



Practical Lab Report

Faculty of Engineering and Technology

Department of Information and Communication Engineering

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Experiment no: 01

Name of the Experiment: To study the characteristics of a simple $\lambda/2$ dipole $\lambda/2$ antenna.

Objective: To study the power gain of a simple dipole $\lambda/2$ 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.

etc. 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 $\lambda = \lambda/2$. 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 3 kHz to 300 GHz. It is mostly used in radio receivers.

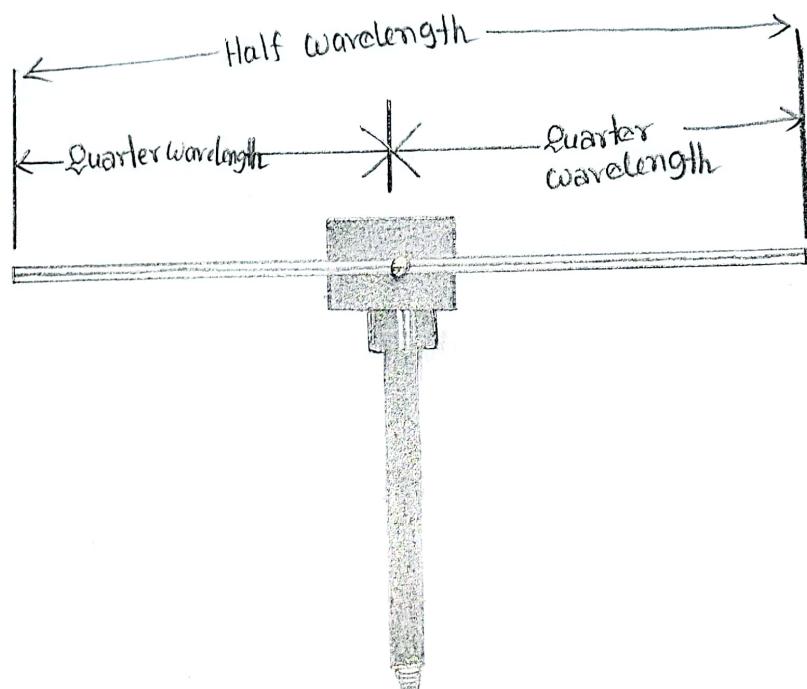


Figure: Half-wave Dipole antenna

Gain (G_t) = Maximum radiation intensity from test

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

Table-1: Experimental data table for simple dipole $\lambda/2$ antenna.

