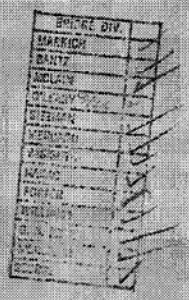
WASHINGTON STATE HIGHWAY DEPARTMENT RESEARCH PROGRAM REPORT **13.1A**

ATTENUATION OF RANDOM DEEP WATER WAVES BY A POROUS WALLED BREAKWATER: APPENDICES

RESEARCH PROJECT
Y-1307



August 1973

PREPARED FOR
WASHINGTON STATE HIGHWAY COMMISSION
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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APPENDIX I

Representative records of various chamber and wind conditions are grouped in order of increasing observed wind speed. For each condition the wind speed direction, chamber width, date, number of data points used in the spectral analysis and the calculated attenuation are listed. A table is presented showing the variance in the spectral peak frequencies, peak frequencies and any secondary peaks which may occur are shown for the force and pressure transducers. For each case, normalized smooth spectral estimates vs. frequency are shown for the superimposed pressure records. The frequency of the peak force is also indicated on the plot.

FIVE FOOT WIDE CHAMBER

(SOLID BOTTOM)

WINDSPEED: 10 mph. DIRECTION: South

CHAMBER WIDTH: 5 feet DATE: 5/15/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE) 70.9%

RUN NUMBER: 12,S7,o NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	fu
FORCES: TOP	104.96	6.880	.5488	722.12	.8179	.79
BOTTOM	127.06	7.139	.5488	907.08	.4547	.79
PRESSURES: REMOTE	.00055	6.742	.5488	.00371	.8269 .3325 .1847	.30 1.14 1.36
IN FRONT OF CHAMBER	.00016	3.6791	.5640	.00059	1.7738 .1872 .2287	.30 1.13 1.36

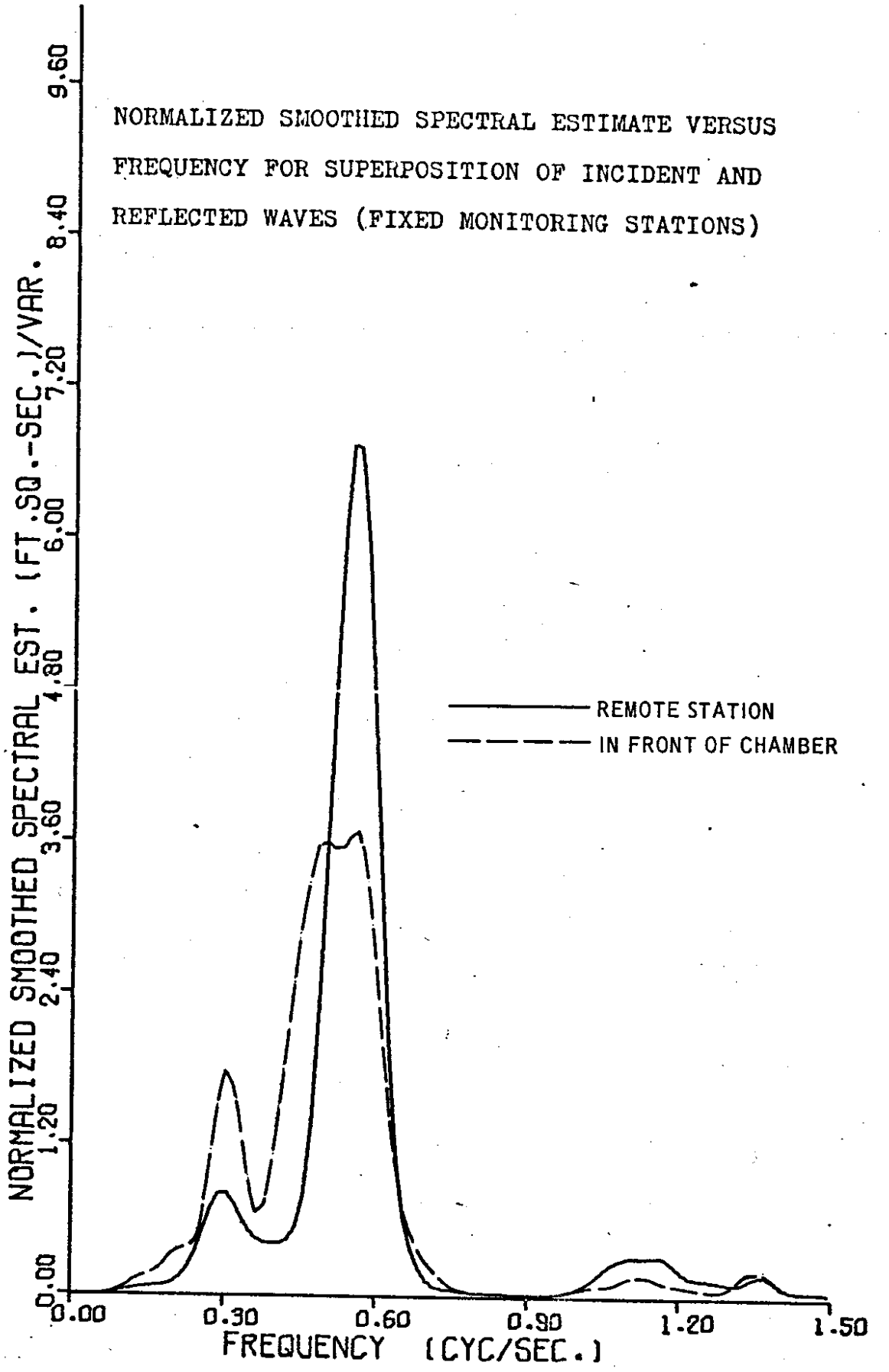

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
REMOTE STATION
IN FRONT OF CHAMBER
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG. 51

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

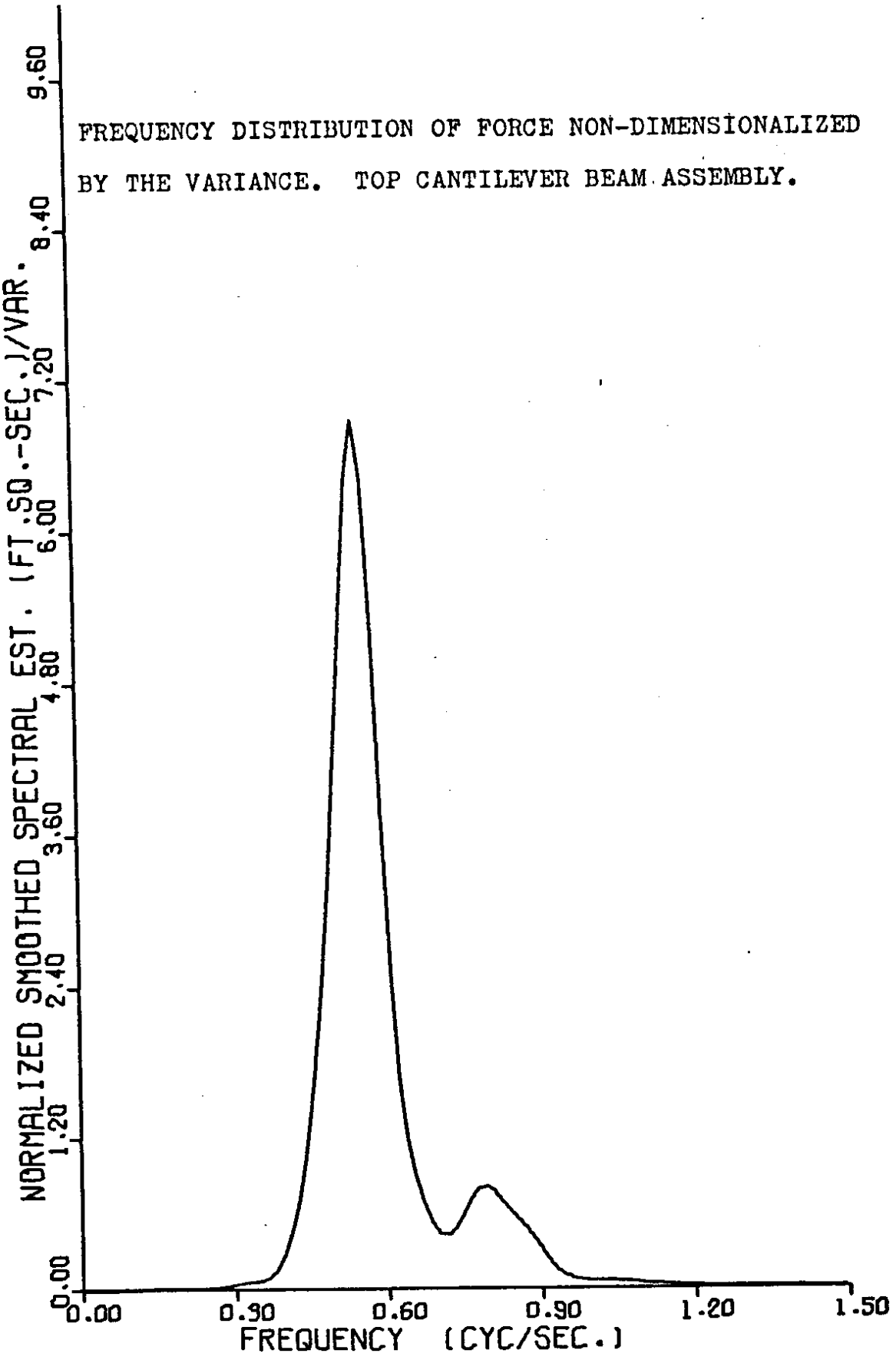


FIG. 52

WINDSPEED: 12-15 mph. DIRECTION: south

CHAMBER WIDTH: 5 feet DATE: 5/12/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): 63.2%

RUN NUMBER: 11,S7,n NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	SECONDARY fu
FORCES: TOP	136.97	6.362	.4878	871.40	.5335	.79
BOTTOM	223.05	7.161	.4878	1597.26	.2333	.79
PRESSURES: REMOTE	.00068	5.124	.5335	.00348	.8483 .3224 .1155	.27 1.11 1.36
IN FRONT OF CHAMBER	.00025	4.366	.4726	.00109	.8615 .2048 .1453	.26 1.05 1.36

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

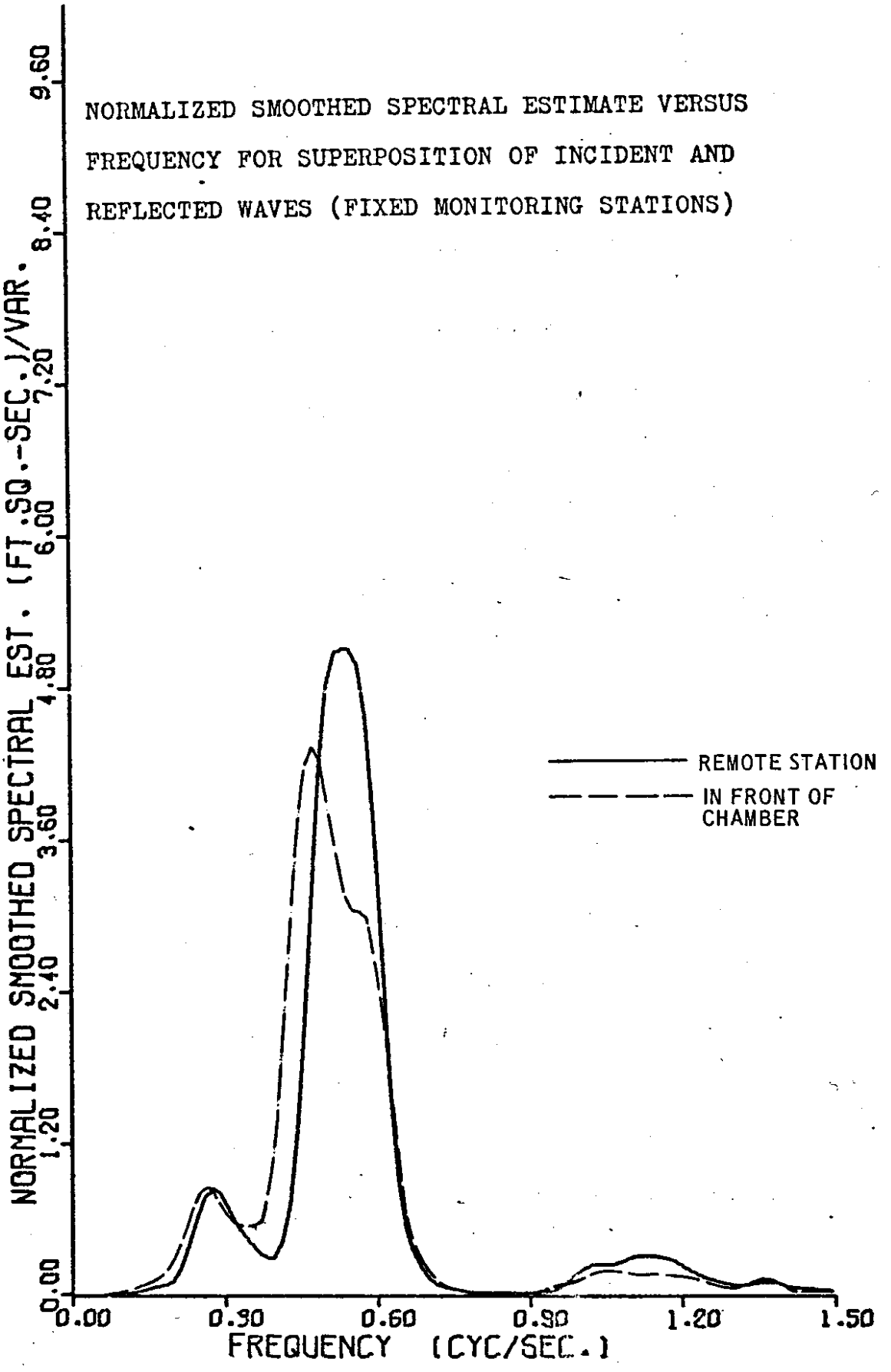


FIG. 53

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

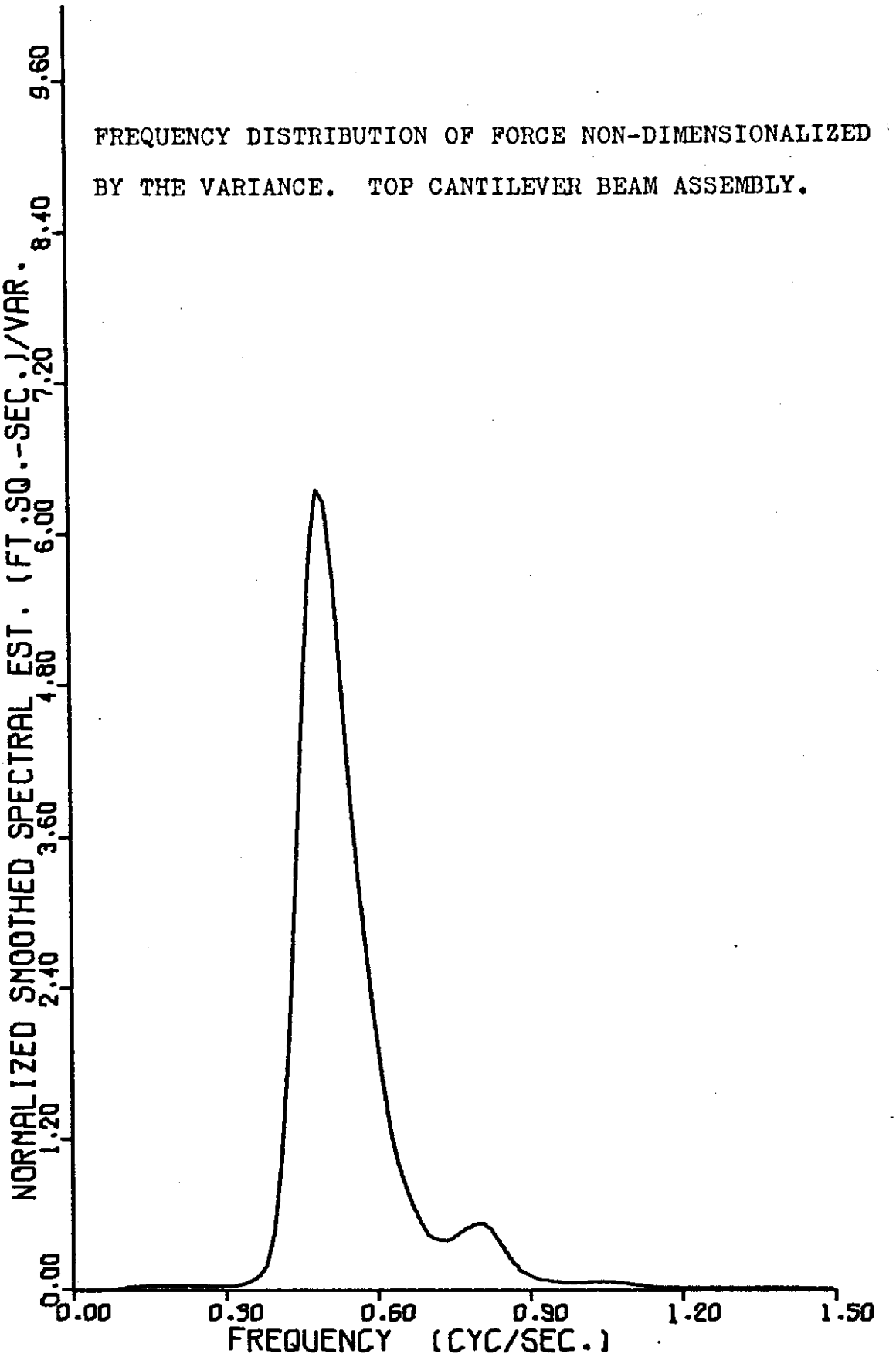


FIG. 54

WINDSPEED: 15 mph. DIRECTION: South

CHAMBER WIDTH: 5 feet DATE: 5/12/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): 58.1%

RUN NUMBER: 11,S7,m NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	SECONDARY fu
FORCES: TOP	245.48	6.750	.4878	1659.99	.3085	.78
BOTTOM	429.61	7.533	.4878	3236.25	.1527	.75
PRESSURES: REMOTE	.00074	6.229	.5183	.00461	.3838 .4354	.32 .99
IN FRONT OF CHAMBER	.00031	6.104	.4573	.00189	.2553 .1348	1.04 1.36

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

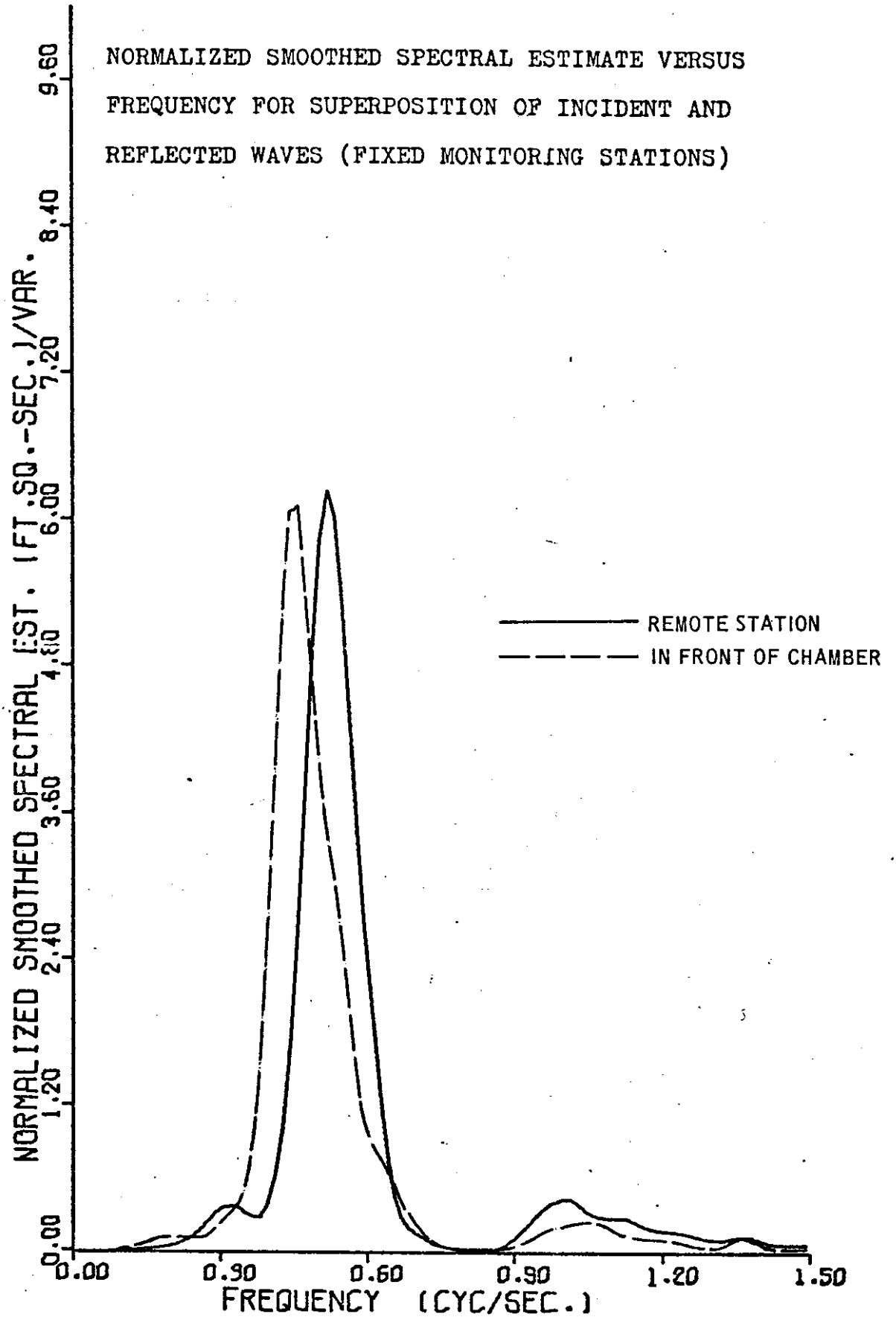


FIG. 55

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

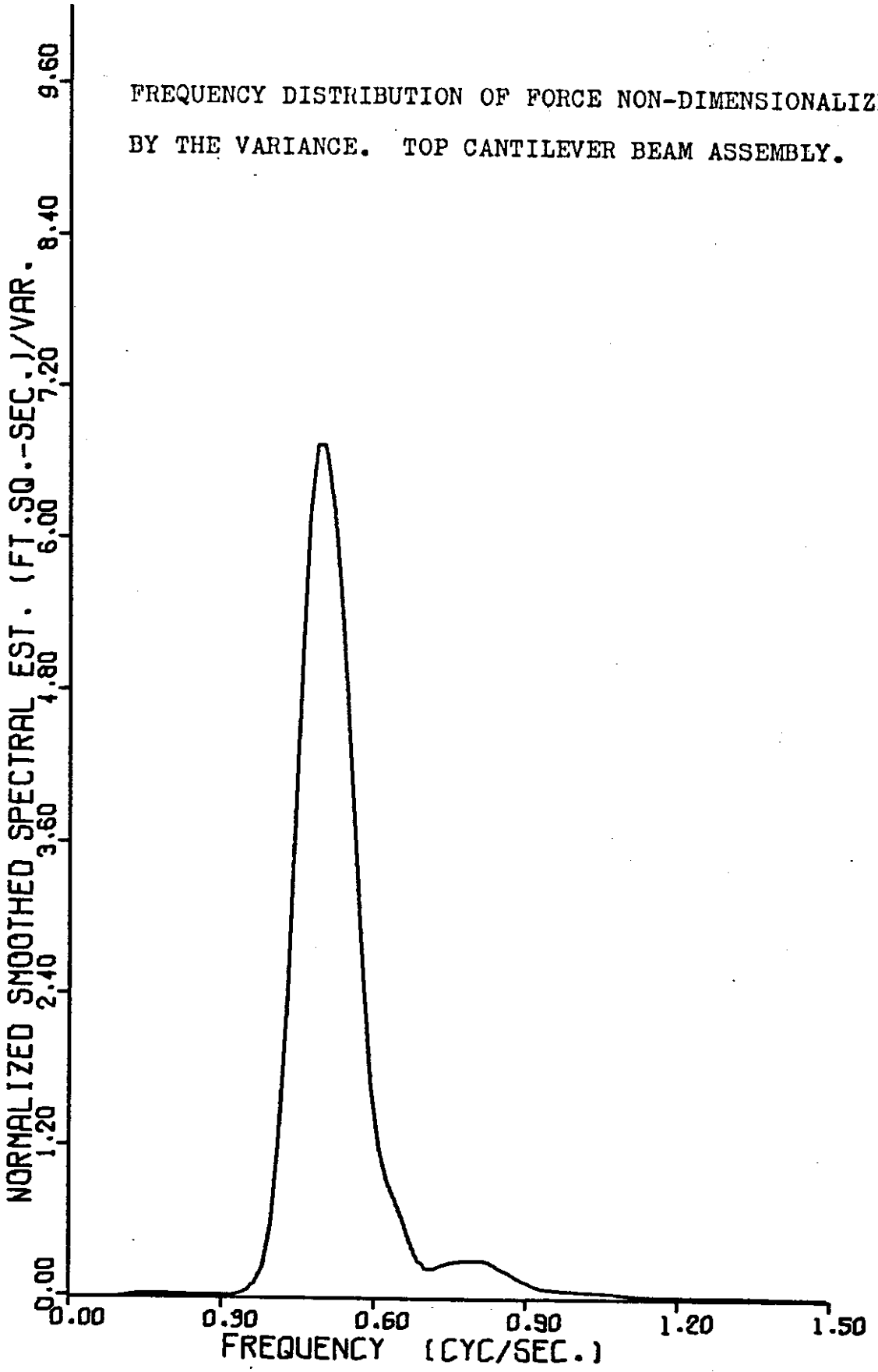


FIG. 56

WINDSPEED: 18-20 mph. DIRECTION: South

CHAMBER WIDTH: 5 feet DATE: 4/17/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): 63.8%

RUN NUMBER: 14,S12,r NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	fu
FORCES: TOP	674.73	5.732	.4878	3867.55	.4409 .2410	.21 .76
BOTTOM	1044.41	6.352	.4726	6634.09	.6492	.14
PRESSURES: REMOTE	.00708	3.068	.4726	.02172	1.8793 .8493	.20 .96
IN FRONT OF CHAMBER	.00256	4.185	.4421	.01071	3.0455	.14

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

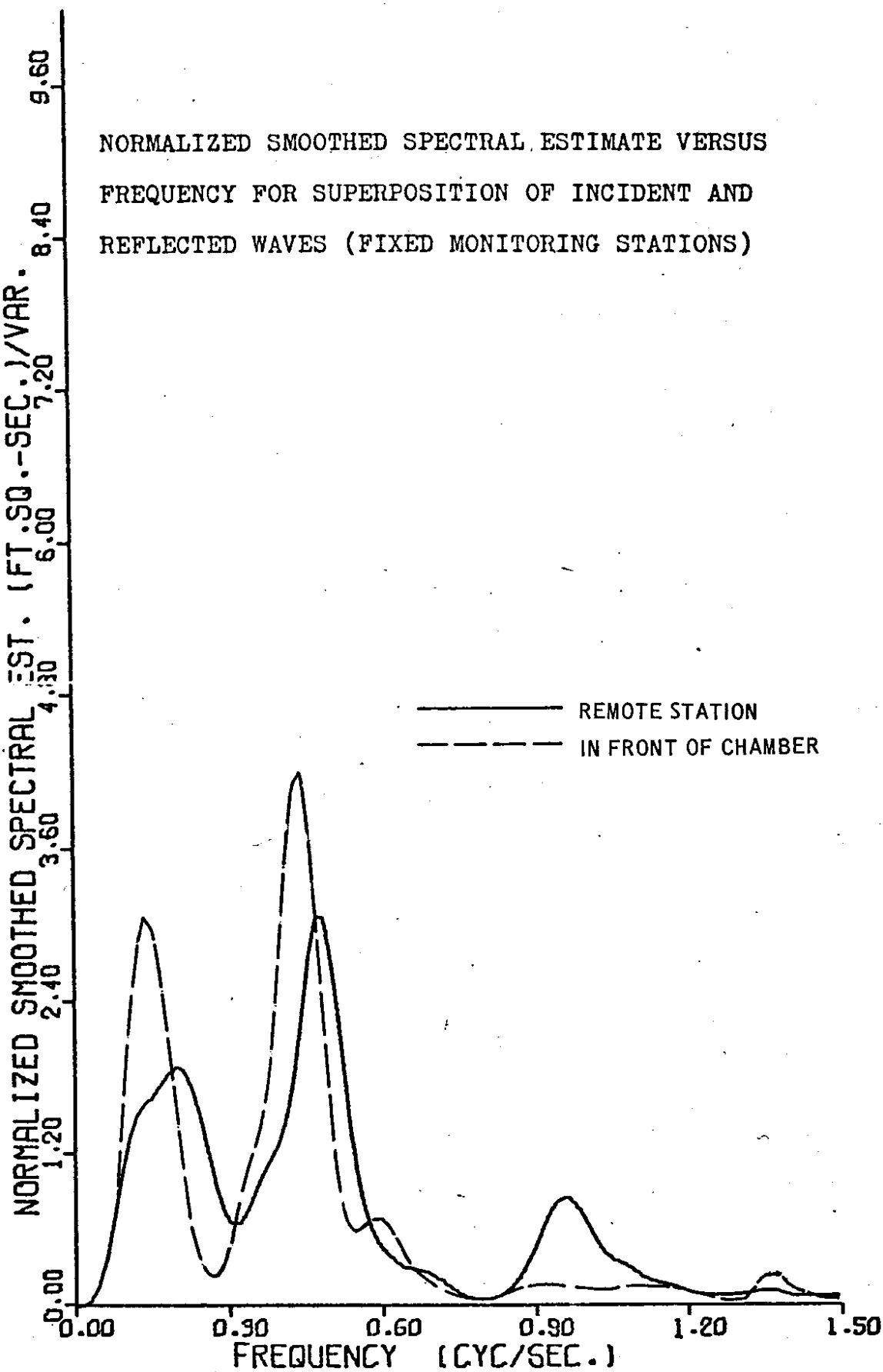


FIG. 57

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

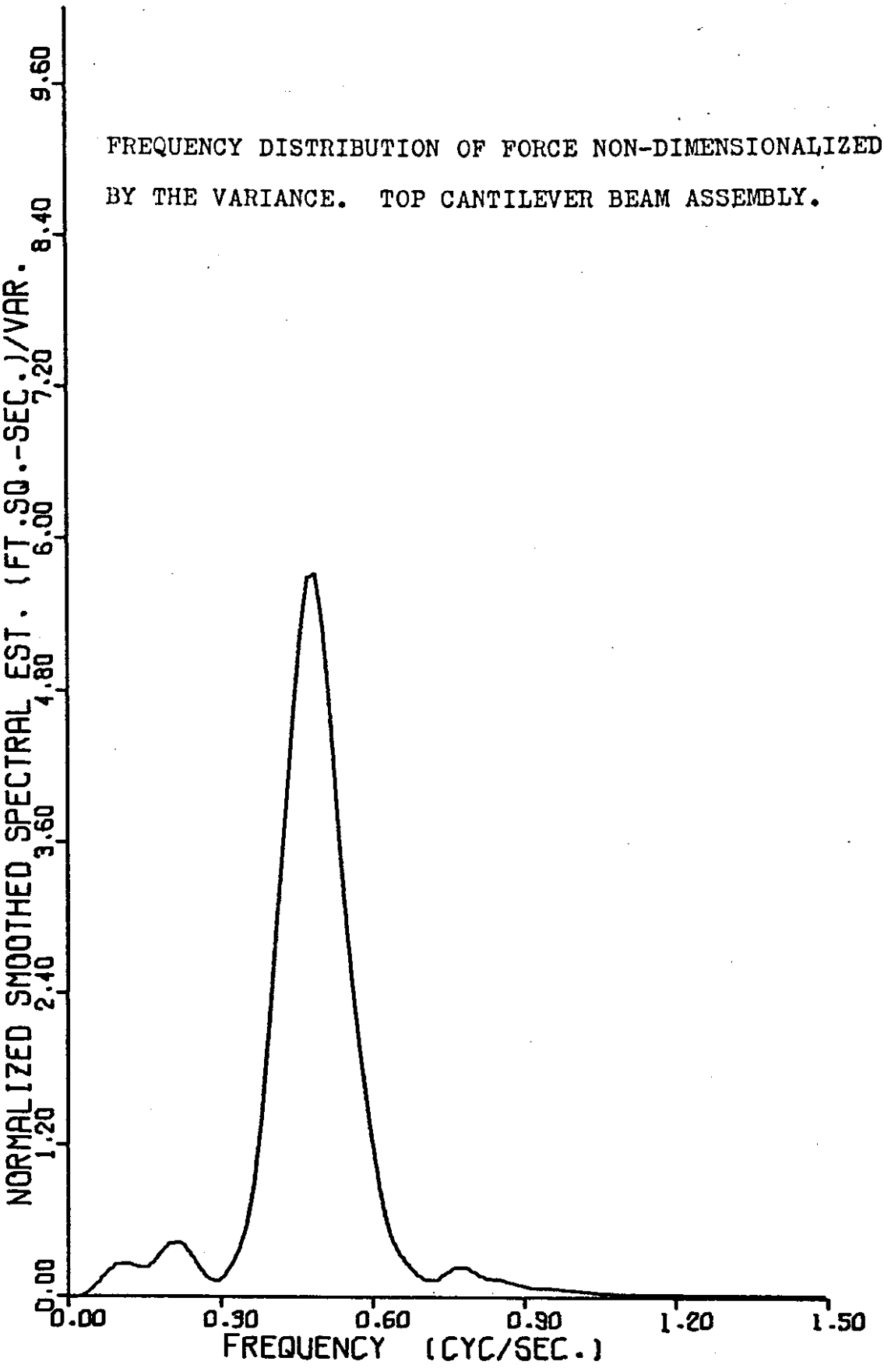


FIG. 58

WINDSPEED: 18-20 mph. DIRECTION: South

CHAMBER WIDTH: 5 feet DATE: 4/17/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): 45.0%

RUN NUMBER: 14,S12,s NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	SECONDARY fu
FORCES: TOP	890.121	5.147	.4573	4581.45	.3149 .5821 .1963 .1007	.14 .23 .78 1.17
BOTTOM	1252.17	5.848	.4573	7322.69	.2190 .4239 .1051	.14 .23 .78
PRESSURES: REMOTE	.00451	3.356	.4726	.01514	.6102 1.0812 .4895 .9944 .4996	.14 .23 1.01 1.17 1.34
IN FRONT OF CHAMBER	.00248	5.117	.4268	.01269	.6922 1.2614 .9054 .4954	.14 .23 1.17 1.34

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERIMPOSED INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

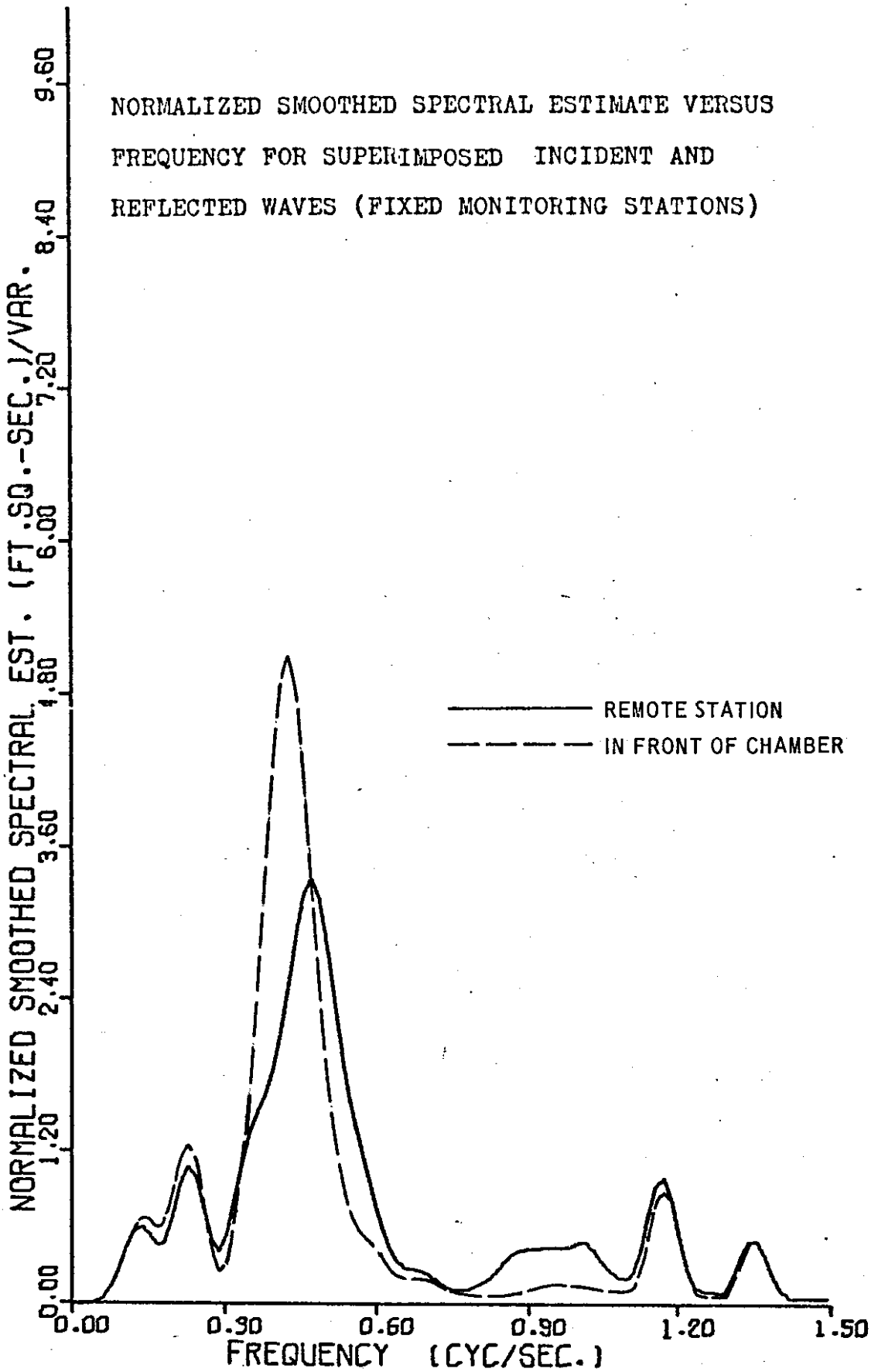


FIG. 59

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

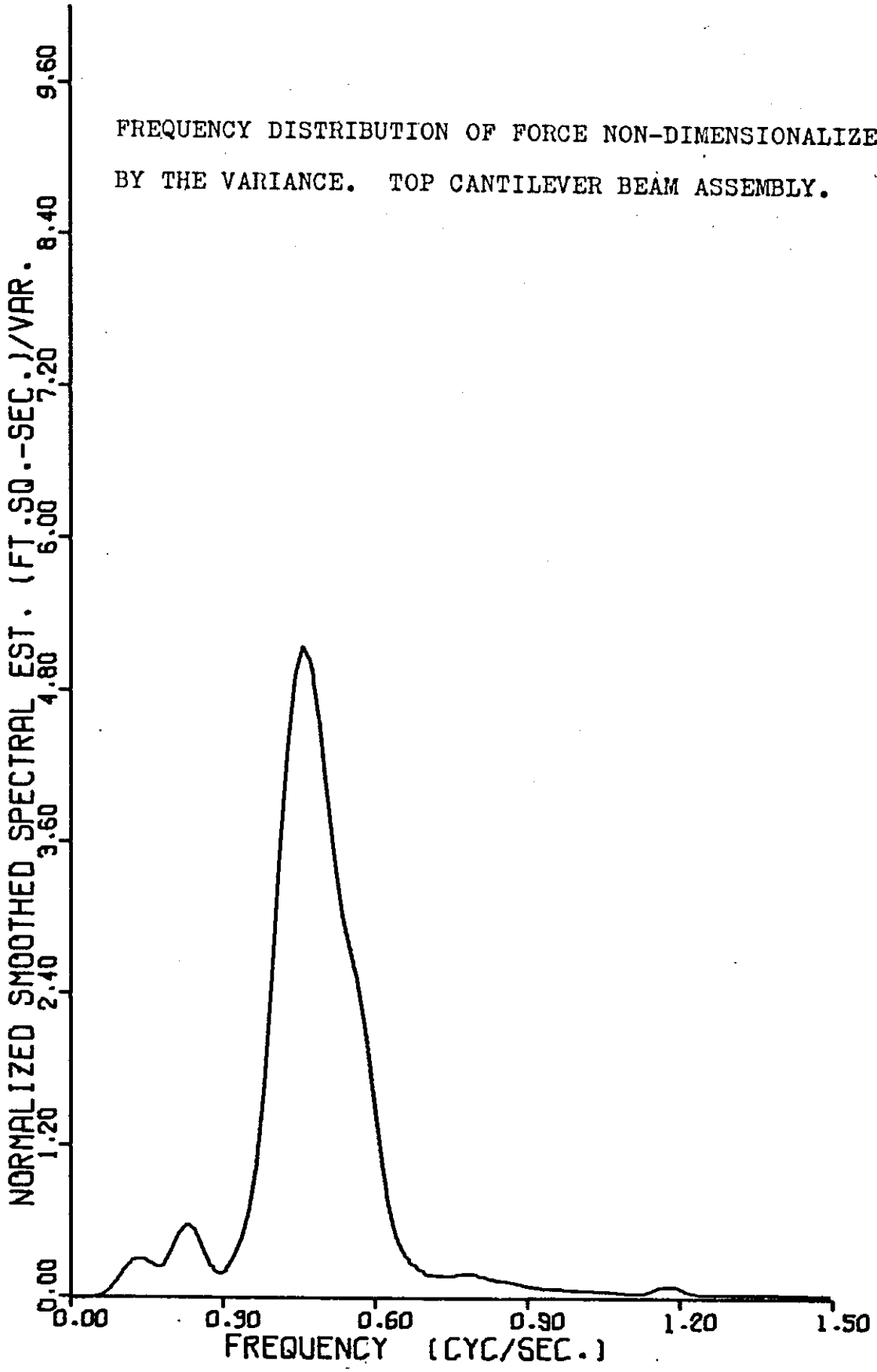


FIG.60

WINDSPEED: 20 mph. DIRECTION: South south west

CHAMBER WIDTH: 5 feet DATE: 5/12/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW/REMOTE)): 54.2%

