STUDIES OF HETEROGENEOUS TWO PHASE FLOW IN LARGE DIAMETER HORIZONTAL PIPELINES

A thesis presented for the Degree of

Doctor of Philosophy

by

FARIS ABDUL AZIZ AL-SAMARRA'E, B.Sc., M.Sc.

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Department of Thermodynamics
and Fluid Mechanics,

Mechanical Engineering Group,

UNIVERSITY OF STRATHCLYDE.

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APPENDIX W

TABULATED RESULTS OF THE FRICTION MULTIPLIERS FOR PHASE 1, 2 AND 3

APPENDIX W TABULATED RESULTS OF THE FRICTION MULTIPLIERS FOR PHASE 1, 2 AND 3

CONTENTS

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
30807	0.0469	0.11621	1.003	0.002965	1.078	0.003186	1.188089	0.003228	1.098	1.286	1.129	1.119
40807	0.1497	0.12258	1.086	0.003161	1.156	0.003363	--	--	1.192	1.474	1.242	1.309
50807	0.2665	0.14269	1.274	0.003675	1.250	0.003605	--	--	1.303	1.650	1.374	1.583
60807	0.3300	0.16073	1.461	0.004190	1.349	0.003871	--	--	1.416	1.803	1.510	1.820
70807	0.3771	0.16740	1.531	0.004360	1.409	0.004013	--	--	1.483	1.882	1.591	2.000
80807	0.4268	0.18084	1.668	0.004707	1.516	0.004279	--	--	1.603	2.013	1.739	2.268
140807	0.4559	0.21751	1.824	0.005621	1.571	0.004839	--	--	1.666	2.095	1.802	2.427
150807	0.5241	0.23164	1.956	0.005965	1.723	0.005256	--	--	1.838	2.346	2.007	2.884
160807	0.5631	0.24909	2.134	0.006390	1.829	0.005478	--	--	1.958	2.529	2.153	3.209
170807	0.5942	0.27420	2.381	0.007076	2.012	0.005979	2.840527	0.007813	2.169	2.841	2.402	3.604
180807	0.6181	0.28802	2.551	0.007494	2.213	0.006502	2.988187	0.008150	2.405	3.166	2.675	3.981
190807	0.6409	0.30038	2.685	0.007790	2.392	0.006940	3.144627	0.008496	2.618	3.442	2.922	4.338
200807	0.6630	--	--	--	2.533	0.007356	3.275417	0.008882	2.787	3.665	3.117	4.675

TABLE W1 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
210807	0.6821	0.31519	2.839	0.008258	2.647	0.007700	3.384252	0.009210	2.927	3.840	3.274	4.981
10907	0.0612	0.20015	1.023	0.003079	1.058	0.003185	1.159602	0.003033	1.073	1.228	1.099	1.111
20907	0.1445	0.20869	1.084	0.003219	1.115	0.003312	--	--	1.144	1.387	1.185	1.258
30907	0.2136	0.23752	1.243	0.003665	1.173	0.003457	--	--	1.213	1.515	1.269	1.411
40907	0.2711	0.24968	1.317	0.003841	1.231	0.003593	--	--	1.281	1.625	1.352	1.568
50907	0.3125	0.26527	1.406	0.004077	1.267	0.003674	--	--	1.322	1.585	1.432	1.685
60907	0.3950	0.29057	1.551	0.004480	1.375	0.003970	--	--	1.444	1.847	1.552	2.003
70907	0.4557	0.32303	1.755	0.005041	1.478	0.004244	--	--	1.560	1.981	1.695	2.312
120907	0.4327	--	--	--	1.490	0.004673	--	--	1.575	2.011	1.698	2.253
130907	0.4884	--	--	--	1.578	0.004840	--	--	1.674	1.983	1.821	2.556
140907	0.5333	0.40610	2.139	0.006485	1.683	0.005102	2.446055	0.006799	1.792	2.169	1.966	2.880
150907	0.5613	0.42365	2.262	0.006769	1.797	0.005378	2.513811	0.006911	1.921	2.359	2.123	3.162
160907	0.5874	0.51917	2.812	0.008368	1.949	0.005800	2.628973	0.007208	2.095	2.607	2.333	3.492

TABLE W2 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES.-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
170907	0.5908	0.50563	2.785	0.008191	2.047	0.006020	2.720471	0.007387	2.208	2.759	2.472	3.618
180907	0.6040	0.56241	2.971	0.008747	2.106	0.006199	2.767528	0.007529	2.276	2.838	2.559	3.771
190907	0.6302	0.58987	3.149	0.009199	2.209	0.006453	2.872136	0.007770	2.397	2.991	2.705	4.080
11007	0.0594	0.28243	1.026	0.003128	1.050	0.003199	1.143931	0.002933	1.063	1.204	1.087	1.101
21007	0.1265	0.29499	1.095	0.003308	1.099	0.003321	--	--	1.125	1.351	1.163	1.221
31007	0.2116	0.33254	1.269	0.003795	1.156	0.003485	--	--	1.204	1.506	1.260	1.400
41007	0.2622	0.35932	1.385	0.004119	1.216	0.003616	--	--	1.263	1.604	1.332	1.535
51007	0.3303	0.37893	1.472	0.004348	1.288	0.003806	--	--	1.347	1.727	1.434	1.746
61007	0.3995	0.45768	1.322	0.005319	1.393	0.004066	--	--	1.465	1.880	1.582	2.038
71007	0.4528	0.47739	1.937	0.005527	1.471	0.004196	--	--	1.551	1.976	1.692	2.293
101007	0.4474	0.53888	1.951	0.006261	1.510	0.004847	--	--	1.598	2.050	1.734	2.325
111007	0.5060	0.60566	2.256	0.007074	1.681	0.005272	2.313541	0.006627	1.790	2.091	1.971	2.753
121007	0.5332	0.65048	2.460	0.007625	1.765	0.005472	2.385164	0.006768	1.885	2.227	2.090	2.977

TABLE W3 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
131007	0.5549	0.68882	2.630	0.008136	1.854	0.005735	2.464765	0.006994	1.986	2.370	2.215	3.191
141007	0.5740	0.71099	2.769	0.008474	1.950	0.005968	2.551894	0.007211	2.096	2.518	2.352	3.408
151007	0.5725	0.78306	3.102	0.009412	2.029	0.006155	2.647229	0.007402	2.186	2.638	2.468	3.479
161007	0.5038	--	--	--	1.628	0.004756	2.319974	0.006191	1.728	1.978	1.910	2.680
21107	0.0452	0.35383	1.047	0.003180	1.044	0.003170	1.132519	0.002827	1.055	1.183	1.077	1.082
31107	0.1240	0.38491	1.162	0.003551	1.095	0.003344	--	--	1.119	1.341	1.156	1.213
41107	0.2063	0.42149	1.302	0.003941	1.153	0.003490	--	--	1.189	1.482	1.242	1.378
51107	0.2330	0.44660	1.357	0.004035	1.181	0.003510	--	--	1.222	1.538	1.283	1.448
61107	0.2928	0.48553	1.495	0.004416	1.235	0.003647	--	--	1.285	1.540	1.351	1.609
71107	0.3626	0.54211	1.708	0.005015	1.325	0.003889	--	--	1.388	1.787	1.490	1.861
81107	0.4223	0.57987	1.869	0.005464	1.410	0.004123	--	--	1.484	1.909	1.611	2.122
101107	0.4452	0.68941	2.031	0.006623	1.492	0.004863	2.123353	0.006285	1.577	2.037	1.713	2.295
111107	0.4636	0.71491	2.132	0.006894	1.567	0.005070	2.171487	0.006386	1.662	1.851	1.819	2.450