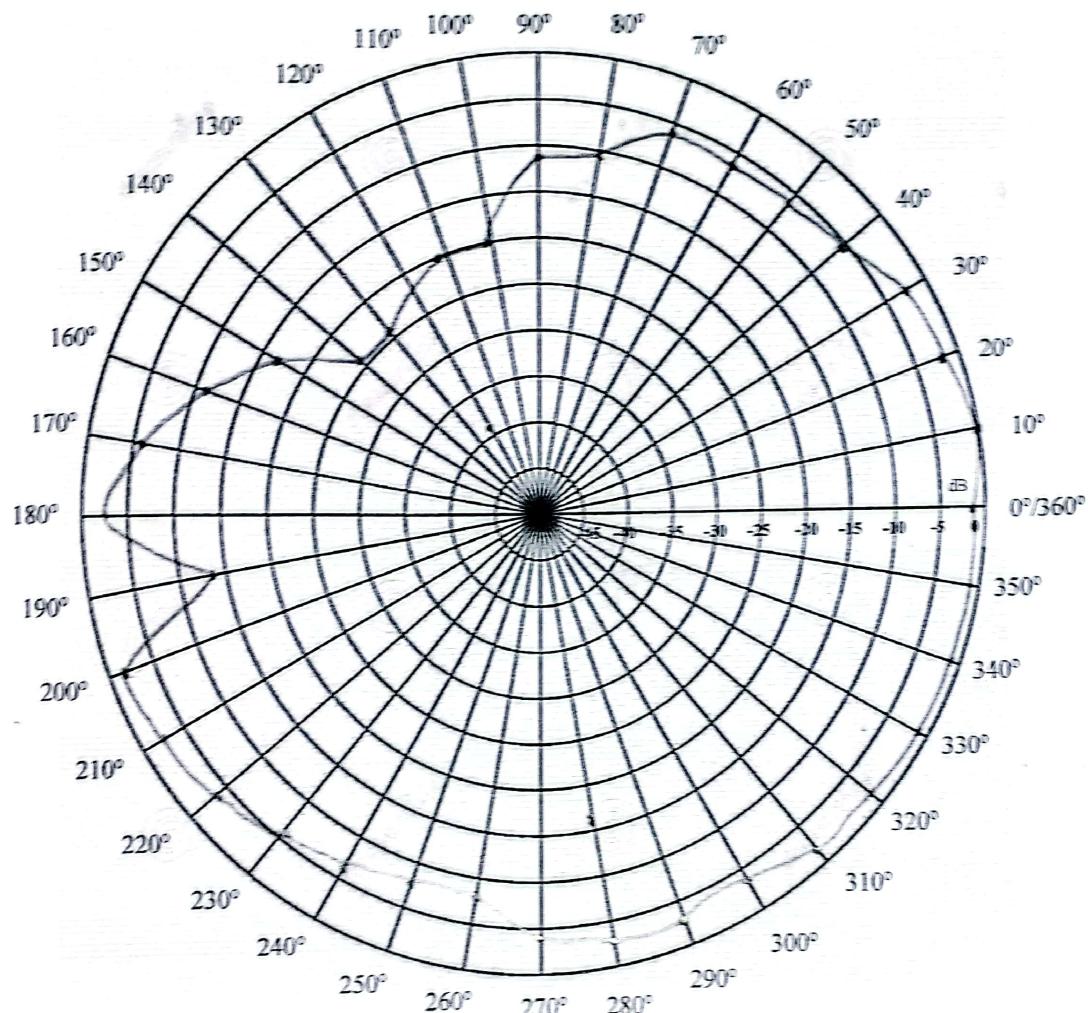
Angle	Reading of antenna	Reading RF detector	Normalized power gain $G = 20 \log(N_i/N) \text{ dB}$
0	200	65	-0.13
10	200	66	0
20	200	63	-0.40
30	200	61	-0.68
40	201	36.4	-5.14
50	202	30.4	-6.73
60	202	27.4	-7.64
70	202	28.4	-7.32
80	202	20	-10.37
90	202	12.9	-14.59
100	202	6.8	-21.12
110	202	5.18	-22.24
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	24.5	-5.63
180	104	44.5	-3.42
190	101	30	-16.39
200	101	47.8	-2.80
210	102	44.0	-3.52
220	103	38	-4.80
230	102	33	-6.02

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain $G_r = 20 \log(N_i/N) \text{ dB}$
240	101	34	-5.76
260	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

ANTENNA RADIATION CHARACTERISTICS

Name:

Antenna Type: Simple dipole $\lambda/2$ Antenna



Calculation:

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

Corresponding reading of N are $N_i = N_1, N_2, \dots, N_n$

Let $N_2 = 65$

$$\begin{aligned} \text{For normalized power gain } G_r &= 20 \log \left(\frac{N_i}{N} \right) \\ &= 20 \log \left(\frac{65}{66} \right) \\ &= -0.13 \end{aligned}$$

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 that the difference between our obtained result and experiment result. The difference occurred due to different types of noise around ~~as as well~~ as well as in.

Experiment no. 09

Name of the experiment : To study the characteristics of a simple
A/H dipole antenna.

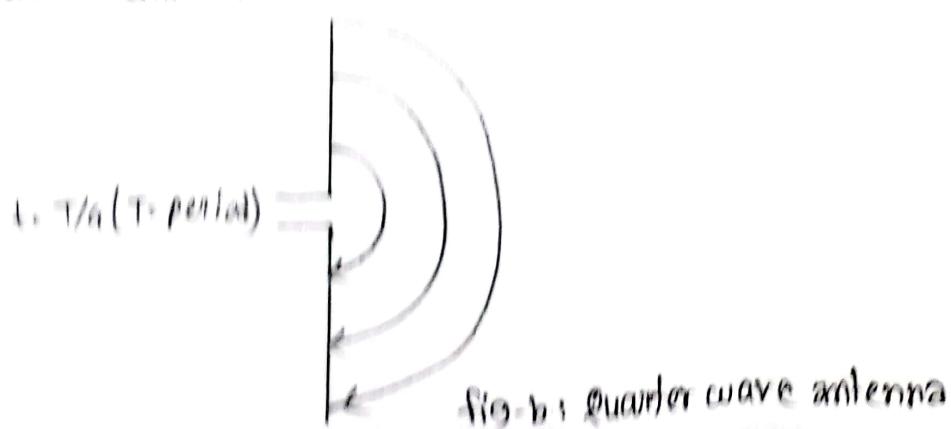
Objectives : To study the power gain of a simple A/H dipole
Antenna.

Theory

The quarter wave antenna is a single element antenna fed at one end and 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 grounded antenna that is one-fourth wavelength of the transmitted and received frequency.