RUN NUMBER: 11,S6,1 NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	SECONDARY fu
FORCES: TOP	297.19	6.560	.4726	1949.57	.288	.75
BOTTOM	522.33	7.342	.4726	3834.95	.1289	.75
PRESSURES: REMOTE	.00096	6.495	.5031	.00624	.3459 .5865	.32 1.01
IN FRONT OF CHAMBER	.00044	7.182	.4421	.00316	1.1332 .2516	.58 1.02

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

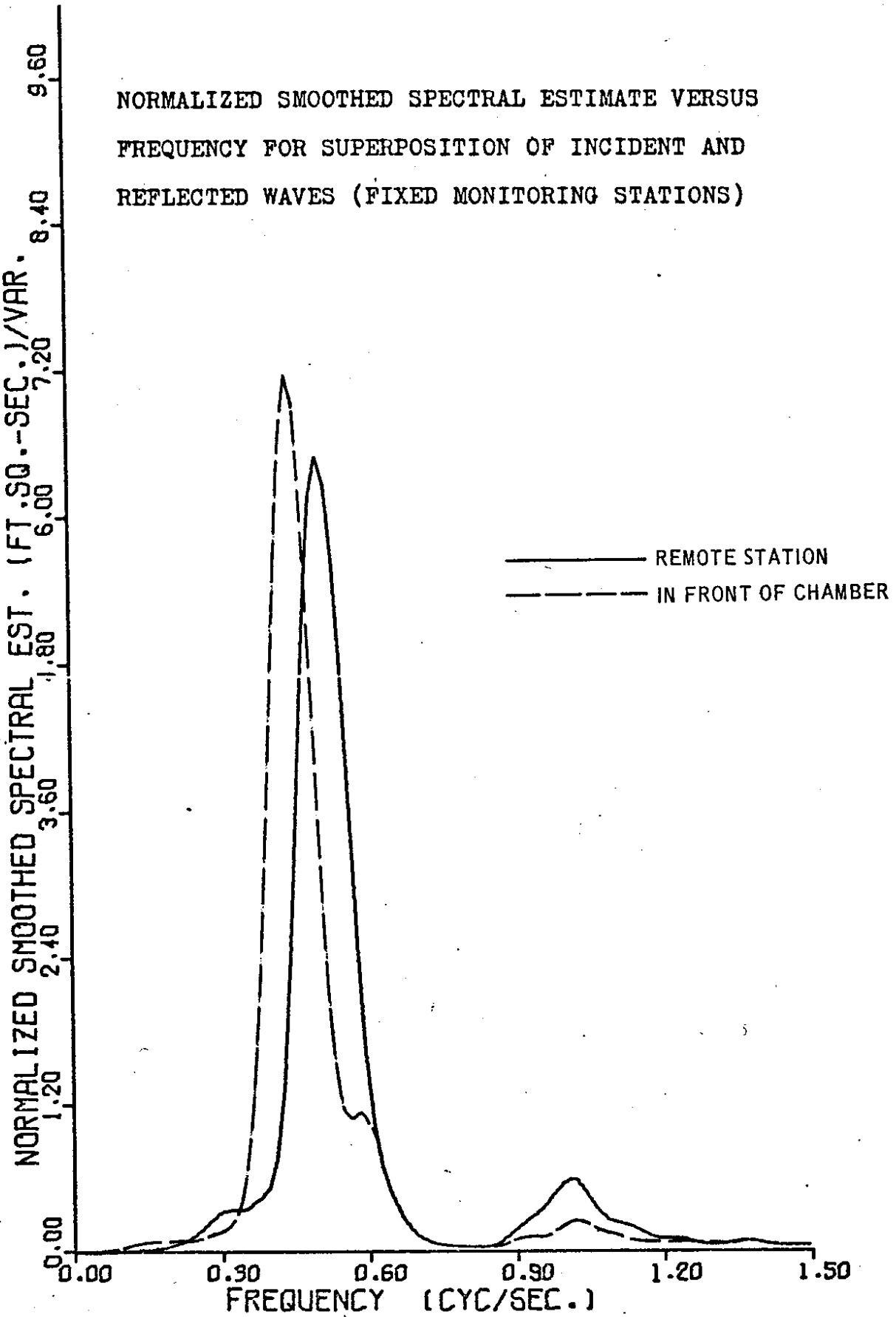


FIG. 61

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

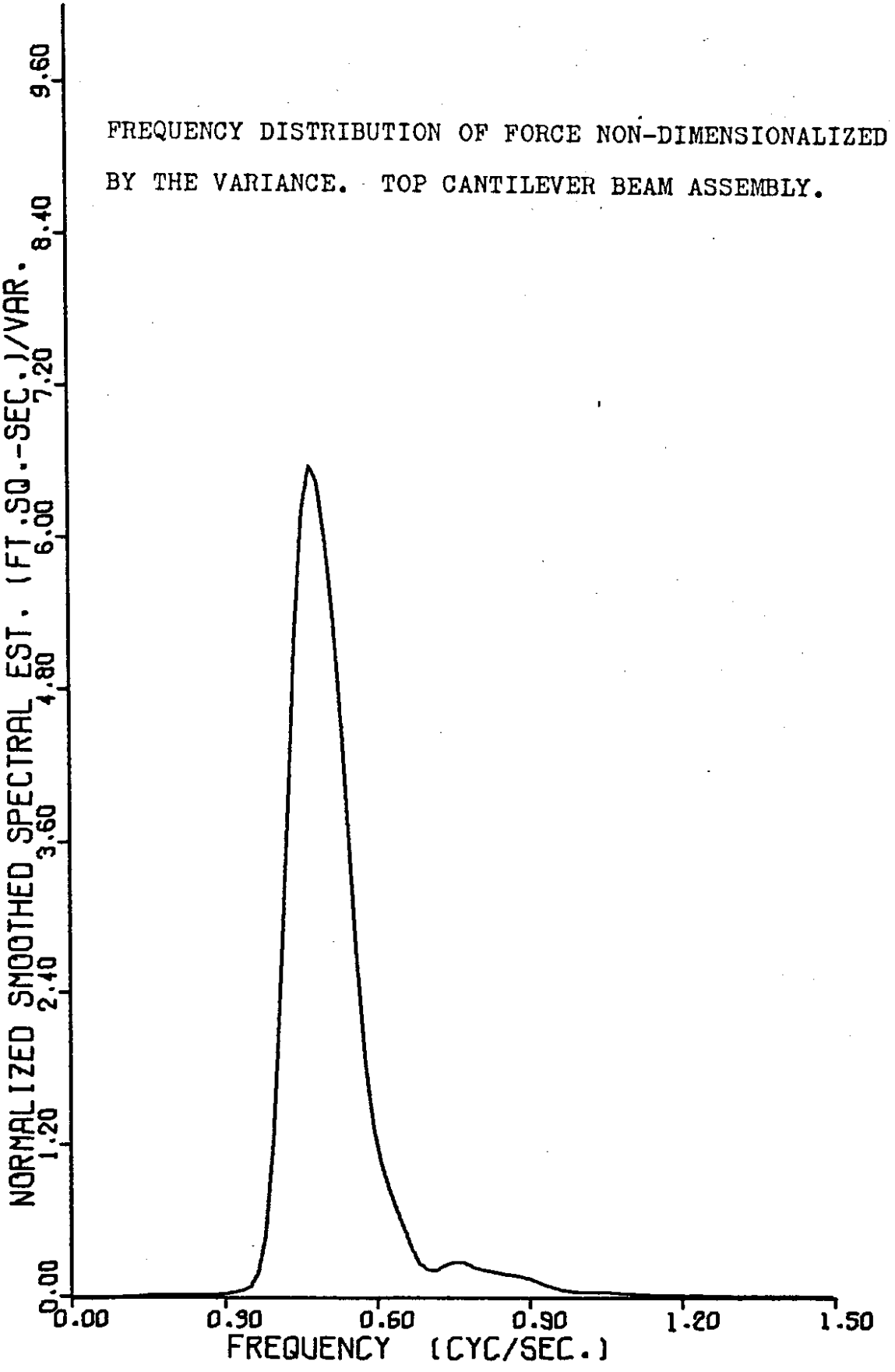


FIG. 62

WINDSPEED: 20 mph. DIRECTION: South south west

CHAMBER WIDTH: 5 feet DATE: 4/17/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): 44.4%

RUN NUMBER: 13,S7,p NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	fu
FORCES: TOP	341.79	6.988	.4878	2381.44	.2959	.76
BOTTOM	559.02	6.386	.4726	3569.90	None	
PRESSURES: REMOTE	.00196	5.046	.4268	.00989	.3836 .2246	.95 1.11
IN FRONT OF CHAMBER	.00109	6.338	.4421	.00691	.1294	1.02

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

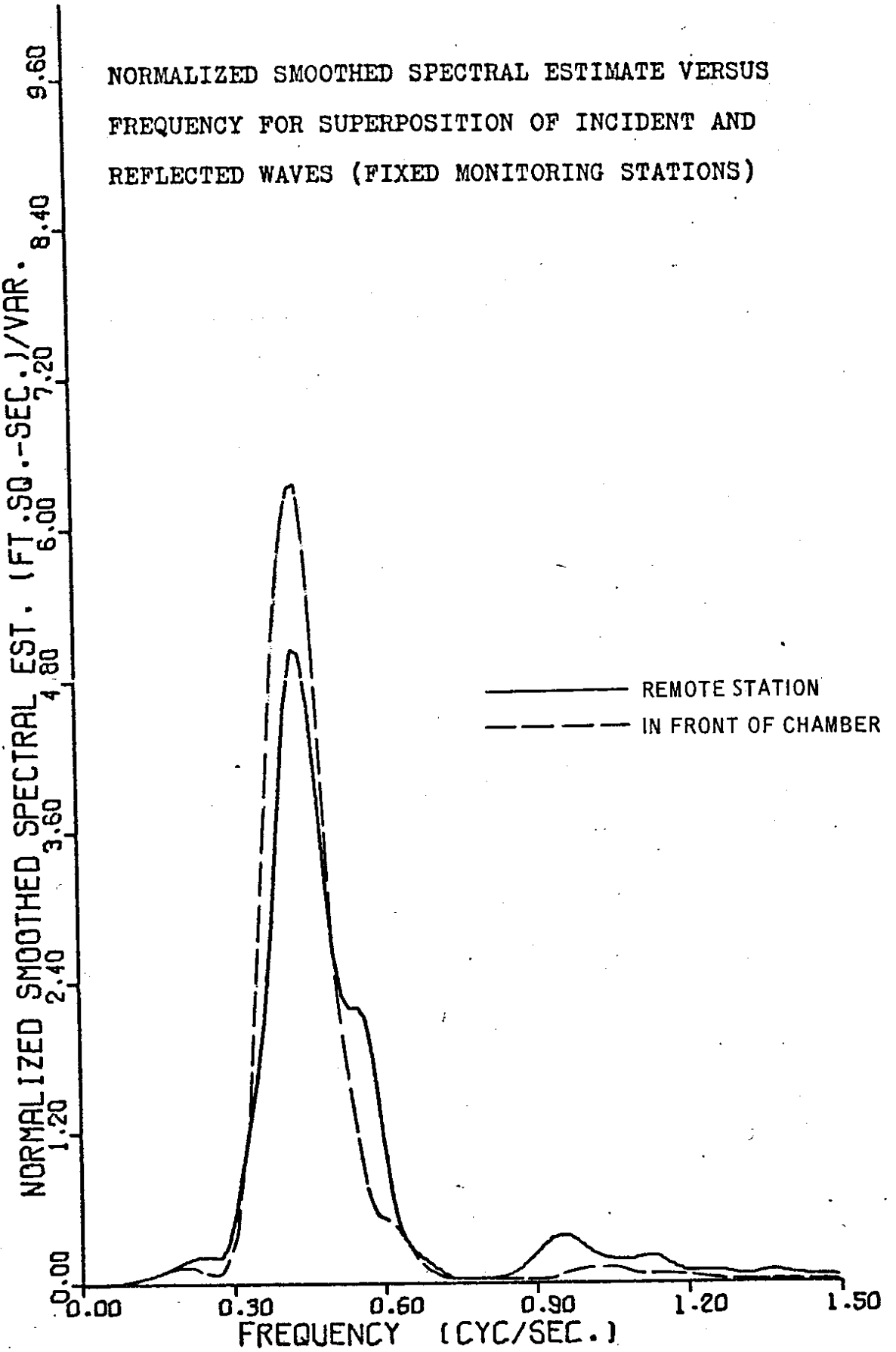


FIG.63

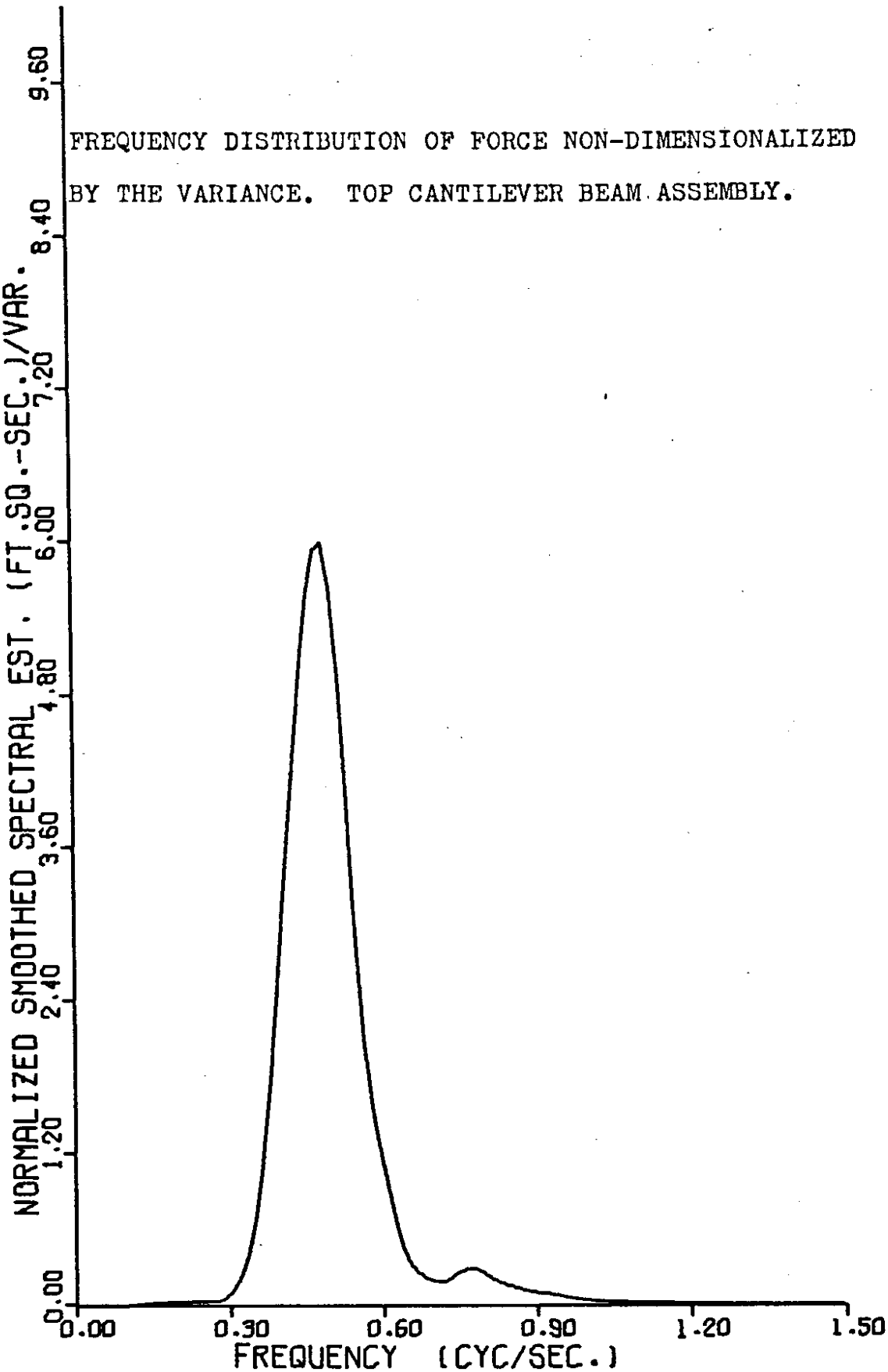

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED
BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG.64

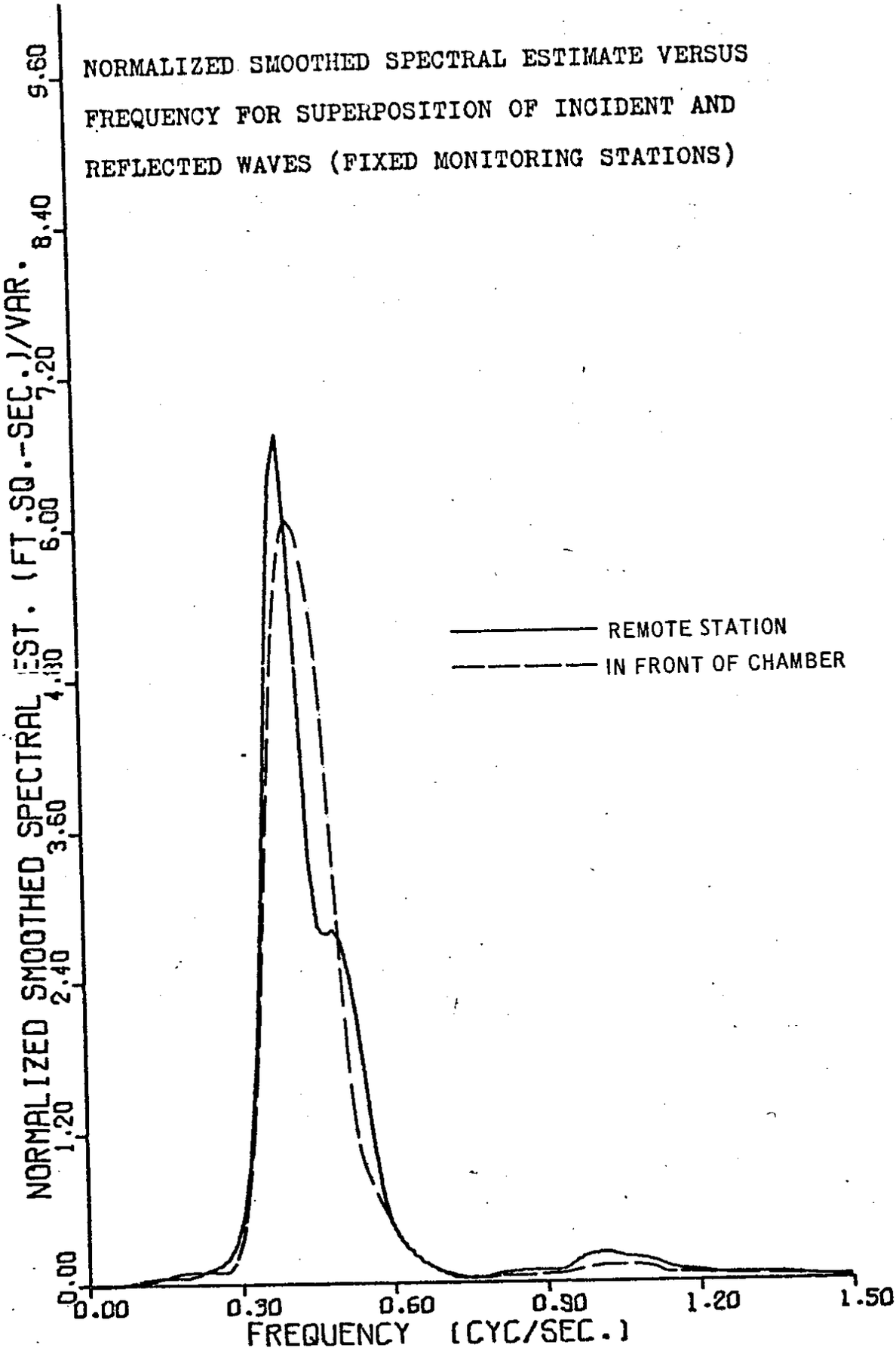
WINDSPEED: 20-25 mph. DIRECTION: South south west

CHAMBER WIDTH: 5 feet DATE: 4/17/71

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): 56.3%

RUN NUMBER: 13,S7,q NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	SECONDARY fu
FORCES: TOP	547.71	5.884	.4726	3222.75	.2855	.78
BOTTOM	592.39	6.470	.4726	3832.76	None	
PRESSURES: REMOTE	.00300	6.747	.3963	.02024	.2379	1.01
IN FRONT OF CHAMBER	.00131	6.119	.41156	.00802	None	



NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

FIG. 65

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

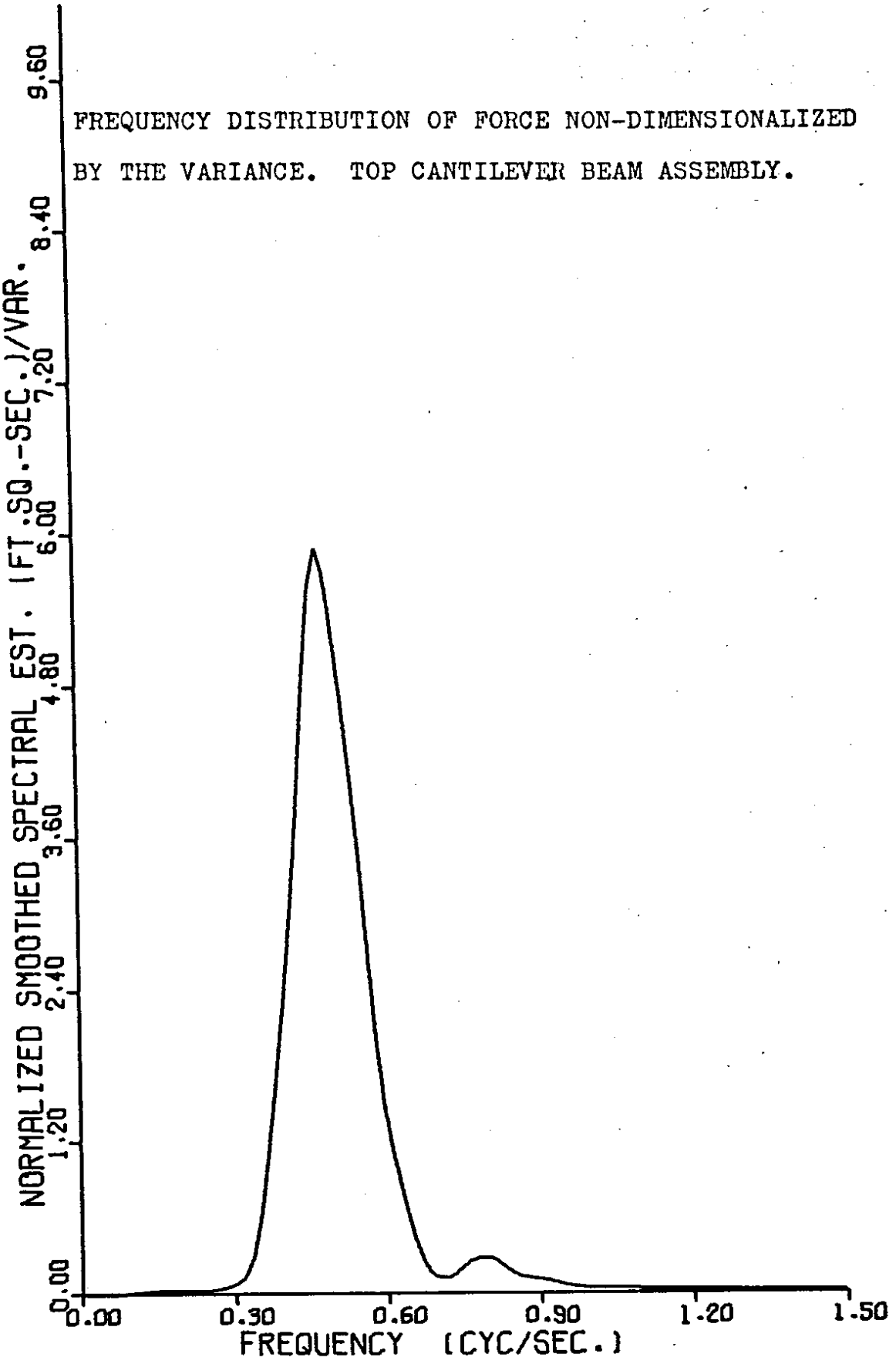


FIG. 66

WINDSPEED: 30mph. DIRECTION: South

CHAMBER WIDTH: 5 feet DATE: 3/14/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): 32.3%

RUN NUMBER: 5,S8,k NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	SECONDARY fu
FORCES: TOP						
Unfiltered	1833.31	4.700	.3963	8616.55	.3567	.66
Filtered	1543.52	5.213	.3811	8046.40	None	
BOTTOM						
Unfiltered	2516.36	5.52	.3811	15,012.6	None	
Filtered	2375.66	5.966	.3811	14,173.2	None	
PRESSURES: REMOTE						
Unfiltered	.02872	2.647	.3201	.07602	.2728 (9.29 folding at NYQ. Freq.)	.78
Filtered	.01157	5.653	.3201	.06540	.6573	.79
IN FRONT OF CHAMBER						
Unfiltered	.00861	8.285	.3659	.07133	.2499	.18
Filtered	.00783	9.016	.3659	.07060	.1689	.18
INSIDE OF CHAMBER						
Unfiltered	.01090	1.789	.3201	.01950	Many	
Filtered	.00063	1.281	.3354	.00081	Many	

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

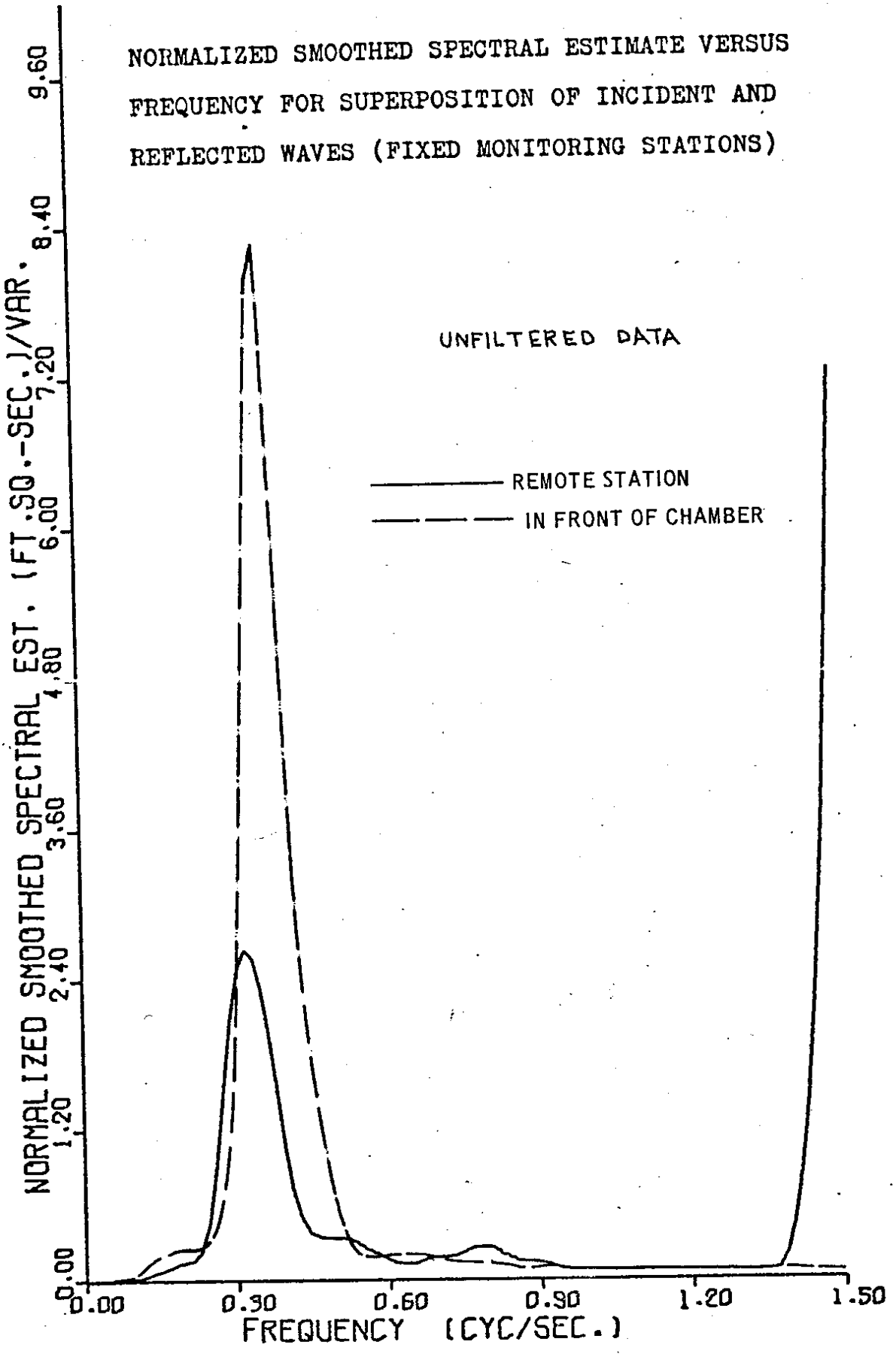


FIG. 67

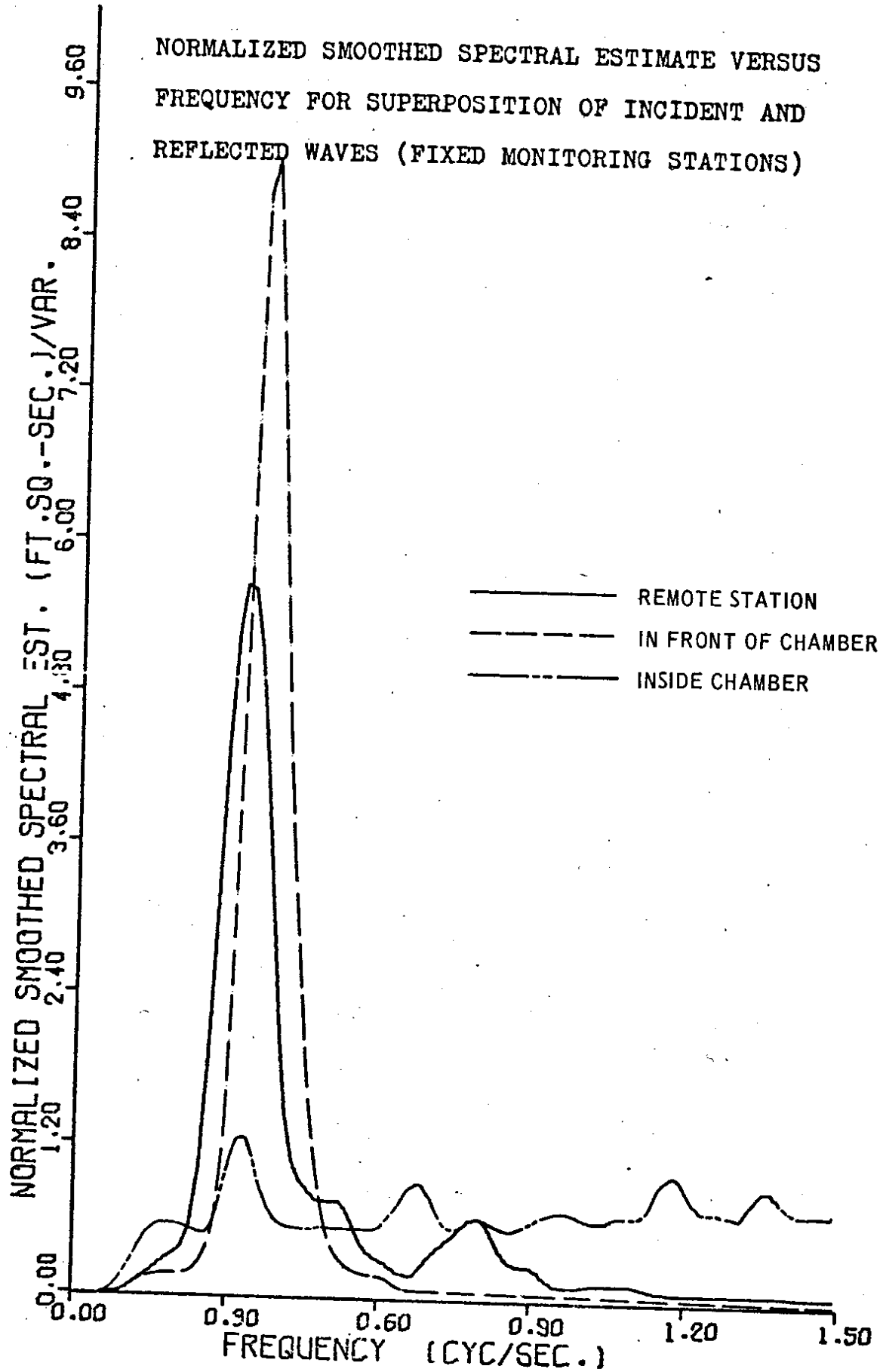

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
REMOTE STATION
IN FRONT OF CHAMBER
INSIDE CHAMBER
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG. 68

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

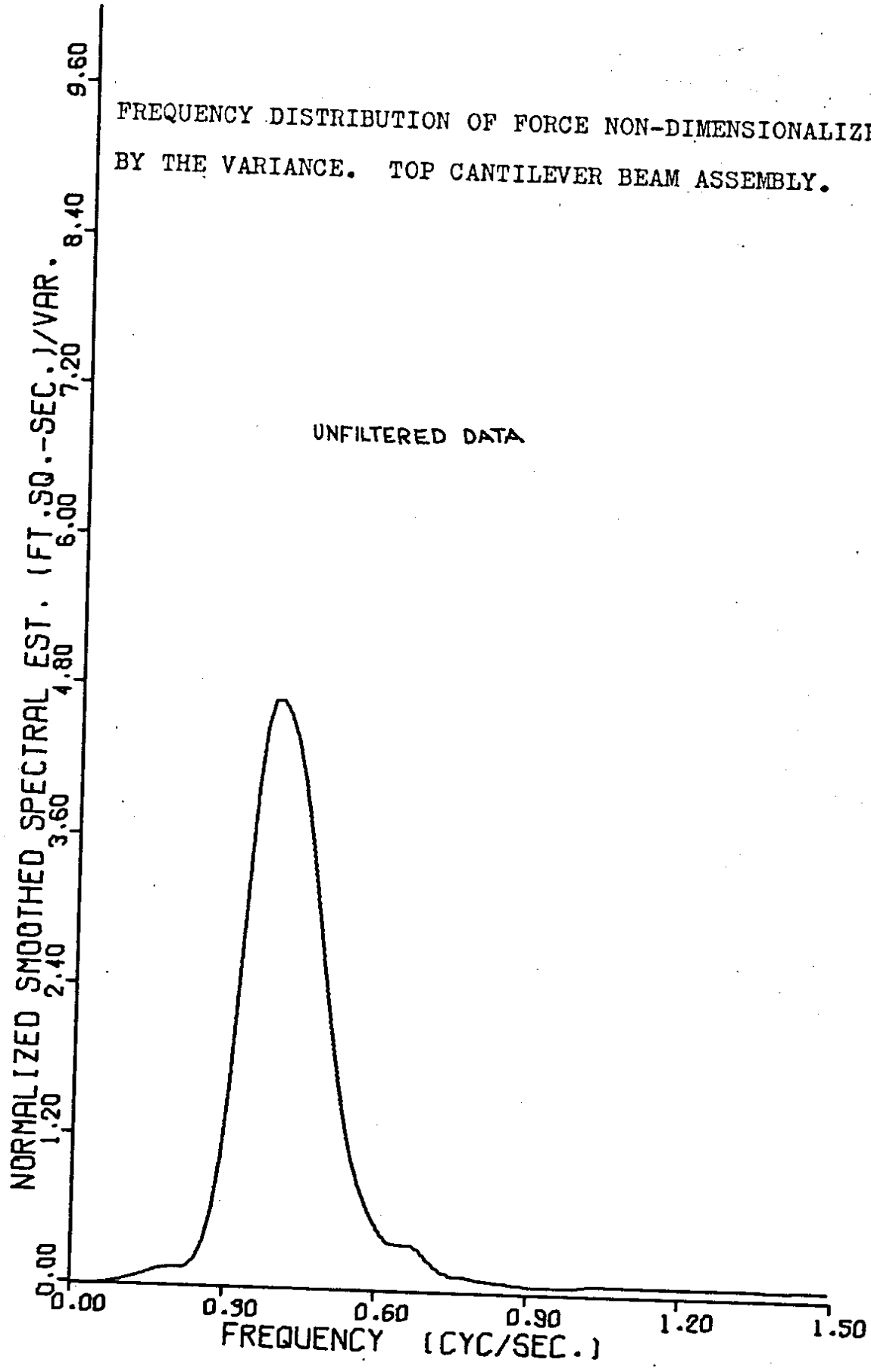


FIG. 69

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

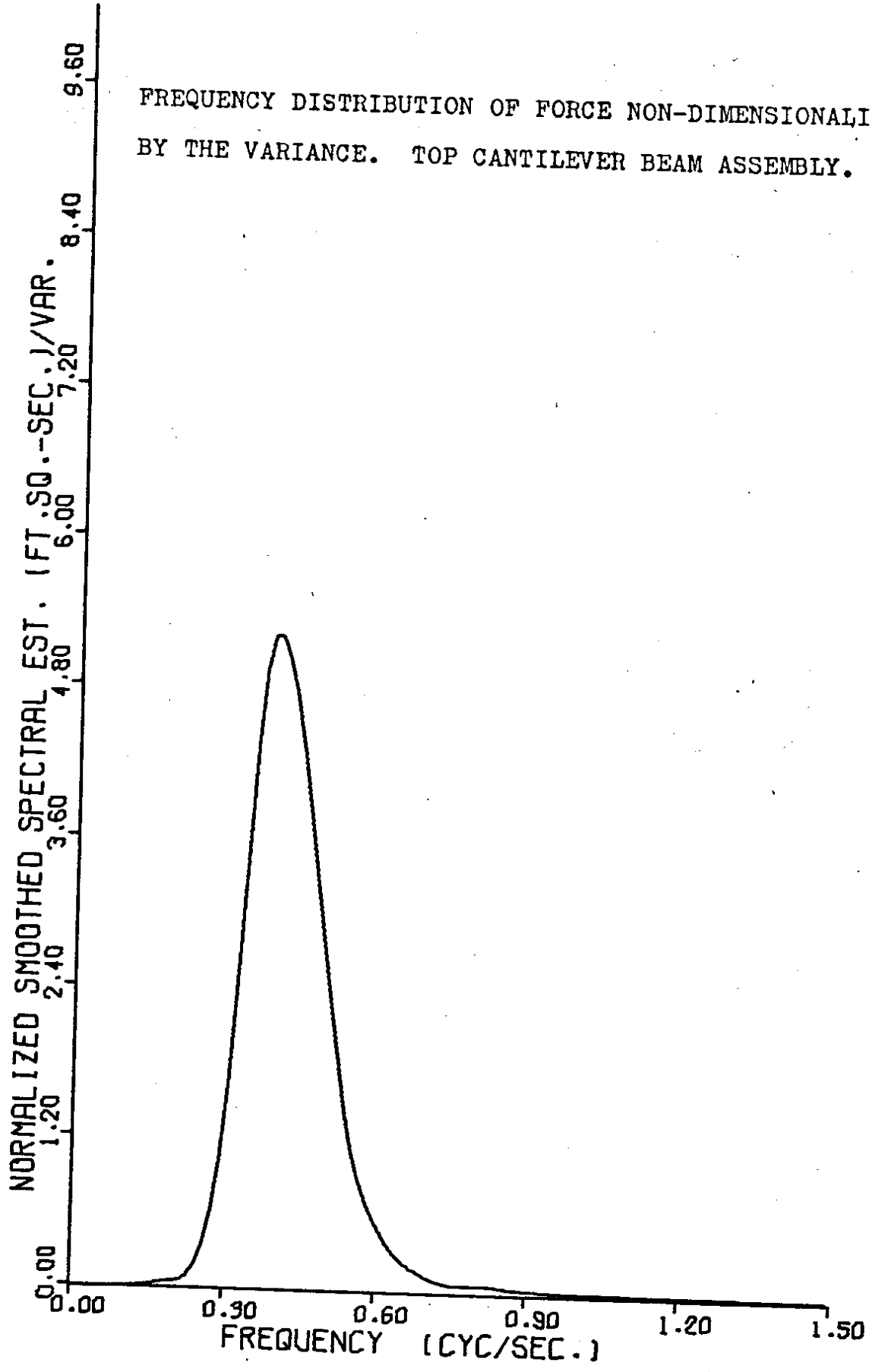


FIG. 70

SEVEN FOOT WIDE CHAMBER
(SOLID BOTTOM)

