Experiment Number 8
EP3290

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1 Aim

To measure the wave length of microwaves by LLOYD'S MIRROR METHOD.

2 Components Required

a. Microwave transmitter

b. Receiver

c. Metal reflector

d. oscilloscope

e. Connecting probes

3 Lloyd's mirror method

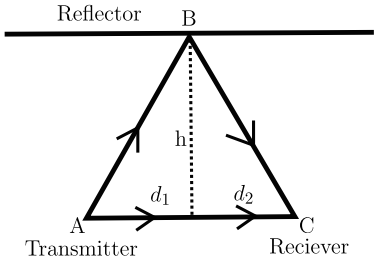

Figure 1: Lloyd's Mirror setup

a. The microwave travels directly between the points A and C.

b. Also part of the wave gets reflected at B and interferes at C with the original wave.

c. A microwave signal is detected when two waves reach the detector in phase

d. The above setup is called Lloyd's mirror.

4 Procedure

a. Arrange the receiver and transmitter at least 1m apart and place a metal reflector such that is located at a point B as shown in the diagram.

b. Tabulate the values by slowly moving the metal reflector perpendicular to the transmitter-receiver part and taking down the distances at which minima and maxima occurs.

c. Let us consider the initially the mirror is at h1 cm from the center line and next minima occur at h2.

Initial path length (ABC) $= \sqrt{h_1^2 + d_1^2} + \sqrt{h_1^2 + d_2^2}$
Path length for $h_2 = \sqrt{h_2^2 + d_1^2} + \sqrt{h_2^2 + d_2^2}$
When the difference between the above two path lengths is λ, we get minima at both h_1 and h_2.
Hence, wavelength

$$\lambda = \sqrt{h_2^2 + d_1^2} + \sqrt{h_2^2 + d_2^2} - \sqrt{h_1^2 + d_1^2} + \sqrt{h_1^2 + d_2^2}$$

5 Observations

S.No	$Distance(mm)$	$Voltage(V)$
1	5	14
2	5.1	13.6
3	5.2	13.9
4	5.3	13.8
5	5.4	14.2
6	5.5	14.1
7	5.6	14.1
8	5.7	13.9
9	5.8	13.8
10	5.9	13.8
11	6	13.8
12	6.1	13.8
13	6.2	13.6
14	6.3	13.4
15	6.4	13.2
16	6.5	13.4
17	6.6	13.6
18	6.7	13.4
19	6.8	13.2
20	6.9	13
21	7	12.8
22	7.1	12.4
23	7.2	12
24	7.3	11.8
25	7.4	11.4
26	7.5	11.2
27	7.6	10.6
28	7.7	10.4
29	7.8	10.2
30	7.9	9.7
31	8	9.5
32	8.1	9.3
33	8.2	9.2
34	8.3	9.1
35	8.4	8.9
36	8.5	9.3
37	8.6	9.4
38	8.7	9.5
39	8.8	9.7
40	8.9	10.2

S.No	$Distance(mm)$	$Voltage(V)$
41	9	10.3
42	9.1	10.8
43	9.2	11
44	9.3	11.2
45	9.4	11.4
46	9.5	11.6
47	9.6	11.7
48	9.7	11.5
49	9.8	11.4
50	9.9	11.3
51	10	10.6
52	10.1	11.2
53	10.2	11.1
54	10.3	11.2
55	10.4	10.9
56	10.5	10.6
57	10.6	10.8
58	10.7	11.3
59	10.8	10.8
60	10.9	11.2
61	11	11.4
62	11.1	11.8
63	11.2	12
64	11.3	12.6
65	11.4	12.8
66	11.5	12.6
67	11.6	12.4
68	11.7	12.6
69	11.8	12.8
70	11.9	12.6
71	12	12.4
72	12.1	12.2
73	12.2	11.8
74	12.3	11.4
75	12.4	10.4
76	12.5	10.3
77	12.6	10.2
78	12.7	10.4
79	12.8	10.4
80	12.9	10.2
81	13	10.1
82	13.1	10.1
83	13.2	9.7
84	13.3	10.3
85	13.4	10.6

S.No	$Distance(mm)$	$Voltage(V)$
86	13.5	10.8
87	13.6	10.9
88	13.7	11
89	13.8	11.1
90	13.9	11.6
91	14	12
92	14.1	12.2
93	14.2	12.4
94	14.3	12.5
95	14.4	12.2
96	14.5	12.2
97	14.6	11.8
98	14.7	11.4
99	14.8	11
100	14.9	10.6
101	15	10.8
102	15.1	10.6
103	15.2	10.2
104	15.3	10.6
105	15.4	10.7
106	15.5	10.4
107	15.6	10.1
108	15.7	9.7
109	15.8	9.9
110	15.9	10
111	16	10.2
112	16.1	10.3
113	16.2	10.4
114	16.3	10.6
115	16.4	10.8
116	16.5	11.5
117	16.6	12.2
118	16.7	12.4
119	16.8	11.6
120	16.9	11.6
121	17	11.7
122	17.1	11.4
123	17.2	10.9
124	17.3	10.6
125	17.4	10.4
126	17.5	10
127	17.6	10.4
128	17.7	10.6
129	17.8	10.2
130	17.9	10.4
131	18	10.6

6 Calculations

6.1 Finding wavelength

7 Advantages

a. The above method is extremely flexible i.e., they do not require proper set up positions.

b. The above method is very quick .We can easily find the wavelength of microwaves in a matter of minutes.

8 Sources of Errors

a. The microwaves diverge a lot. Hence, it is very difficult to detect high output amplitudes. Therefore, any external noise gives errors to the measurements.

b. Human body is a good absorber of microwaves. Hence, even while doing experiment we could accidentally cause error.

9 Conclusions

Thus the wavelength of microwaves is calculated.

LlOYD'S mirror method λ =