Quarter wave antenna is also omnidirectional.



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

$$G = 20 \log \left(\frac{N_i^2}{N} \right)$$

N = maximum reading

N_i = corresponding reading
of N [$i = 1, 2, \dots, n$]

Equipment:

- 1) Main unit
- 2) Antenna trainer
- 3) Receiving mast
- 4) BNC connector
- 5) Simple dipole $\lambda/4$ antenna
- 6) R.F. detector
- 7) Others

Experimental Data Table:

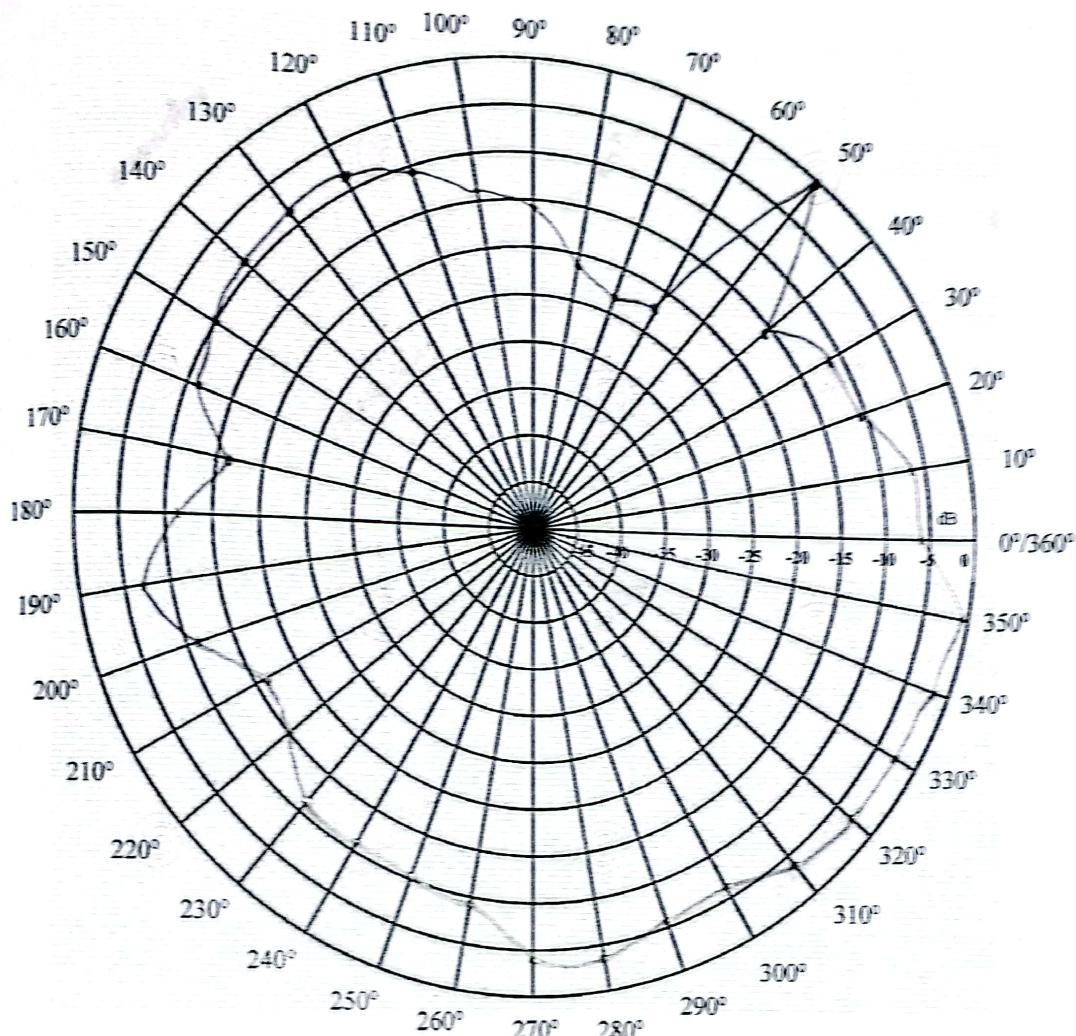
Experimental data table for simple dipole $\lambda/4$ antenna.