WINDSPEED: 7-10 mph. DIRECTION: South south west

CHAMBER WIDTH: 7 feet DATE: 2/25/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): 85.8%

RUN NUMBER: 2,S11,f NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	fu
FORCES: TOP	222.74	2.978	.5031	663.32	.2279	.20
					1.8417	.61
					.4011	.87
					.5642	1.04
					1.0217	1.22
BOTTOM	146.21	3.088	.5031	451.50	2.1990	.40
					1.7115	.61
					.5219	1.10
					.3390	1.22
PRESSURES: REMOTE	.00472	3.004	.6098	.01418	1.3289	.21
					1.9057	.49
					.3233	.76
					.8912	1.04
					.7730	1.23
IN FRONT OF CHAMBER	.00067	2.646	.5945	.00177	2.0769	.38
					1.8620	.50
					.3108	.76
					.7936	1.10
					.4628	1.22
INSIDE OF CHAMBER	.00965	3.059	.6098	.0295	.3094	.18
					.8306	.35
					2.4789	.50
					.4497	.76
					.7184	1.02
					.6880	1.23

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

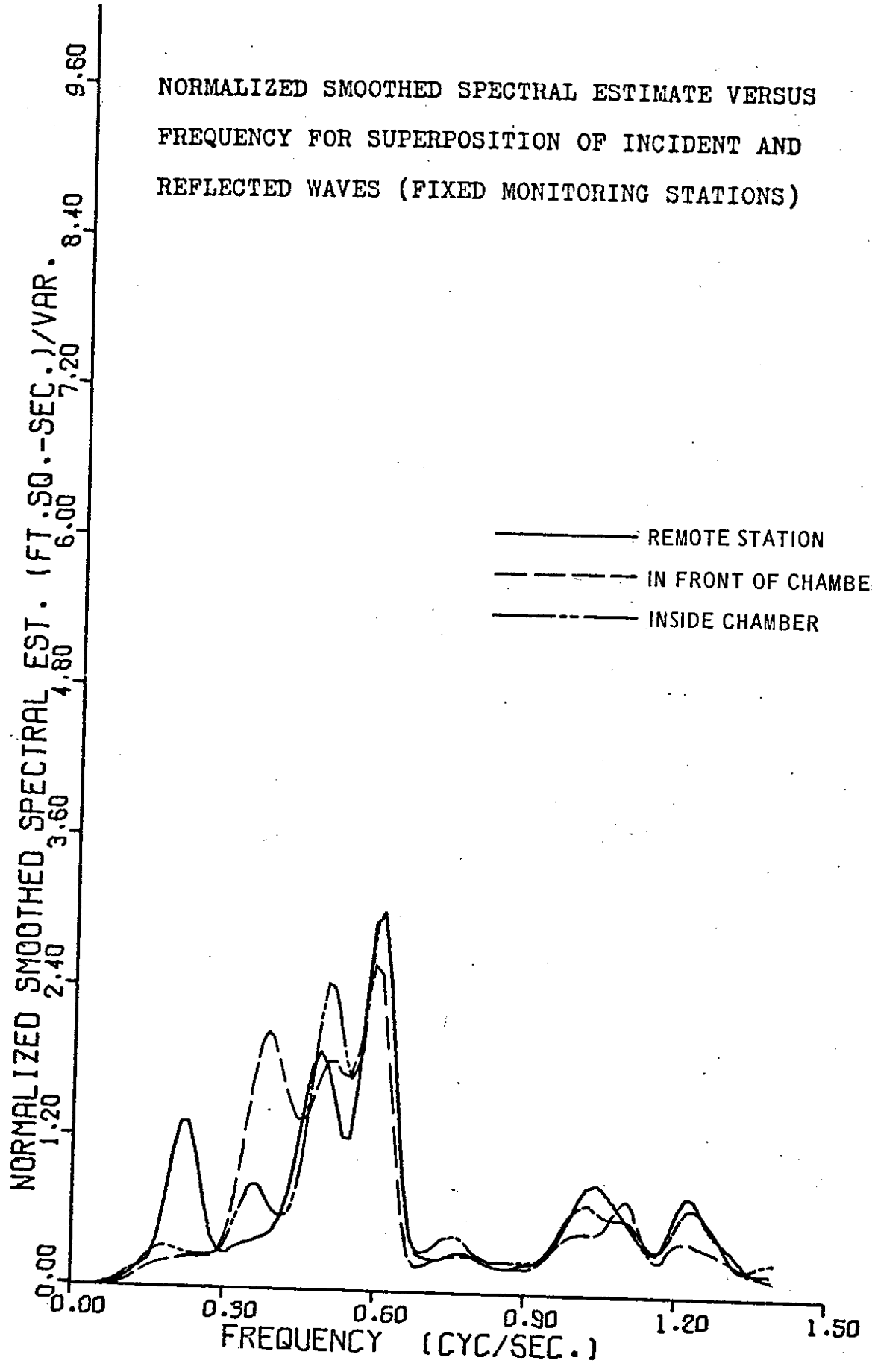


FIG.71

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

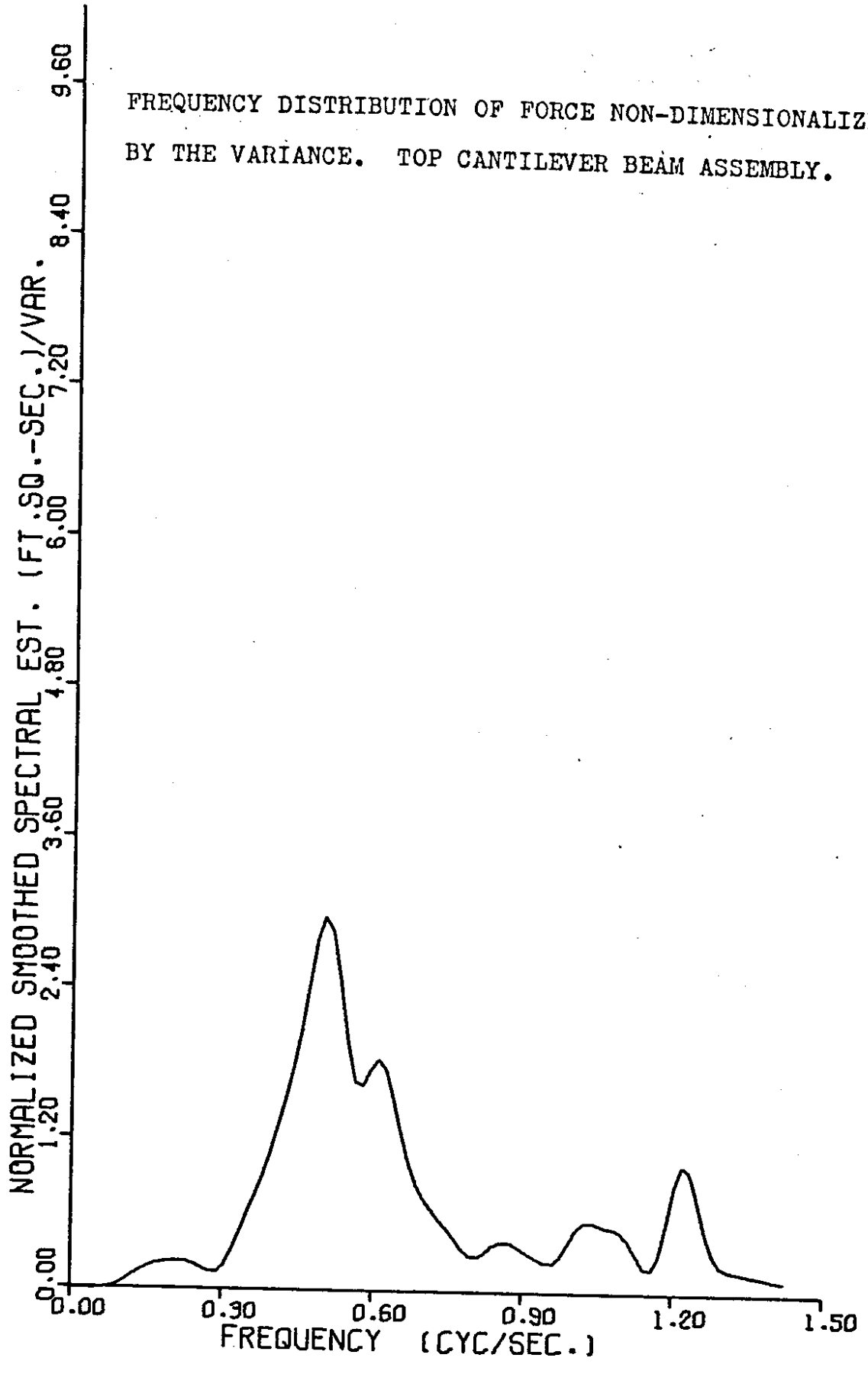


FIG. 72

WINDSPEED: 10-12 mph. DIRECTION: South south west

CHAMBER WIDTH: 7 feet DATE: 2/25/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): 84.9%

RUN NUMBER: 2,S11,e NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	SECONDARY fu
FORCES: TOP	272.22	3.490	.4878	950.05	.283 .424 .705	.85 1.01 1.22
BOTTOM	207.93	4.458	.4573	926.95	.354 .373	1.01 1.20
PRESSURES: REMOTE	.00491	3.159	.5793	.01551	1.467 .803 .704 .722	.21 .35 1.02 1.22
IN FRONT OF CHAMBER	.00074	2.597	.5793	.00192	2.063 1.901 .676 .533 .338	.40 .49 1.01 1.11 1.20
INSIDE OF CHAMBER	.00916	3.329	.5793	.03049	.704 .848 .569	.38 .99 1.22

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

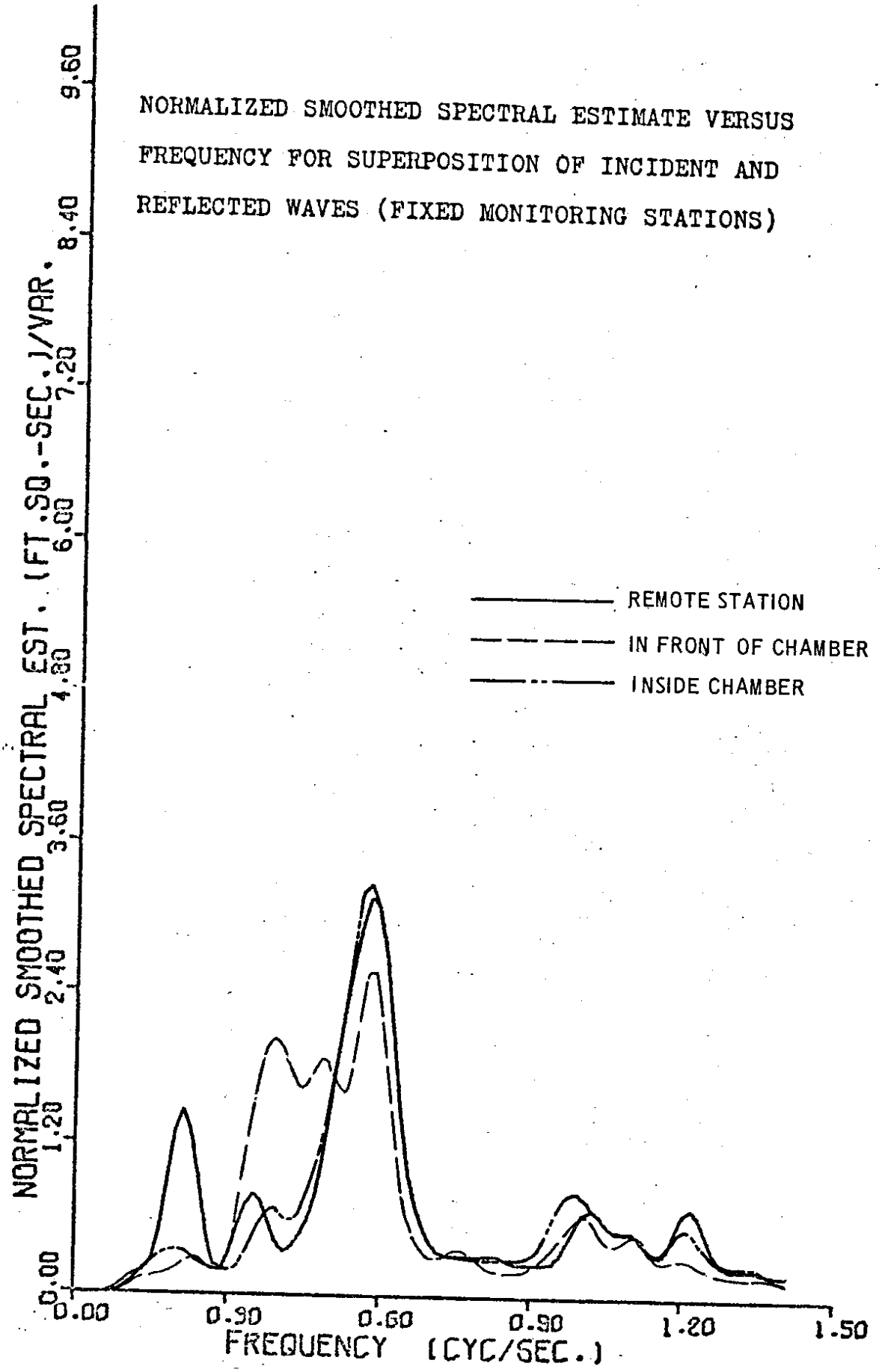


FIG. 73

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

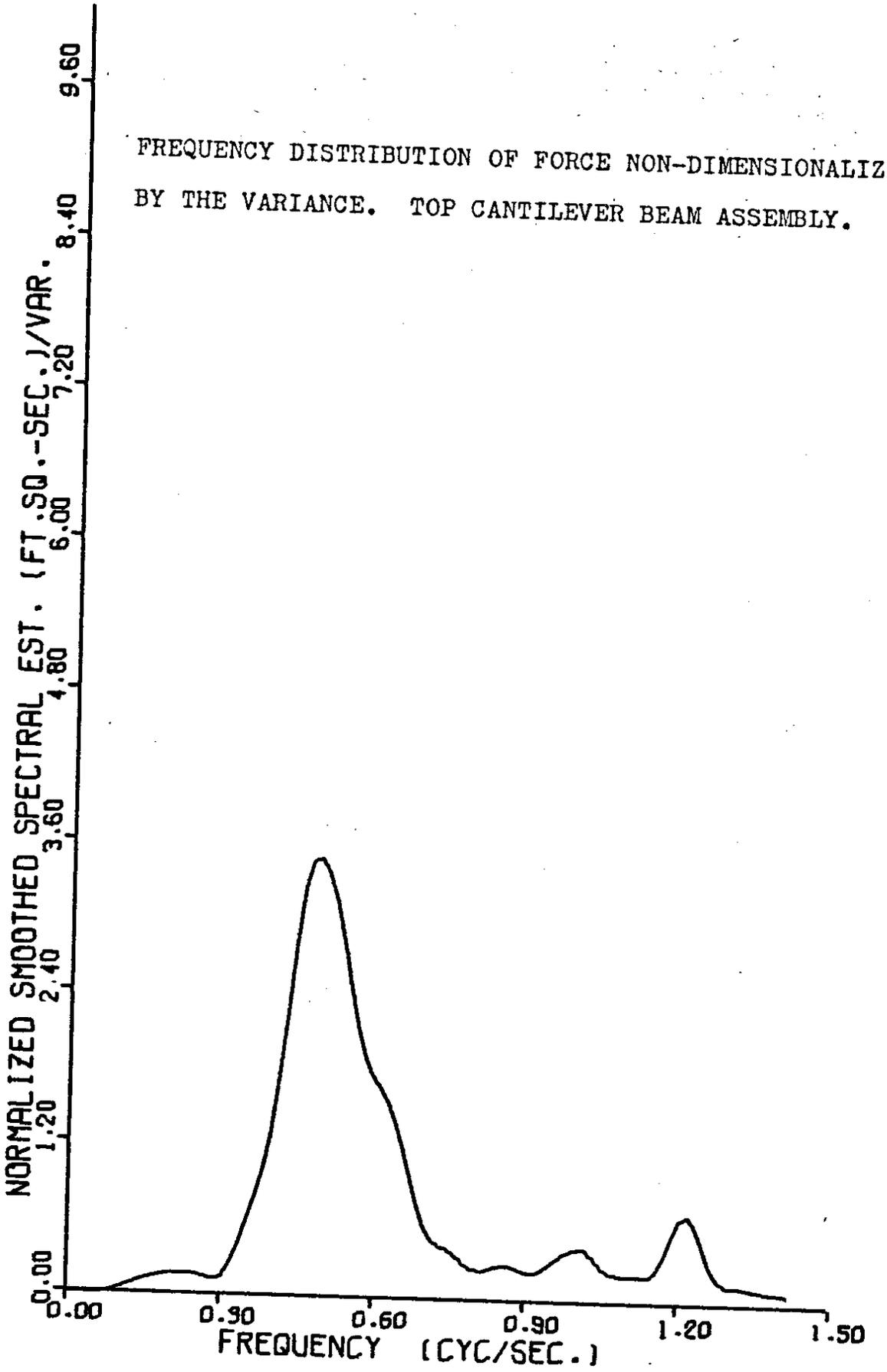


FIG. 74

WINDSPEED: 15 mph. DIRECTION: South

CHAMBER WIDTH: 7 feet DATE: 2/25/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW/REMOTE)): 38.9%

RUN NUMBER: 1,s4,b NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	SECONDARY fu
FORCES: TOP	237.24	6.805	.4268	1614.4	.7918	.66
BOTTOM	351.72	7.798	.4268	2742.71	.4202	.66
PRESSURES: REMOTE	.00175	3.902	.5031	.00683	1.400 0.564	.30 1.01
IN FRONT OF CHAMBER	.00107	7.292	.3963	.00780	None	

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

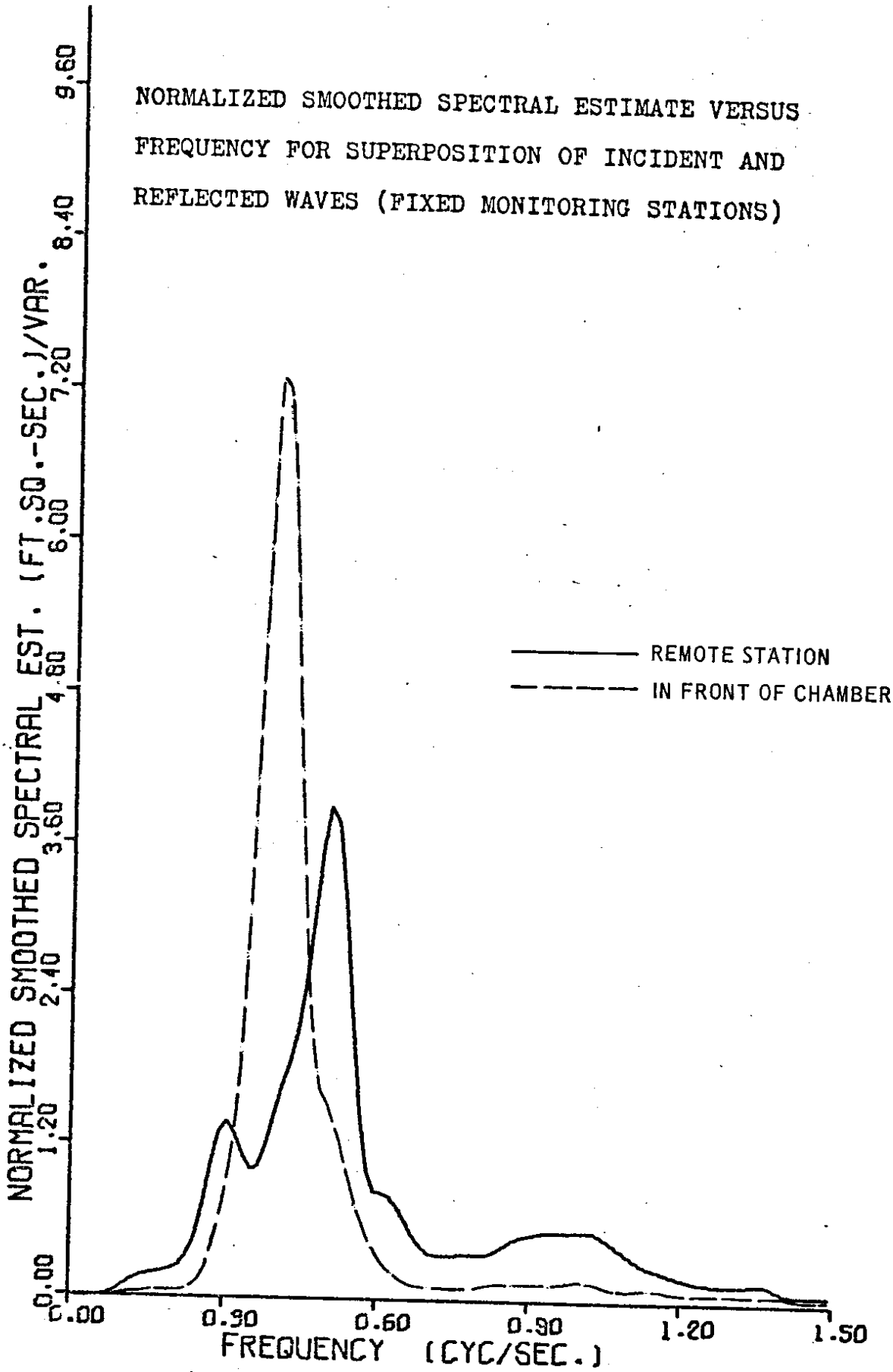


FIG. 75

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

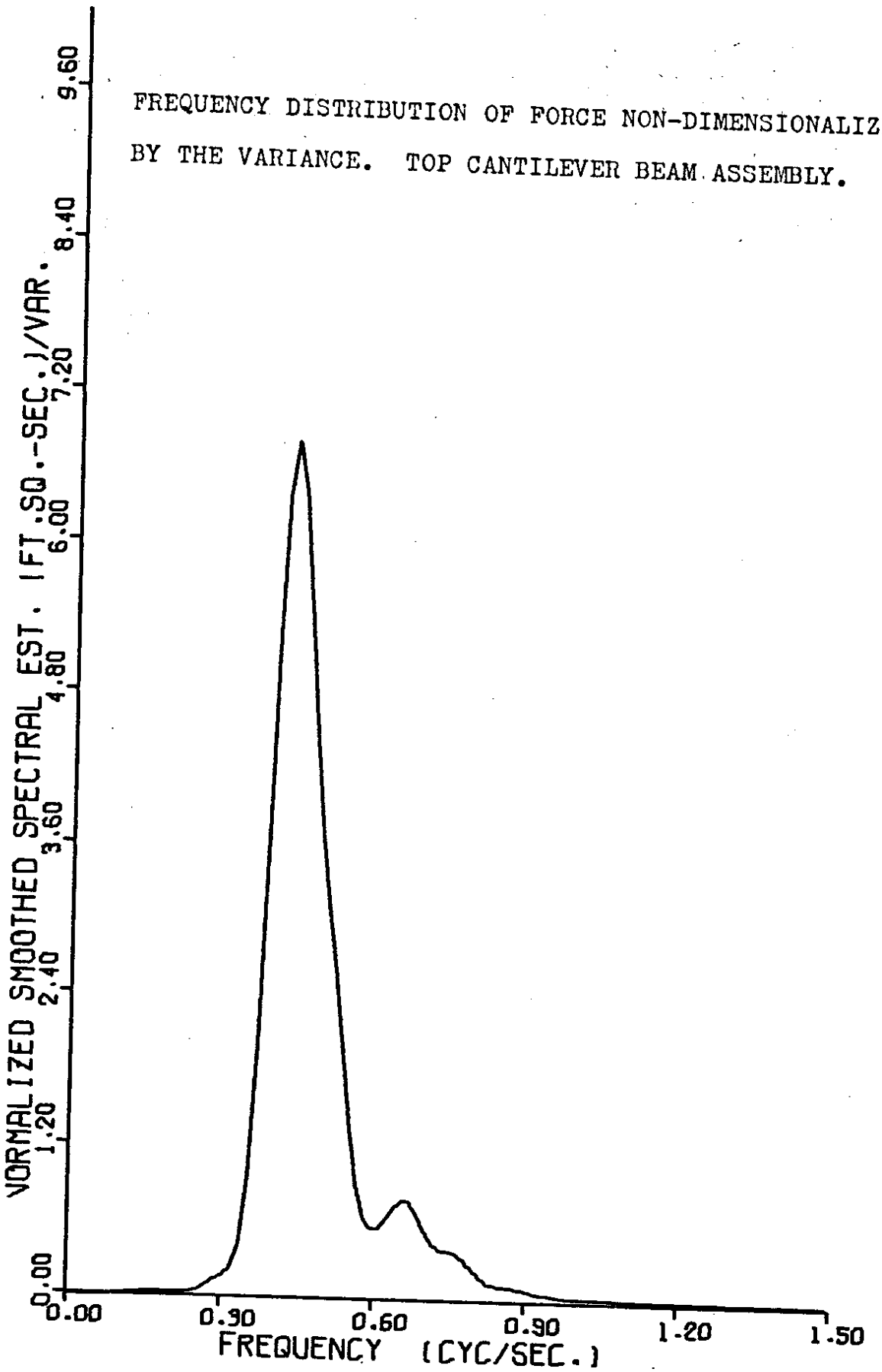


FIG. 76

WINDSPEED: 15 mph. (25 gust)DIRECTION: South

CHAMBER WIDTH: 7 feet DATE: 2/25/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): 62.8%

RUN NUMBER: 1,S10,a NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	fu
FORCES: TOP	423.91	6.414	.4268	2718.83	.2265 @ .7620 @ .2182 @ .2811 @	.20 .59 .85 1.23
BOTTOM	367.39	7.992	.4116	2936.18	.3642 .2592 .2237 .1847	.59 .73 .85 1.19
PRESSURES: REMOTE	.00277	1.474	.4900	.00408	2.80 .6461 .4027 1.0123 .4497	.2134 .73 .85 1.07 1.22
IN FRONT OF CHAMBER	.00103	6.060	.4116	.00624	.2278 .2780	.73 .85
INSIDE OF CHAMBER	.00410	3.383	.4116	.01387	1.4864 1.0962 .4943 .3715 .4096	.59 .73 .85 1.02 1.22

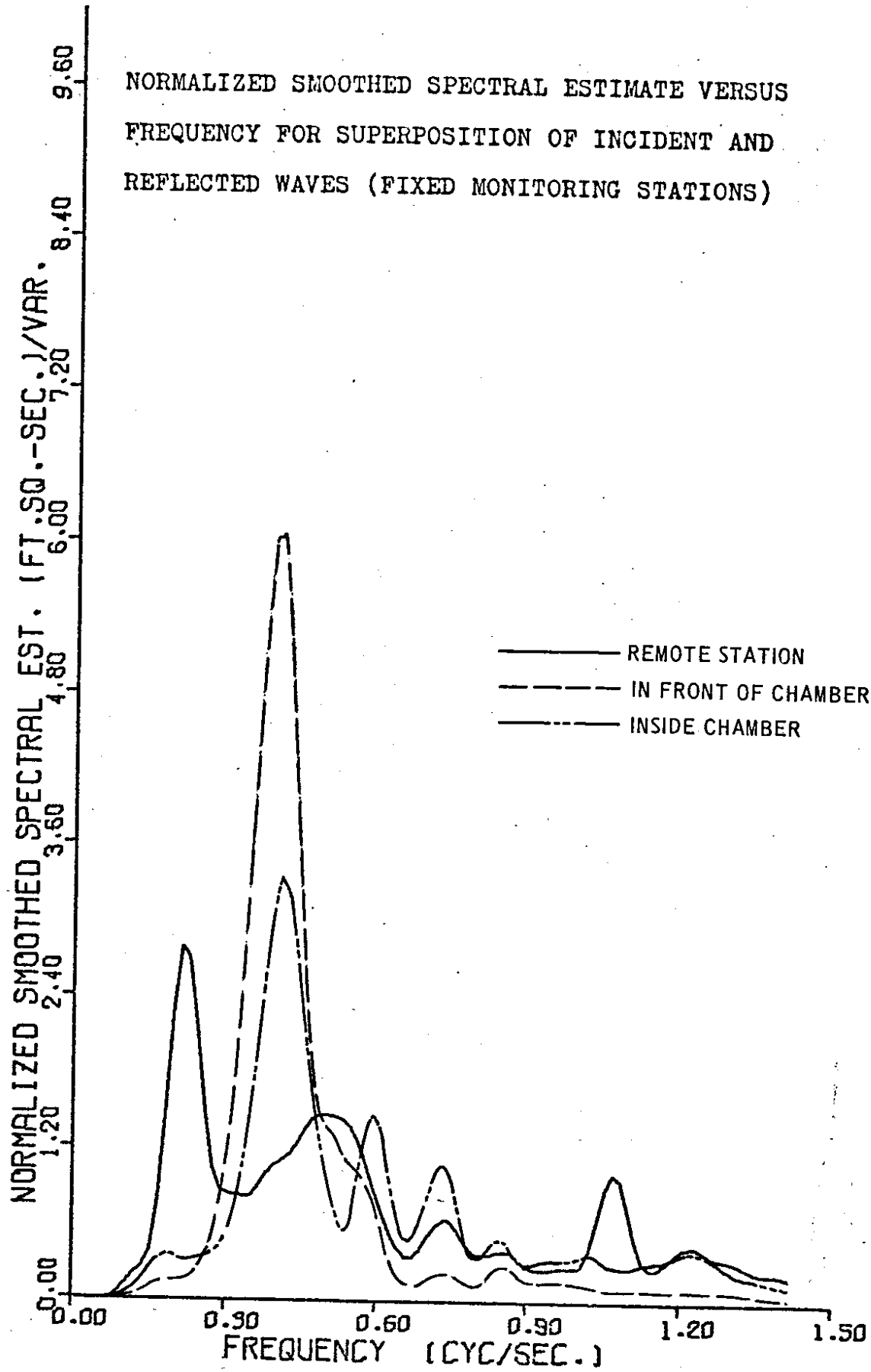

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
REMOTE STATION
IN FRONT OF CHAMBER
INSIDE CHAMBER
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG. 77

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

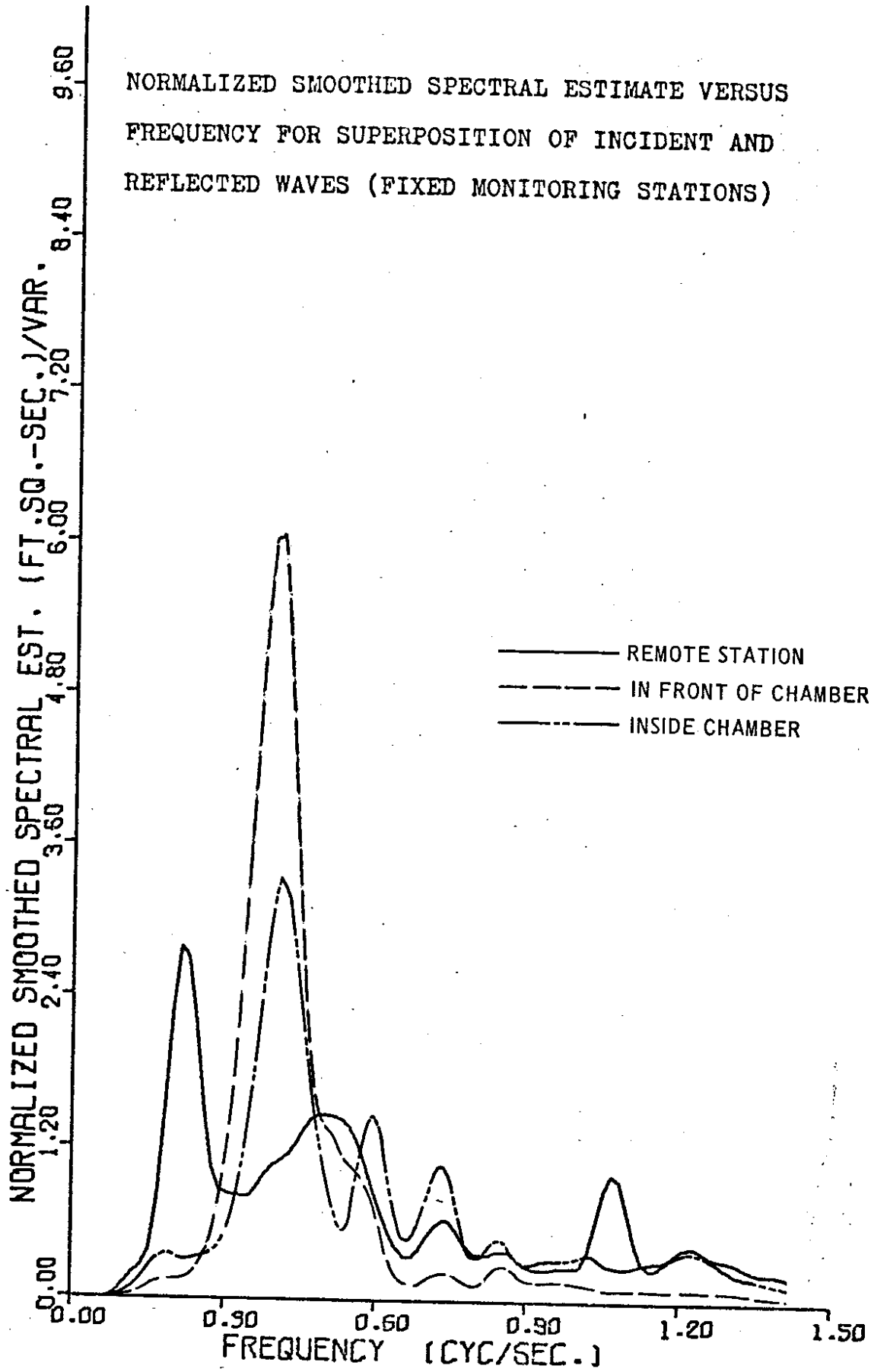


FIG. 77

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

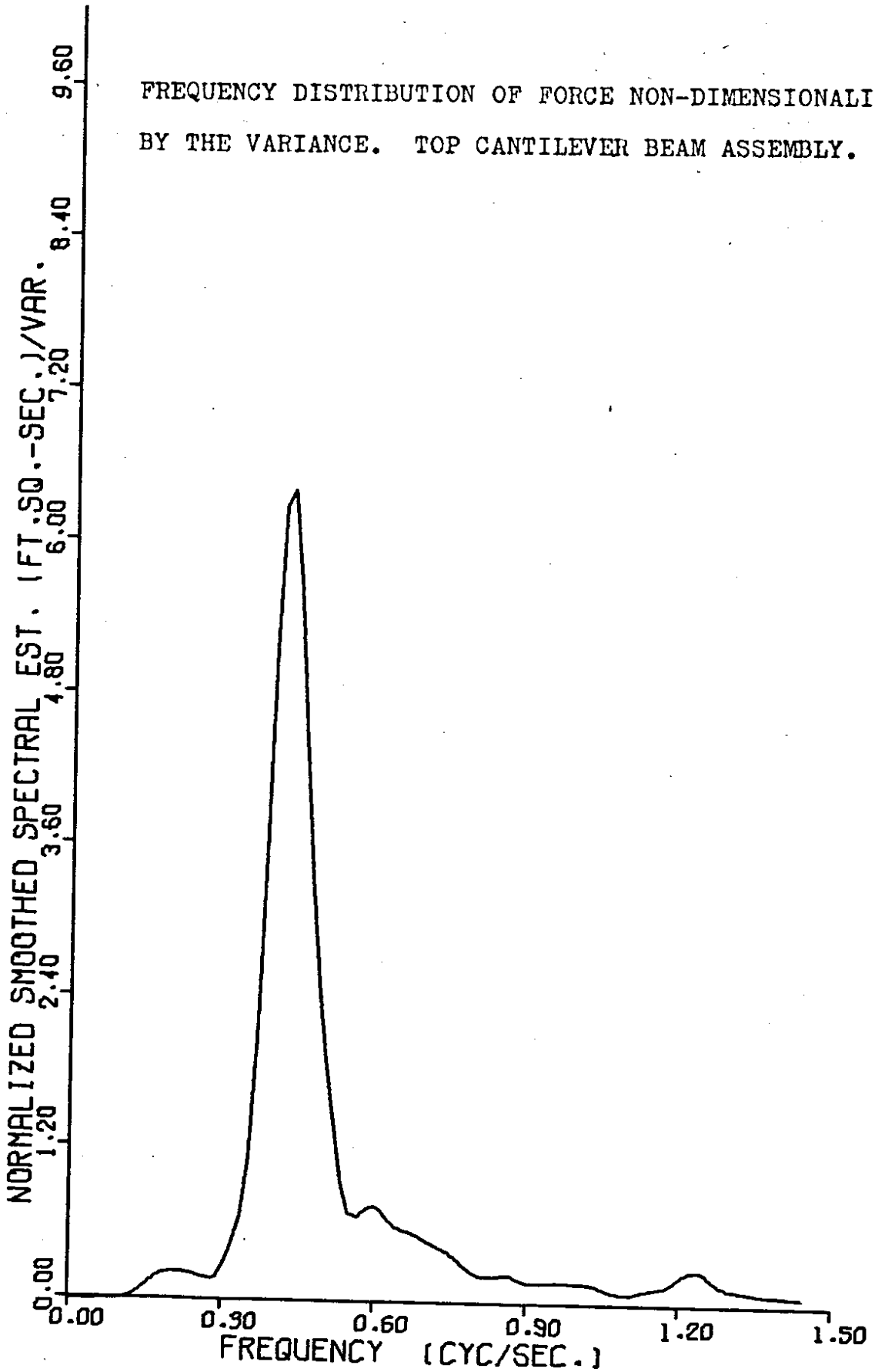


FIG. 78

WINDSPEED: 15-18 mph. DIRECTION: South

CHAMBER WIDTH: 7 feet DATE: 2/25/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): 15.7%

