of simple dipole $\lambda/2$ antenna and the result graph, we find the difference between our obtained result and experiment result. The difference occurred due to different types of noise around us.

Experiment No: 02

Experiment Name: To study the characteristics of a simple $\lambda/4$ dipole antenna.

Objective: To study the power gain of a simple dipole $\lambda/4$ antenna.

Theory:

The quarter wave antenna is a single element antenna fed at one end that behaves as a dipole antenna. It is formed by a conductor in length $\lambda/4$. It is fed in the lower end which is near a conductive surface which works as a reflector.

A quarter wave antenna is grouned antenna that is one fourth wave length of the transmitted and received frequency. Quarter wave antenna is also omnidirectional.

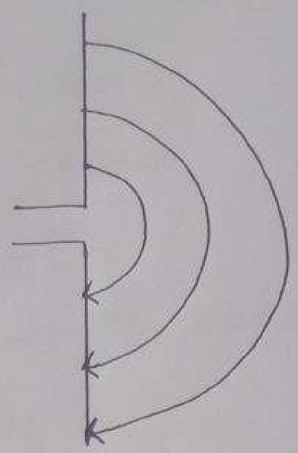

Fig: Quarter wave antenna

The power gain of a simple dipole $\lambda/4$ antenna is calculated by the following equation

$$G = 20\log\left(\frac{N_i}{N}\right)$$

N = Maximum reading

N_i = Corresponding reading of N $[i = 1, 2 \cdots n]$

Apparatus Required:

1. Main unit
2. Antenna trainer
3. Receiving mast
4. BNC connector
5. Simple dipole $\lambda/4$ antenna
6. RF detector
7. others

Experimental Data Table:

Experimental data table for Simple dipole $\lambda/4$ antenna

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain, $G = 20\log\left(\frac{N_i}{N}\right)$ dB
0	100	41	-6.33
10	100	34	-7.96
20	100	22	-11.74
30	101	20	-12.57
40	101	14	-15.67
50	101	85	0
60	100	6	-23.03
70	100	5	-24.61
80	102	7.5	-21.09
90	102	13	-16.31
100	102	16	-14.51
110	101	23	-11.35
120	101	31	-8.76
130	100	31.5	-8.62
140	100	30	-9.05
150	101	24	-10.98
160	100	21	-12.14
170	101	13	-16.31
180	102	20	-12.57
190	102	34	-7.96
200	100	21	-12.14
210	101	13	-16.31

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain, $G = 20\log\left(\frac{N_i}{N}\right)$
220	102	14	−15.67
230	100	20	−12.57
240	100	22	−11.74
250	90	26	−10.29
260	90	30	−9.05
270	100	50	−4.61
280	100	52	−4.27
290	101	44	−5.72
300	100	46	−5.33
310	100	53	−4.10
320	100	55	−3.78
330	102	60	−3.03
340	102	62	−2.74
350	101	72	−1.44
360	101	41	−6.33

Calculation:

For normalized power gain, $G = 20\log\left(\frac{N_i}{N}\right)$

$$= 20\log\left(\frac{41}{85}\right)$$

$$= -6.33\,dB$$

as $N = 85$ and $N_i = 41$

we have to calculate all the values by this method.

Result and Discussion:

From the experiment of ~~di~~ simple dipole $\lambda/4$ antenna and the result graph, we find that there is a difference between our obtained result and experiment. The different causes due to, noise.

Experiment NO : 03

Experiment Name: To study the characteristics of a Yagi-UDA 3-elements folded dipole antenna.

Objective: To study the power gain of yagi-UDA 3-elements folded dipole antenna

Theory:

Yagi-UDA antenna: It is the most commonly used type of antenna for TV reception. This antenna is famous for its high gain and directivity. Frequency range of Yagi-uda antenna operate is around 30MHZ to 3GHZ. Yagi-uda antennas consist of a single driven element connected to a radio transmitter and receive through a transmission line and additional passive radiators with no electrical connection, usually including one reflector and any number of ~~de~~ directors

3- element Yagi-uda antenna:

It consists of three elements that are director, dipole and reflector. It may have one or multiple directors. Dipole is the feed point where feedline is usually attached from transmitter. It helps in transfer of energy from transmitter module to antenna. The feed point is located at the center of the driven element.