TABLE W4 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
121107	0.4954	0.74992	2.277	0.007269	1.639	0.005231	2.231303	0.006489	1.742	1.969	1.920	2.658
131107	0.5243	0.80582	2.501	0.007939	1.781	0.005655	2.361861	0.006859	1.903	2.201	2.123	2.952
21707	0.0485	0.42747	1.013	0.003157	1.038	0.003236	1.120190	0.002798	1.048	1.166	1.068	1.079
31707	0.1045	0.44944	1.085	0.003319	1.074	0.003286	--	--	1.093	1.282	1.124	1.170
41707	0.1603	0.50151	1.235	0.003728	1.115	0.003366	--	--	1.144	1.395	1.188	1.277
51707	0.1944	0.53280	1.337	0.003972	1.155	0.003430	--	--	1.192	1.485	1.247	1.365
61707	0.2534	0.57487	1.464	0.004307	1.202	0.003538	--	--	1.247	1.581	1.317	1.505
71707	0.3373	0.64842	1.657	0.004866	1.288	0.003783	--	--	1.346	1.733	1.440	1.760
101707	0.3626	0.72383	1.745	0.005682	1.350	0.004393	--	--	1.417	1.849	1.521	1.893
111707	0.4150	0.78660	1.969	0.006239	1.440	0.004563	2.060916	0.005915	1.518	1.970	1.650	2.139
121707	0.4347	0.83475	2.079	0.006528	1.499	0.004707	2.093463	0.005961	1.584	2.045	1.736	2.271
131707	0.4797	0.94821	2.422	0.007550	1.597	0.004978	2.173623	0.006162	1.694	1.849	1.876	2.545
141707	0.4976	0.95213	2.478	0.007651	1.668	0.005149	2.242186	0.006309	1.774	1.961	1.979	2.702

TABLE W5 COMPARISON OF FRICTION PRESSURE DROP DATA

VALUES OF TWO-PHASE FRICTION MULTIPLIER

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
151707	0.5182	0.99146	2.539	0.007853	1.749	0.005410	2.320178	0.006557	1.865	2.085	2.099	2.887
32307	0.0467	0.48229	1.031	0.003201	1.034	0.003212	1.113204	0.002729	1.043	1.154	1.063	1.074
42307	0.1102	0.50612	1.107	0.003365	1.075	0.003269	--	--	1.095	1.286	1.127	1.177
52307	0.1694	0.54780	1.219	0.003681	1.110	0.003352	--	--	1.137	1.381	1.180	1.282
62307	0.1927	0.60409	1.350	0.004017	1.144	0.003403	--	--	1.178	1.462	1.232	1.350
72307	0.2536	0.63636	1.440	0.004276	1.192	0.003537	--	--	1.235	1.564	1.302	1.492
82307	0.3214	0.70579	1.628	0.004817	1.262	0.003735	--	--	1.317	1.695	1.406	1.597
112307	0.3629	0.81474	1.717	0.005641	1.314	0.004318	--	--	1.377	1.799	1.473	1.848
122307	0.4048	0.87280	1.894	0.006118	1.391	0.004494	1.992284	0.005814	1.454	1.912	1.584	2.049
132307	0.4180	0.90594	2.023	0.006367	1.453	0.004573	2.038541	0.005806	1.533	1.992	1.676	2.164
142307	0.4519	0.99048	2.204	0.006901	1.527	0.004782	2.092558	0.005941	1.616	2.086	1.784	2.361
152307	0.4873	1.07285	2.448	0.007588	1.615	0.005004	2.176380	0.006135	1.713	1.856	1.912	2.396
162307	0.5009	1.08364	2.493	0.007669	1.647	0.005064	2.210445	0.006190	1.749	1.905	1.960	2.691

TABLE W6 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
12407	0.0490	0.47553	0.892	0.002784	1.032	0.003221	1.106369	0.002688	1.040	1.145	1.059	1.073
22407	0.0969	0.56732	1.078	0.003317	1.064	0.003273	--	--	1.080	1.253	1.110	1.151
32407	0.1548	0.61861	1.197	0.003625	1.093	0.003310	--	--	1.117	1.339	1.156	1.245
42407	0.2197	0.63410	1.237	0.003714	1.124	0.003376	--	--	1.155	1.418	1.203	1.363
72407	0.2236	0.73933	1.368	0.004477	1.179	0.003857	--	--	1.220	1.554	1.281	1.432
82407	0.2976	--	--	--	1.240	0.004002	--	--	1.292	1.672	1.370	1.625
92407	0.3412	0.86407	1.683	0.005425	1.303	0.004201	--	--	1.364	1.781	1.451	1.787
102407	0.3758	0.95096	1.854	0.005937	1.355	0.004339	--	--	1.422	1.861	1.537	1.930
112407	0.4098	0.99460	1.972	0.006277	1.419	0.004518	1.986554	0.005713	1.495	1.954	1.632	2.099
122407	0.4371	1.09541	2.173	0.006894	1.501	0.004763	2.048920	0.005886	1.586	2.062	1.752	2.281
132407	0.4575	1.15425	2.300	0.007306	1.553	0.004933	2.097028	0.006040	1.645	1.743	1.828	2.412
142407	0.4682	1.19642	2.390	0.007502	1.572	0.004933	2.118487	0.006035	1.655	1.769	1.858	2.472
12507	0.0268	0.63508	1.058	0.003373	1.030	0.003284	1.099873	0.002692	1.037	1.138	1.055	1.052