RUN NUMBER: 1,S4,c NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	SECONDARY fu
FORCES: TOP	216.67	8.744	.4421	1894.56	.5174	.67
BOTTOM	342.16	9.417	.4421	3222.12	.2719	.67
PRESSURES: REMOTE	.00083	5.039	.4878	.00418	1.494 .212	.34 .96
IN FRONT OF CHAMBER	.00070	7.029	.4268	.00492	None	
INSIDE OF CHAMBER	.00103	7.714	.4268	.00795	1.181 .151 .133	.26 .67 .88

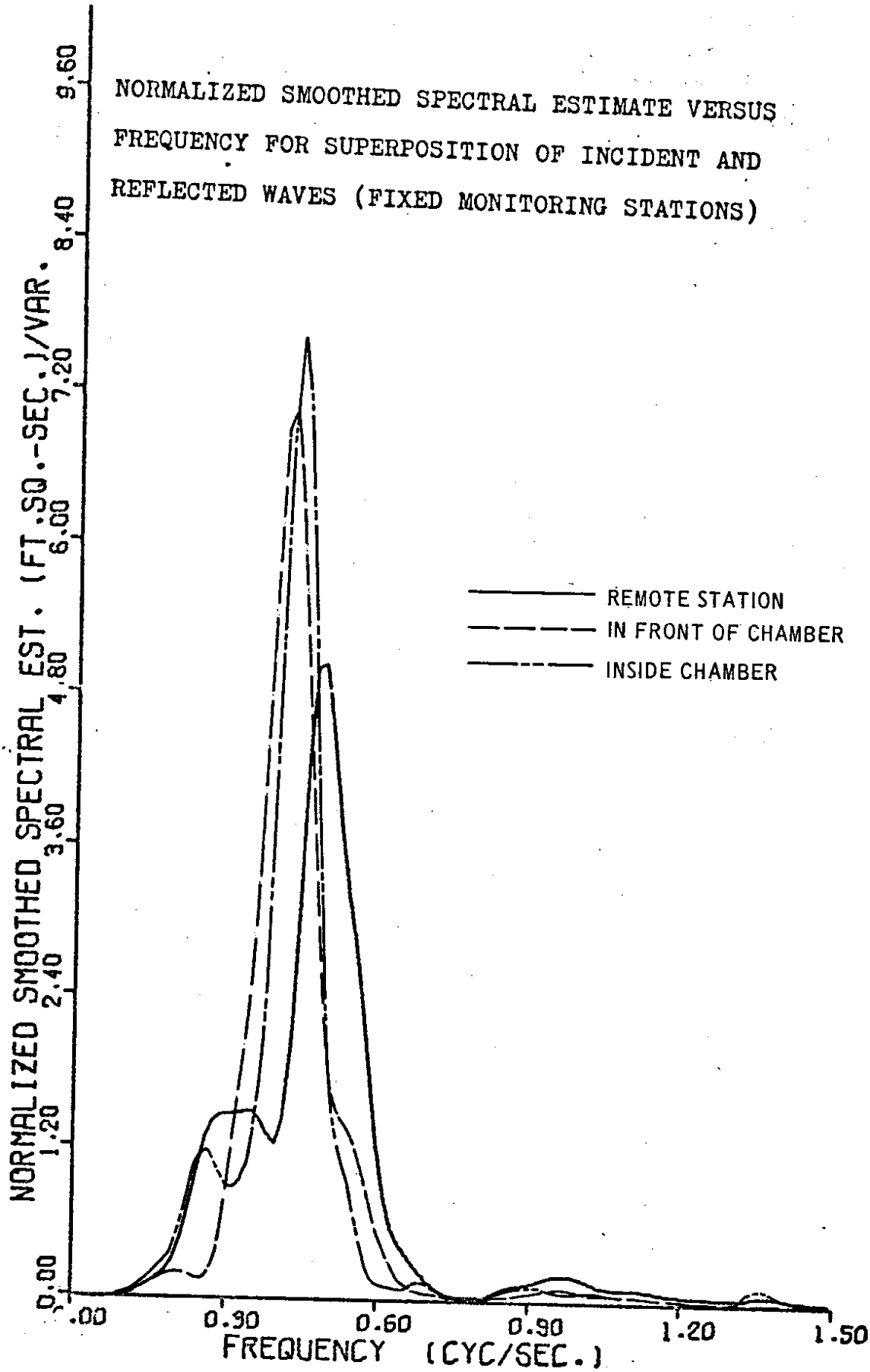

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
REMOTE STATION
IN FRONT OF CHAMBER
INSIDE CHAMBER
.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG. 79

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

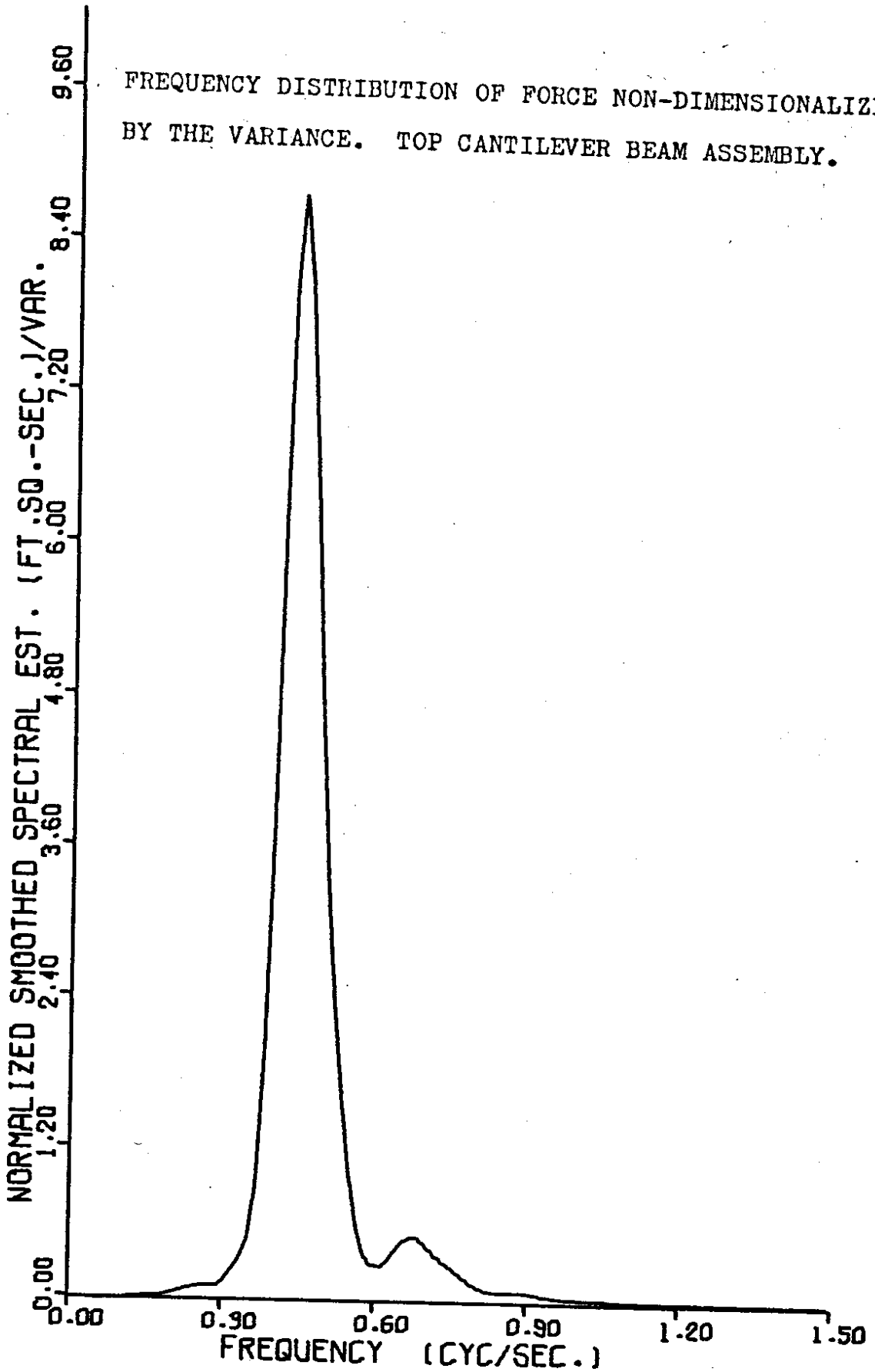


FIG. 80

WINDSPEED: 18-20 mph. DIRECTION: South

CHAMBER WIDTH: 7 feet DATE: 2/25/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): 23.3%

RUN NUMBER: 1,S5,d NO. DATA POINTS: 512

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	fu
FORCES: TOP	113.89	6.991	.4573	796.20	.972	.67
BOTTOM	161.75	7.780	.4573	1258.41	.596	.66
PRESSURES: REMOTE	.00043	4.946	.4878	.00213	.424 .231 .181	.21 .90 1.36
IN FRONT OF CHAMBER	.00033	5.325	.4116	.00176	.355 2.436 .227 .227	.21 .55 .84 1.37

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)

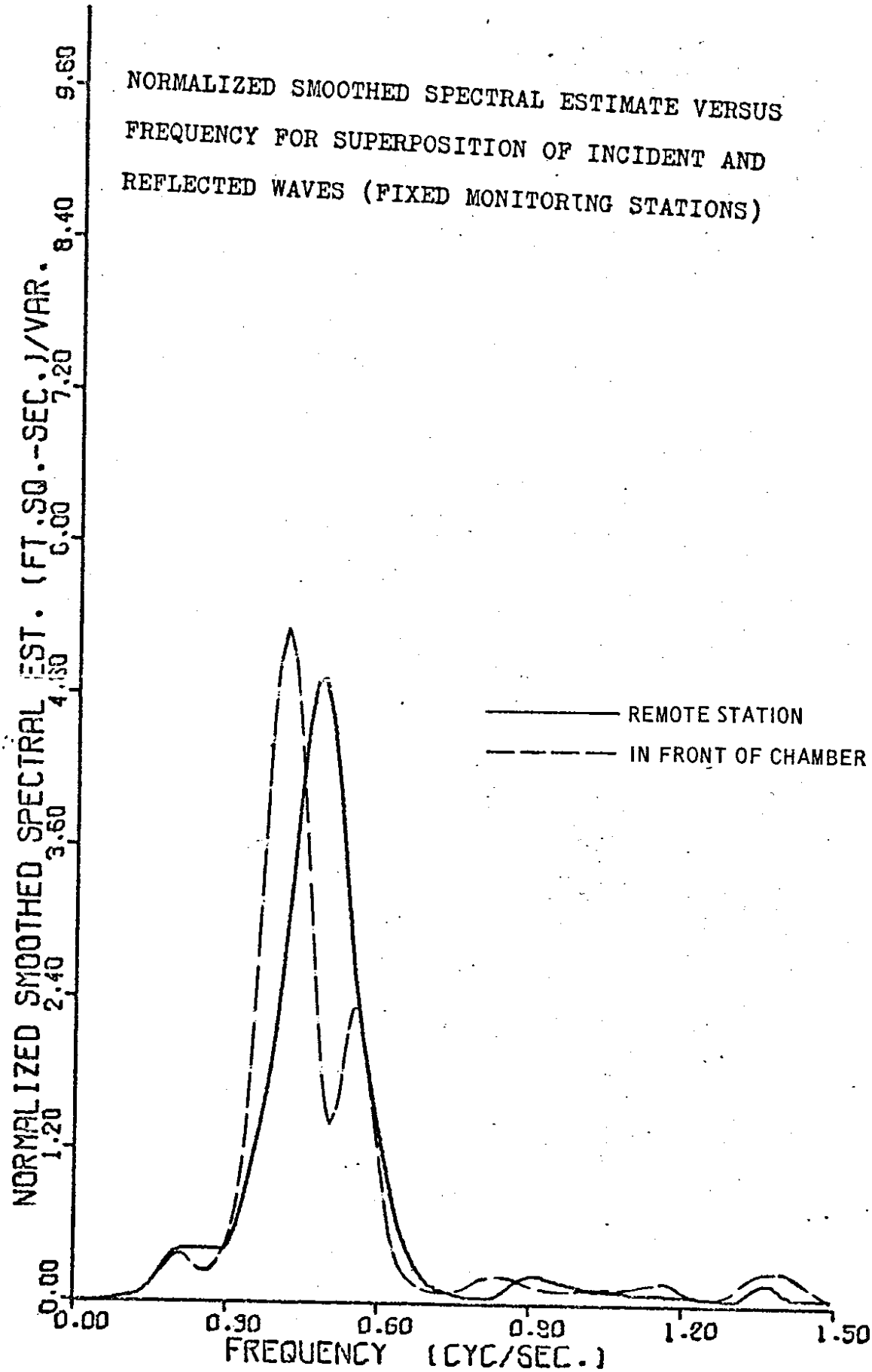


FIG.81

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

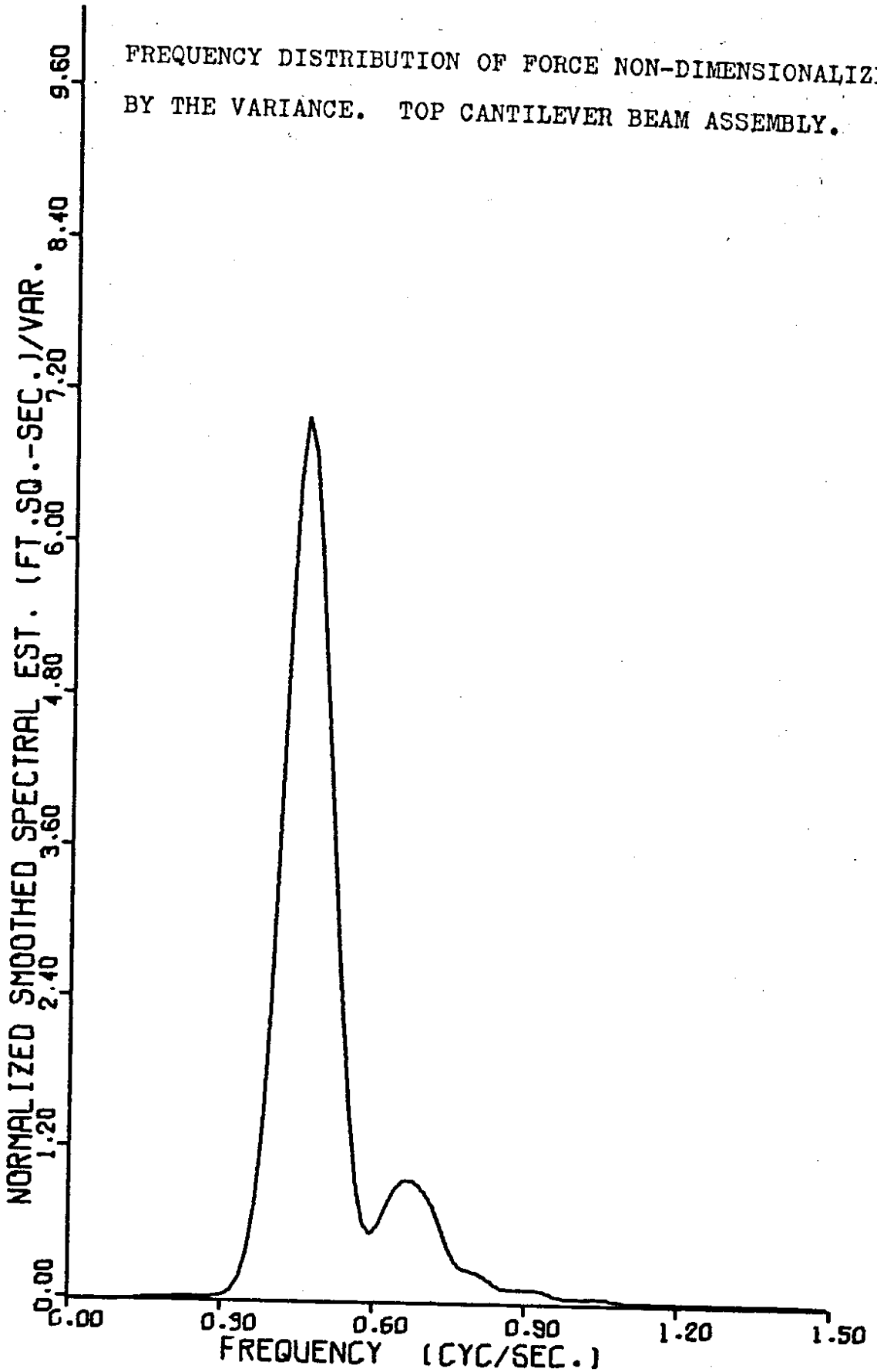


FIG.82

WINDSPEED: 35 mph DIRECTION: South

CHAMBER WIDTH: 7 feet DATE: 3/1/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): 47.1%

RUN NUMBER: 4,S9,i NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	SECONDARY fu
FORCES: TOP	1874.96	5.408	.3659	10,139.8	None	
BOTTOM	2768.12	6.235	.3506	17,259	.1369	.78
PRESSURES: REMOTE	.01857	5.902	.3354	.10960	1.9134 (filtered .6076	.12 D.C.) .50
IN FRONT OF CHAMBER	.00982	8.447	.3506	.08295	.1417	.78
INSIDE OF CHAMBER	.01105	2.539	.39634	.02806	Many?	?

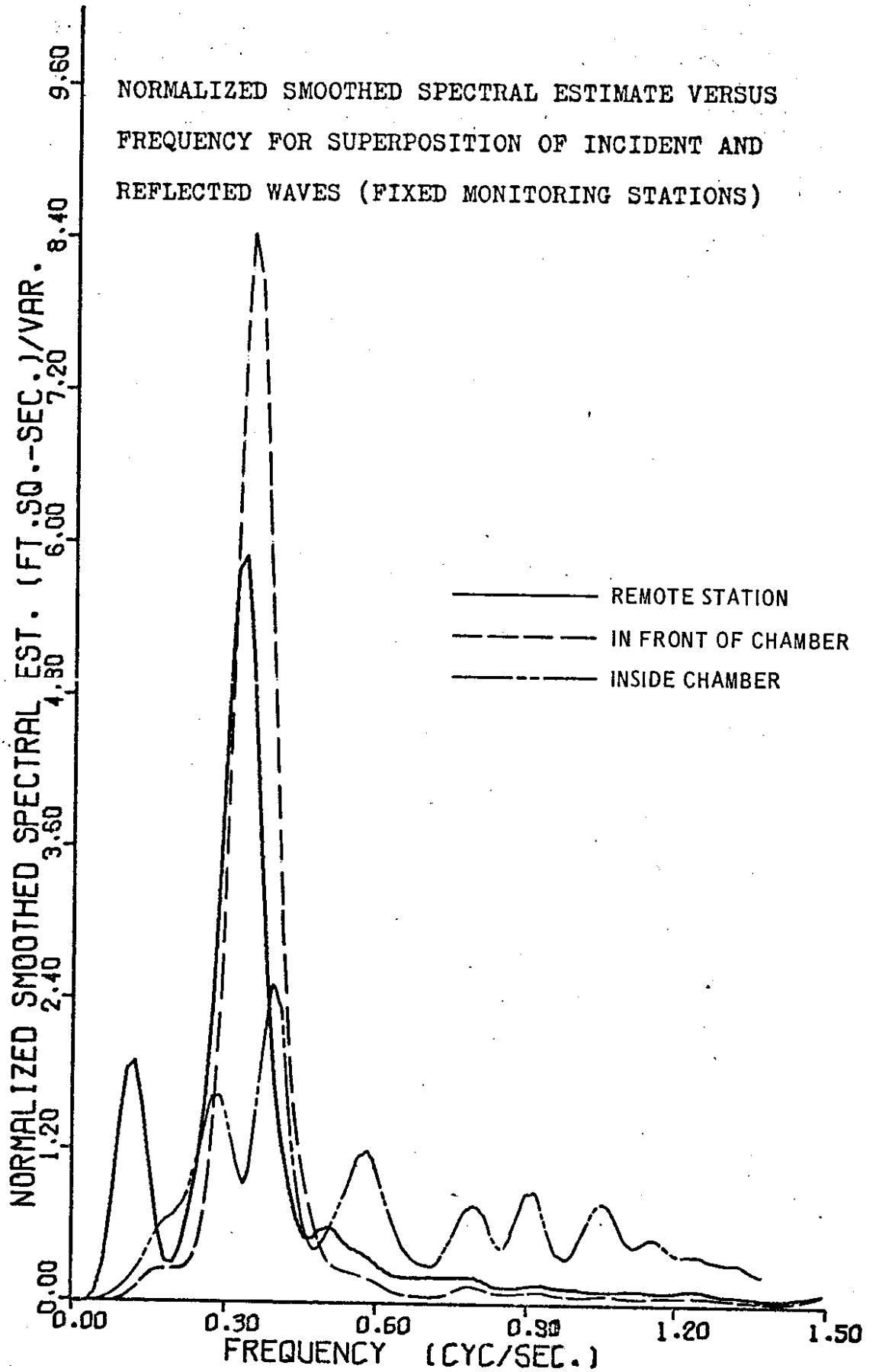

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERPOSITION OF INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
REMOTE STATION
IN FRONT OF CHAMBER
INSIDE CHAMBER

FIG. 83

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

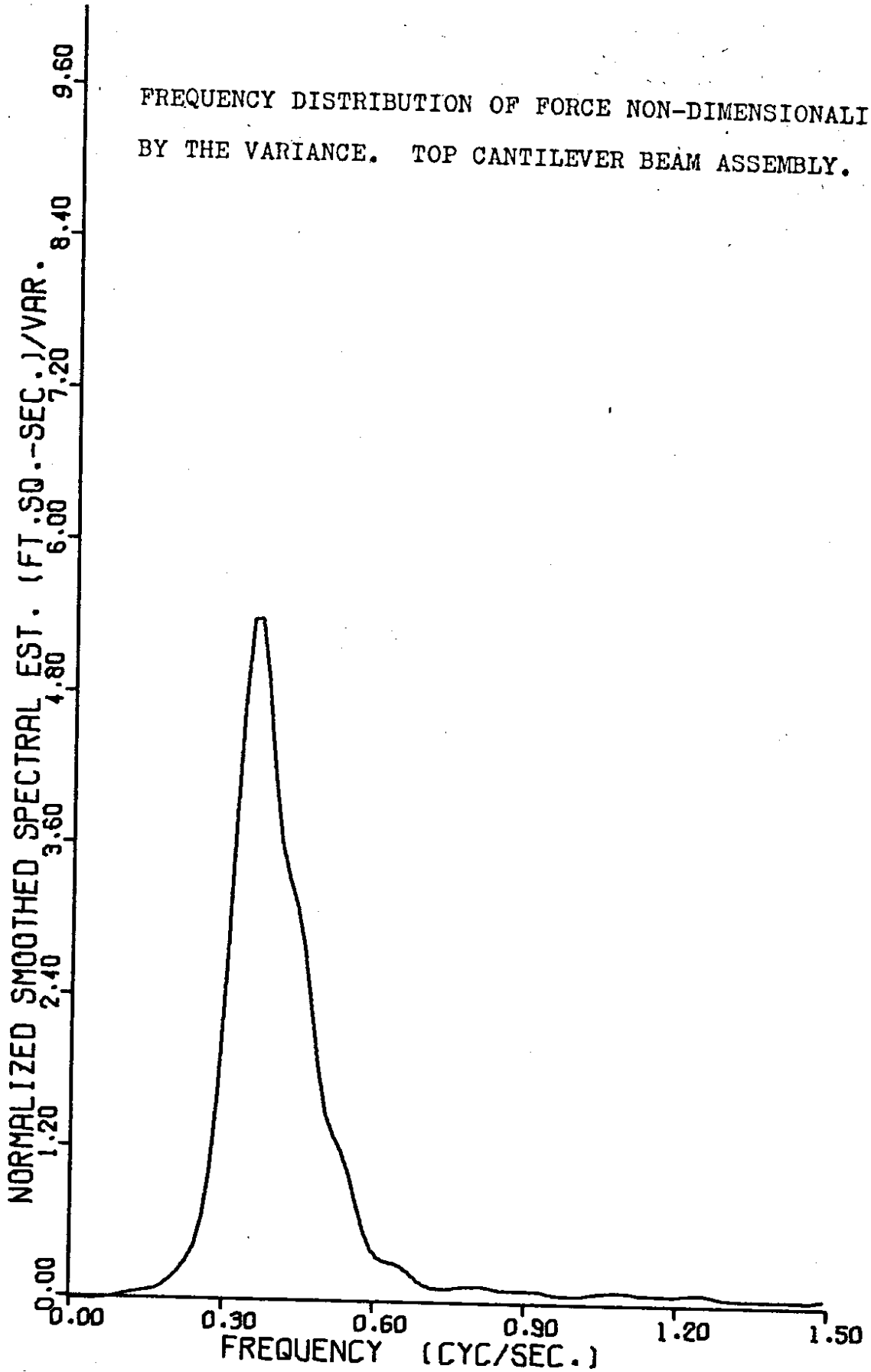


FIG. 84

WINDSPEED: 35mph DIRECTION: South

CHAMBER WIDTH: 7 feet DATE: 3/1/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): 48.0%

RUN NUMBER: 4,S11, j NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	fu
FORCES: TOP	2485.81	6.684	.3811	16,615.2	.1326	.76
BOTTOM	3444.08	7.101	.3659	24,456.4	None	
PRESSURES: REMOTE	.01626	7.289	.3201	.11852	None (filtered D.C.)	
IN FRONT OF CHAMBER	.00845	8.478	.3506	.07164	.1983	.78
INSIDE OF CHAMBER	.01044	1.66	.2744	.01733	Many	

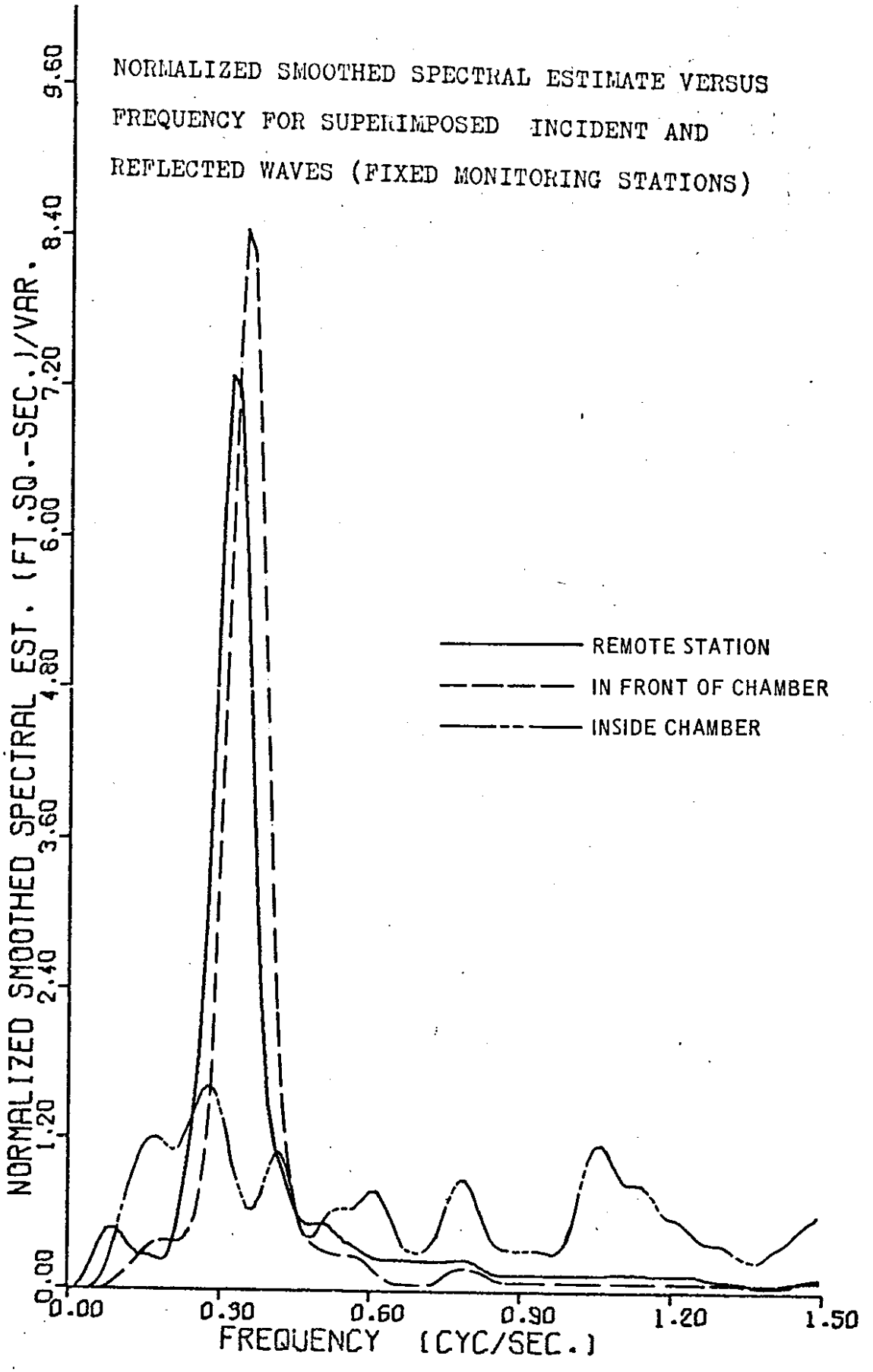

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERIMPOSED INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
REMOTE STATION
IN FRONT OF CHAMBER
INSIDE CHAMBER

FIG. 85

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

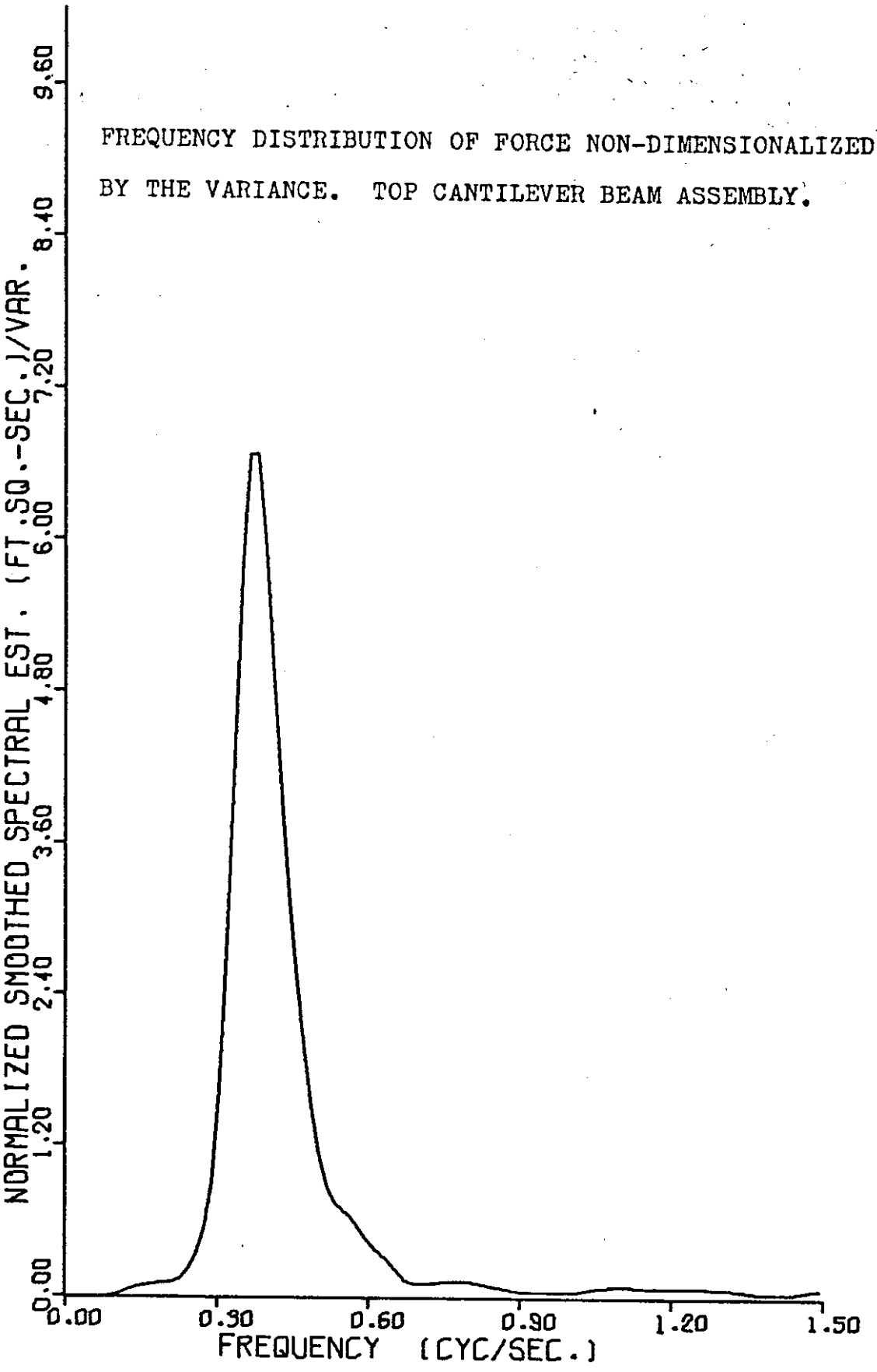


FIG. 86

WINDSPEED: 35-40 DIRECTION: South south west

CHAMBER WIDTH: 7 feet DATE: 2/27/72

ATTENUATION (1- VARIANCE RATIO(CHAMBER(BW)/REMOTE)): -13.3%

RUN NUMBER: 3,S10,h NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK S(fu)/σ^2	PEAK FREQ.	50 LAG PEAK S(fu)	SECONDARY S(fu)/σ^2	SECONDARY fu
FORCES: TOP	3125.43	7.173	.3963	22,418.7	.2931 .1786	.66 1.33
BOTTOM	3600.45	7.806	.3811	28,105.2	.1238	1.33
PRESSURES: REMOTE	.00879	4.598	.3506	.04042	.4225 1.4034 .5950 .7068	.15 .49 .75 1.33
IN FRONT OF CHAMBER	.00996	9.212	.3659	.09175	.2166 .1716 .2550	.17 .78 1.33
INSIDE OF CHAMBER	.01944	3.670	.3811	.07134	.8785 .7216 .8188 .4400 1.9037	.15 .61 .76 1.22 1.34

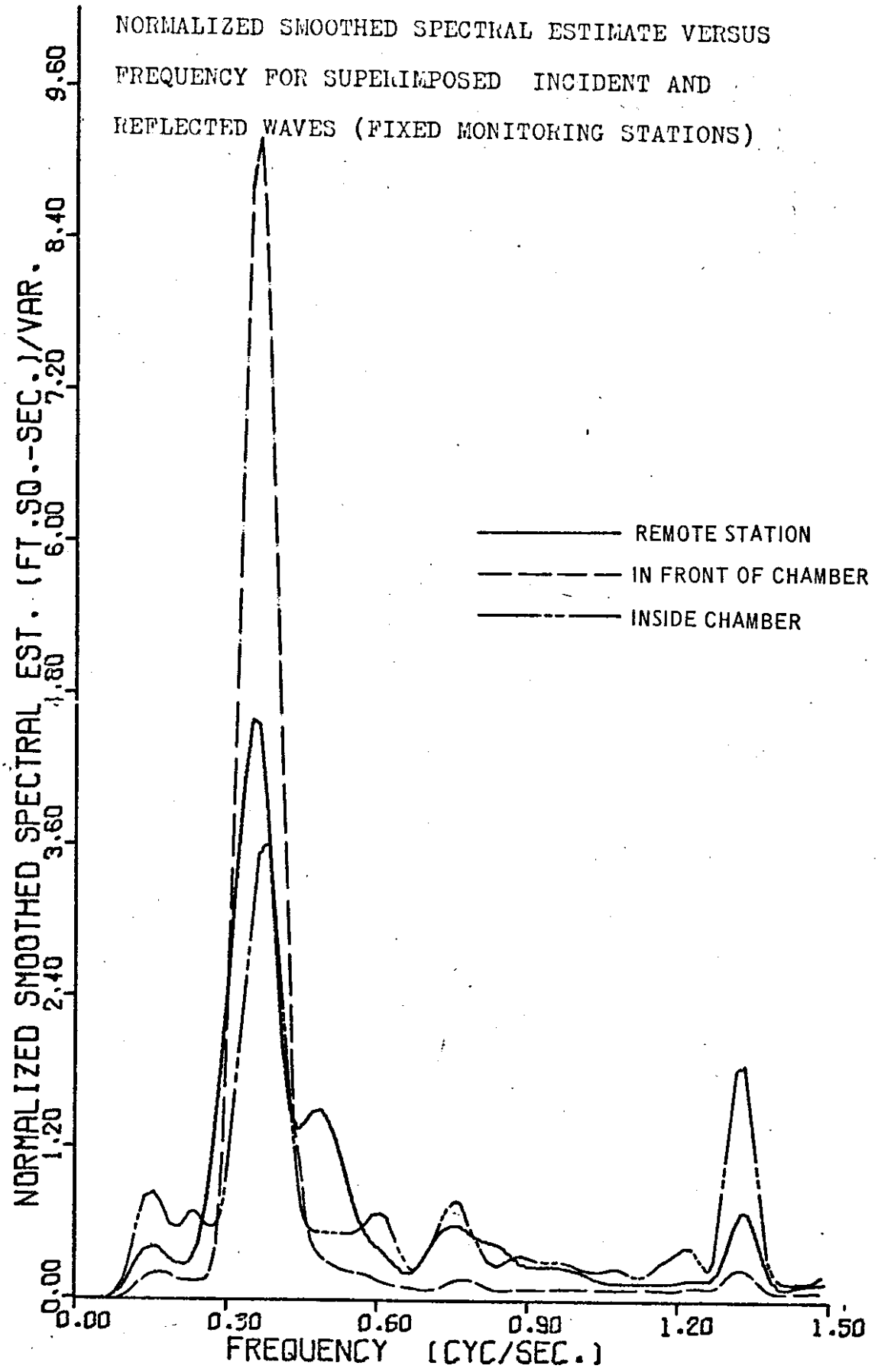

NORMALIZED SMOOTHED SPECTRAL ESTIMATE VERSUS FREQUENCY FOR SUPERIMPOSED INCIDENT AND REFLECTED WAVES (FIXED MONITORING STATIONS)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
REMOTE STATION
IN FRONT OF CHAMBER
INSIDE CHAMBER