The director is designed mainly for receiving EM waves. It helps to achieve desired gain and directional pattern. The reflector is placed at rear of dipole or driven element.

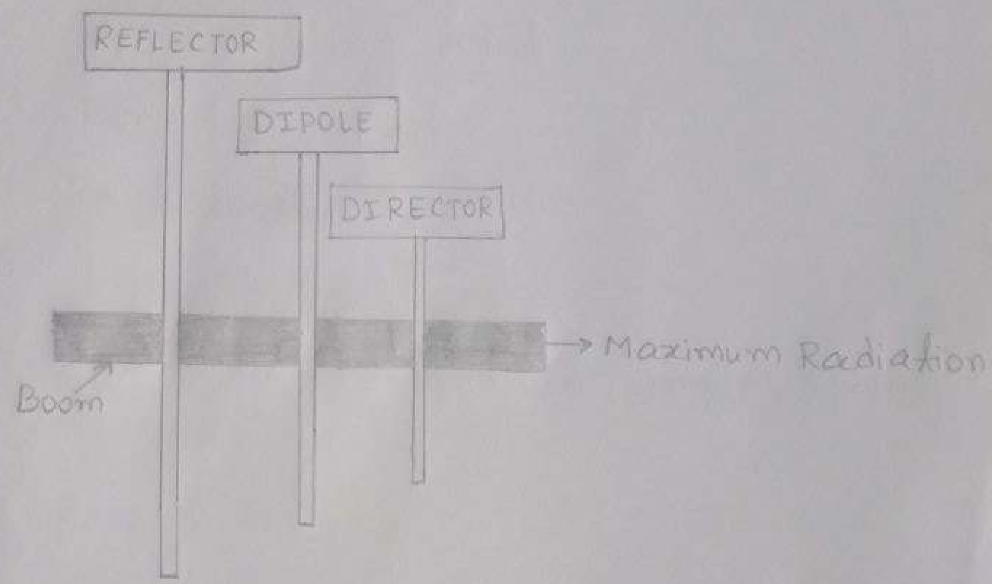

Fig: 3-element yagi-uda antenna

Power gain of yagi-UDA 3-elements Simple dipole is,

$$G = 20\log\left(\frac{N_i}{N}\right)dB$$

N = Maximum reading

N_i = Corresponding reading of N

Apparatus Required:

1. Antenna trainer
2. Transmitting Mast
3. Receiving mast
4. RF detector
5. BNC Cable
6. Yagi-uda 3-elements simple dipole antenna
7. power supply

Experimental Data Table:

Experimental data table for yagi-UDA 3-element folded dipole antenna.

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain, $G = 20\log(\frac{N_i}{N})$ dB
0	100	75.5	-0.56
10	100	65.5	-1.79
20	100	57.5	-2.92
30	101	57.3	-2.95
40	101	48.4	-4.42
50	100	33.5	-7.62
60	100	24.5	-10.33
70	100	13.3	-15.64
80	100	2.8	-29.17
90	102	1.9	-32.54
100	102	4.4	-25.25
110	101	7.8	-20.27
120	101	20.4	-11.92
130	102	31.2	-8.23
140	101	33.2	-7.69
150	100	30.8	-8.34
160	100	18.8	-12.63
170	102	29	-8.87
180	101	39	-6.29

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain, $G_r = 20\log(\frac{N_i}{N})$ dB
190	102	45	-5.05
200	102	80.5	0
210	100	75	-0.61
220	100	60.7	-2.45
230	90	55.6	-3.21
240	100	52.7	-3.68
250	100	50	-4.14
260	101	59	-2.70
270	101	52	-3.80
280	90	60	-2.55
290	100	62	-2.27
300	102	65	-1.86
310	100	63	-2.13
320	100	67	-1.59
330	101	70	-1.21
340	101	72	-0.97
350	102	71	-1.09
360	101	75.5	-0.56

Calculation:

From table we obtain the maximum reading from the RF detector is

$N = 80.5$

Corresponding reading of N, $N_i = 75.5$

$\therefore$ Normalized power gain, $G = 20\log\left(\frac{75.5}{80.5}\right)$

$= -0.56$

Result and Discussion:

From the experiment of yagi-UDA 3-element folded dipole we see there is difference between our obtained outcome and experiment.

The difference is due to noise of the environment.