TABLE W7 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
22507	0.0783	--	--	--	1.060	0.003345	--	--	1.076	1.244	1.104	1.129
32507	0.1139	0.67892	1.167	0.003622	1.088	0.003376	--	--	1.111	1.327	1.148	1.195
42507	0.1517	0.72177	1.247	0.003849	1.117	0.003447	--	--	1.146	1.403	1.191	1.268
52507	0.2192	0.81592	1.419	0.004417	1.173	0.003652	--	--	1.214	1.538	1.277	1.420
62507	0.2797	0.87564	1.537	0.004790	1.225	0.003817	--	--	1.274	1.642	1.353	1.575
72507	0.3112	0.94321	1.668	0.005149	1.265	0.003905	--	--	1.320	1.714	1.413	1.680
82507	0.3537	1.02382	1.826	0.005653	1.329	0.004116	--	--	1.393	1.822	1.509	1.847
112507	0.3973	1.12090	1.887	0.006514	1.396	0.004820	1.914737	0.005956	1.470	1.944	1.596	2.010
122507	0.3990	1.17975	2.004	0.006816	1.439	0.004893	1.954400	0.005998	1.517	2.001	1.660	2.093
132507	0.4260	1.25624	2.167	0.007336	1.516	0.005133	2.030801	0.006221	1.604	2.103	1.774	2.264
12807	0.0251	0.67784	1.034	0.003300	1.028	0.003281	1.095311	0.002657	1.035	1.132	1.053	1.049
22807	0.0504	--	--	--	1.057	0.003320	--	--	1.072	1.235	1.100	1.129
32807	0.1142	0.74296	1.166	0.003601	1.085	0.003349	--	--	1.107	1.319	1.144	1.192

TABLE W8 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
42807	0.1301	0.77875	1.227	0.003750	1.108	0.003387	--	--	1.135	1.382	1.180	1.235
52807	0.1970	0.86534	1.384	0.004243	1.157	0.003546	--	--	1.194	1.502	1.255	1.371
62807	0.2458	0.95635	1.549	0.004750	1.210	0.003710	--	--	1.257	1.614	1.334	1.502
72807	0.2994	1.04735	1.718	0.005256	1.265	0.003871	--	--	1.320	1.716	1.417	1.659
22907	0.3193	1.18563	1.794	0.006236	1.319	0.004587	1.841540	0.005757	1.383	1.832	1.498	1.762
32907	0.3493	1.24643	1.923	0.006602	1.371	0.004707	1.882170	0.005816	1.441	1.911	1.566	1.889
42907	0.3807	1.32292	2.073	0.007101	1.443	0.004943	1.946472	0.006016	1.522	2.014	1.671	2.050
52907	0.4128	1.42884	2.297	0.007774	1.523	0.005155	2.033946	0.006229	1.611	1.684	1.791	2.233
23007	0.0347	0.77836	1.074	0.003406	1.028	0.003260	1.092250	0.002617	1.034	1.130	1.052	1.056
33007	0.0715	0.79111	1.108	0.003518	1.053	0.003351	--	--	1.069	1.229	1.097	1.118
43007	0.1049	0.84995	1.197	0.003803	1.080	0.003431	--	--	1.101	1.309	1.136	1.177
53007	0.1215	0.87172	1.242	0.003908	1.105	0.003476	--	--	1.132	1.379	1.175	1.222
63007	0.1903	0.94625	1.362	0.004312	1.148	0.003636	--	--	1.184	1.489	1.242	1.352

TABLE W9 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
73007	0.2436	1.05716	1.544	0.004896	1.207	0.003827	--	--	1.253	1.617	1.331	1.495
83007	0.2813	1.13562	1.676	0.005305	1.251	0.003959	--	--	1.304	1.702	1.398	1.609
13107	0.3015	1.20720	1.686	0.005875	1.290	0.004495	1.807776	0.005659	1.349	1.787	1.449	1.692
23107	0.3236	1.27389	1.798	0.006179	1.326	0.004556	1.832720	0.005662	1.390	1.845	1.503	1.779
33107	0.3595	1.38372	1.966	0.006714	1.393	0.004759	1.889608	0.005810	1.466	1.949	1.605	1.939
43107	0.3748	1.44256	2.076	0.007046	1.434	0.004865	1.932409	0.005913	1.511	2.007	1.667	2.024
63107	0.0236	0.80758	1.028	0.003296	1.026	0.003292	1.087879	0.002611	1.033	1.125	1.050	1.046
73107	0.0746	0.84485	1.098	0.003446	1.053	0.003305	--	--	1.067	1.222	1.094	1.118
83107	0.1054	0.87329	1.144	0.003590	1.074	0.003369	--	--	1.093	1.290	1.127	1.171
93107	0.1259	0.90888	1.204	0.003759	1.098	0.003428	--	--	1.123	1.361	1.166	1.219
103107	0.1787	1.00224	1.342	0.004207	1.141	0.003577	--	--	1.175	1.473	1.233	1.329
113107	0.2226	1.10914	1.504	0.004748	1.188	0.003751	--	--	1.231	1.580	1.305	1.442
123107	0.2648	1.21211	1.654	0.005251	1.242	0.003944	--	--	1.293	1.689	1.387	1.570

TABLE W10 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
10108	0.2270	1.32685	1.683	0.005986	1.275	0.004535	1.771189	0.005658	1.332	1.769	1.629	1.648
20103	0.3336	1.42099	1.857	0.006510	1.355	0.004751	1.837878	0.005793	1.423	1.901	1.550	1.834
30108	0.3723	1.54966	2.066	0.007119	1.409	0.004856	1.897506	0.005889	1.484	1.981	1.634	1.989
40108	0.3982	1.66223	2.249	0.007701	1.477	0.005057	1.975236	0.006107	1.559	2.076	1.739	2.137
60108	0.0388	0.87633	1.043	0.003403	1.025	0.003362	1.083621	0.002620	1.031	1.121	1.047	1.057
70108	0.0226	--	--	--	1.048	0.003366	--	--	1.060	1.207	1.086	1.120
80108	0.1178	0.96665	1.177	0.003749	1.075	0.003426	--	--	1.095	1.297	1.130	1.185
90108	0.1484	0.98753	1.212	0.003855	1.098	0.003493	--	--	1.123	1.363	1.165	1.244
100108	0.1927	1.08952	1.347	0.004305	1.139	0.003640	--	--	1.172	1.470	1.229	1.344
110108	0.2382	1.17386	1.471	0.004698	1.180	0.003769	--	--	1.221	1.556	1.293	1.455
120108	0.2729	1.27977	1.618	0.005201	1.224	0.003936	--	--	1.273	1.660	1.352	1.563
10408	0.2660	1.40530	1.674	0.005959	1.265	0.004510	1.750673	0.005604	1.320	1.755	1.417	1.599
20408	0.3152	1.51317	1.843	0.006455	1.328	0.004652	1.804469	0.005679	1.392	1.863	1.515	1.764