Angle	Reading of Antenna	Reading of RF detector	Normalized power gain $G_t = 20 \log(N_t/N)$
0	100	47	-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
220	102	19	-15.67
230	100	20	-12.57

Angle	Reading of Antenna	Reading of RF detector	Normalized power Gain, $G = 20 \log(M_i/N)$
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	-1.94
360	101	82	-6.33

ANTENNA RADIATION CHARACTERISTICS

Name:
Antenna Type: Simple $\lambda/4$ dipole antenna



calculation:

For normalized power gain $G_r = 20 \log \left(\frac{N_1}{N_2} \right)$
 $= -6.33 \text{ dB}$

as $N_1 = 85$ and $N_2 = 41$

we have to calculate all the values by this method

Result and Discussion:

From the experiment of simple dipole $\lambda/2$ 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

12

Name of the experiment: 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 antennas operate is around 80 MHz to 3 GHz. 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 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 the 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.

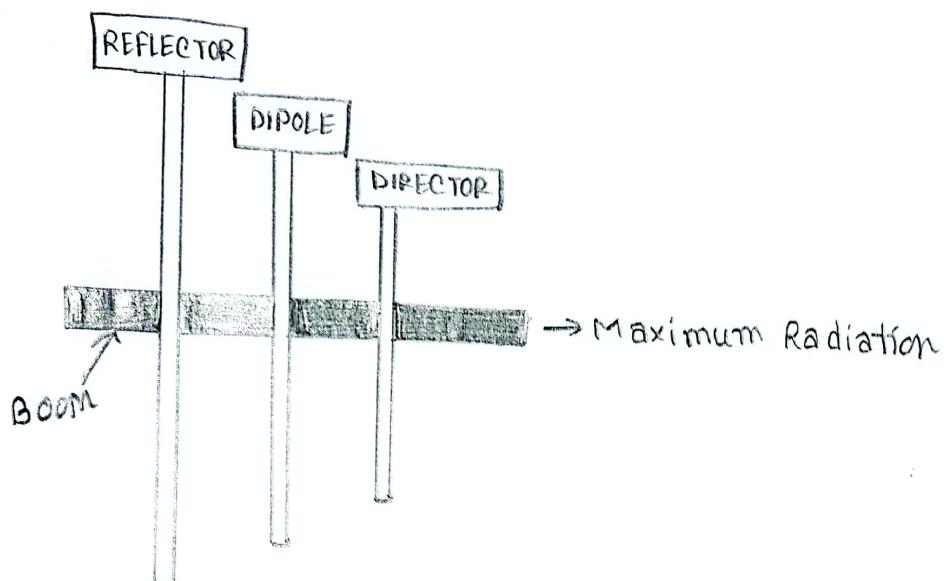


fig.c - 3-element Yagi-Uda antenna

power gain of Yagi-UDA 5-elements simple dipole is ,

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

N = Maximum reading

N_i = Corresponding reading of N

Apparatus Required:

- 1) Antenna trainer
- 2) Transmitting Mart
- 3) Receiving mart
- 4) RF detector
- 5) BNC cable
- 6) Yagi-UDA 5-elements simple dipole antenna
- 7) Power supply