FIG. 87

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

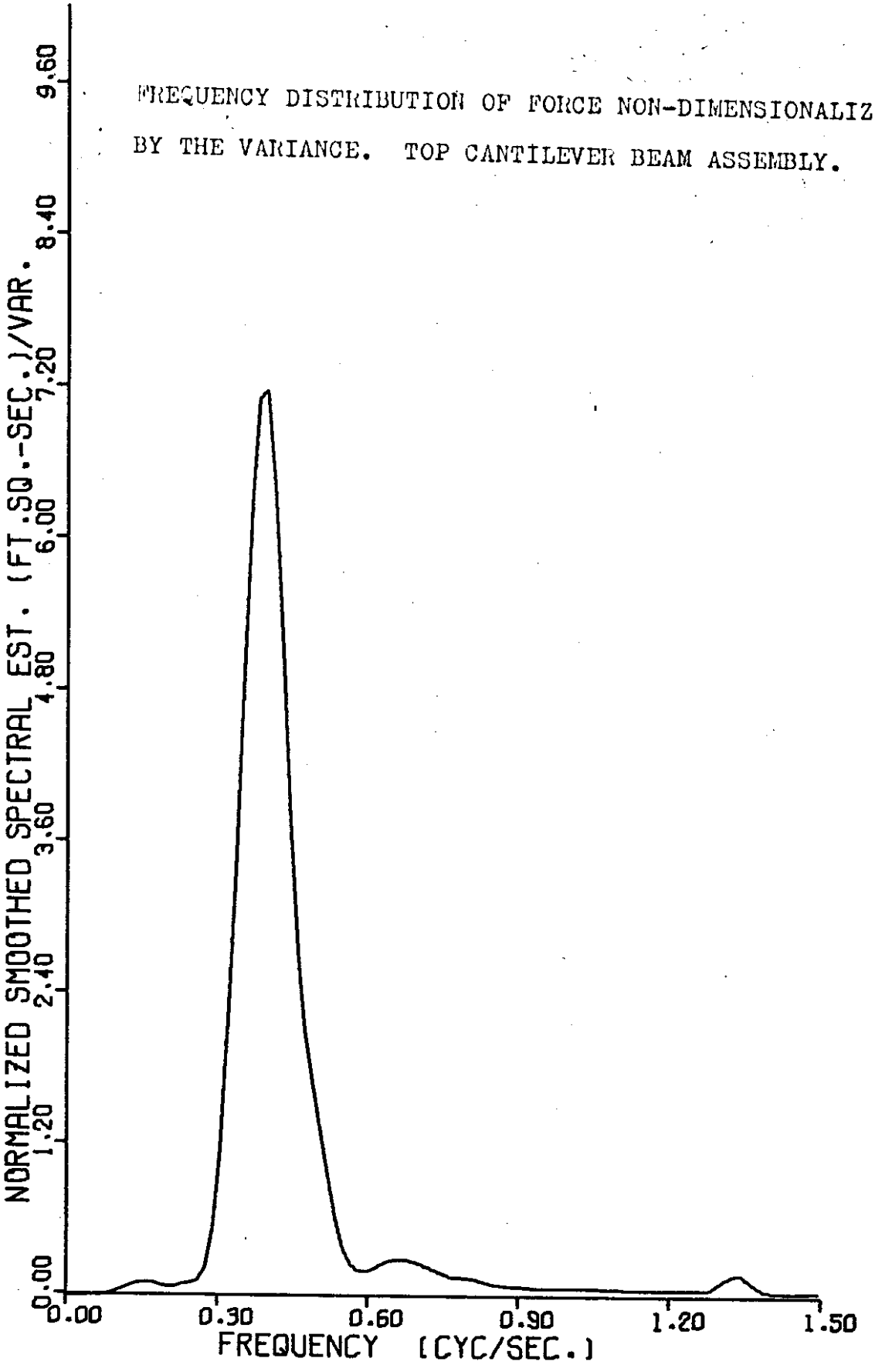


FIG. 88

WINDSPEED: 35-40 (gusts 50) DIRECTION: S/SSW

CHAMBER WIDTH: 7 feet DATE: 2/27/72

ATTENUATION (1- VARIANCE RATIO (CHAMBER(BW)/REMOTE)): -10.7%

RUN NUMBER: 3,S3,g NO. DATA POINTS: 1024

TYPE OF MEASUREMENT	VARIANCE σ^2	PEAK $S(fu)/\sigma^2$	PEAK FREQ.	50 LAG PEAK $S(fu)$	SECONDARY $S(fu)/\sigma^2$	SECONDARY fu
FORCES: TOP	2154.68	7.815	.3963	16,838.8	.0887 .2393	.15 .67
BOTTOM	3227.33	8.333	.3963	26,893.3	.1149	.67
PRESSURES: REMOTE	.00798	5.547	.3659	.04427	.3082 .5977 .6345	.15 .76 1.37
IN FRONT OF CHAMBER	.00883	9.636	.3659	.08509	.1869 .2861	.17 1.37
INSIDE OF CHAMBER	.01229	5.789	.3811	.07115	1.1999 2.2619	.15 1.37

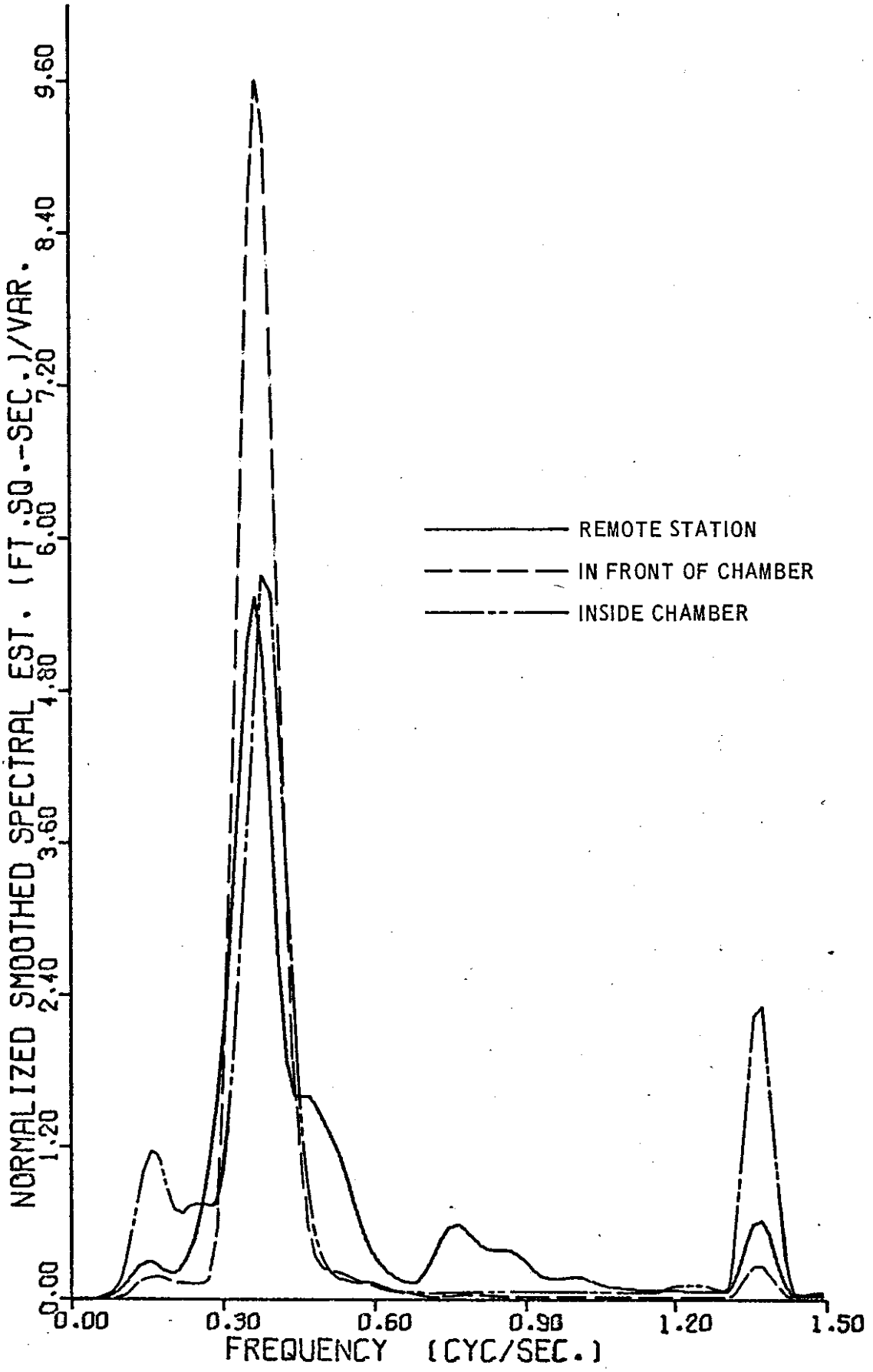

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
REMOTE STATION
IN FRONT OF CHAMBER
INSIDE CHAMBER

FIG. 89

FREQUENCY DISTRIBUTION OF FORCE NON-DIMENSIONALIZED BY THE VARIANCE. TOP CANTILEVER BEAM ASSEMBLY.

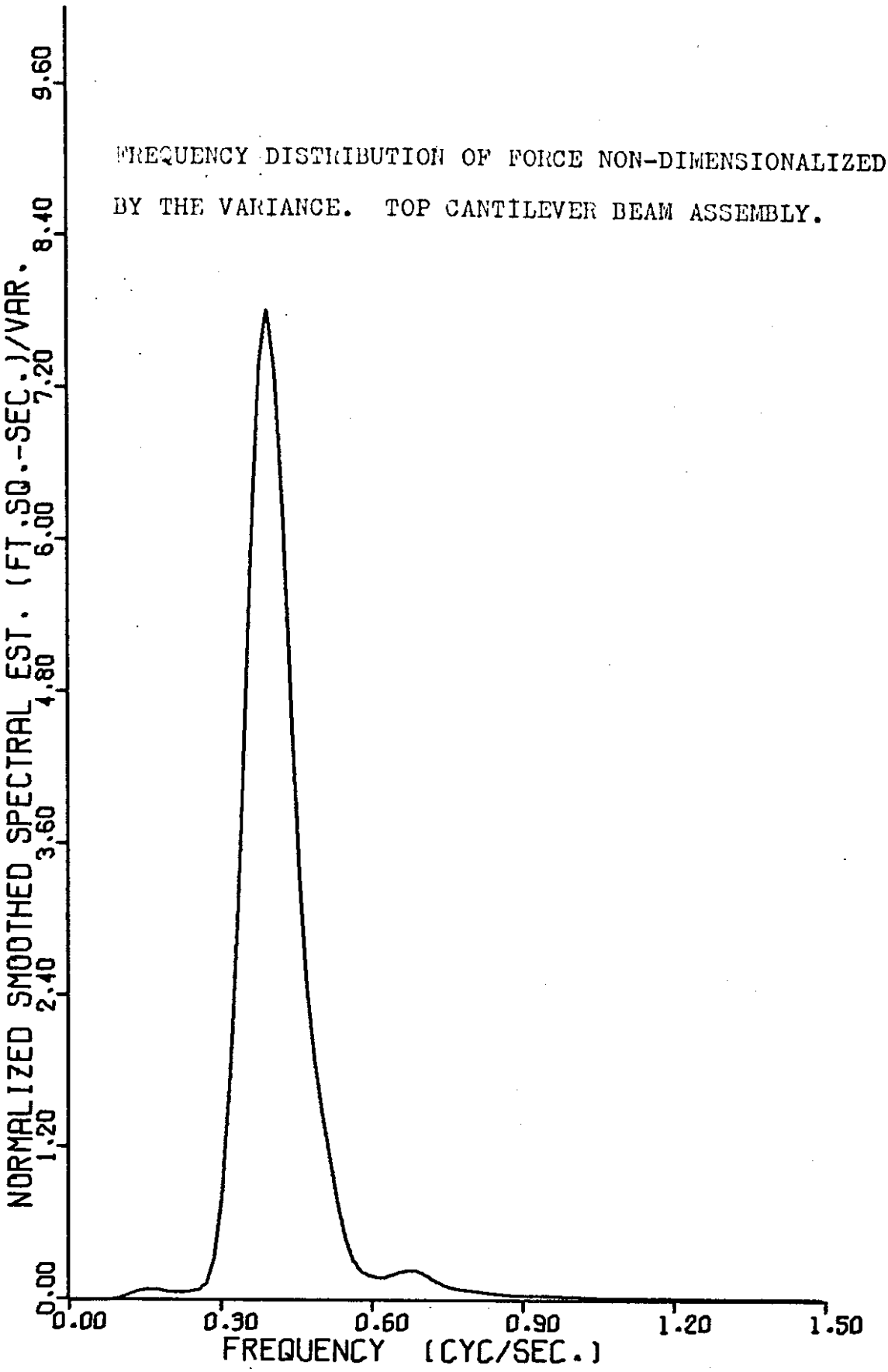


FIG. 90

APPENDIX II

Spectral plots in front of the breakwater and at the remote station are superimposed for representative wind conditions. Both curves, on each plot, are non-dimensionalized to the variance at the remote station. The figures are presented in order of increasing windspeed; the five foot wide chamber without bottom first, then the five foot with solid bottom, followed by the seven foot wide chamber with solid bottom. Notice that, though the peaks of each curve vary for different wind conditions , the portion of the curves which appear to have more energy in front of the breakwater than at the remote station only occur near the resonant frequency of the chamber as enumerated in the analysis.

Figures 91-100 Chamber width= five feet; no bottom

Figures 101-116 Chamber width= five feet; solid bottom

Figures 116-126 Chamber width= seven feet; solid bottom

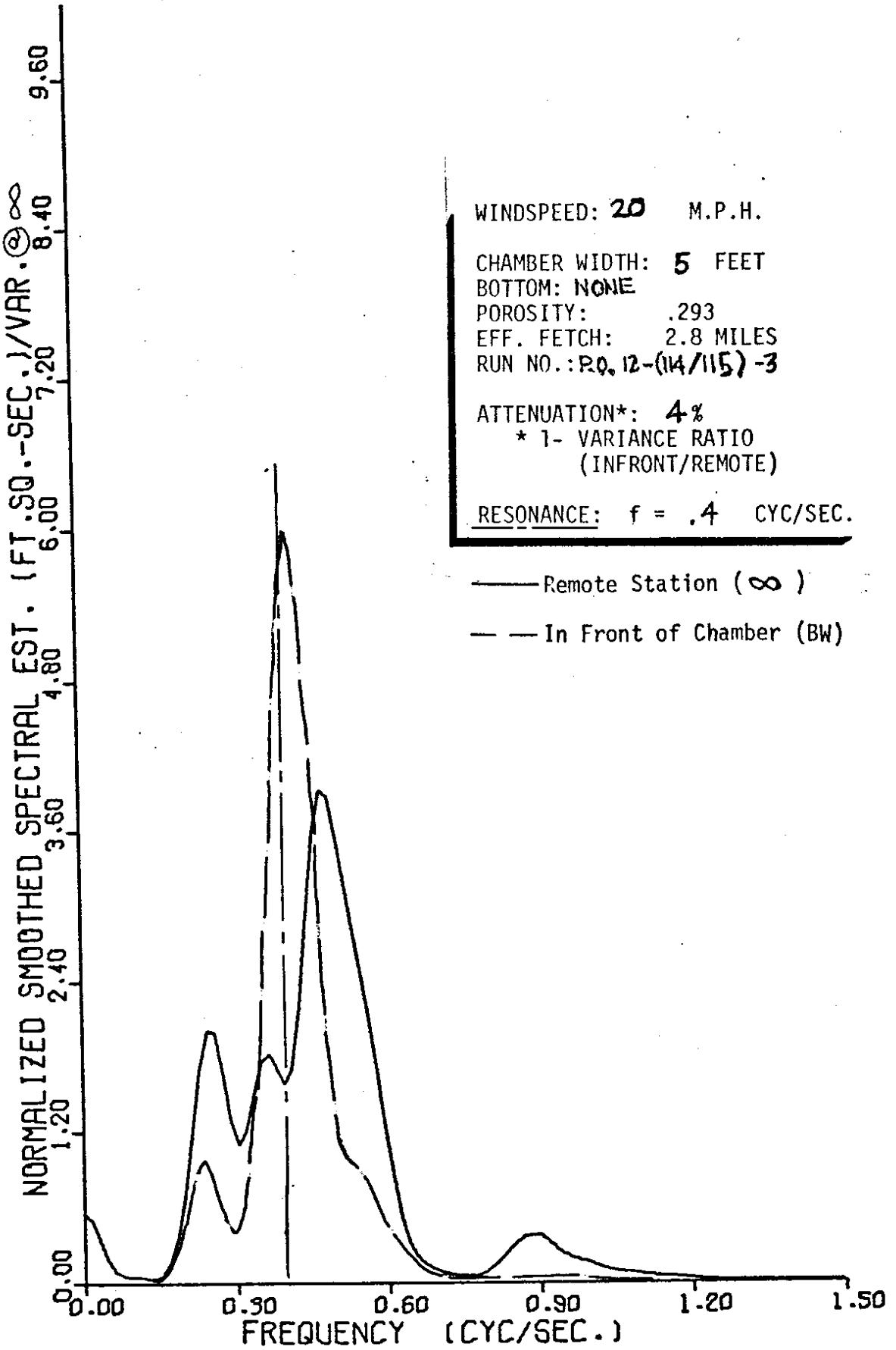

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: P.O. 12-(114/115)-3
ATTENUATION*: 4%
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
——— Remote Station (∞)
— — In Front of Chamber (BW)

FIG. 91

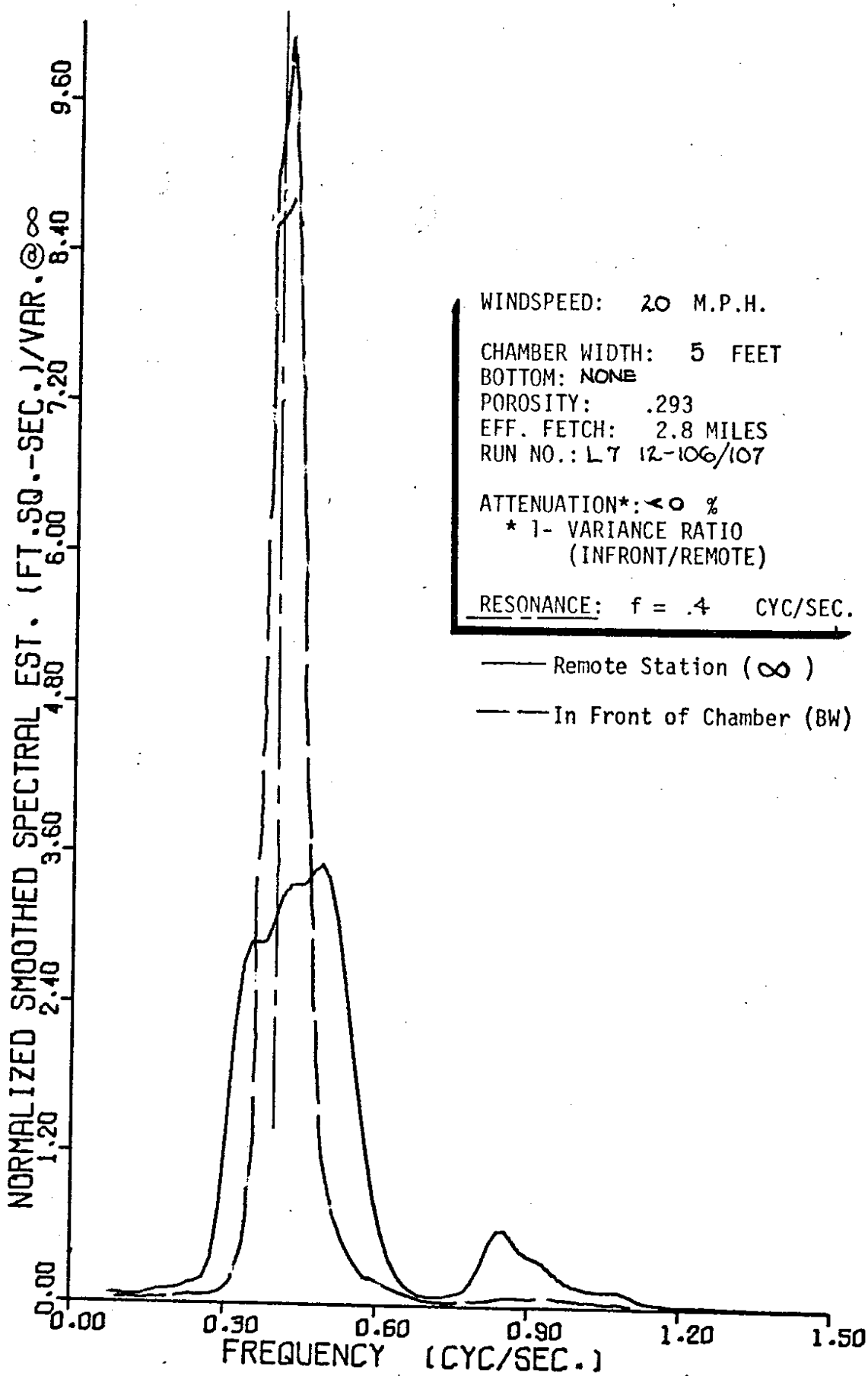

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: L7 12-106/107
ATTENUATION*: <0 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 92

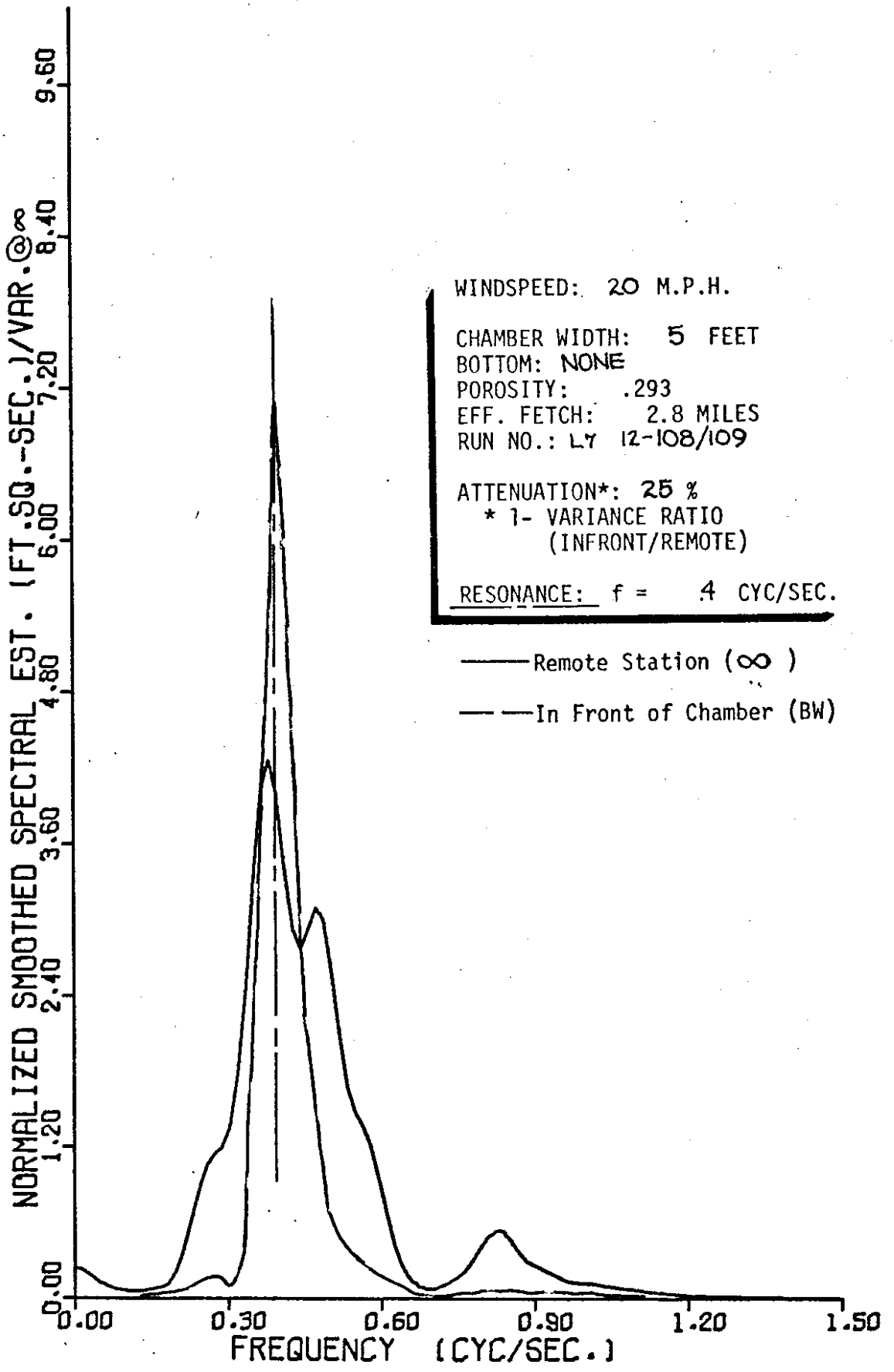

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: LY 12-108/109
ATTENUATION*: 25 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 93

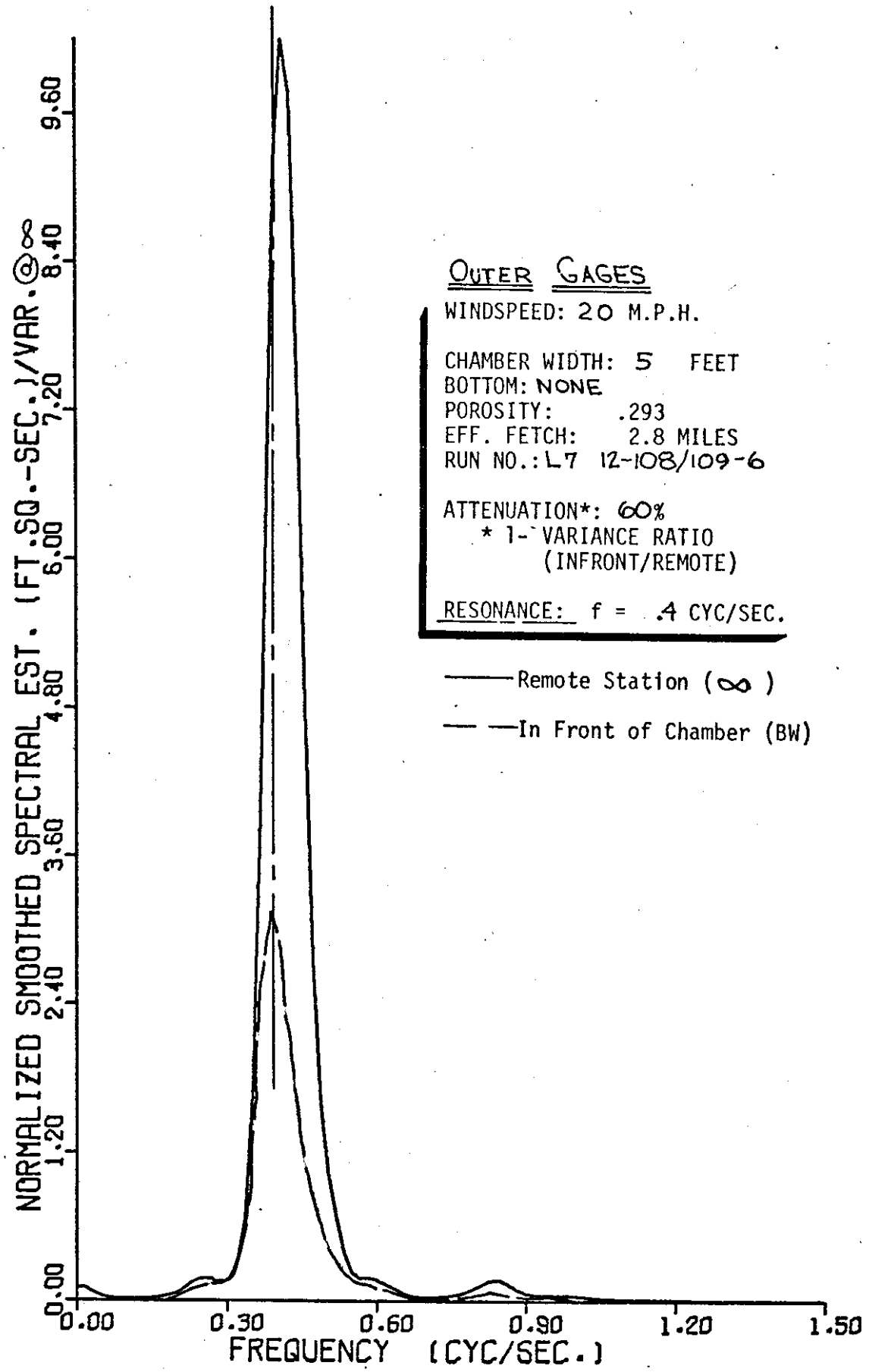

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
OUTER GAGES
WINDSPEED: 20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: L7 12-108/109-6
ATTENUATION*: 60%
* 1-VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG.94

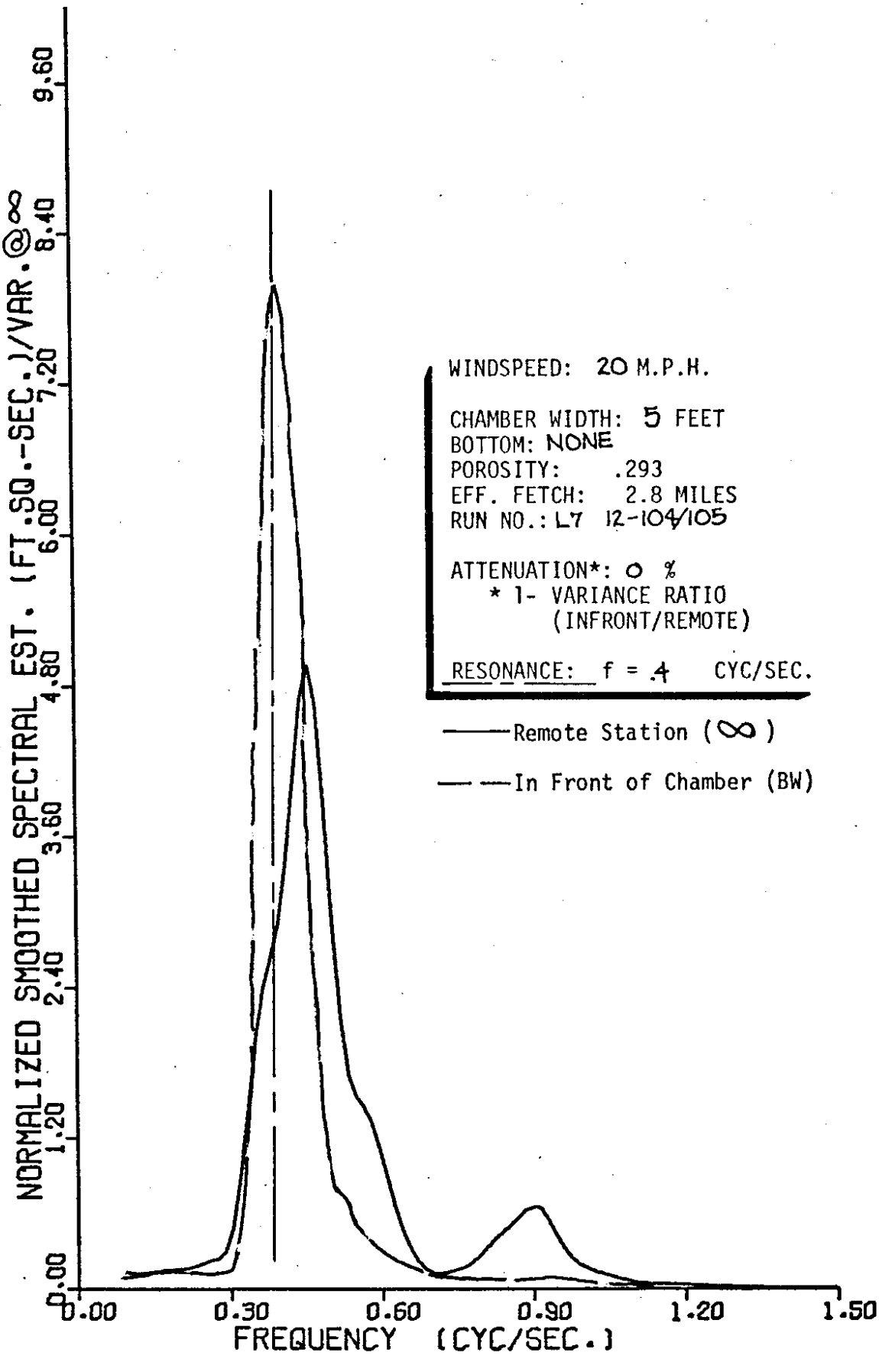

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: L7 12-104/105
ATTENUATION*: 0 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 95

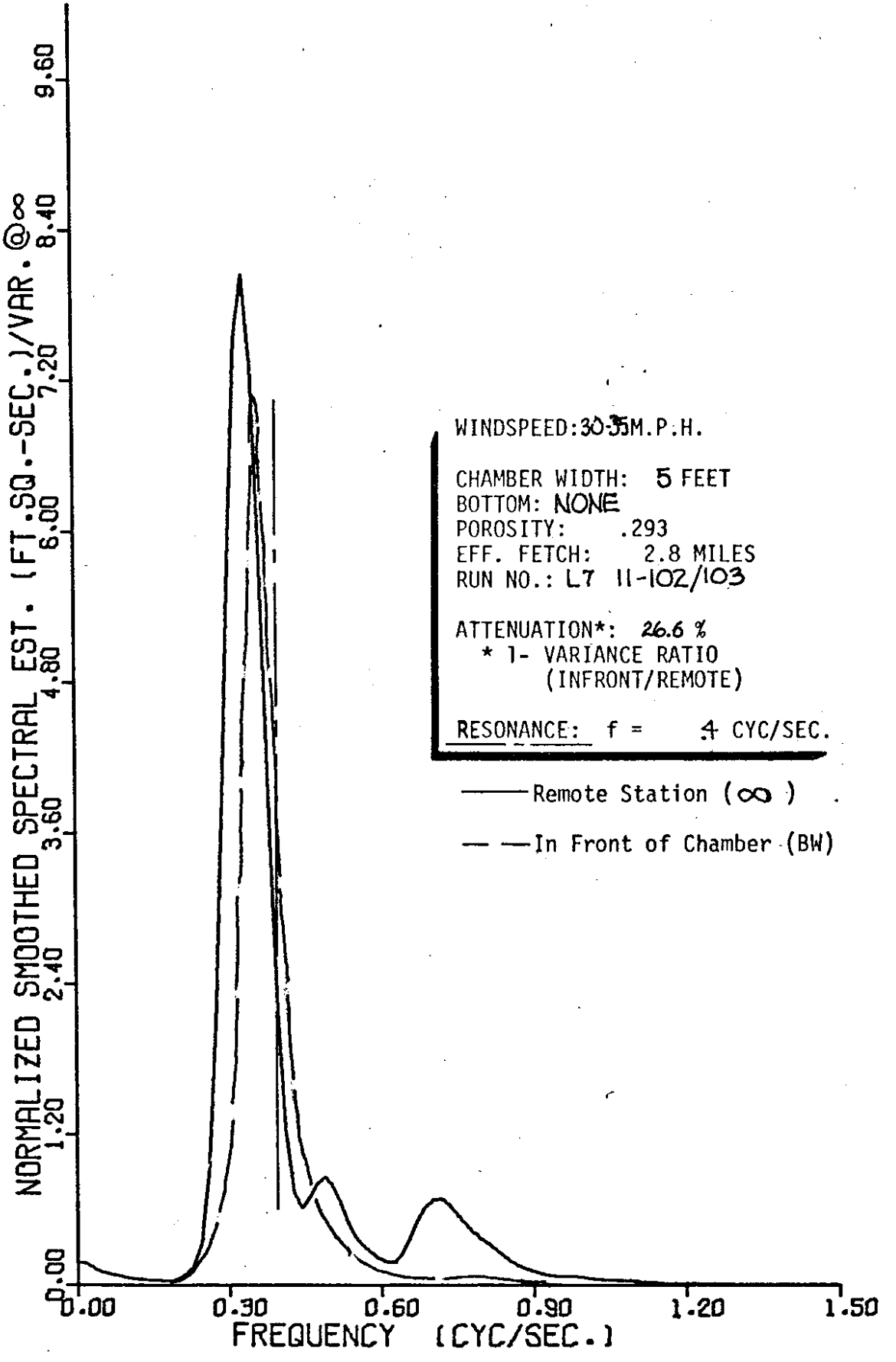

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED:30-35M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: L7 11-102/103
ATTENUATION*: 26.6 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 96

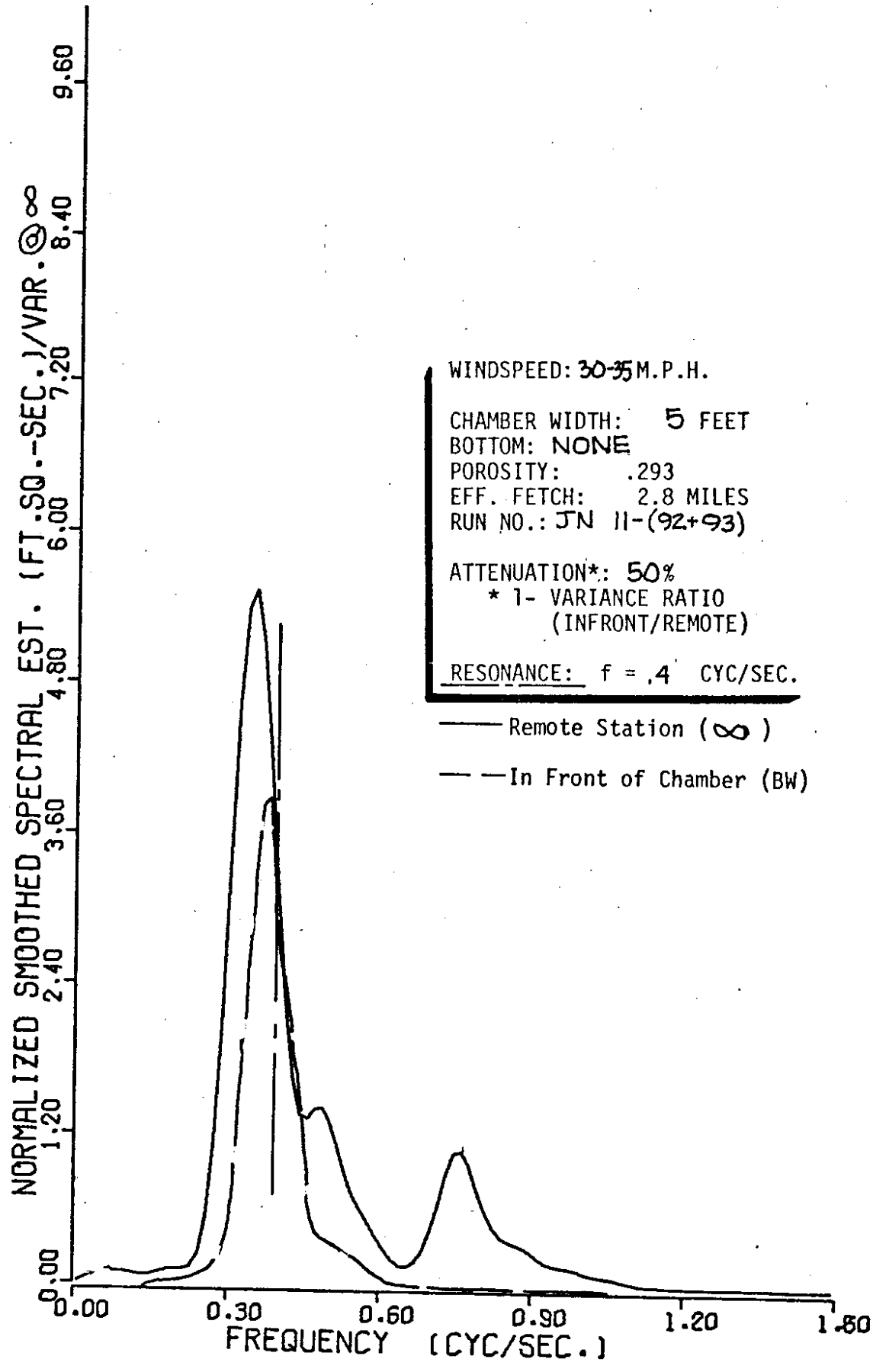

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 30-35 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: JN 11-(92+93)
ATTENUATION*: 50%
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 97