TABLE W11 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
30408	0.3687	1.62595	2.016	0.007091	1.436	0.005051	1.919528	0.006086	1.513	2.032	1.681	2.011
60408	0.0248	1.01793	1.043	0.003406	1.022	0.003337	1.074041	0.002547	1.027	1.109	1.042	1.042
70408	0.0675	--	--	--	1.046	0.003370	--	--	1.058	1.201	1.083	1.104
80408	0.1053	1.13071	1.207	0.003889	1.067	0.003440	--	--	1.085	1.276	1.118	1.164
90408	0.1225	1.21407	1.294	0.004132	1.090	0.003480	--	--	1.113	1.345	1.155	1.207
100408	0.1630	1.17092	1.267	0.004040	1.117	0.003562	--	--	1.146	1.420	1.198	1.282
110408	0.2065	1.30331	1.443	0.004639	1.162	0.003734	--	--	1.200	1.532	1.269	1.389
10508	0.2598	1.51121	1.604	0.005727	1.224	0.004371	--	--	1.273	1.684	1.361	1.541
20508	0.3136	1.67498	1.827	0.006475	1.310	0.004645	1.772020	0.005639	1.372	1.846	1.496	1.740
30508	0.3682	1.95447	2.154	0.007692	1.406	0.005021	1.880344	0.006044	1.480	2.005	1.547	1.975
70508	0.0717	0.08679	1.103	0.003287	1.101	0.003281	1.211158	0.003470	1.127	1.348	1.162	1.166
80508	0.2054	0.08954	1.150	0.003381	1.224	0.003597	--	--	1.273	1.606	1.336	1.458
90508	0.3613	0.11356	1.474	0.004283	1.457	0.004236	--	--	1.538	1.946	1.652	2.018

TABLE W12 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
100508	0.4670	0.14857	1.947	0.005579	1.686	0.004826	--	--	1.792	2.371	1.955	2.598
110508	0.5507	0.16593	2.216	0.006307	2.037	0.005797	--	--	2.197	3.024	2.431	3.356
120508	0.6138	0.20172	2.651	0.007546	2.414	0.006870	3.318307	0.008825	2.663	3.660	2.941	4.118
130508	0.6799	0.24703	3.264	0.009283	2.967	0.008439	3.789450	0.010160	3.321	4.563	3.703	5.173
11208	0.4010	0.03553	5.209	0.016099	1.360	0.004203	1.659828	0.005085	1.503	1.893	1.857	1.980
21208	0.4073	0.03596	5.338	0.016189	1.764	0.005349	--	--	2.000	3.116	2.681	2.451
31208	0.4109	0.03638	5.461	0.016268	2.217	0.006605	--	--	2.632	4.151	3.690	2.847
41208	0.4127	0.03426	6.120	0.018102	2.738	0.008098	--	--	3.358	5.201	4.932	3.110
51208	0.4568	0.02073	4.148	0.012276	3.636	0.010763	--	--	4.644	6.902	7.184	3.635
61208	0.4317	0.02538	4.118	0.013545	2.873	0.009449	--	--	3.708	5.686	5.366	3.181
71208	0.4507	0.02073	3.497	0.011102	3.814	0.012107	--	--	5.000	7.357	7.409	3.576
81208	--	--	--	--	4.517	0.013946	--	--	5.933	8.523	8.914	--
91208	--	--	--	--	5.243	0.015972	7.921188	0.023852	6.911	9.732	10.491	--

Table header: VALUES OF TWO-PHASE FRICTION MULTIPLIER

TABLE W13 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
101208	--	--	--	--	5.834	0.017547	8.240903	0.024536	7.680	10.656	11.769	--
111208	--	--	--	--	6.704	0.020266	8.978939	0.026956	8.921	12.124	14.132	--
121208	--	--	--	--	7.359	0.022007	9.495667	0.028238	9.746	13.104	15.674	--
131208	--	--	--	--	8.655	0.025564	10.627279	0.031309	11.527	15.035	18.897	--
11308	0.2109	0.02493	1.675	0.005164	1.234	0.003787	1.439818	0.004469	1.305	1.649	1.427	1.479
21308	--	--	--	--	1.300	0.003889	1.492597	0.004494	1.384	1.753	1.537	--
31308	0.2202	0.03561	2.451	0.007256	1.250	0.003699	1.455631	0.004353	1.321	1.668	1.653	1.510
41308	0.2699	0.03775	2.623	0.007650	1.352	0.003944	1.534961	0.004488	1.443	1.823	1.622	1.743
51308	0.0000	0.03903	2.743	0.007851	1.587	0.004542	--	--	1.758	2.619	2.053	0.000
61308	0.0000	0.03946	2.787	0.007902	1.940	0.005500	--	--	2.175	3.368	2.610	0.000
71308	0.0000	0.03818	2.752	0.007734	2.363	0.006641	--	--	2.695	4.195	3.292	0.000
81308	0.0000	0.04915	3.587	0.009993	3.506	0.009766	--	--	4.172	6.259	5.145	0.000
101308	0.0000	0.04569	3.200	0.009875	4.472	0.013799	5.986637	0.018001	5.568	8.111	6.783	0.000

TABLE W14 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
111308	--	--	--	--	5.633	0.017108	6.947486	0.020742	7.101	10.076	8.717	--
121308	0.1260	0.02720	1.069	0.003147	1.162	0.003424	1.378836	0.004087	1.244	1.555	1.297	1.323
131308	0.2076	0.03532	1.408	0.004090	1.288	0.003742	--	--	1.391	1.762	1.469	1.528
141308	0.3723	0.04231	1.690	0.004839	1.566	0.004486	--	--	1.712	2.103	1.843	2.153
151308	0.5058	0.05156	2.103	0.005846	2.018	0.005610	--	--	2.238	3.396	2.446	3.070
161308	0.6057	0.05370	2.169	0.006134	2.404	0.006799	--	--	2.714	4.158	2.965	3.991
191308	0.6503	0.07572	2.953	0.008962	2.902	0.008807	4.446937	0.012869	3.373	5.169	3.636	4.683
201308	0.7019	0.07784	3.104	0.009292	3.256	0.009748	4.644996	0.013305	3.830	5.814	4.150	5.497
211308	0.7089	0.07699	3.120	0.009236	3.726	0.011033	4.984638	0.014197	4.442	6.666	4.828	5.813
221308	0.7364	0.07277	2.911	0.008485	4.185	0.012199	5.361657	0.015115	5.032	7.480	5.413	6.460
231308	0.7279	0.06600	2.674	0.007695	4.511	0.012980	5.663538	0.015822	5.451	8.048	5.869	6.418
21408	0.1047	0.04688	1.222	0.003559	1.158	0.003374	1.329128	0.003845	1.196	1.477	1.244	1.261
31408	0.2488	0.05299	1.356	0.003894	1.347	0.003868	--	--	1.413	1.793	1.501	1.663