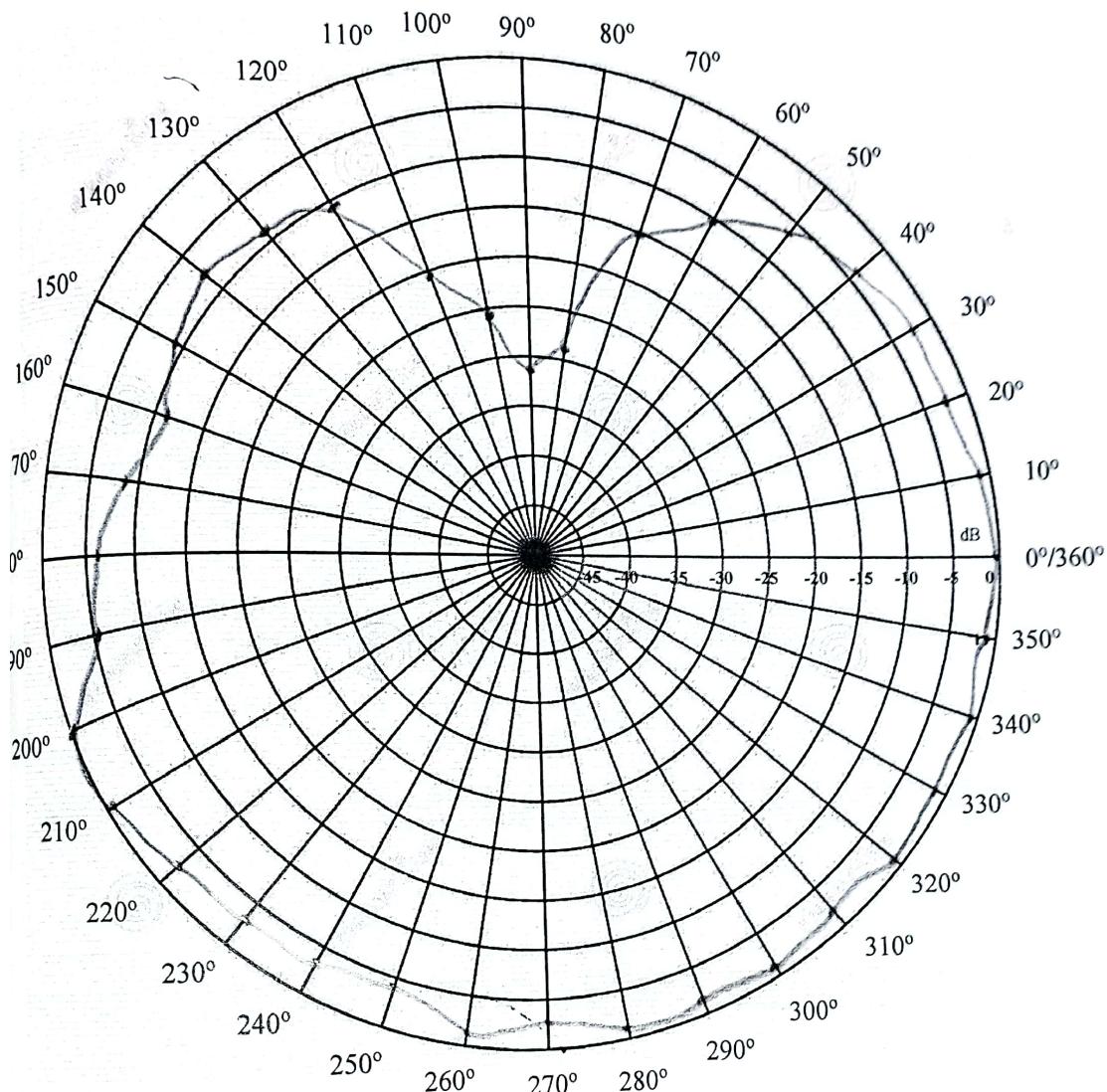
Table: Experimental data table for yagi-Uda 3-element folded dipole antenna.

Angle	Reading of Antenna trainer	Reading of RF detector	Gain $G_t = 20 \log(N_t/N)$
0	100	95.5	-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	9.8	-20.17
90	102	1.9	-32.54
100	102	4.4	-25.25
110	101	7.8	-20.27
120	101	20.9	-11.92
130	102	31.2	-8.23
140	101	23.2	-7.69
150	100	30.8	-8.34
160	100	18.8	-12.63
170	102	29	-8.87
180	101	39	-6.29
190	102	45	-5.05
200	102	80.5	0

Angle	Reading of Antenna-trainer	Reading of RF detector	Gain $G = 20 \log(N_i/N)$
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	-4.19
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

YNA RADIATION CHARACTERISTICS

Type: Yagi-Uda 3-element folded dipole antenna



calculation:

From table we obtain the maximum reading from the RF detector is $N=66$ $N=80.5$

Corresponding reading of $N_1, N_2 = 75.5$

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

$$= -0.56$$

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: 09

18

Name of the experiment: 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:

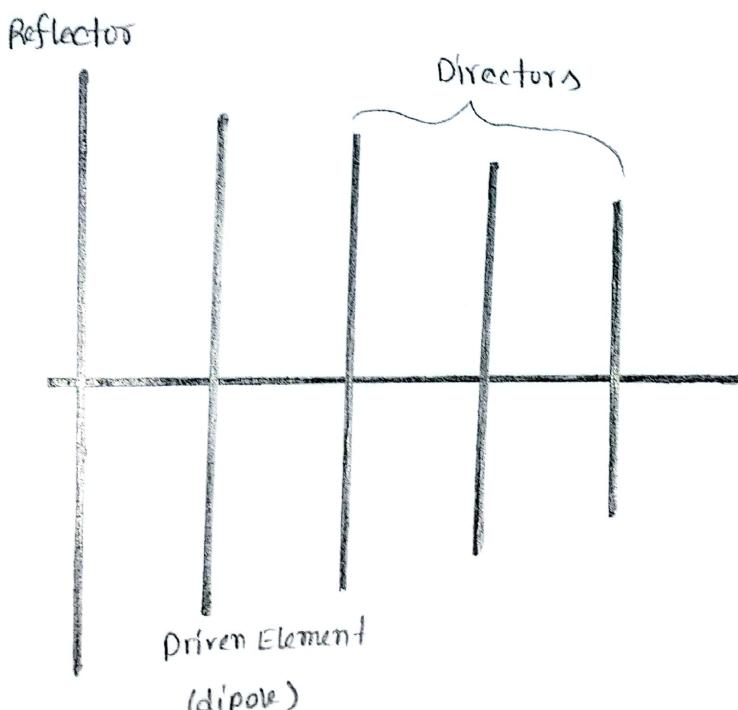


fig-d: Yagi-Uda 5-elements simple dipole antenna

Figure shows us Yagi-Uda 5-elements simple dipole antenna.