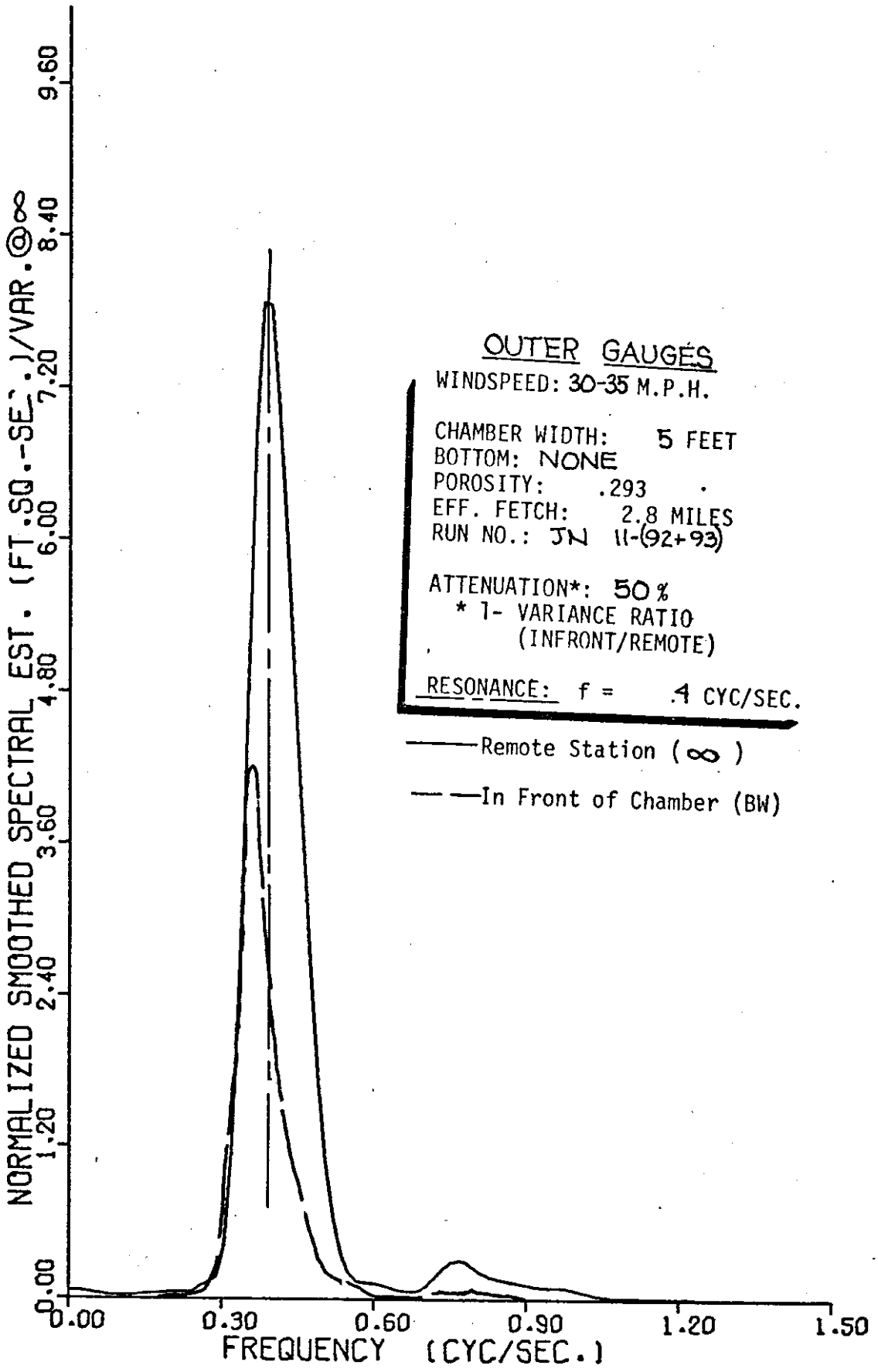

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
OUTER GAUGES
WINDSPEED: 30-35 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: JN 11-(92+93)
ATTENUATION*: 50%
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 98

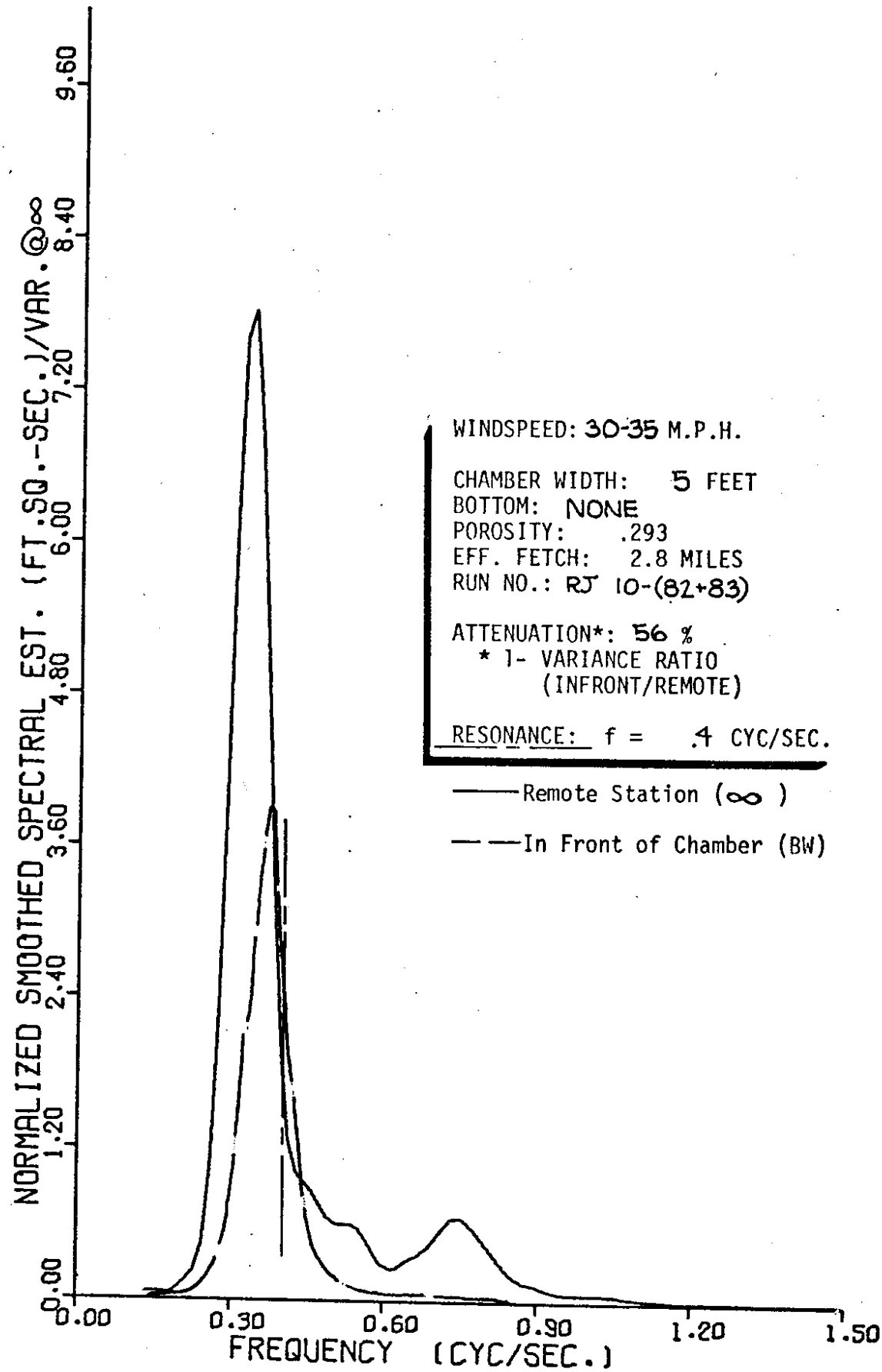

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 30-35 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: RJ 10-(82+83)
ATTENUATION*: 56 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
——Remote Station (∞)
— —In Front of Chamber (BW)

FIG. 99

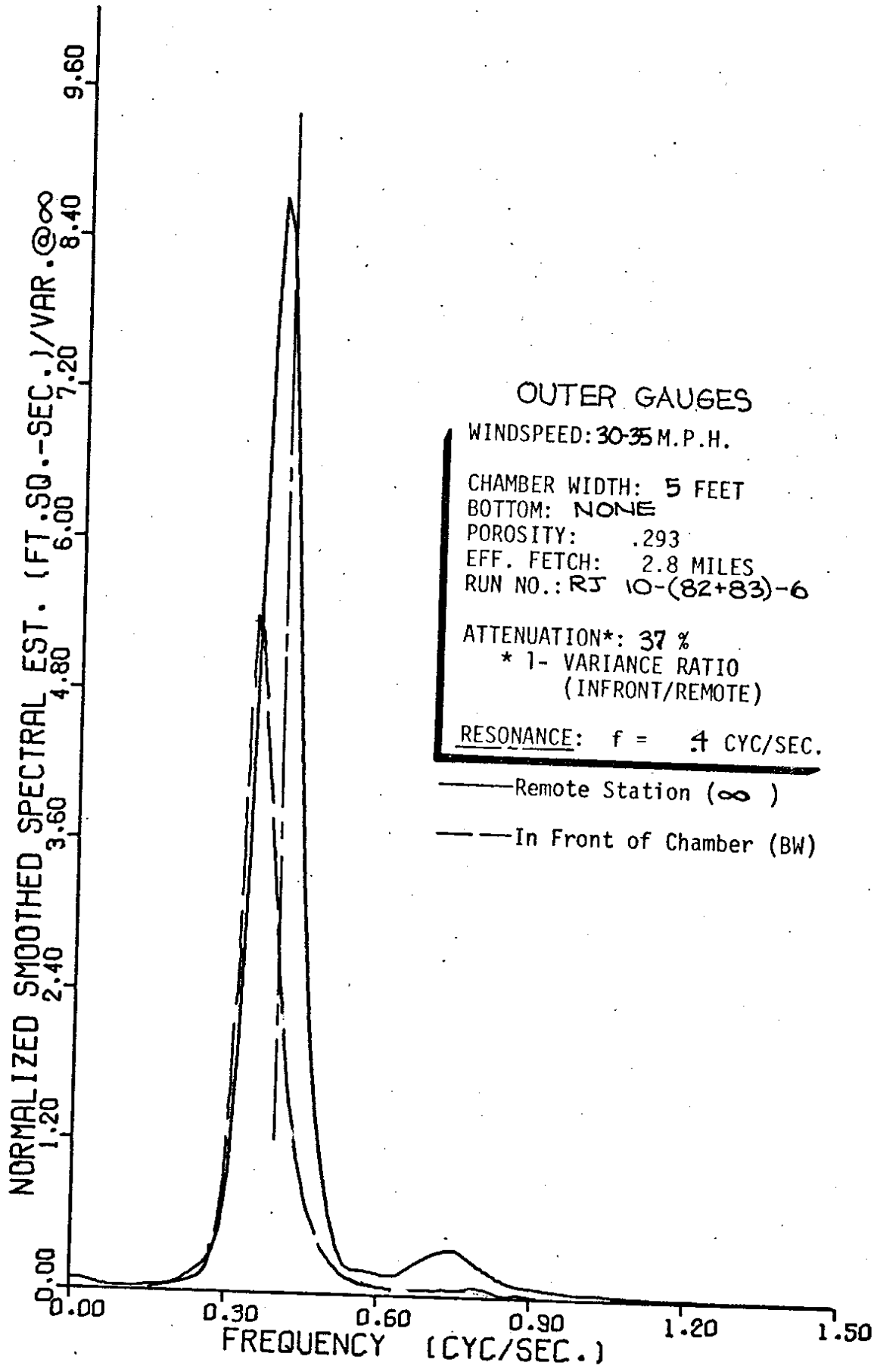

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
2.40
4.80
7.20
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
OUTER GAUGES
WINDSPEED: 30-35 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: NONE
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: RJ 10-(82+83)-6
ATTENUATION*: 37 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .4 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 100

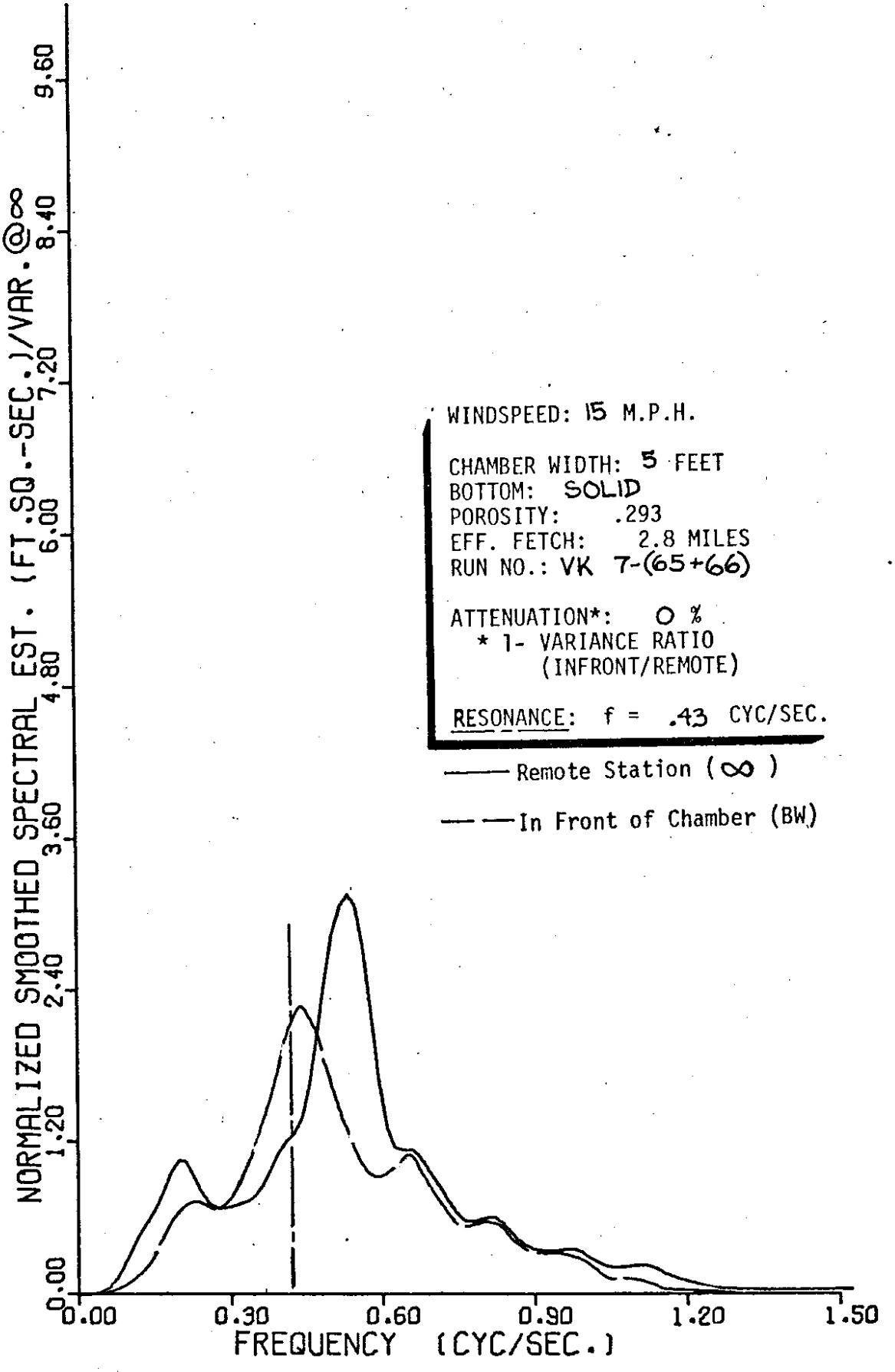

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 15 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: VK 7-(65+66)
ATTENUATION*: 0 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 101

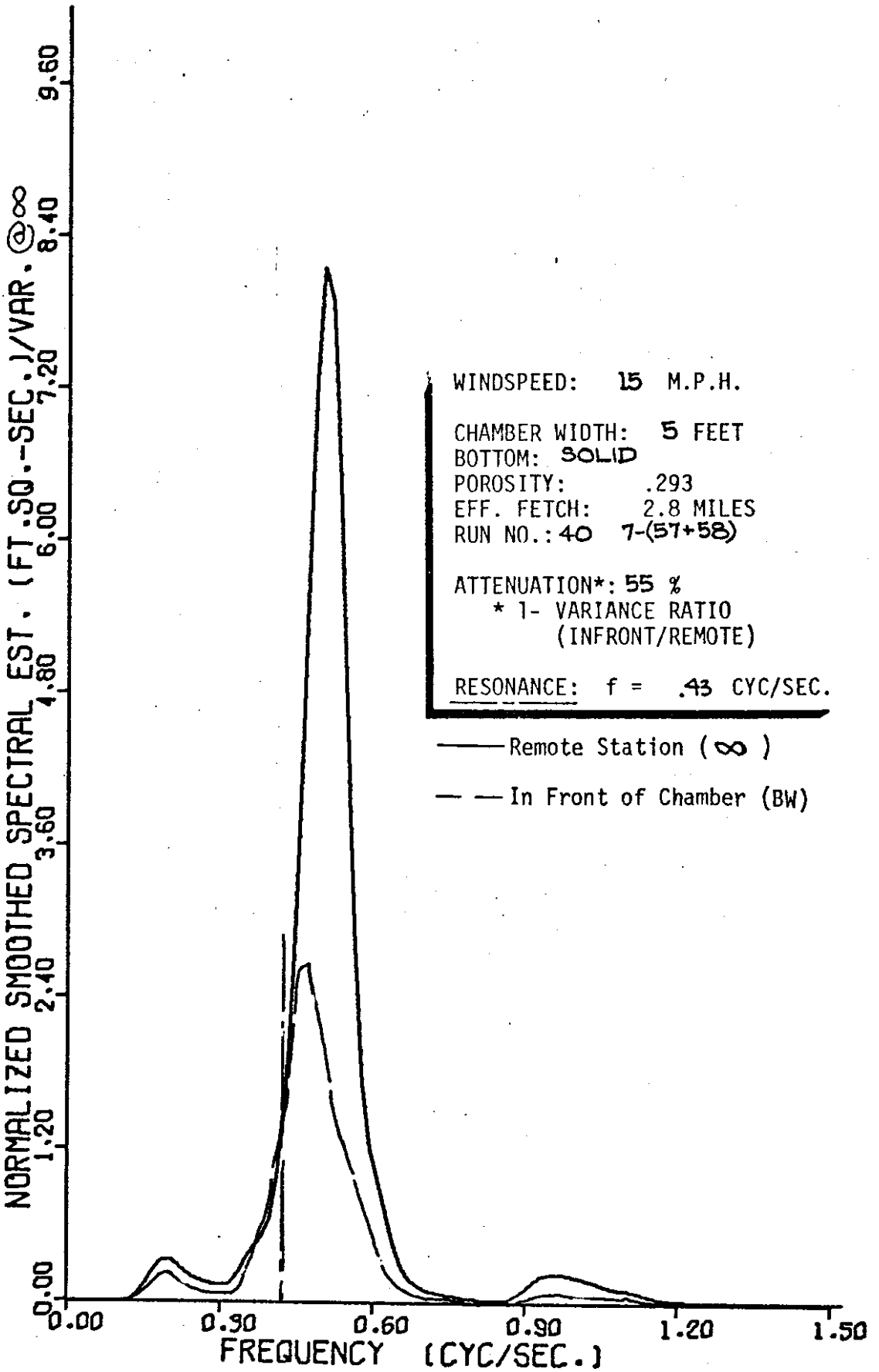

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 15 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 40 7-(57+58)
ATTENUATION*: 55 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 102

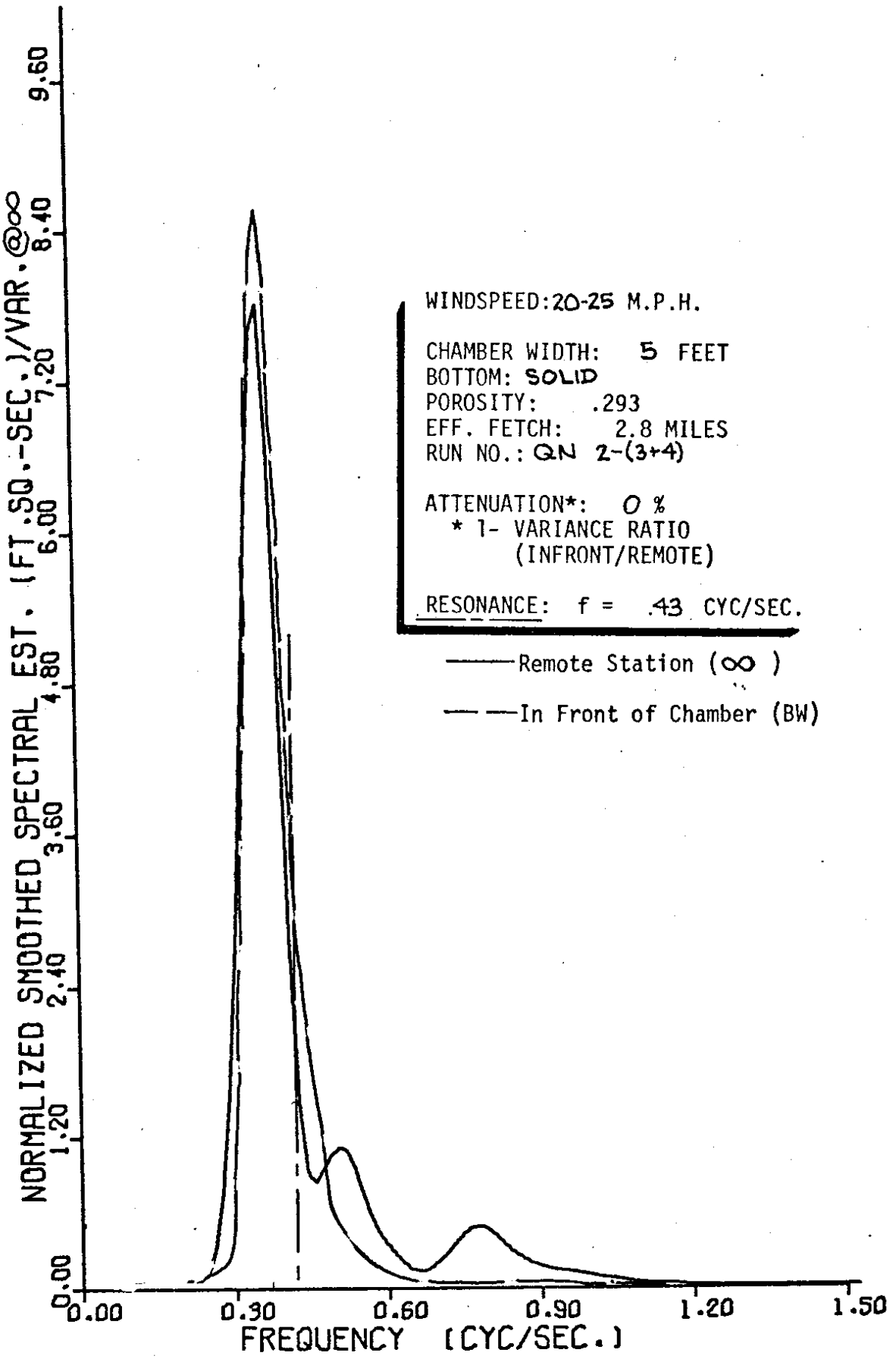

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED:20-25 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: QN 2-(3+4)
ATTENUATION*: 0 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 103

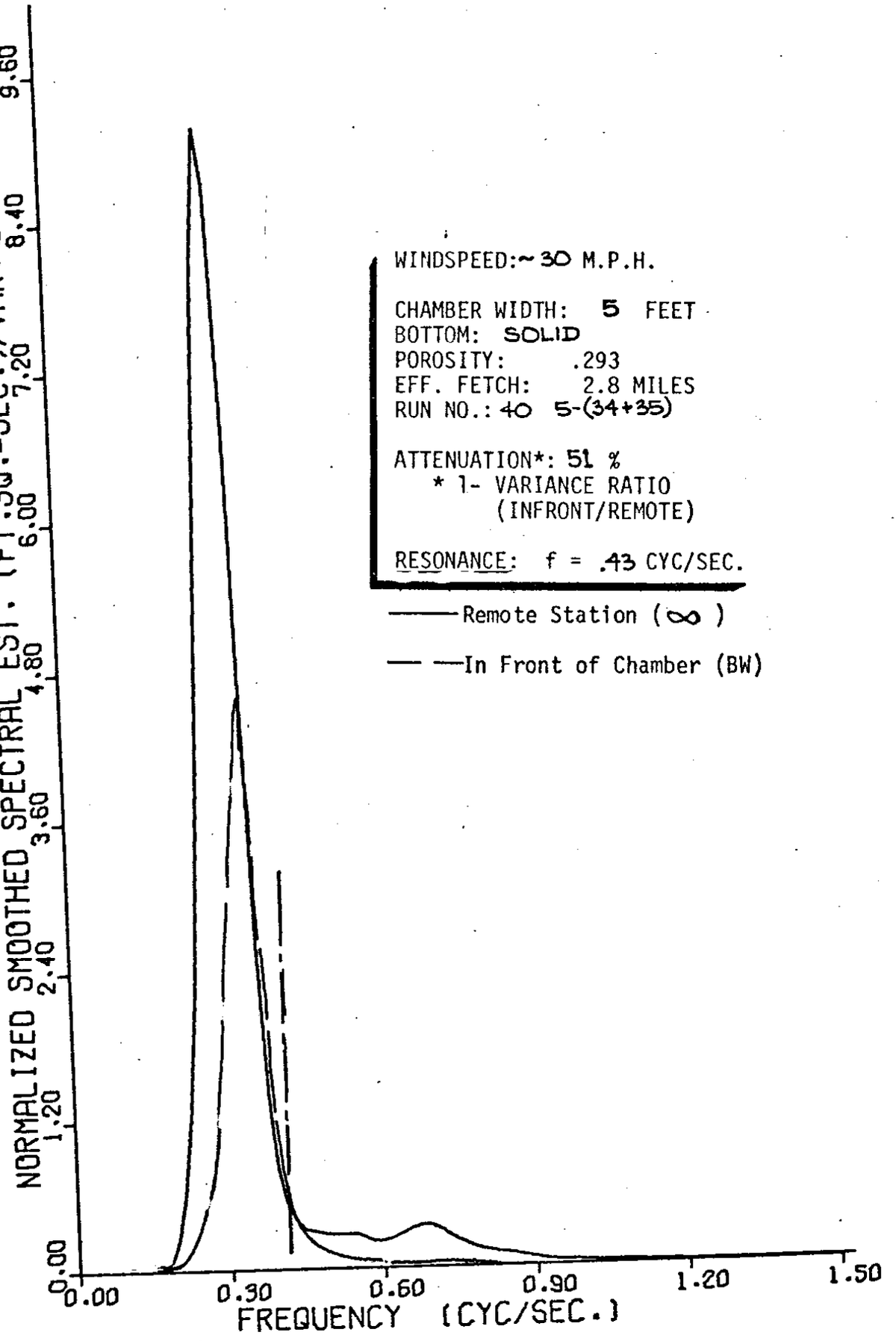

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED:~30 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 40 5-(34+35)
ATTENUATION*: 51 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
——Remote Station (∞)
— —In Front of Chamber (BW)

FIG. 104

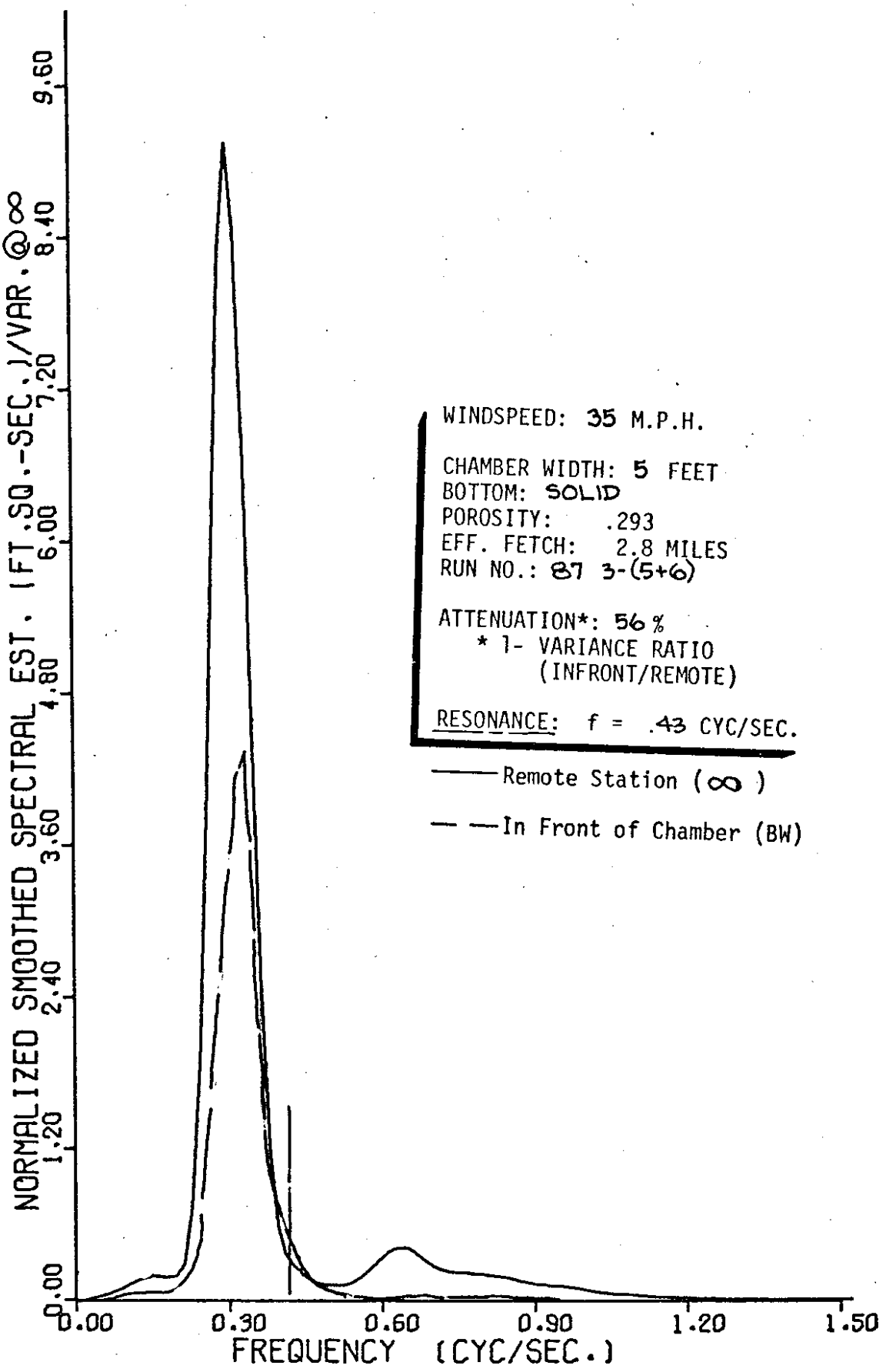

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 35 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 87 3-(5+6)
ATTENUATION*: 56 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG.105

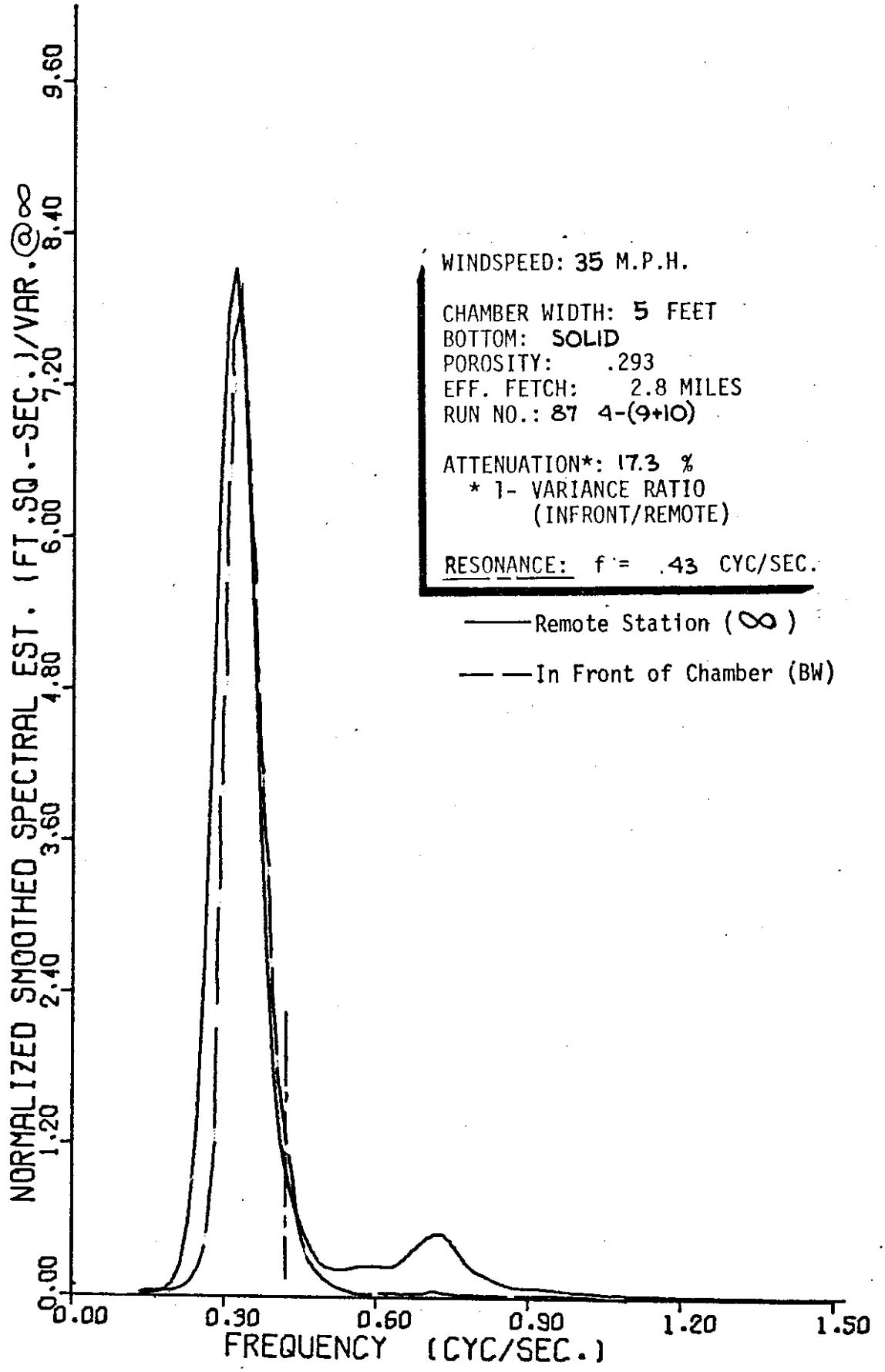

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 35 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 87 4-(9+10)
ATTENUATION*: 17.3 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 106

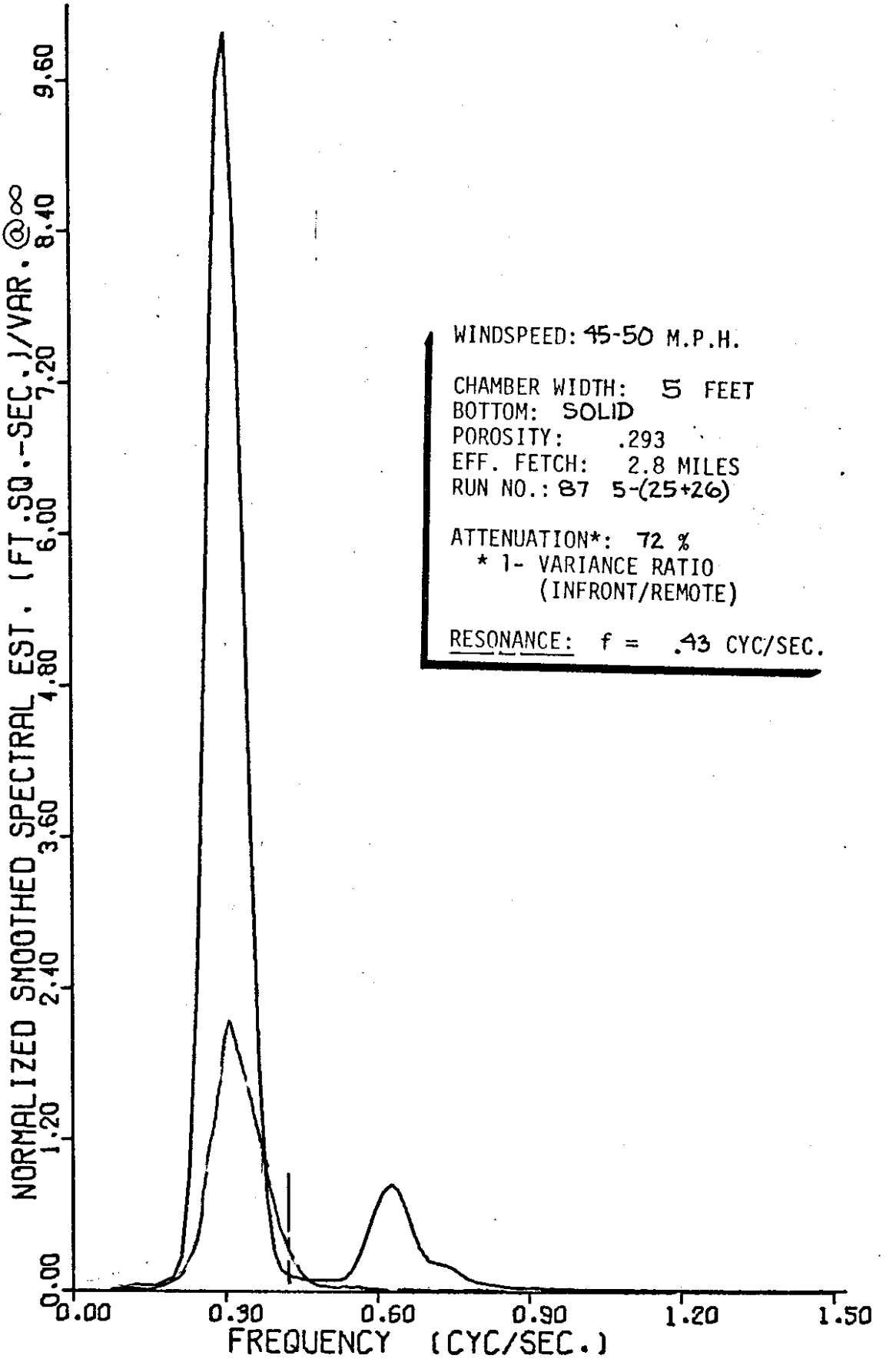

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 45-50 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 87 5-(25+26)
ATTENUATION*: 72 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.