TABLE W15 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
			VALUES OF TWO-PHASE FRICTION MULTIPLIER									
41403	0.3878	0.06282	1.625	0.004612	1.590	0.004512	--	--	1.686	2.085	1.824	2.236
51403	0.5020	0.06932	1.822	0.005105	1.844	0.005169	--	--	1.975	2.864	2.160	2.916
61403	0.6139	0.07067	1.876	0.005185	2.236	0.006181	--	--	2.431	3.608	2.630	3.969
71403	0.6537	0.07209	1.917	0.005286	2.626	0.007242	3.980054	0.010381	2.901	4.318	3.204	4.648
91403	0.6738	0.03661	0.923	0.002722	2.998	0.008846	4.057779	0.011341	3.370	5.026	3.683	5.107
101403	0.6946	0.05342	1.359	0.003988	3.291	0.009659	4.286564	0.011967	3.739	5.548	4.083	5.535
111408	0.6636	0.08628	2.198	0.006377	3.683	0.010686	4.629785	0.012851	4.236	6.222	4.621	5.332
121408	0.6971	0.07351	1.889	0.005375	3.919	0.011150	4.862362	0.013286	4.532	6.610	4.933	5.849
131408	0.0764	0.05256	1.000	0.002753	1.131	0.003114	1.267681	0.003466	1.162	1.410	1.207	1.202
141403	0.2573	0.06610	1.270	0.003472	1.315	0.003595	--	--	1.377	1.740	1.463	1.642
151403	0.3681	0.07862	1.525	0.004092	1.547	0.004152	--	--	1.637	2.026	1.773	2.136
21503	0.4444	0.09423	1.710	0.004999	1.704	0.004980	--	--	1.815	2.510	1.970	2.537
31508	0.5698	0.07266	1.324	0.003852	2.058	0.005986	--	--	2.223	3.185	2.437	3.489

TABLE W16 COMPARISON OF FRICTION PRESSURE DROP DATA

VALUES OF TWO-PHASE FRICTION MULTIPLIER

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
41508	0.6129	0.06869	1.264	0.003627	2.312	0.006634	3.487912	0.009382	2.523	3.639	2.778	4.026
51508	0.6539	0.07180	1.303	0.003692	2.579	0.007304	3.606080	0.009597	2.844	4.037	3.140	4.719
61508	0.6721	0.07465	1.367	0.003834	2.877	0.008069	3.823617	0.010116	3.211	4.588	3.545	5.021
71508	0.7118	0.07748	1.425	0.004008	3.244	0.009124	4.136905	0.011037	3.670	5.212	4.049	5.774
81508	0.7271	0.07976	1.506	0.004177	3.449	0.009566	4.343362	0.011471	3.925	5.552	4.335	6.135
21808	0.1602	0.07011	0.995	0.002899	1.106	0.003222	1.217360	0.003450	1.133	1.359	1.170	1.267
31808	0.2547	0.08004	1.145	0.003297	1.265	0.003642	--	--	1.320	1.671	1.391	1.580
41808	0.3351	0.09395	1.366	0.003885	1.454	0.004133	--	--	1.533	1.932	1.645	1.952
51808	0.4334	0.10356	1.500	0.004244	1.617	0.004575	--	--	1.716	2.238	1.862	2.405
61808	0.5559	0.12749	1.870	0.005286	1.944	0.005495	--	--	2.039	2.882	2.297	3.293
71808	0.5990	0.13621	2.011	0.005650	2.229	0.006261	3.297206	0.008652	2.422	3.383	2.681	3.847
81808	0.6512	0.14298	2.106	0.005867	2.457	0.006845	3.417398	0.008912	2.695	3.763	2.991	4.493
21908	0.6675	0.11866	1.691	0.005048	2.672	0.007978	3.511709	0.009832	2.954	4.170	3.259	4.824

TABLE W17 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
31908	0.6979	0.17348	2.531	0.007415	3.034	0.008887	3.850440	0.010646	3.411	4.763	3.761	5.444
41908	0.7261	0.16750	2.439	0.007091	3.231	0.009392	4.045527	0.011140	3.657	5.074	4.038	5.993
51908	0.0880	0.08187	0.937	0.002589	1.095	0.003024	1.207867	0.003187	1.119	1.326	1.156	1.176
61908	0.2509	0.10356	1.213	0.003307	1.288	0.003512	--	--	1.346	1.700	1.428	1.600
91908	0.4332	0.13161	1.461	0.004299	1.580	0.004651	--	--	1.676	2.087	1.811	2.363
101908	0.5319	0.15524	1.753	0.005108	1.777	0.005180	--	--	1.899	2.500	2.075	2.984
111908	0.5659	0.16917	1.919	0.005569	1.983	0.005755	--	--	2.134	2.865	2.350	3.391
121908	0.6278	0.17221	1.972	0.005659	2.222	0.006378	3.115821	0.008324	2.415	3.268	2.675	4.070
131908	0.6592	0.17554	2.018	0.005762	2.457	0.007015	3.283254	0.008753	2.696	3.647	2.993	4.573
141908	0.6656	0.18152	2.096	0.005965	2.617	0.007447	3.420347	0.009113	2.889	3.904	3.216	4.768
151908	0.6974	0.19084	2.198	0.006237	2.844	0.008070	3.629913	0.009682	3.168	4.255	3.528	5.321
12008	0.0926	0.09777	0.930	0.002734	1.093	0.003212	1.200183	0.003320	1.117	1.326	1.151	1.179
22008	0.2260	0.11121	1.066	0.003042	1.232	0.003517	--	--	1.282	1.616	1.348	1.497

TABLE W18 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
32008	0.3389	0.12984	1.271	0.003607	1.380	0.003917	--	--	1.451	1.840	1.549	1.876
42008	0.4298	0.14004	1.389	0.003907	1.531	0.004308	--	--	1.620	2.024	1.733	2.295
52008	0.5167	0.17093	1.702	0.004785	1.729	0.004859	--	--	1.842	2.342	2.018	2.857
62008	0.5848	0.18613	1.856	0.005178	1.911	0.005331	--	--	2.050	2.655	2.264	3.434
72008	0.6270	0.19456	1.959	0.005460	2.159	0.006019	3.030434	0.007848	2.339	3.071	2.601	4.004
112008	0.6307	0.20064	1.916	0.005732	2.362	0.007056	3.116399	0.008676	2.585	3.429	2.858	4.217
122008	0.6425	0.22134	2.159	0.006394	2.591	0.007673	3.330485	0.009220	2.861	3.792	3.174	4.506
132008	0.6751	0.23203	2.299	0.006705	2.718	0.007929	3.461934	0.009462	3.016	3.981	3.353	4.948
12508	--	--	--	--	8.512	0.029757	10.765760	0.037553	12.563	15.973	19.979	--
22608	0.6847	0.01696	3.962	0.014155	12.085	0.043173	14.716820	0.052802	18.653	21.826	30.770	7.249
32608	0.6991	0.02379	4.933	0.016469	14.356	0.047925	16.728550	0.055832	20.967	23.916	33.924	8.420
42608	0.7450	0.03233	5.806	0.018716	17.485	0.056368	20.085344	0.063859	24.799	27.119	38.821	10.200
52608	0.7765	0.03988	6.874	0.021467	20.772	0.064870	23.469751	0.073354	28.865	31.834	44.796	12.347