It has three directors, one reflector and a driven element which is a folded dipole.

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

N = Maximum reading

N_i = Corresponding reading of N

Apparatus Required:

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

Table:

20

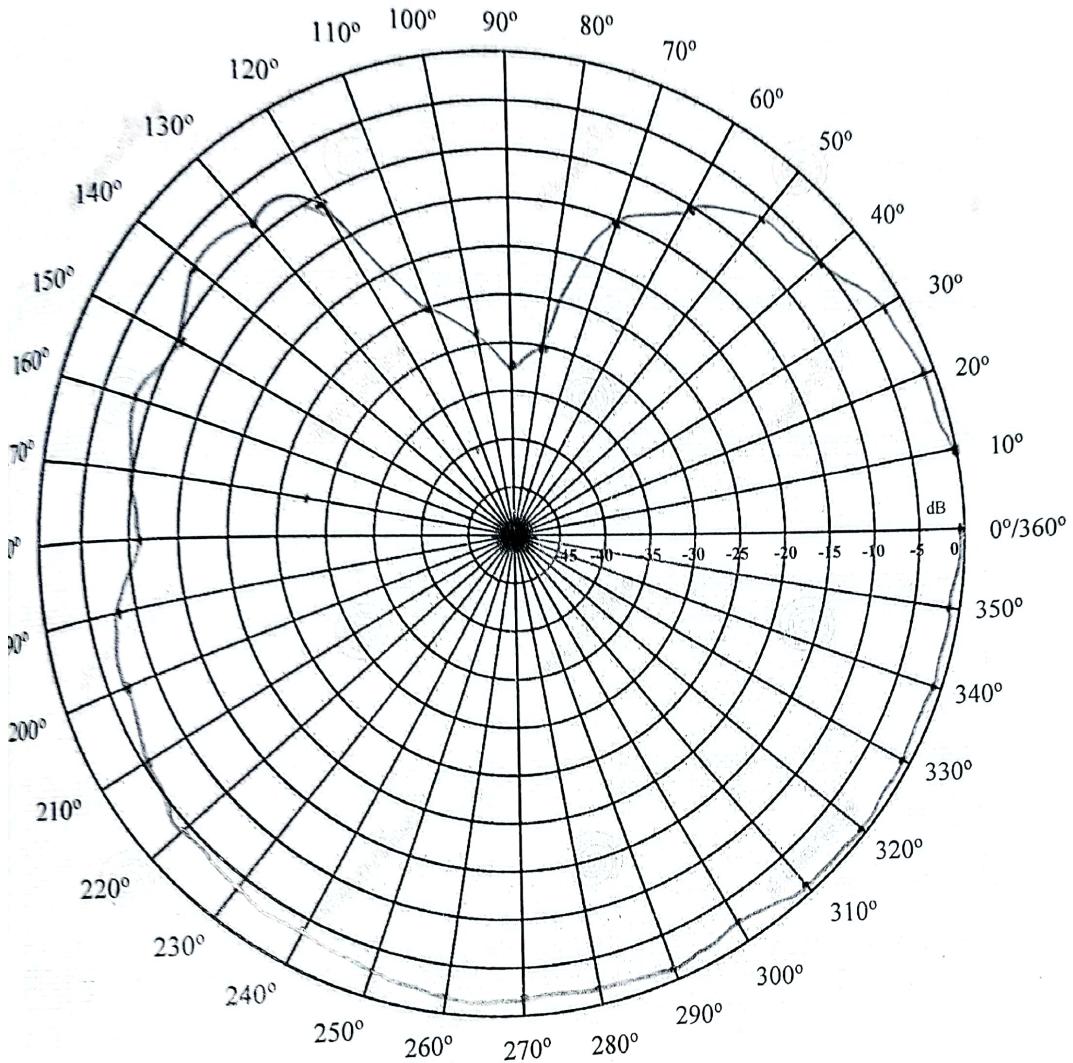
Experimental table for Yagi-UDA 5 element antenna