FIG. 107

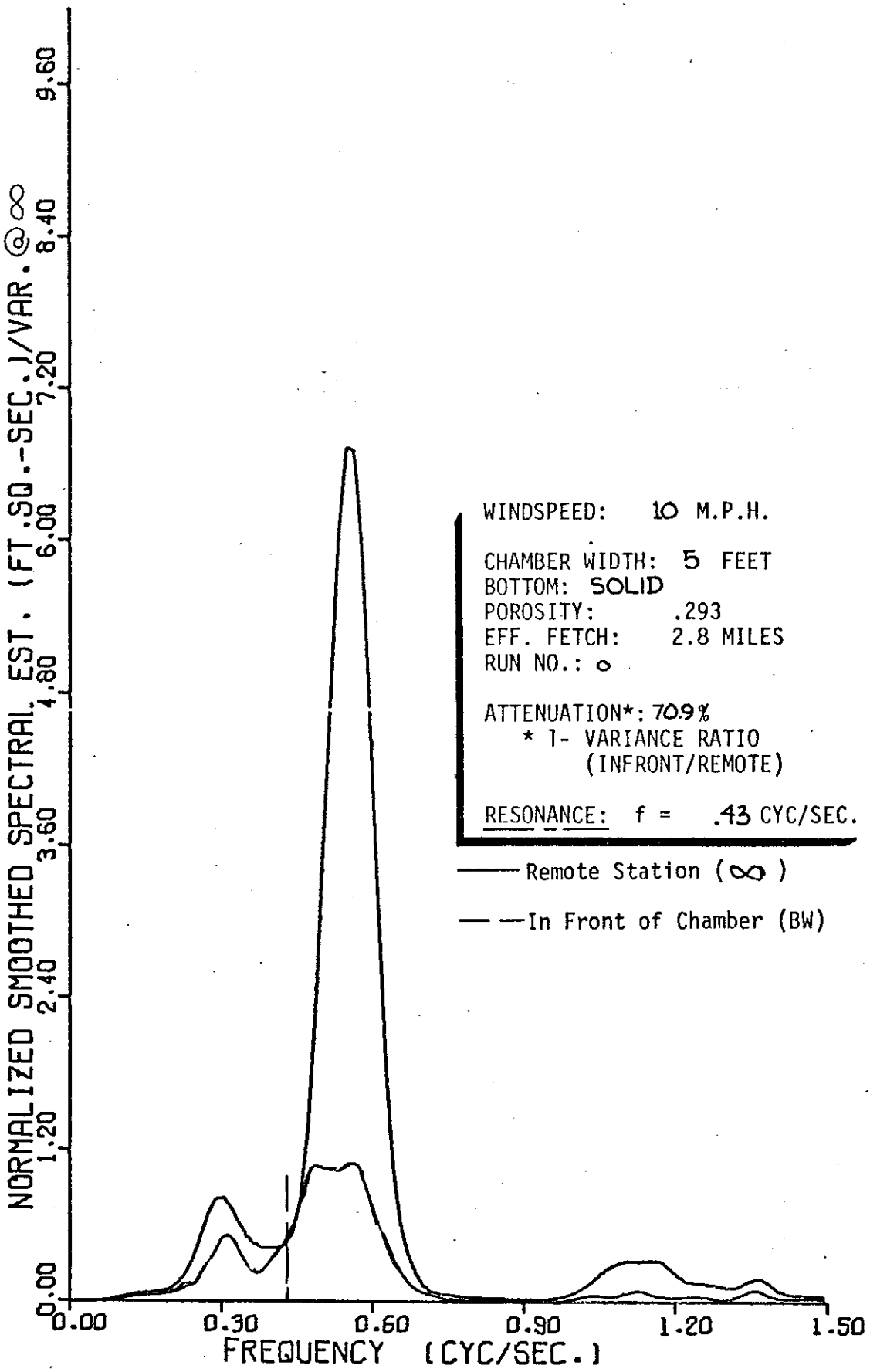

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 10 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: o
ATTENUATION*: 70.9%
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 108

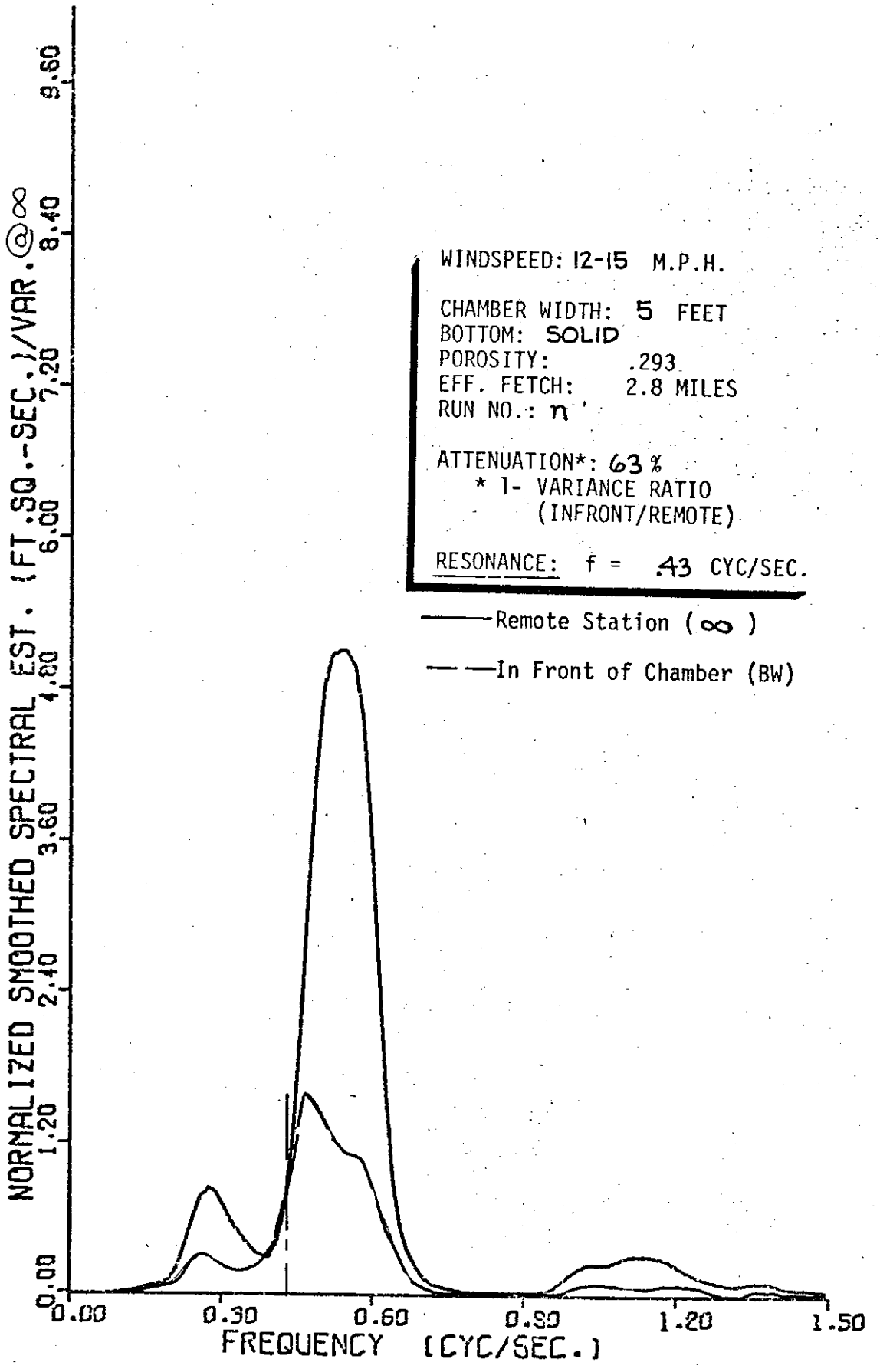

WINDSPEED: 12-15 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: n
ATTENUATION*: 63 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG. 109

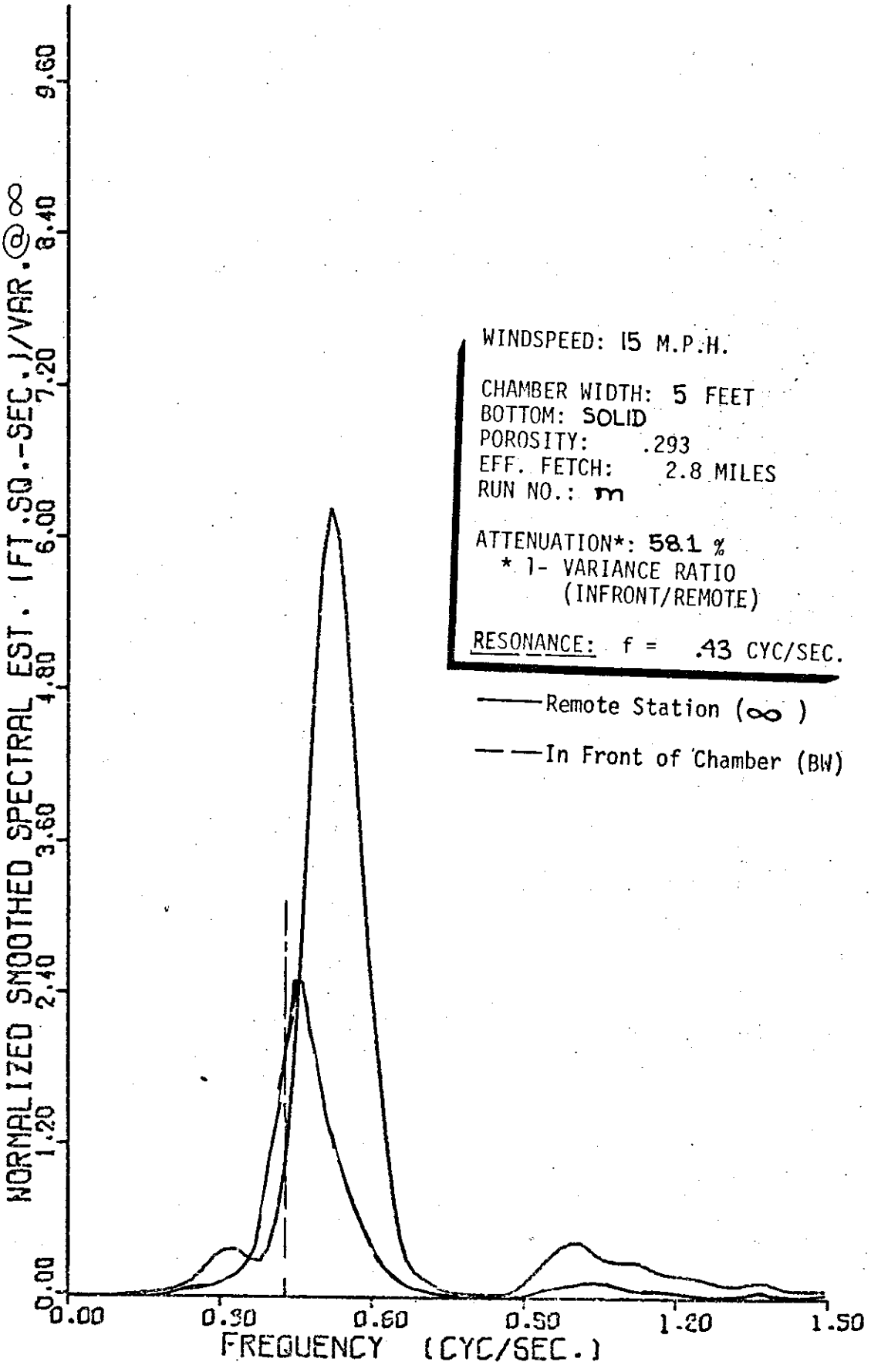

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 15 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: m
ATTENUATION*: 58.1 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
——Remote Station (∞)
— —In Front of Chamber (BW)

FIG.110

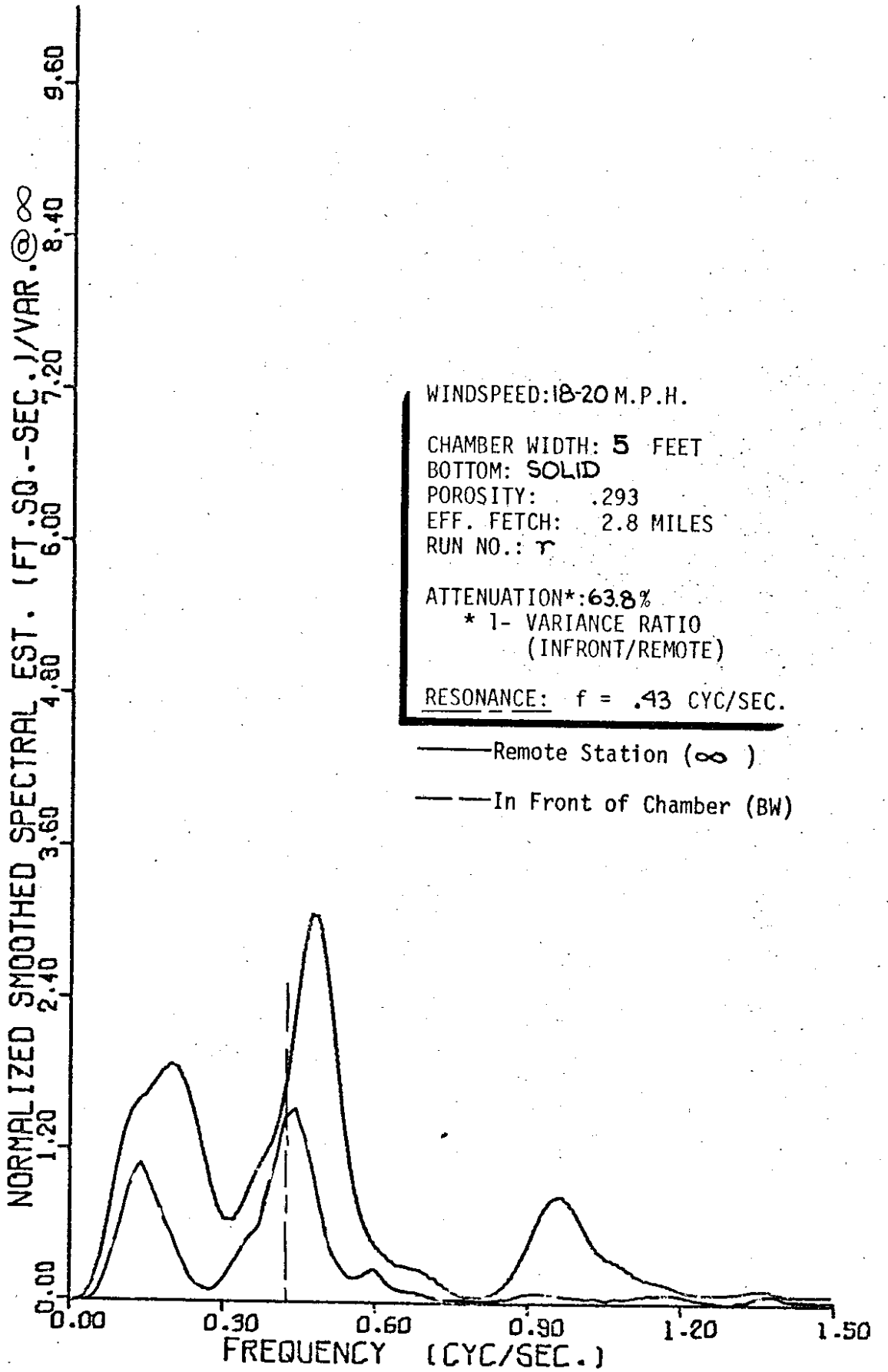

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED:18-20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 7
ATTENUATION*:63.8%
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
——Remote Station (∞)
——In Front of Chamber (BW)

FIG.111

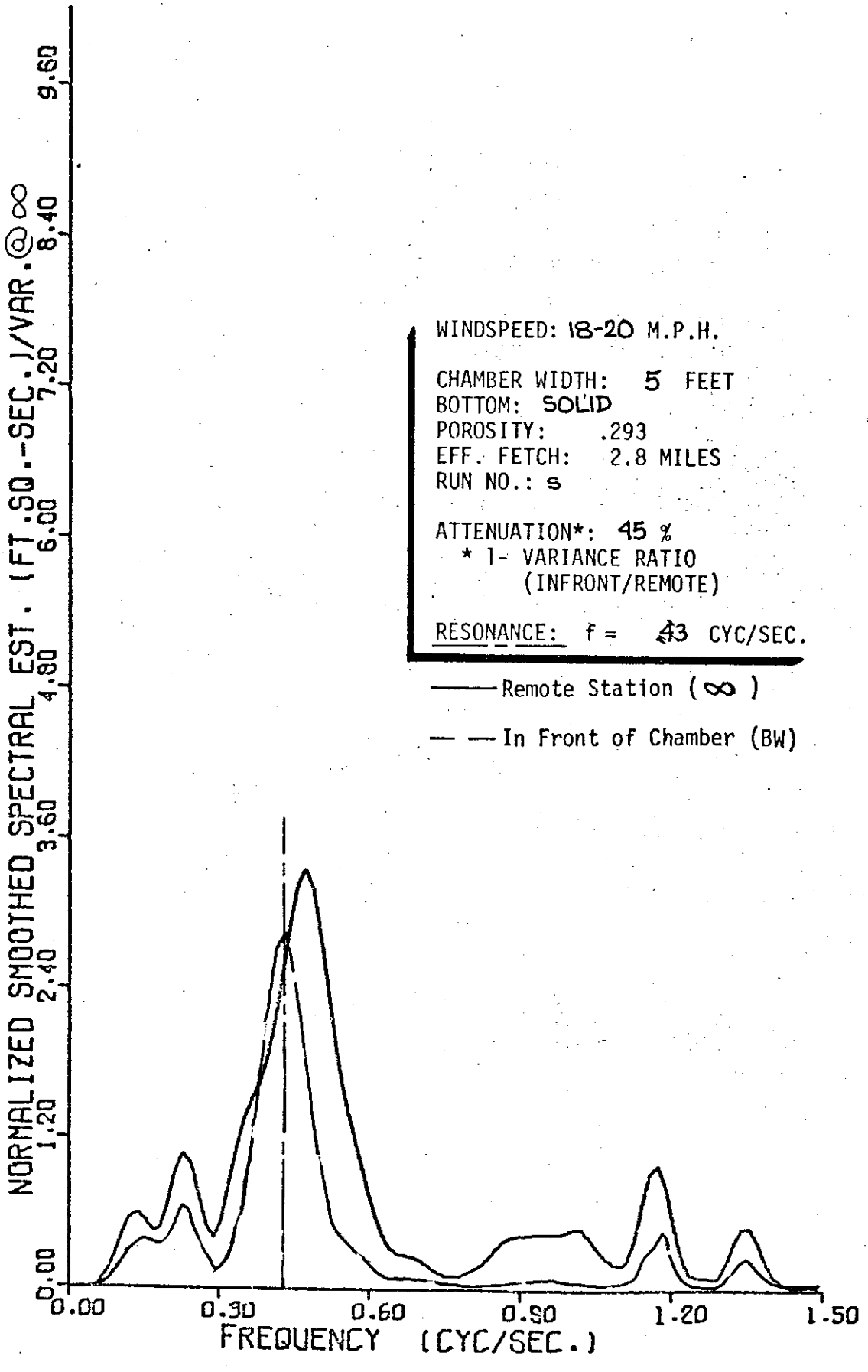

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 18-20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: s
ATTENUATION*: 45 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 112

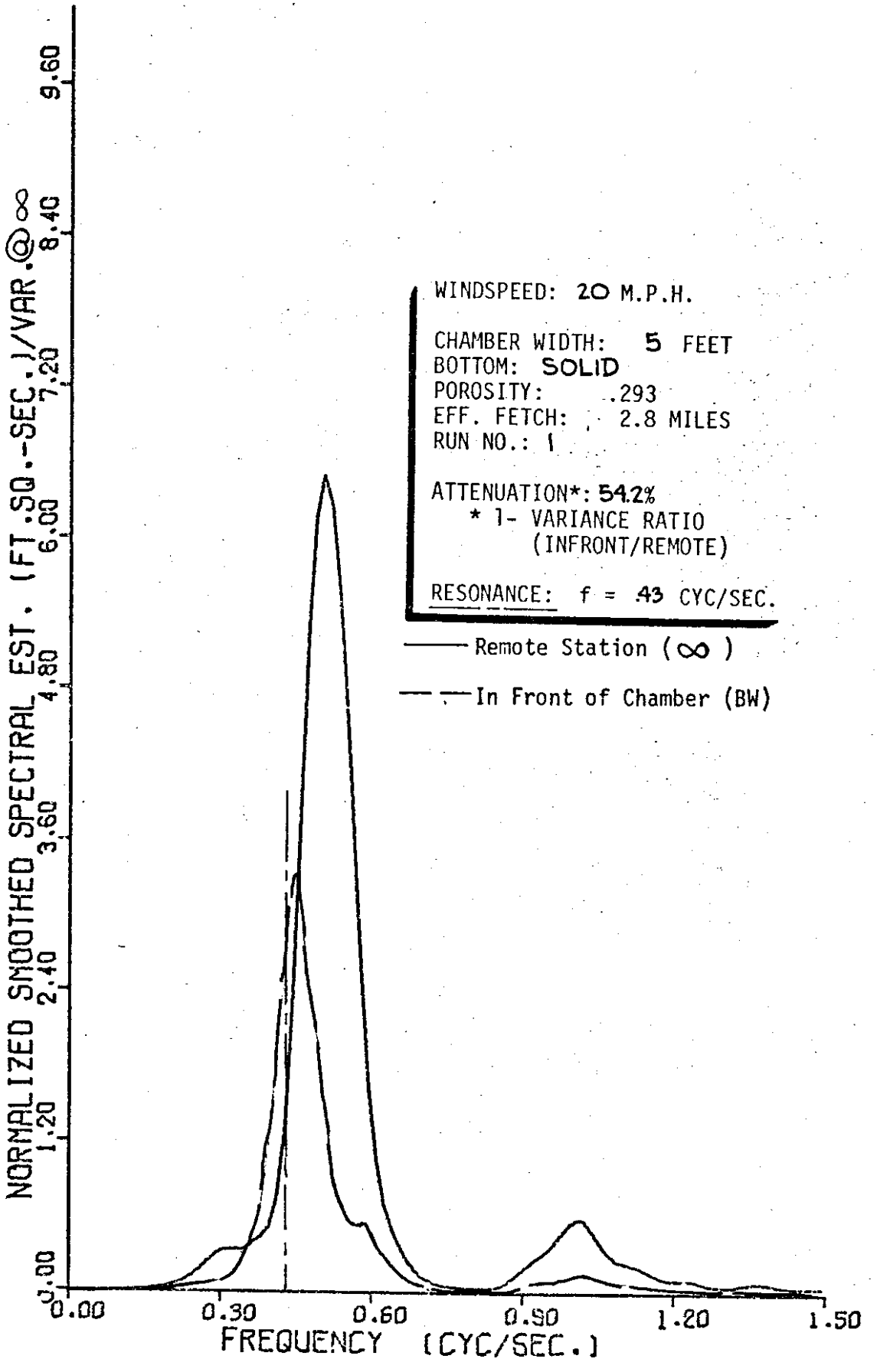

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 1
ATTENUATION*: 54.2%
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 113

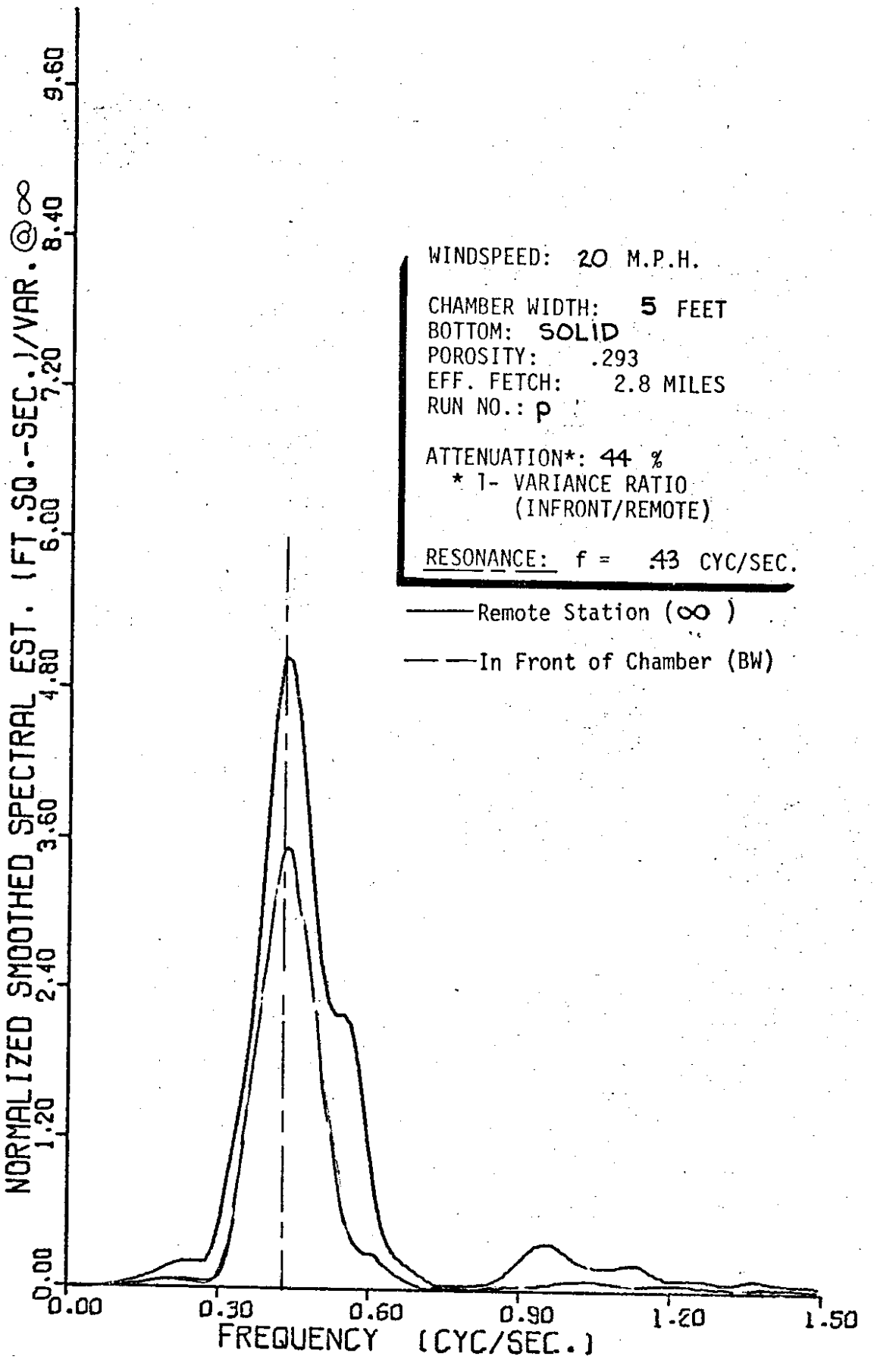

WINDSPEED: 20 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: P
ATTENUATION*: 44 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG.114

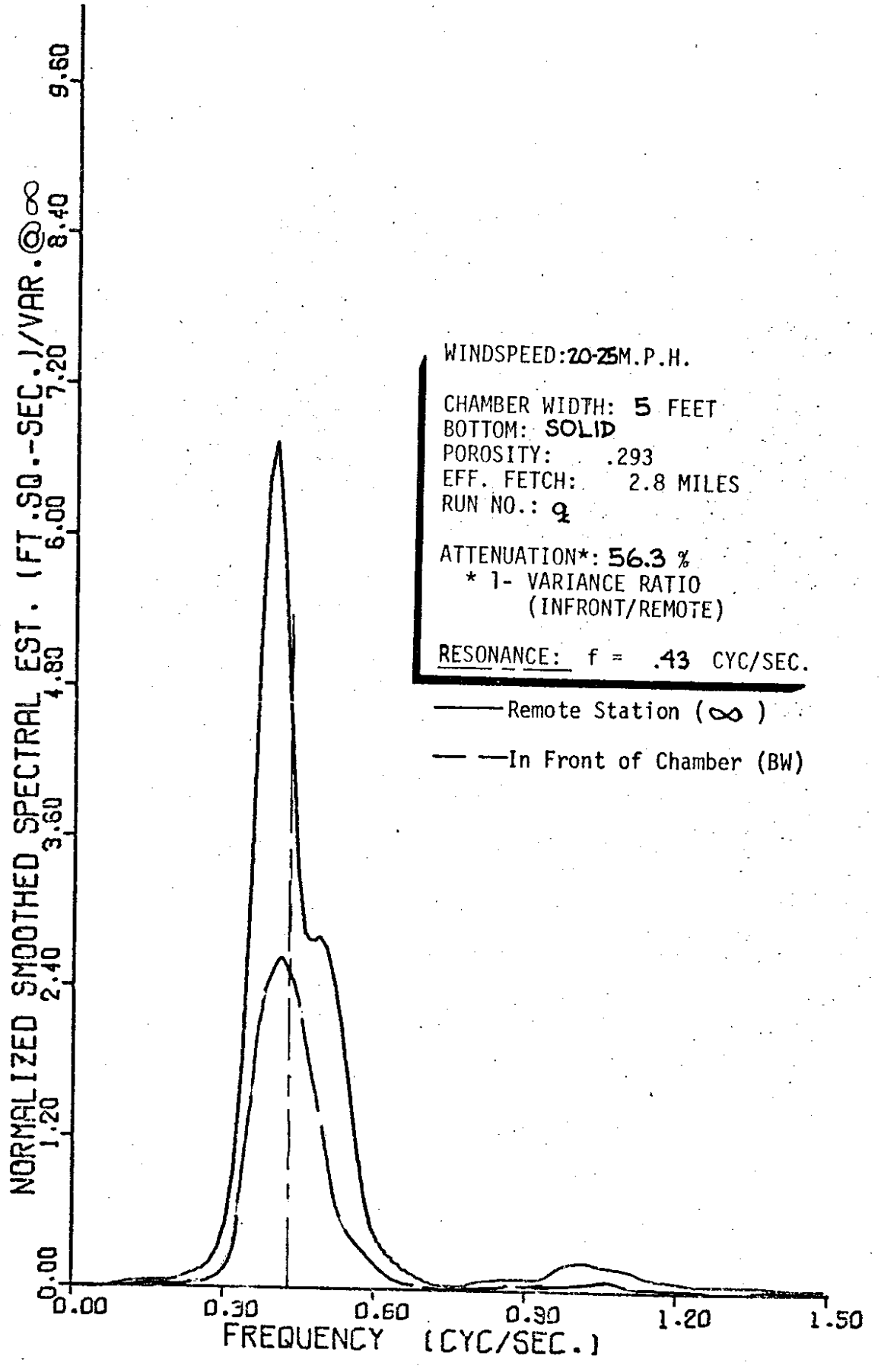

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 20-25 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 9
ATTENUATION*: 56.3 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
——Remote Station (∞)
— —In Front of Chamber (BW)

FIG.115

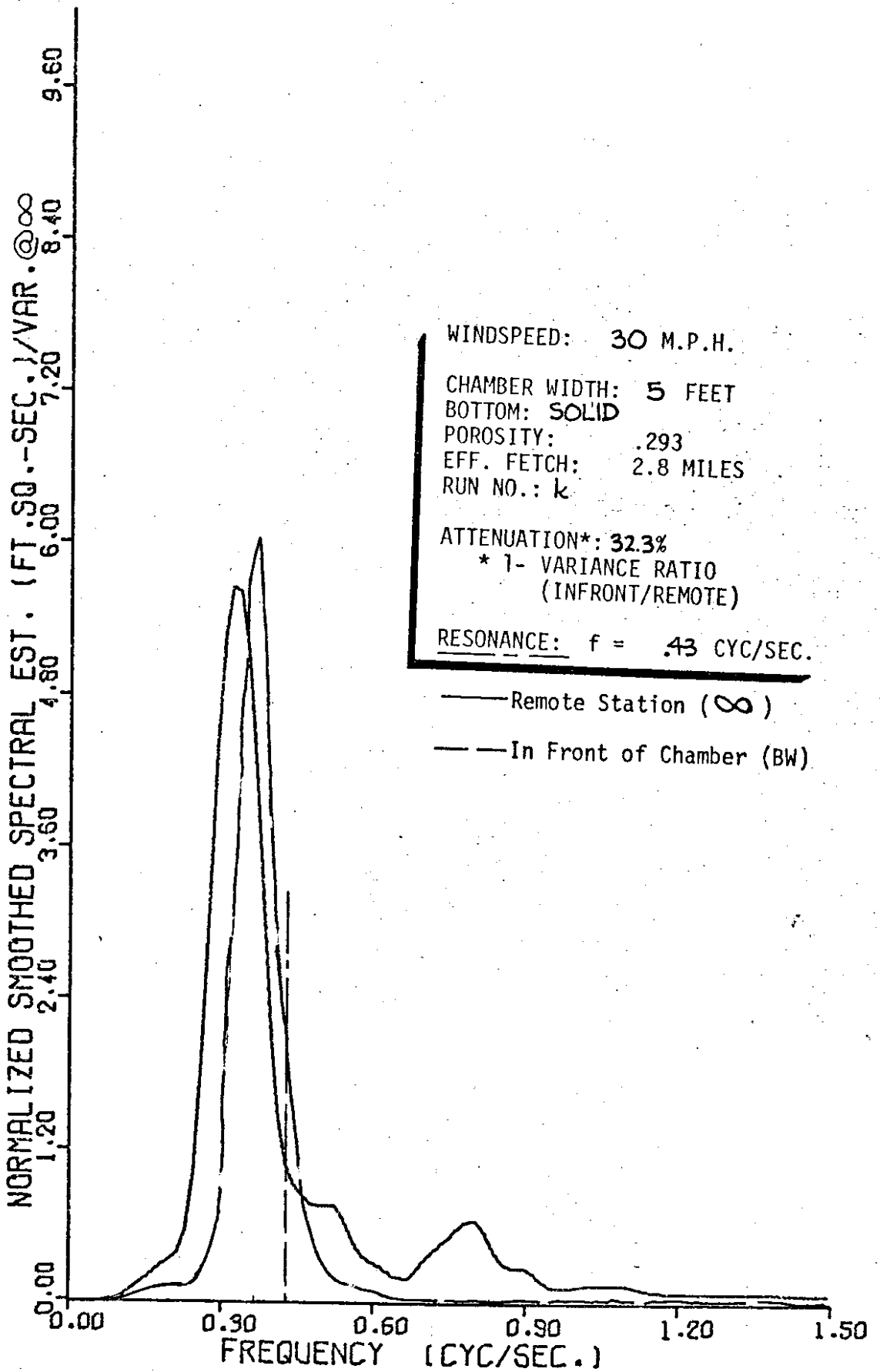

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 30 M.P.H.
CHAMBER WIDTH: 5 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: k
ATTENUATION*: 32.3%
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .43 CYC/SEC.
——Remote Station (∞)
— —In Front of Chamber (BW)

FIG. 116

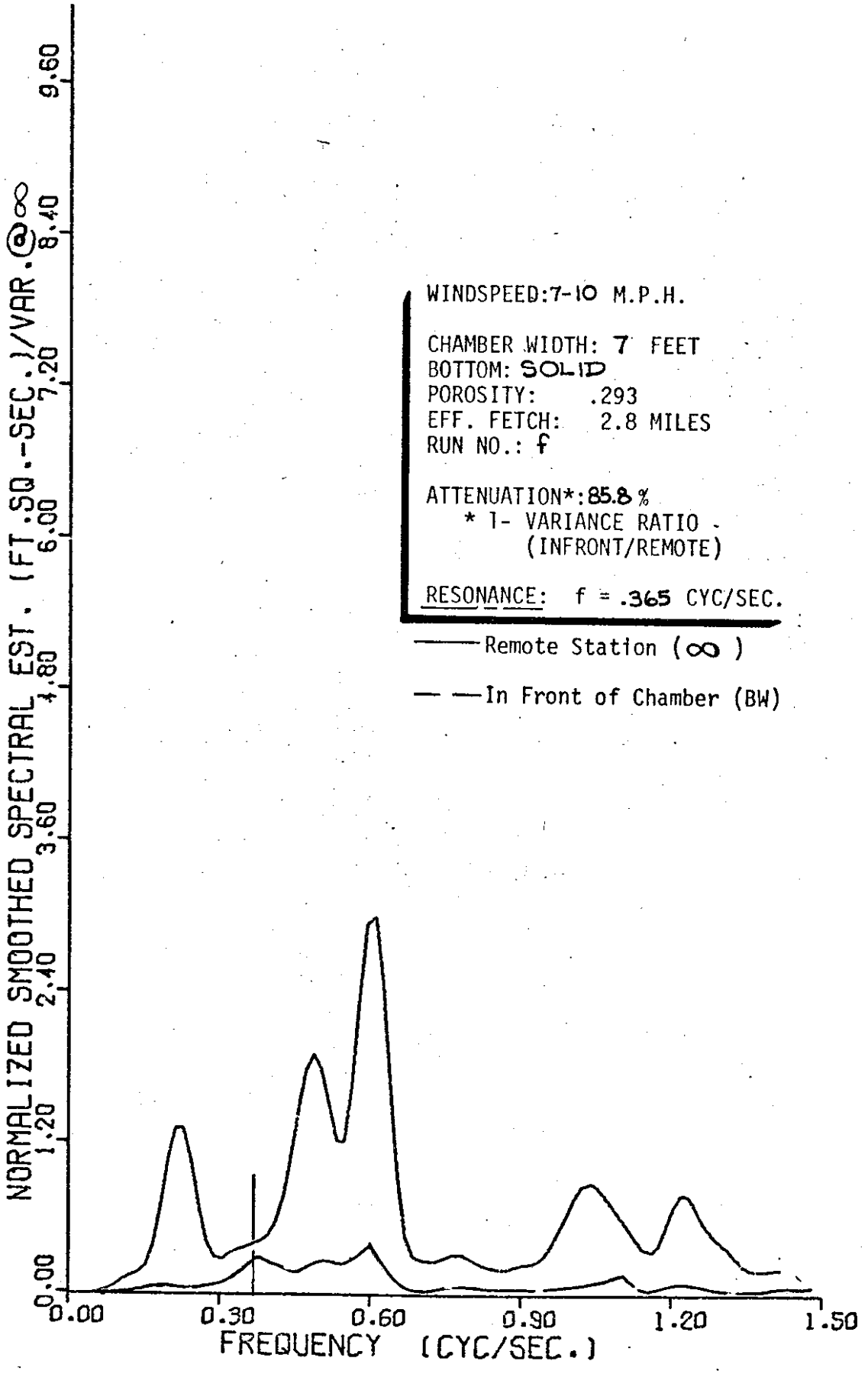

WINDSPEED:7-10 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: f
ATTENUATION*:85.8 %
* 1- VARIANCE RATIO - (INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)
NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)

FIG.117

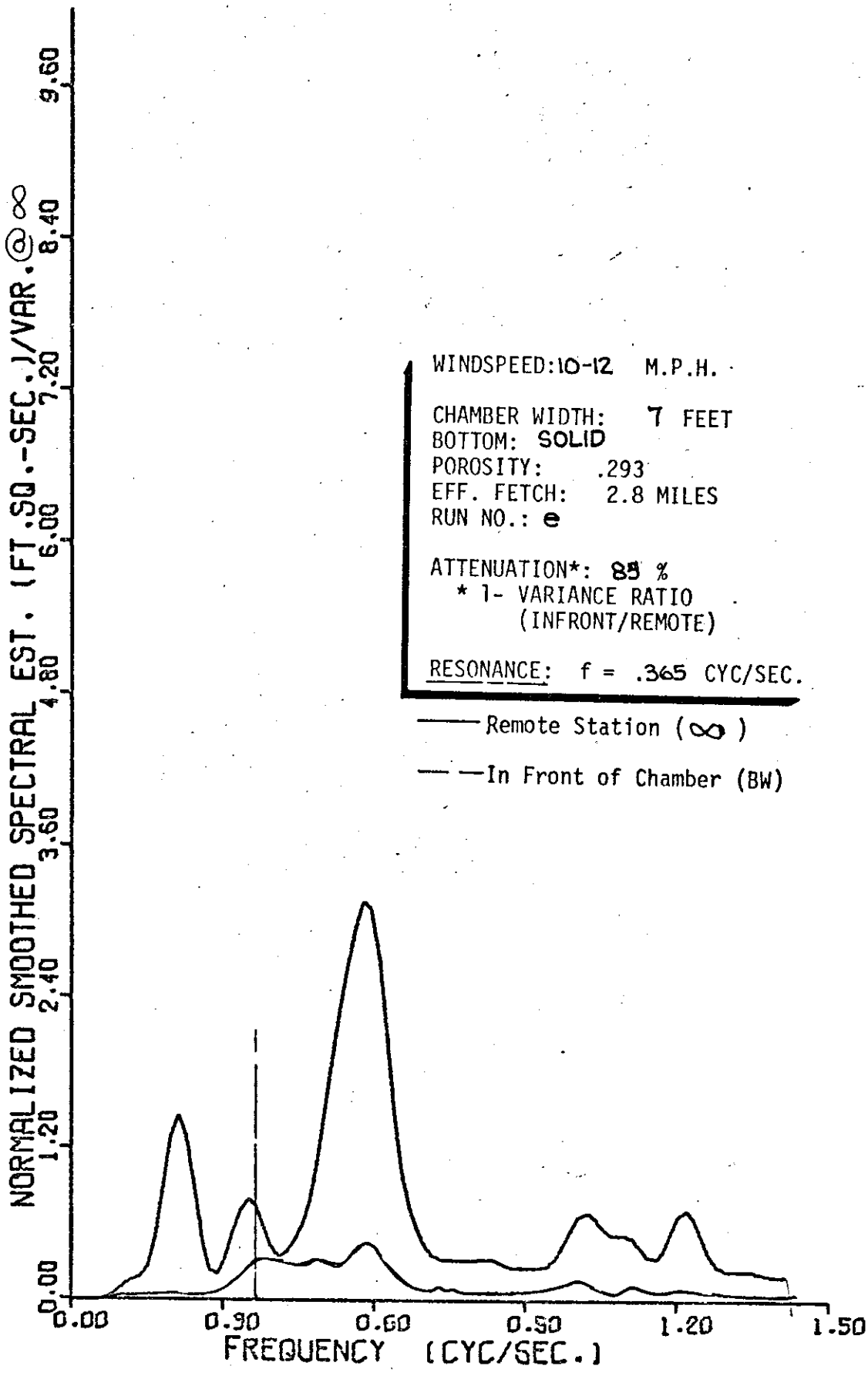

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED:10-12 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: e
ATTENUATION*: 85 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 118