TABLE W19 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
72608	0.8534	0.10621	14.663	0.048795	21.868	0.072772	24.708721	0.082702	31.128	35.049	45.334	15.180
82608	0.8812	0.10915	15.331	0.049903	25.265	0.082241	28.731534	0.094847	35.539	41.956	51.945	18.510
92608	0.8801	-:-	-:-	-:-	28.582	0.089332	32.582086	0.103406	40.187	48.428	58.016	20.077
12708	0.8896	0.12307	17.433	0.060021	28.865	0.099383	34.317255	0.119905	42.280	53.023	60.732	21.069
22708	0.8870	0.14465	20.543	0.069654	30.759	0.104284	36.815593	0.126462	44.662	57.300	64.116	22.097
42708	0.8941	0.14975	24.016	0.083830	35.166	0.122750	44.153848	0.155148	52.526	68.714	76.314	25.675
52708	0.8835	0.13406	20.887	0.070009	30.523	0.102310	36.426246	0.123746	44.188	56.515	65.053	21.691
62708	0.8749	0.08591	14.454	0.047457	24.626	0.080856	28.183955	0.093776	35.367	41.446	53.738	17.620
12908	0.8070	0.10022	9.364	0.029318	6.456	0.020214	7.899792	0.024450	8.318	11.467	11.040	8.597
22908	0.8280	0.09512	8.865	0.026767	9.578	0.028921	10.852377	0.032709	12.342	15.952	16.674	10.181
32908	0.8620	0.07992	7.318	0.021755	11.479	0.034127	12.730573	0.037940	14.805	18.505	19.986	12.456
42908	0.8558	0.10572	10.174	0.030161	13.570	0.040228	14.893242	0.044336	17.597	21.203	24.090	12.652
52908	0.8685	0.16289	16.959	0.050030	16.351	0.048237	18.057990	0.052541	21.281	24.561	29.751	14.311

TABLE W20 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
62908	0.8588	-.-	-.-	-.-	19.476	0.057537	21.210057	0.062114	25.411	28.075	35.447	14.852
72908	0.8578	0.17476	15.579	0.046104	20.428	0.060453	22.213572	0.065475	26.542	29.419	35.684	15.231
92908	0.8685	0.14641	13.056	0.041292	17.969	0.056831	19.816469	0.061797	24.014	26.629	32.083	14.723
102908	0.8661	0.19456	15.141	0.047767	20.620	0.065050	22.685399	0.071457	27.408	30.531	35.454	15.720
112908	0.8595	0.19711	15.687	0.049756	22.598	0.071674	24.980727	0.079806	30.178	34.522	39.160	16.236
122908	0.8737	0.16573	13.309	0.042335	25.235	0.080270	28.228179	0.091035	33.782	39.947	43.828	18.400
10109	0.7304	0.07065	3.207	0.010021	4.901	0.015314	6.041808	0.018409	6.070	8.912	6.724	6.469
20109	0.8255	0.09433	4.441	0.013739	7.487	0.023163	8.604252	0.026397	9.400	13.111	10.704	9.719
30109	0.8504	0.12141	5.831	0.017786	8.995	0.027437	10.118623	0.030750	11.343	15.316	13.052	11.281
50109	0.8415	0.22036	9.609	0.030772	10.994	0.035206	12.169866	0.039026	14.137	18.345	15.906	11.225
60109	0.8621	0.22761	10.186	0.032505	13.107	0.041827	14.251663	0.045674	16.955	21.187	19.259	12.956
70109	0.8606	0.23644	10.635	0.033500	14.537	0.045948	15.830079	0.049987	18.850	23.067	21.489	13.340
80109	0.8605	0.26145	11.705	0.036982	16.500	0.052132	18.151131	0.056520	21.370	25.454	24.402	13.986

TABLE W21 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
90109	0.8635	0.24997	11.356	0.035827	18.099	0.057098	19.953581	0.062105	23.460	27.319	26.920	14.771
100109	0.8635	0.22840	10.505	0.033191	19.582	0.061869	21.585413	0.067758	25.425	29.241	29.271	15.365
10209	0.7506	0.14710	4.115	0.012717	4.135	0.012780	5.129798	0.015285	4.977	7.338	5.326	6.713
20209	0.7866	0.17162	5.058	0.014820	5.937	0.017397	6.884051	0.019819	7.113	10.402	7.756	8.309
30209	0.8446	0.28930	8.794	0.025574	7.770	0.022595	8.750523	0.025246	9.339	13.239	10.398	11.058
40209	0.8473	0.32107	9.361	0.027261	9.587	0.027919	10.466128	0.030394	11.600	15.823	13.042	11.649
10309	0.8457	0.33735	9.321	0.030231	10.414	0.033778	11.499061	0.037292	13.191	17.632	14.529	11.410
20309	0.8524	0.34902	10.031	0.032504	12.324	0.039932	13.514220	0.043955	15.712	20.381	17.402	12.289
40309	0.8526	0.26017	7.217	0.024151	13.636	0.045633	14.980367	0.050332	17.576	22.186	19.443	12.635
50309	0.8665	0.26537	7.383	0.024592	15.446	0.051446	17.094442	0.056489	19.955	24.492	22.170	14.080
10409	0.7234	0.22124	3.754	0.011508	3.824	0.011721	4.641530	0.013617	4.426	6.248	4.824	6.219
20409	0.7588	0.27822	4.806	0.014332	4.735	0.014119	5.613631	0.016245	5.588	7.727	6.113	7.254
30409	0.7974	0.39619	6.763	0.020276	6.047	0.018129	7.019552	0.020700	7.243	9.852	8.019	8.678

TABLE W22 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
40409	0.8107	0.43669	7.471	0.022549	7.635	0.023044	8.606767	0.025759	9.173	12.202	10.372	9.531
50409	0.8189	--	--	--	8.960	0.027403	9.992063	0.030435	10.816	14.129	12.359	10.164
60409	0.8210	--	--	--	9.891	0.030417	10.974560	0.033699	11.986	15.377	13.778	10.482
10509	0.8148	0.44228	7.178	0.024154	10.236	0.034458	11.351212	0.038194	12.623	16.105	14.324	10.223
20509	0.8358	0.44571	7.175	0.024166	11.198	0.037712	12.397842	0.041835	13.852	17.409	15.827	11.379
30509	0.8458	0.46788	7.604	0.025811	12.251	0.041616	13.582795	0.046281	15.225	18.907	17.509	12.187
50509	0.7195	0.29420	3.540	0.010725	3.256	0.009864	4.016585	0.011519	3.696	5.014	4.067	5.892
60509	0.7561	0.39766	4.710	0.014211	4.178	0.012606	5.014575	0.014563	4.872	6.409	5.370	7.006
70509	0.7734	0.48112	5.806	0.017602	5.237	0.015876	6.192720	0.018336	6.217	8.058	6.921	7.771
80509	0.7918	--	--	--	6.427	0.019709	7.415331	0.022424	7.702	9.814	8.695	8.611
10809	0.7836	0.63783	7.324	0.024631	7.373	0.024797	8.426122	0.028085	8.939	11.304	10.117	8.534
20809	0.7989	0.62410	7.234	0.024337	8.279	0.027851	9.416325	0.031501	10.051	12.601	11.532	9.228
30809	0.8000	0.63214	7.277	0.024416	9.012	0.030235	10.206100	0.034127	10.970	13.577	12.671	9.449