Angle	Reading of Antenna	Reading of RF detector	Normalized gain $G = 20 \log_{10} (N_i/N)$
0	100	75.5	-0.56
10	100	80.5	0
20	100	65.5	-1.70
30	101	57.3	-2.95
40	100	41.4	-5.78
50	101	33.9	-7.64
60	101	24.4	-10.37
70	101	13.3	-15.64
80	102	2.4	-30.51
90	102	2.6	-20.82
100	100	1.9	-32.54
110	100	9.4	-25.25
120	101	20.4	-11.02
130	102	31.2	-8.23
140	100	33.9	-7.51
150	09	18.8	-12.63
160	100	29	-8.87
170	100	3	-28.57
180	100	18.3	-12.87
190	101	29	-8.87
200	101	39	-6.29
210	102	45	-5.05

Angle	Reading of Antenna	Reading of RF detector	Normalize gain $G = 20 \log(N_i/N)$
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	-3.09
280	100	60	-2.85
290	100	62	-2.27
300	101	63	-1.86
310	101	63	-2.129
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

RADIATION CHARACTERISTICS

Type: Yagi-Uda 5 elements simple dipole antenna



Calculation:

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

Let corresponding reading of N is 75.5

$$\begin{aligned}\text{i: Normalized power gain } G_c &= 20 \log \left(\frac{N_i}{N} \right) \\ &= 20 \log \left(\frac{75.5}{80.5} \right) \\ &= -0.56\end{aligned}$$

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

Name of the experiment: 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:

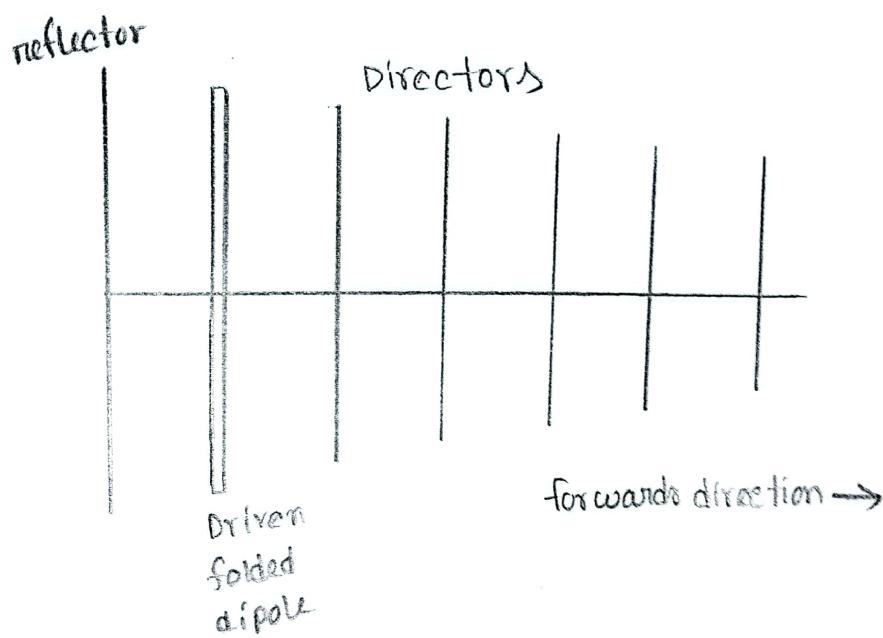


fig:e- Yagi-Uda 7-elements simple dipole antenna.

figure shows us Yagi-Uda 7-elements simple dipole antenna.
It has 5 directors, one reflector and a driven element.

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

here, N_i = Corresponding reading of each of values

N = Maximum reading

Experimental requirement:

- 1) Antenna training
- 2) Transmitting mast.
- 3) Receiving mast
- 4) RF Defactor
- 5) Yagi-Uda 7-elements simple dipole antenna
- 6) power supply.

Table:

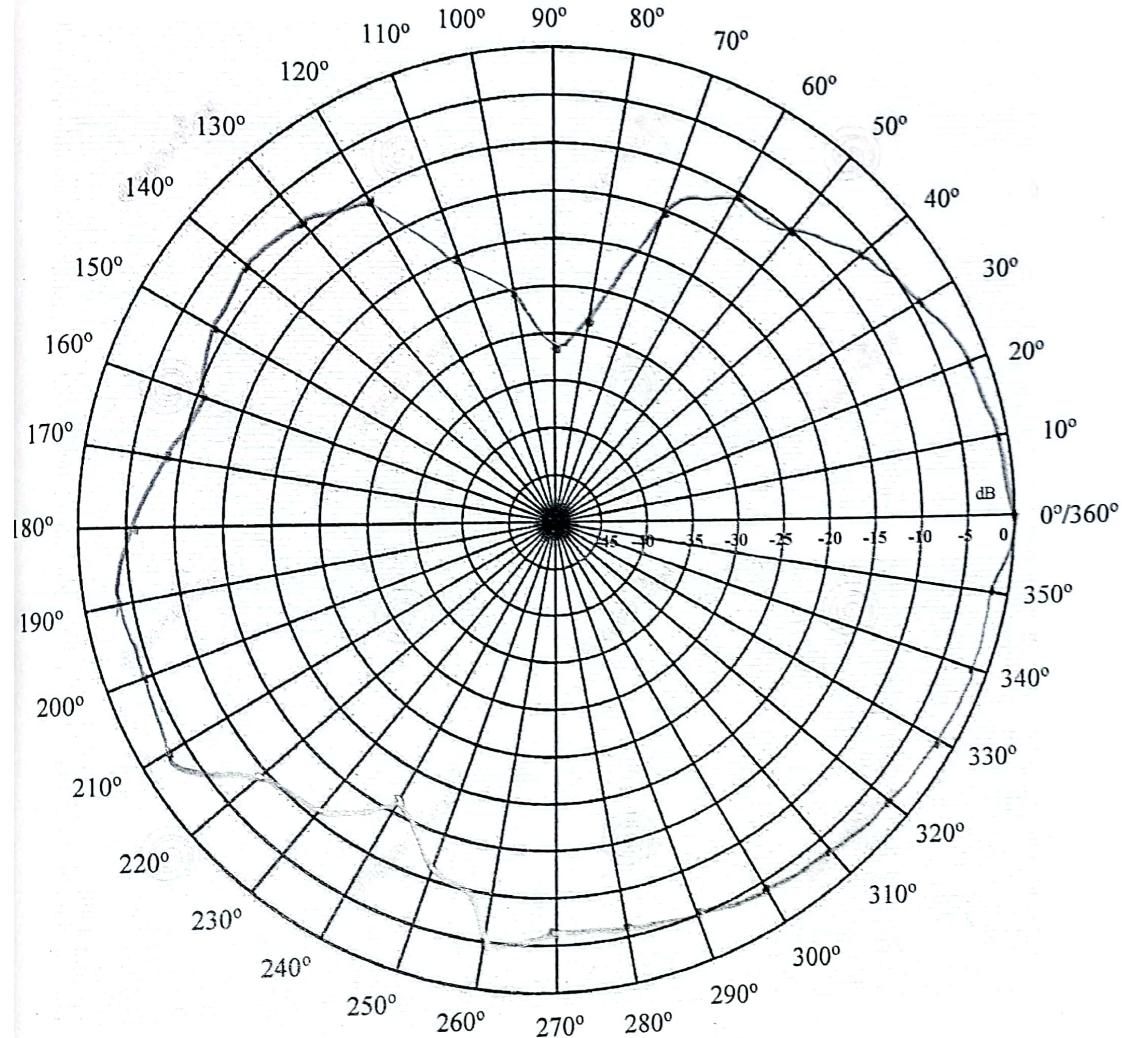
Experimental data table

Degree	Reading of antenna	Reading of RF detector	Normalized power gain $G_r = 20 \log(n_i/n)$
0	100	78.8	0
10	100	66.5	-1.61
20	100	87.3	-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	-32.36
100	100	4.4	-25.06
110	100	7.8	-20.09
120	101	20.4	-11.79
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	59	-3.12
200	101	48	-4.31
210	100	50	-3.05

Degree	Reading of Antenna	Reading of RF Detector	Normalized power gain, $G_t = 20 \log (N_t/N)$
220	100	30	-98.39
230	101	20	-11.91
240	101	10	-17.03
250	100	20	-11.01
260	102	44	-5.06
270	102	30	-8.39
280	102	33.5	-7.43
290	100	39.8	-5.03
300	90	45.6	-9.75
310	90	48.6	-4.20
320	100	55.5	-3.04
330	101	60.8	-2.23
340	101	68.8	-1.18
350	100	75.5	-0.37
360	102	78.8	0

ENNA RADIATION CHARACTERISTICS

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na Type:



calculation:

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

Corresponding reading of N are

$$N_i = N_1, N_2, \dots, N_n$$

$$\text{Let } N_1 = 65.5$$

$$\therefore Cr = 20 \log(N_i/N)$$

$$= 20 \log(65.5/78.8)$$

$$= -1.61$$

Result and discussion:

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