Experiment No: 04

Experiment Name: To study the characteristics of a Yagi-UDA 5-elements simple dipole antenna.

Objective: To study the power of yagi-uda 5-elements simple dipole antenna.

Theory:

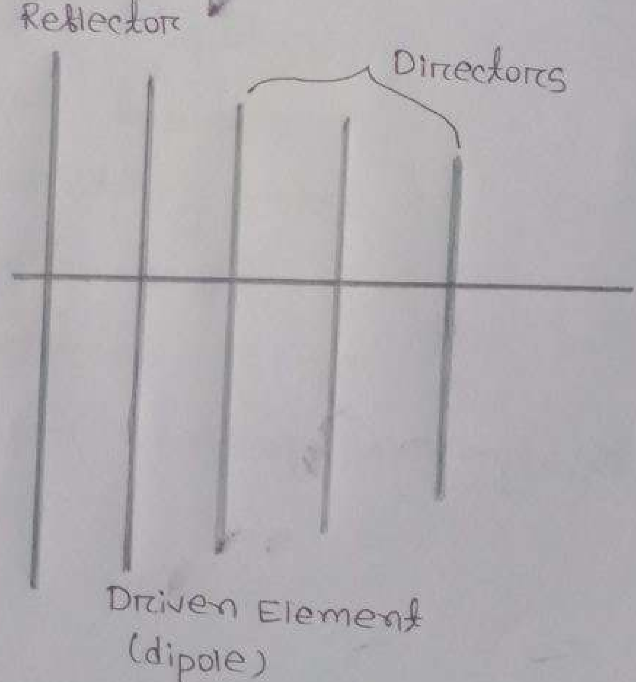

Fig: Yagi-uda 5-elements simple dipole antenna

Figure shows us Yagi-uda 5-elements simple dipole antenna. It has three directors, one reflectors and a driven element which is a folded dipole.

$$\text{power gain}(G) = 20\log\left(\frac{N_i}{N}\right) dB$$

Here,

N = Maximum reading

N_i = Corresponding reading of N

Apparatus Required:

1. Antenna trainer
2. Transmitting mast
3. Receiving mast
4. RF detector
5. Yagi-uda 5-elements simple dipole antenna
6. power supply

Experimental Data Table:

Experimental data table for Yagi-uda 5-element antenna.

Angle	Reading of Antenna	Reading of RF detector	Normalized gain $G = 20\log(\frac{N_i}{N})$ dB
0	100	75.5	-0.56
10	100	80.5	0
20	100	65.5	-1.79
30	101	57.5	-2.95
40	100	41.5	-5.78
50	101	33.4	-7.64
60	101	24.4	-10.37
70	101	13.3	-15.64
80	102	2.4	-30.51
90	102	2.6	-29.82
100	100	1.9	-32.54
110	100	4.4	-25.25
120	101	20.4	-11.92
130	102	31.2	-8.23
140	100	33.9	-7.51
150	99	18.8	-12.63
160	100	29	-8.87
170	100	3	-28.57
180	100	18.3	-12.87

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain, $G = 20\log\left(\frac{N_i}{N}\right)$ dB
190	101	29	-8.87
200	101	39	-6.29
210	102	45	-5.05
220	100	47	-4.67
230	100	48	-4.49
240	100	50	-4.14
250	101	52	-3.80
260	101	53	-3.63
270	100	57	-2.99
280	100	60	-2.55
290	100	62	-2.27
300	101	65	-1.86
310	101	63	-2.139
320	100	70	-1.21
330	100	72	-0.97
340	100	73	-0.85
350	102	74.5	-0.67
360	102	75.5	-0.56

Calculation:

From table we obtain the maximum reading from the detector is 80.5

Let, corresponding reading of N is 75.5

$\therefore$ Normalized power gain, $G = 20\log\left(\frac{N_i}{N}\right)$

$$= 20\log\left(\frac{75.5}{80.5}\right)$$

$$= -0.56$$

Result and Discussion:

From the experiment, we find the difference between our obtained result and experimental result. This happen due to noise.

Experiment No: 05

Experiment Name: To study the characteristics of a Yagi-UDA 7-elements simple dipole antenna.

Objective: To study the gain of Yagi-Uda 7-element Simple antenna.