TABLE W 23 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
50809	0.6735	0.36295	3.431	0.010590	2.889	0.008915	3.598264	0.010432	3.235	4.272	3.539	5.036
60809	0.7057	0.45376	4.295	0.013282	3.834	0.011854	4.633722	0.013710	4.433	5.676	4.974	5.940
70809	0.7371	0.56153	5.393	0.016819	4.801	0.014971	5.726987	0.017355	5.671	7.090	6.318	6.817
80309	0.7660	0.60213	5.816	0.018183	5.673	0.017735	6.707077	0.020575	6.768	8.329	7.632	7.764
90809	0.7874	0.76806	7.488	0.023757	6.865	0.021781	7.967421	0.025002	8.236	10.035	9.468	8.591
10909	0.7906	--	--	--	7.553	0.026289	8.712317	0.030086	9.160	11.125	10.525	8.789
20909	0.8113	0.86779	7.986	0.027952	8.007	0.028023	9.229161	0.032102	9.702	11.783	11.264	9.599
30909	0.8246	0.89702	8.297	0.029362	8.971	0.031747	10.299787	0.036336	10.948	13.148	12.807	10.364
40909	0.8501	0.67146	7.686	0.026487	10.034	0.034581	11.339835	0.039062	12.305	15.066	14.308	11.865
11109	0.6515	0.39756	3.277	0.010270	2.884	0.009038	3.576135	0.010525	3.229	4.224	3.571	4.786
21109	0.6635	--	--	--	3.812	0.012030	4.625072	0.013966	4.405	5.606	4.904	5.354
31109	0.6868	0.50965	4.116	0.013164	4.778	0.015282	5.725076	0.017793	5.645	6.922	6.327	5.966
41109	0.7203	0.57408	4.609	0.014908	5.675	0.018355	6.689013	0.021227	6.779	8.147	7.698	6.739

TABLE W24 COMPARISON OF FRICTION PRESSURE DROP DATA

VALUES OF TWO-PHASE FRICTION MULTIPLIER

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
71109	0.7375	0.55381	5.168	0.018161	6.438	0.022626	7.509990	0.026042	7.795	9.345	8.828	7.212
81109	0.7641	0.79317	6.181	0.022051	7.200	0.025683	8.389224	0.029655	8.735	10.410	10.065	7.985
91109	0.7891	0.91114	7.053	0.025280	7.757	0.027805	9.030787	0.032150	9.404	11.171	10.980	8.803
101109	0.8143	1.01793	7.827	0.028544	8.321	0.030346	9.689601	0.035169	10.128	11.979	11.927	9.795
11209	0.6132	0.51704	3.151	0.010211	2.435	0.007892	3.057984	0.009214	2.676	3.381	2.932	4.124
21209	0.6663	0.79111	4.046	0.013723	3.727	0.012639	4.563576	0.014794	4.302	5.164	4.856	5.353
31209	0.7173	1.15719	5.855	0.020229	4.708	0.016265	5.705684	0.019152	5.559	6.323	6.384	6.426
41209	0.7503	--	--	--	5.237	0.018202	6.333797	0.021532	6.231	6.983	7.218	7.224
51209	0.7873	1.36411	7.177	0.025545	5.814	0.020695	7.027323	0.024605	6.963	7.809	8.161	8.313
81209	0.7645	1.52592	7.637	0.029340	5.940	0.022821	7.169861	0.027123	7.170	8.034	8.357	7.699
91209	0.7980	1.80149	8.921	0.034789	6.594	0.025715	7.972138	0.030753	7.986	8.884	9.477	8.809
11509	0.5766	0.76276	2.840	0.009598	2.305	0.007789	2.903200	0.009092	2.520	3.085	2.826	3.748
21509	0.6321	1.16209	4.309	0.014916	3.139	0.010866	3.900264	0.012756	3.551	4.171	4.047	4.725

TABLE W25 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
31509	0.6942	1.68577	6.339	0.022787	3.949	0.014194	4.877922	0.016844	4.585	5.117	5.317	5.812
41509	0.7429	1.73326	6.827	0.025020	4.598	0.016848	5.698417	0.020288	5.415	5.800	6.375	6.875
61509	0.7353	2.05156	7.446	0.029823	4.772	0.019112	5.905611	0.023037	5.671	5.949	6.547	6.753
71509	0.7516	2.18885	8.038	0.031991	5.192	0.020667	6.439954	0.025099	6.204	6.463	7.361	7.218
81509	0.7674	2.25162	8.242	0.033703	5.644	0.023079	7.019383	0.028237	6.784	7.051	8.150	7.709
11609	0.7532	0.98067	2.854	0.011963	4.313	0.018076	5.439019	0.022077	5.076	5.097	6.036	6.971
21609	0.7821	1.45727	4.384	0.018338	4.725	0.019767	5.972440	0.024352	5.605	5.517	6.736	7.819
31609	0.8180	1.77795	5.354	0.022865	5.155	0.022017	6.546036	0.027402	6.157	6.038	7.505	9.120
51609	0.5409	2.39578	7.109	0.024411	2.128	0.007307	2.701197	0.008559	2.308	2.737	2.594	3.378
61609	0.6414	2.46148	7.540	0.026746	2.958	0.010495	3.711737	0.012397	3.323	3.815	3.824	4.725
71609	0.6882	2.58210	8.052	0.029213	3.566	0.012936	4.465698	0.015461	4.089	4.482	4.799	5.579
81609	0.7507	2.84100	8.923	0.033194	4.245	0.015794	5.318849	0.019131	4.961	5.083	5.881	6.916
11709	0.4990	1.24153	2.643	0.009381	1.902	0.006752	2.445119	0.007958	2.044	2.344	2.302	2.958

TABLE W26 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
21709	0.5929	1.55240	3.377	0.012463	2.405	0.008878	3.070484	0.010540	2.639	3.039	3.062	3.942
31709	0.6621	2.38793	5.267	0.021454	2.959	0.012052	3.828395	0.014714	3.323	3.748	4.014	4.948
41709	0.7127	-.-	-.-	-.-	3.460	0.013849	4.466009	0.017061	3.955	4.142	4.799	5.891
11809	0.7188	3.09793	6.562	0.029513	3.719	0.016725	4.823417	0.020826	4.305	4.324	5.247	6.092
21809	0.7521	3.70301	7.902	0.037142	4.172	0.019611	5.458382	0.024856	4.896	4.534	6.061	6.896
41809	0.4586	1.43864	2.383	0.008761	1.720	0.006324	2.235872	0.007493	1.835	2.042	2.061	2.605
51809	0.5724	2.30359	3.941	0.015341	2.325	0.009052	3.002367	0.010856	2.543	2.888	2.988	3.735
61809	0.6407	2.95181	5.110	0.020831	2.766	0.011275	3.586044	0.013732	3.082	3.387	3.721	4.605
11909	0.6957	4.06585	6.624	0.031397	3.137	0.014867	4.119106	0.018521	3.560	3.694	4.369	5.458
21909	0.7291	4.65033	7.617	0.037859	3.566	0.017725	4.766339	0.022723	4.111	3.906	5.174	6.198
12209	0.4405	1.74363	2.398	0.009093	1.647	0.006243	2.150584	0.007409	1.752	1.905	1.970	2.461
22209	0.5241	2.45952	3.407	0.013730	2.093	0.008435	2.728789	0.010155	2.267	2.552	2.666	3.256
32209	0.6241	3.38919	4.935	0.021093	2.552	0.010906	3.351927	0.013398	2.818	3.113	3.440	4.305