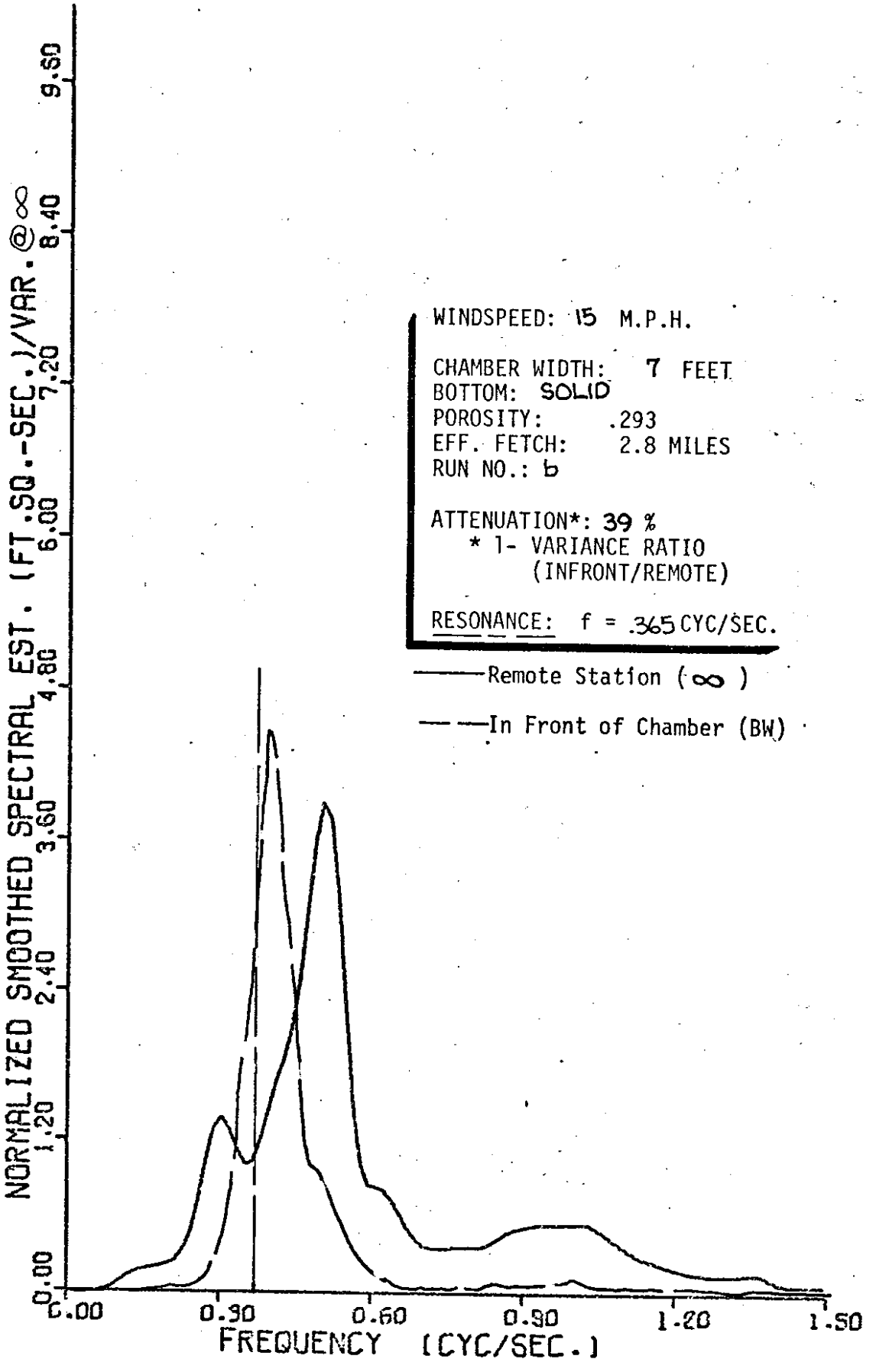

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 15 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: b
ATTENUATION*: 39 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 119

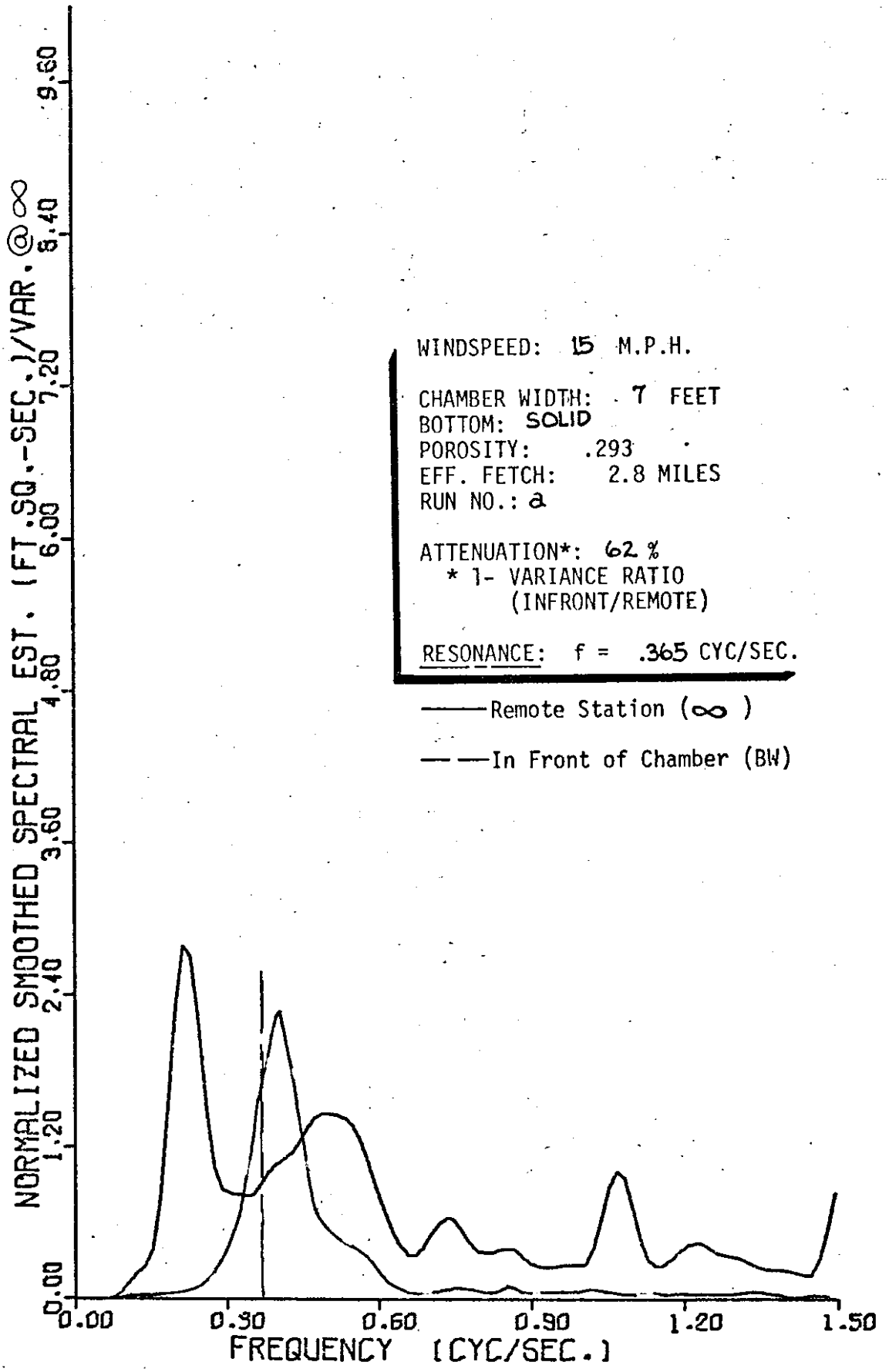

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 15 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: a
ATTENUATION*: 62 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
——Remote Station (∞)
— —In Front of Chamber (BW)

FIG.120

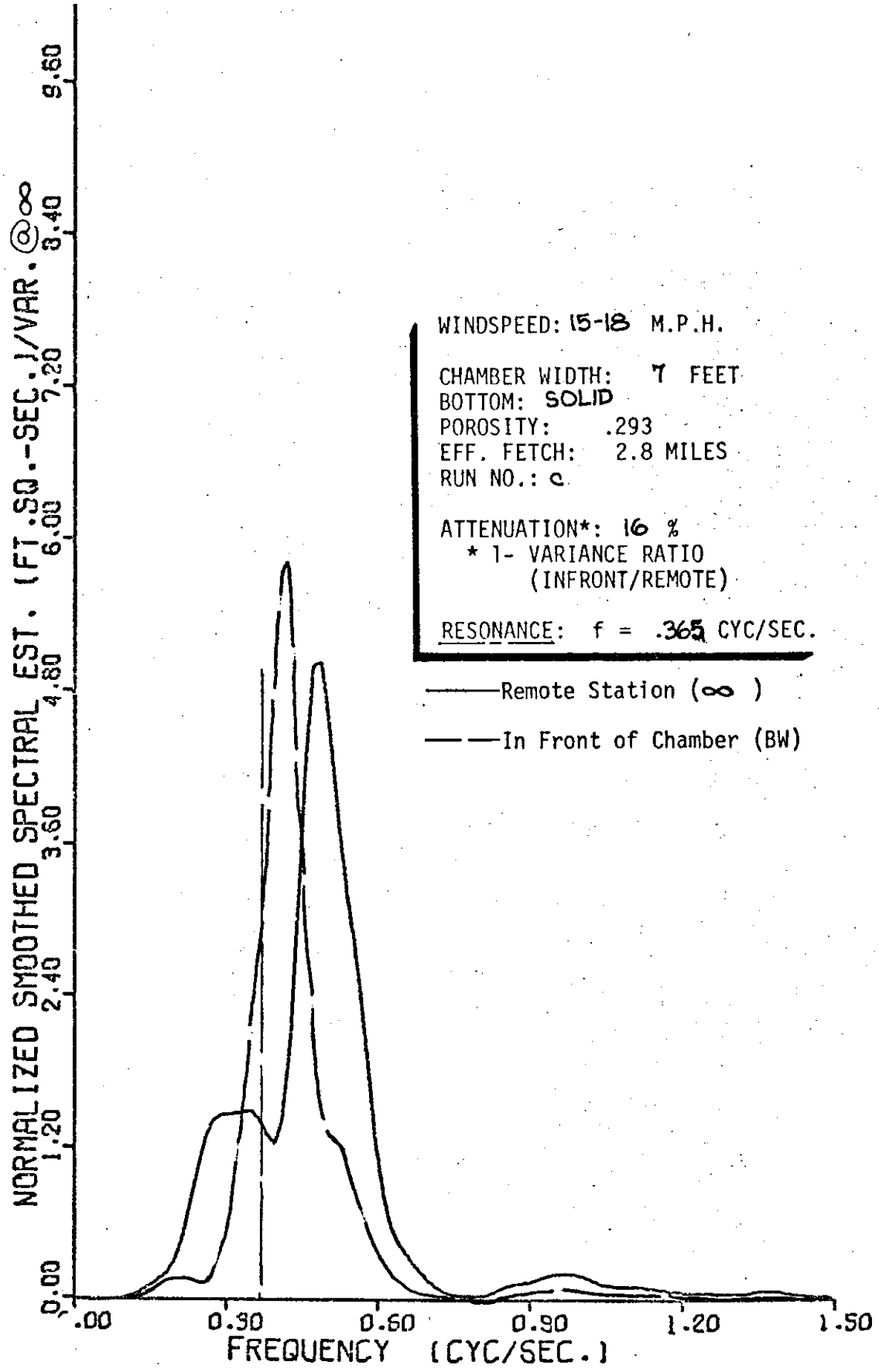

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 15-18 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: c
ATTENUATION*: 16 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
———Remote Station (∞)
— — —In Front of Chamber (BW)

FIG. 121

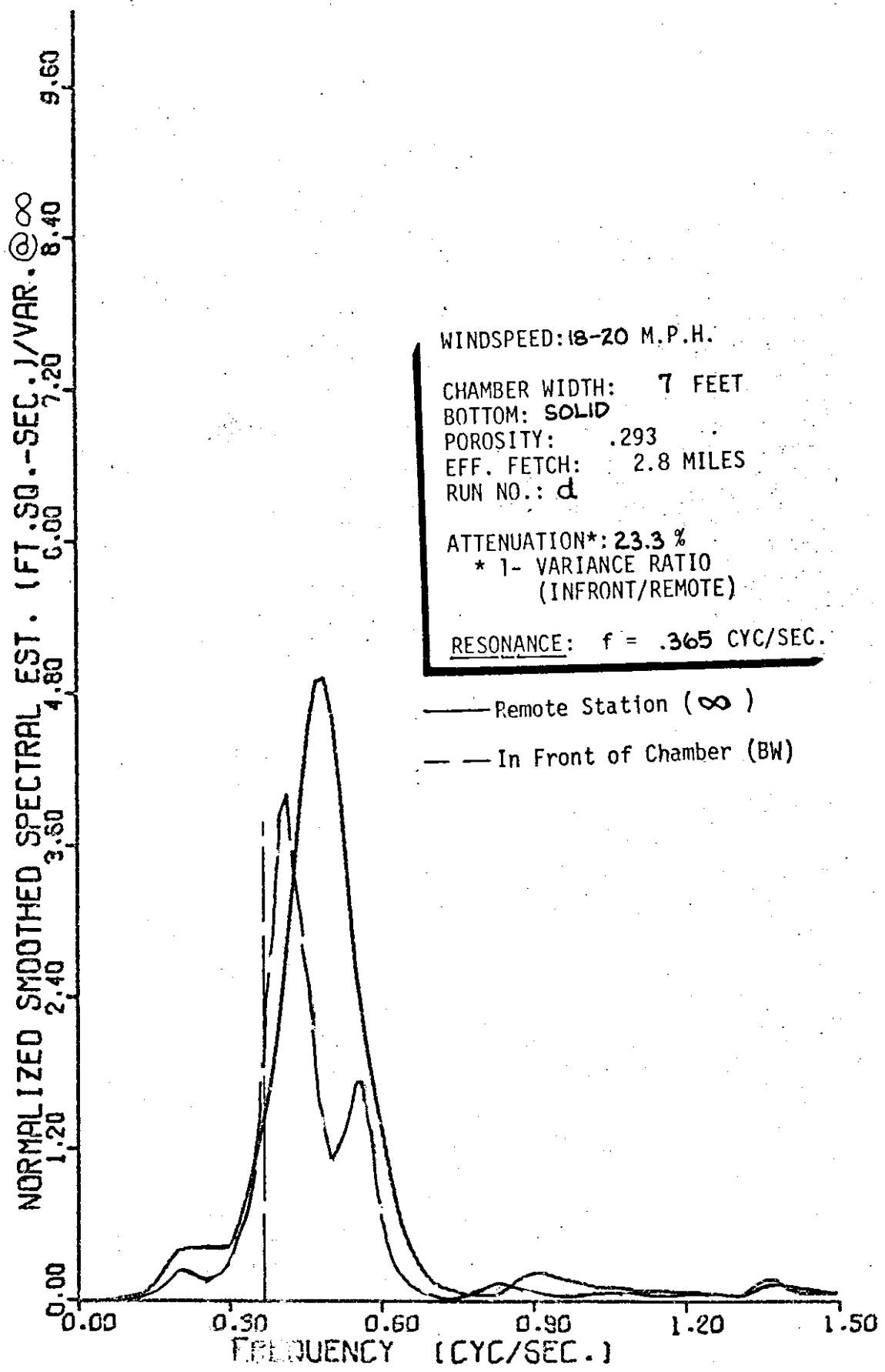

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR.@∞
0.00
2.40
4.80
7.20
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 18-20 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: d
ATTENUATION*: 23.3 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 122

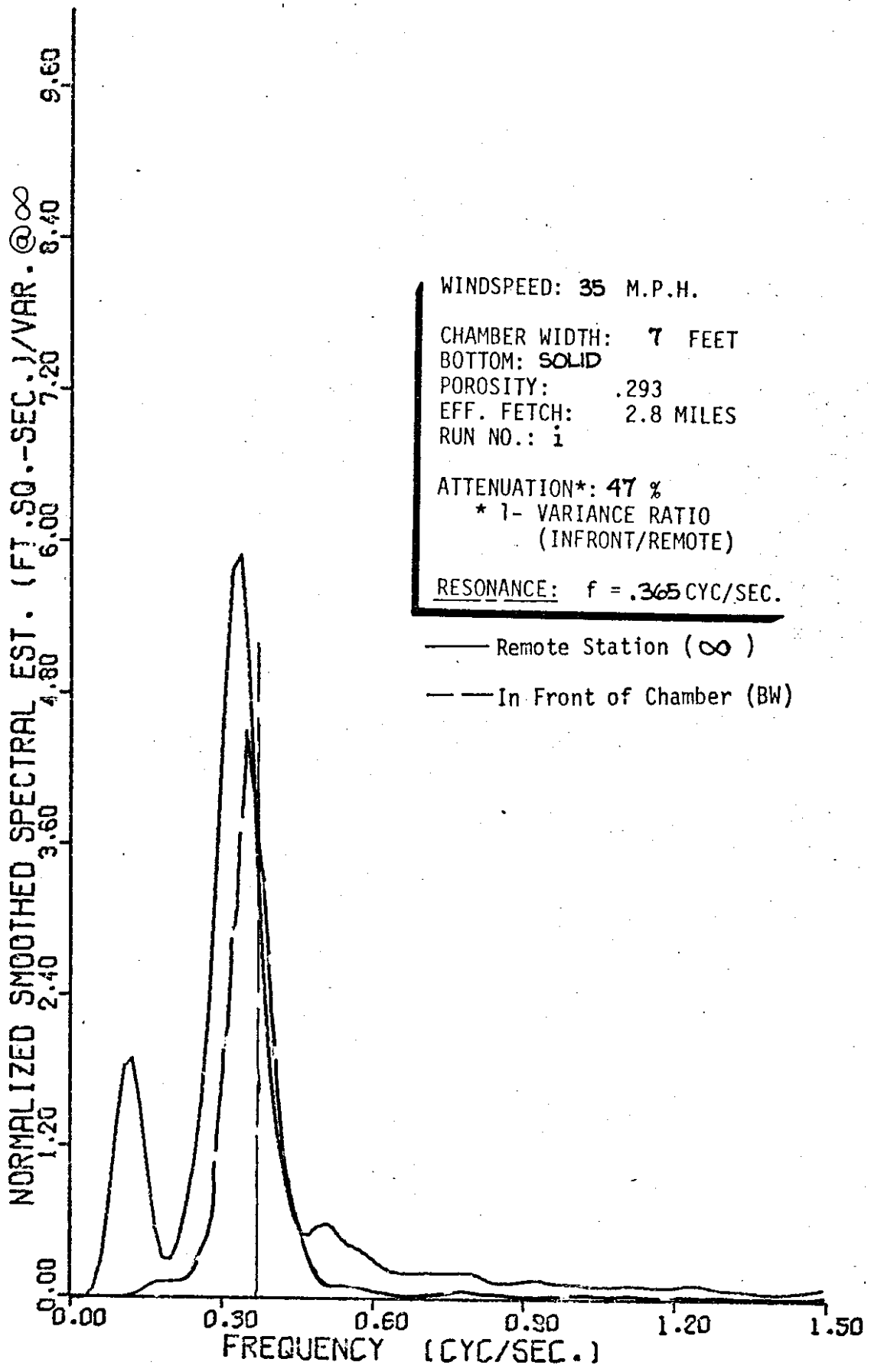

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 35 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 1
ATTENUATION*: 47 %
* 1- VARIANCE RATIO (INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 123

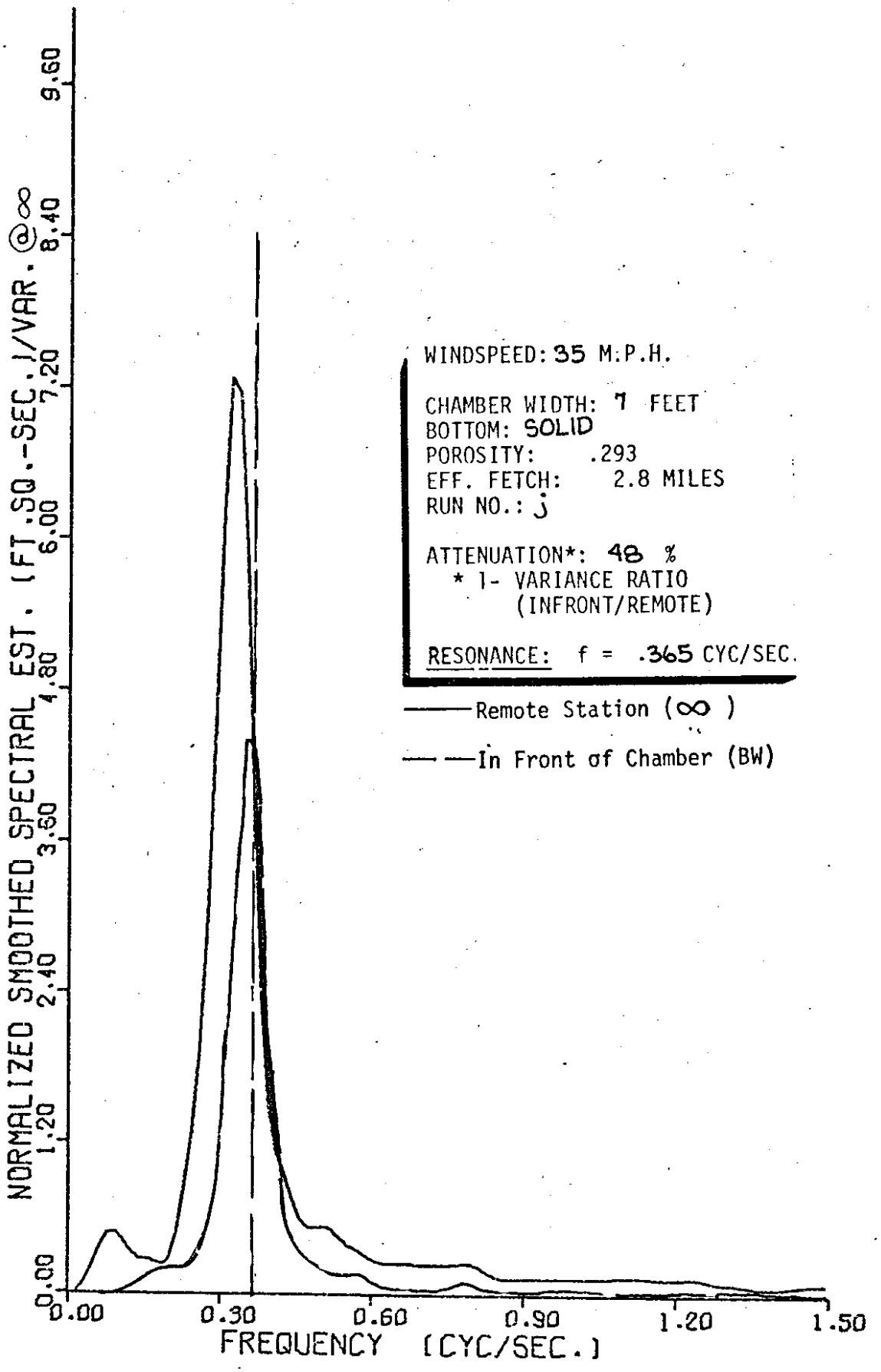

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC./VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 35 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: j
ATTENUATION*: 48 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG. 124

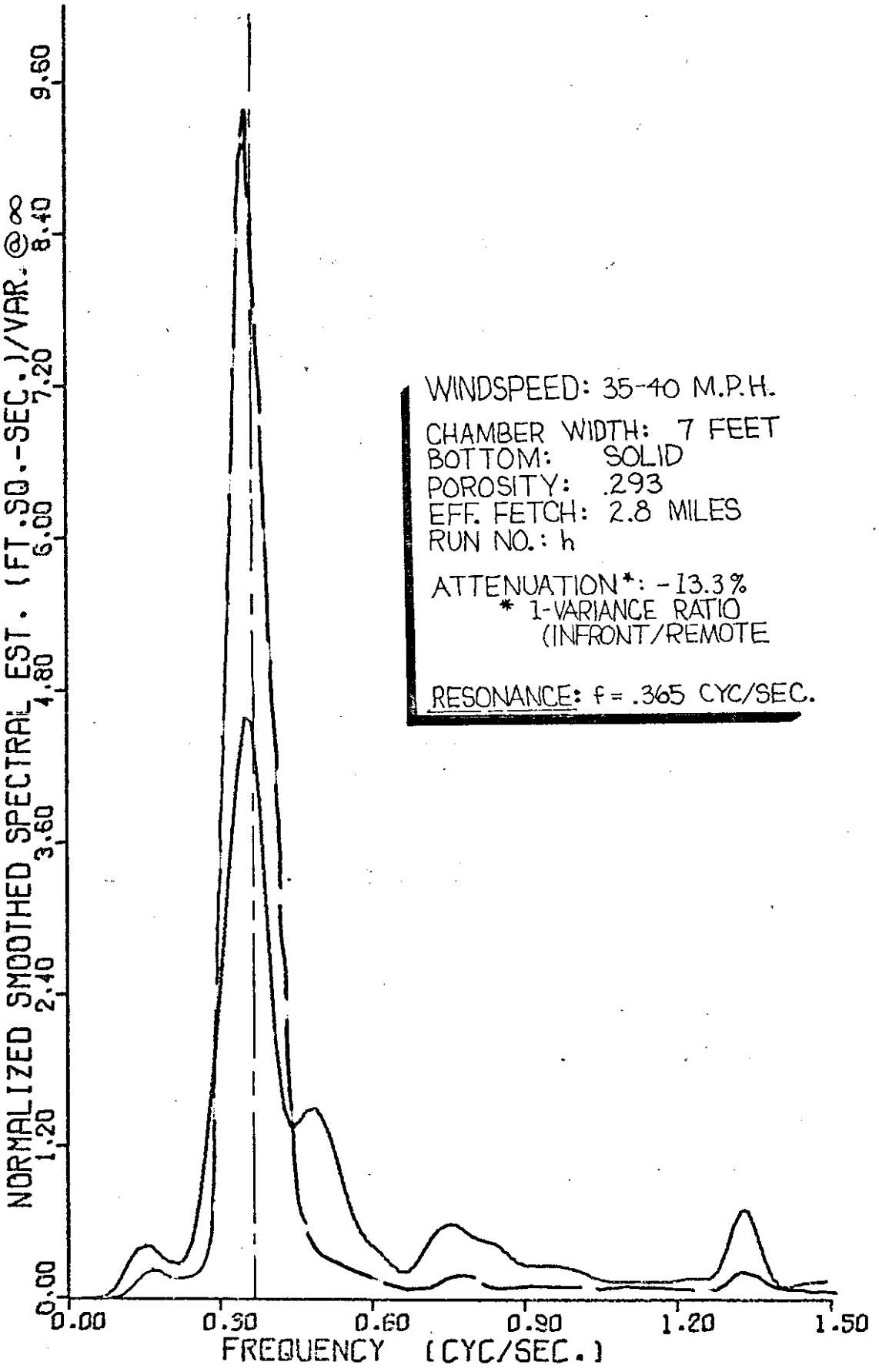

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED: 35-40 M.P.H.
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: h
ATTENUATION*: -13.3%
* 1-VARIANCE RATIO (INFRONT/REMOTE
RESONANCE: f = .365 CYC/SEC.

FIG. 125

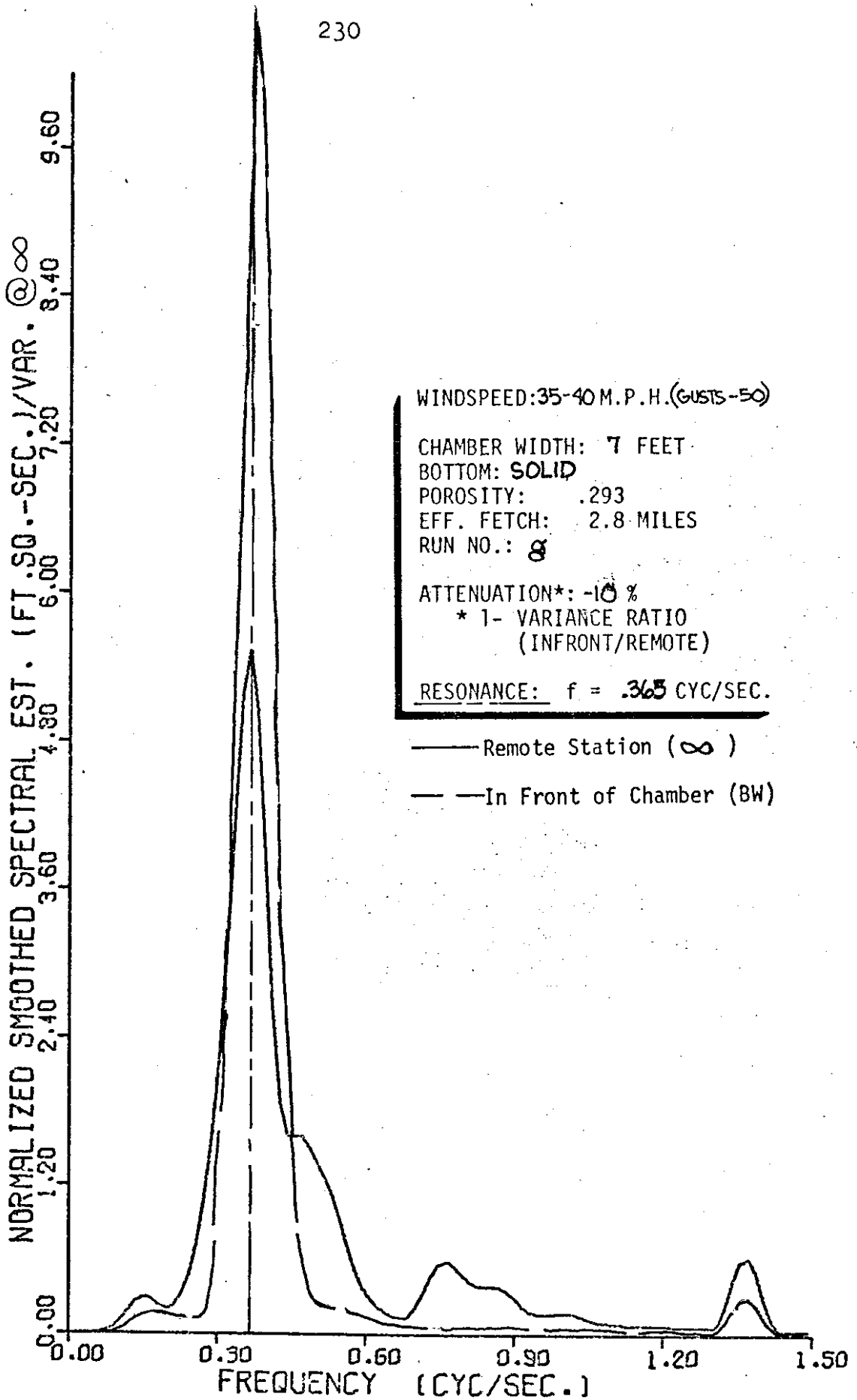

NORMALIZED SMOOTHED SPECTRAL EST. (FT.SQ.-SEC.)/VAR. @∞
0.00
1.20
2.40
3.60
4.80
6.00
7.20
8.40
9.60
0.00
0.30
0.60
0.90
1.20
1.50
FREQUENCY (CYC/SEC.)
WINDSPEED:35-40 M.P.H.(GUSTS-50)
CHAMBER WIDTH: 7 FEET
BOTTOM: SOLID
POROSITY: .293
EFF. FETCH: 2.8 MILES
RUN NO.: 8
ATTENUATION*: -18 %
* 1- VARIANCE RATIO
(INFRONT/REMOTE)
RESONANCE: f = .365 CYC/SEC.
Remote Station (∞)
In Front of Chamber (BW)

FIG.126

APPENDIX III

Representative digitized data records.

DATA RECORDS USED IN APPENDIX I

Digital Run Number	Analog Run No.	Spectra	Tape & Rec.	Output	Calibration Top Force	Bottom Force	Remote Pressure	Near Pressure	Inside Pressure
a	1	S10(9/13 & 9/14)	743	IT	1.015	.971	-.00344	.00151	.00513
b	1 beg.	S 4(4/ 1 & 4/ 2)	27	JH	.957	1.008	-.00349	.00147	.00525
c	1 mid.	S 4(4/ 4 & 4/ 5)	27	JH	.957	1.008	-.00349	.00147	.00525
d	1 end	S 5(4/ 6 & 4/ 7)	27	JH	.957	1.008	-.00349	.00147	
e	2 beg.	S11(8/ 5 & 8/ 6)	743	JH	1.015	.971	-.00577	.00256	.0086
f	2 +	S11(8/ 7 & 8/ 8)	743	WY	1.015	.971	-.00577	.00256	.0086
g	3 beg.	$\begin{matrix}S\ 2\\S\ 3\end{matrix}$(6/12 & 6/13)	27	WY	.957	1.008	-.00349	.00248	.0088
h	3 beg.	S10(9/11 & 9/12)	743	WY	1.015	.971	-.00344	.00256	.0086
i	4 beg.	S 9(8/ 1 & 8/ 2)	743	WY	1.015	.971	-.00344	.00256	.0086
j	4 beg.+	S11(8/ 3 & 8/ 2)	743	AI	1.015	.971	-.00344	.00256	.0086
k	5	S 8(3/ 3 & 3/ 4)	325	AI	1.000	1.000	-.00336	.0025	.0086
l	11 beg.	S 6(7/ 1 & 7/ 2)	966	AI	1.116	1.047	-.00354	.0027	
m	11 mid.	S 7(7/ 3 & 7/ 4)	966	AI	1.116	1.047	-.00354	.0027	
n	11 end	S 7(7/ 5 & 7/ 6)	966	AI	1.116	1.047	-.00354	.0027	
o	12 mid.	S 7(7/ 7 & 7/ 8)	966	MM	1.116	1.047	-.00354	.0027	
p	13 beg.	S 7(7/ 9 & 7/10)	966	MM	1.116	1.047	-.00354	.0027	
q	13 night after	S 7(7/11 & 7/12)	966	MM	1.116	1.047	-.00354	.0027	
r	14	(7/13 & 7/15)	966	MM	1.116	1.047	-.00354	.0027	
s	14 mid.	(7/15 & 7/16)	966	MM	1.116	1.047	-.00354	.0027	

APPENDIX IV

SUMMARY OF FORCE FLUCTUATIONS ON POROUS WALL

Background: A 3.3 foot section of the porous chamber wall was cantilevered at the top (3' above SWL) and bottom (7' below SWL) and the fluctuating forces resulting from the net effect of the wave action on both sides of the wall were recorded and analysed. (For details see ref. pp. 36,40,45,51,52,55,58 and 79).

Attached are the measured maximum values of force for the cases shown in APPENDIX I. To use this information the following points may be helpful:

*"MAX FORCE EXERTED TOWARD BRIDGE" refers to the maximum force recorded during a record due to a low chamber level and wave crest outside chamber. "MAX FORCE MEASURED AWAY FROM BRIDGE" occurs during some cycle of the record when the chamber is relatively full and the wave in front of the wall is near a trough.

*Each forch listed should be DIVIDED BY 3.3 to produce the force per unit length of porous wall.

*Notice that the peak values for the top and bottom of the panel NEED NOT OCCUR at the same time thus the total peak force is $F_{Total} - \frac{1}{3.3} F_{Top} + F_{Bottom}$. The maximum value of the sum of the forces at a given instant of time was found to be 118 pounds per linear foot of wall (ref. p. 81). Should the need exist for knowing the sum of the top and bottom forces at a given time the data is available but extremely time consuming to digest.

*APPENDIX I (ref) contains spectral plots proportional to the frequency distribution of the peak force squared and non-dimensionalized by a mean force squared. These curves are intended primarily to visually demonstrate the frequency distribution of the force. The use of the attached tables should allow calculations where maximum values are desired independent of frequency. It can be noted that if the spectral plot is the only available information, a rough estimate of the max force can be arrived at as follows:

$$\frac{[\text{Max force toward bridge}] + [\text{Max force away}]}{2} = 2[S(f\ )/\ ^{2}]$$

FIVE FOOT CHAMBER W/SOLID BOTTOM

(Measured Resultant on 3.3' Panel)

Pg	Wind Speed Direction	MAX FORCE EXERTED TOWARD BRIDGE	MAX FORCE MEASURED AWAY FROM B.	
134 o	10 S	Top 44.72 Bot 39.77	31.16 45.04	All numbers correspond to the peak value monitored at the top & bottom of a 3.3 foot long test section.
137 n	12-15 S	Top 46.31 Bot 47.03	38.51 50.34	Also note that the time at which the peak force occurred for the top and bottom beam need not coincide.
140 m	15 S	Top 64.92 Bot 66.79	53.38 76.65	
143 r	18-20 S	Top 159.72 Bot 93.98	89.15 107.05	
146 s	18-20 S	Top 121.25 Bot 118.32	107.53 118.30	
149 l	20 S.S.W.	Top 64.42 Bot 63.87	54.99 63.85	
152 p	20 S.S.W.	Top 70.43 Bot 72.17	52.32 72.31	
155 g	20-25 S.S.W.	Top 93.16 Bot 103.45	84.23 96.53	
158 k	30 S	Top 266.77 Bot 112.16	230.23 126.94	
		Top Bot		

SEVEN FOOT CHAMBER W/SOLID BOTTOM

(Measured Resultant on 3.3' Panel)

Pg	Wind Speed Direction	MAX FORCE EXERTED TOWARD BRIDGE	MAX FORCE MEASURED AWAY FROM B.	
164 f	7-10 S.S.W.	Top 41.21 Bot 42.20	44.06 44.03	Note: all numbers correspond to the peak VALUE monitored at top and bottom of a 3.3 foot long test section.
167 e	10-12 S	Top 44.01 Bot 47.40	55.46 47.76	Also note that the time at which the peak force occurred for the top beam need not coincide with the bottom beam.
170 b	15 S	Top 57.60 Bot 70.49	62.98 76.47	
173 a	15 (25 gust) S	Top 67.83 Bot 58.67	65.13 83.78	
176 c	15-18 S (S.S.W.?)	Top 50.78 Bot 48.74	54.11 60.50	
179 d	18-20? S (S.S.W.?)	Top 34.67 Bot 38.33	37.10 40.99	
182 i	35 S	Top 177.5 Bot 213.2	150.4 188.8	
185 j	35 S	Top 250.40 Bot 162.70	215.42 236.10	
188 h	35-40 S.S.W.	Top 244.6 Bot 200.2	164.5 235.8	
191 g	35-40 (50 gust) S.S.W.	Top 190.97 Bot 142.06	126.42 112.07	