Theory:

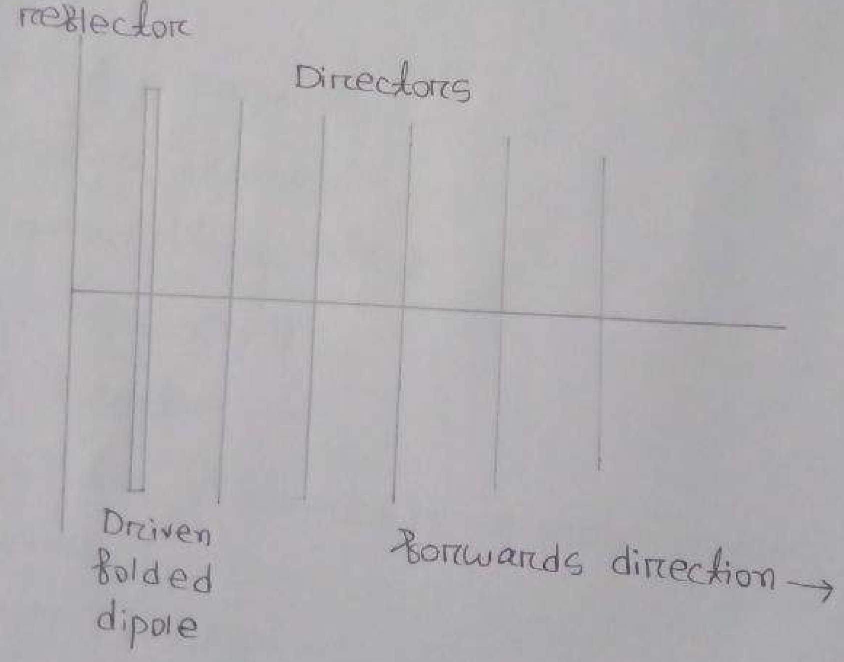

Fig: Yagi-uda 7-elements Simple dipole antenna

Figure shows us Yagi-uda 7-elements simple dipole antenna. It has 5 directors one reflectors and a driven element.

power gain, $G = 20\log\left(\frac{N_i}{N}\right)$ dB

here,

N_i = Corresponding reading of each of values

N = Maximum reading

Apparatus Required:

1. Antenna trainer
2. Transmitting mast
3. Receiving mast
4. RF detector
5. Yagi-uda 7-elements simple dipole antenna
6. power supply

Experimental Data Table:

Experimental data table for Yagi-Uda 7-element Simple dipole antenna.

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain, $G = 20\log(\frac{N_i}{N})$ dB
0	100	78.8	0
10	100	65.5	-1.61
20	100	57.3	-2.77
30	99	48.5	-4.22
40	99	33.6	-7.40
50	100	24.5	-10.15
60	101	24.5	-10.15
70	101	13.3	-15.45
80	100	2.8	-28.99
90	100	1.9	-92.36
100	100	4.4	-25.06
110	100	7.8	-20.09
120	101	20.4	-11.74
130	101	30.2	-8.33
140	100	33.2	-7.51
150	100	30.8	-8.16
160	100	18.8	-12.45
170	102	29	-8.68
180	102	39	-6.11
190	100	55	-3.12

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain, $G = 20\log\left(\frac{N_i}{N}\right)$ dB
200	101	48	-4.91
210	100	50	-3.95
220	100	30	-8.39
230	101	20	-11.91
240	101	10	-17.93
250	100	20	-11.91
260	102	44	-5.06
270	102	30	-8.39
280	102	33.5	-7.43
290	100	39.8	-5.93
300	90	45.6	-4.75
310	90	48.6	-4.20
320	100	55.5	-3.04
330	101	60.8	-2.29
340	101	68.8	-1.18
350	100	75.5	-0.37
360	102	78.8	0

Calculation:

From table we obtain the maximum reading from the RF detector is $N = 66$

Corresponding reading of N are

$$N_i = N_1, N_2 --- N_n$$

Let, $N_1 = 65.5$

$$\therefore \text{Gain, } G = 20\log\left(\frac{N_i}{N}\right)$$

$$= 20\log\left(\frac{65.5}{66}\right)$$

$$= -1.61$$

Result and Discussion:

From the experiment, we find the difference between our obtained result and experimental result. The difference occured due to different types of noise around us.