TABLE W 27 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
42209	0.6872	4.35417	6.354	0.028748	2.921	0.013215	3.909572	0.016718	3.275	3.428	4.113	5.228
12309	0.4082	1.99762	2.350	0.009183	1.596	0.006235	2.090745	0.007407	1.695	1.846	1.908	2.301
22309	0.5190	2.98222	3.567	0.015010	1.998	0.008406	2.629511	0.010193	2.155	2.473	2.532	3.145
32309	0.6052	3.84422	4.705	0.020959	2.404	0.010710	3.196028	0.013274	2.638	2.969	3.253	4.037
52309	0.4284	1.98684	2.089	0.008330	1.557	0.006209	2.050066	0.007401	1.651	1.811	1.866	2.320
62309	0.5799	3.27838	3.611	0.016405	1.944	0.008830	2.602788	0.010888	2.092	2.479	2.522	3.436
72309	0.6575	4.17961	4.948	0.022209	2.414	0.010837	3.215117	0.013459	2.651	2.982	3.276	4.515

TABLE W28 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
10801	0.1305	0.14588	1.132	0.003631	1.077	0.003455	1.182575	0.003448	1.097	1.290	1.126	1.201
20801	0.1988	0.15955	1.276	0.003978	1.154	0.003598	--	--	1.191	1.478	1.237	1.370
30801	0.2367	0.17055	1.356	0.004191	1.227	0.003794	--	--	1.277	1.620	1.338	1.508
40801	0.2903	--	--	--	1.298	0.003943	--	--	1.358	1.735	1.435	1.681
50801	0.3862	0.20953	1.703	0.005101	1.417	0.004243	--	--	1.492	1.901	1.596	2.033
60801	0.5318	0.26478	2.174	0.006473	1.738	0.005176	--	--	1.854	2.350	2.028	2.938
70801	0.5595	0.40381	3.366	0.010100	2.301	0.006906	3.029183	0.008446	2.512	3.298	2.787	4.436
90801	0.1047	0.23207	1.117	0.003700	1.060	0.003509	1.157273	0.003312	1.076	1.242	1.100	1.155
100801	0.1837	0.26746	1.313	0.004274	1.120	0.003645	--	--	1.150	1.407	1.188	1.310
110801	0.2686	0.31143	1.549	0.005019	1.238	0.004009	--	--	1.289	1.650	1.332	1.571
120801	0.3706	0.36953	1.827	0.005854	1.395	0.004468	--	--	1.468	1.891	1.566	1.966
130801	0.4691	0.47269	2.380	0.007566	1.660	0.005213	2.388566	0.006953	1.744	2.100	1.897	2.556
140801	0.5930	0.55524	2.844	0.009009	1.976	0.006259	2.612681	0.007621	2.129	2.668	2.354	3.557

TABLE W29 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
150801	0.6218	--	--	--	2.223	0.007061	2.856078	0.008401	2.419	3.057	2.707	4.018
10901	0.0887	0.32689	1.137	0.003837	1.051	0.003546	1.141333	0.003222	1.065	1.215	1.087	1.130
20901	0.1632	0.36963	1.329	0.004419	1.100	0.003658	--	--	1.125	1.360	1.160	1.263
30901	0.2345	0.42224	1.523	0.004941	1.191	0.003864	--	--	1.234	1.566	1.290	1.462
40901	0.3119	0.47426	1.714	0.005484	1.267	0.004054	--	--	1.323	1.703	1.397	1.684
50901	0.4199	0.54628	2.026	0.006434	1.454	0.004619	--	--	1.535	1.974	1.654	2.171
60901	0.4997	0.68220	2.537	0.008044	1.624	0.005150	2.271469	0.006570	1.726	1.996	1.887	2.657
70901	0.5685	0.84852	3.220	0.010189	1.829	0.005788	2.432671	0.007056	1.959	2.339	2.173	3.240
80901	0.5081	--	--	--	2.033	0.006649	2.641307	0.007961	2.194	2.702	2.477	3.123
100901	0.0807	0.39616	1.151	0.003823	1.043	0.003465	1.129045	0.003061	1.054	1.187	1.075	1.114
110901	0.1547	0.42695	1.255	0.004126	1.094	0.003593	--	--	1.118	1.344	1.153	1.246
120901	0.2293	0.50498	1.518	0.004914	1.179	0.003817	--	--	1.220	1.543	1.275	1.440
130901	0.2947	0.58423	1.735	0.005502	1.247	0.003955	--	--	1.300	1.670	1.372	1.628

TABLE W30 COMPARISON OF FRICTION PRESSURE DROP DATA

VALUES OF TWO-PHASE FRICTION MULTIPLIER

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
140901	0.3996	0.64337	1.946	0.006066	1.387	0.004325	--	--	1.459	1.886	1.558	2.031
150901	0.4772	0.82512	2.523	0.007828	1.556	0.004828	2.183453	0.006164	1.648	2.099	1.804	2.485
160901	0.5185	--	--	--	1.733	0.005459	2.319537	0.006677	1.848	2.117	2.038	2.869
170901	0.4579	--	--	--	1.877	0.006016	2.469146	0.007263	2.011	2.368	2.275	2.760
11201	0.0748	0.54062	1.140	0.003832	1.038	0.003488	1.115320	0.002972	1.048	1.170	1.067	1.103
21201	0.1192	0.60774	1.268	0.004211	1.073	0.003562	--	--	1.092	1.286	1.122	1.184
31201	0.1803	0.64626	1.372	0.004478	1.141	0.003723	--	--	1.175	1.465	1.223	1.330
41201	0.2450	0.70407	1.521	0.004886	1.197	0.003845	--	--	1.241	1.583	1.304	1.485
51201	0.3589	0.85037	1.847	0.005956	1.338	0.004314	--	--	1.404	1.829	1.505	1.869
61201	0.4388	1.08125	2.395	0.007802	1.534	0.004998	2.084858	0.006156	1.625	2.099	1.784	2.327
71201	0.4465	1.51754	3.363	0.011162	1.702	0.005648	2.246672	0.006797	1.813	2.024	2.031	2.542
91201	0.0657	0.71589	1.152	0.003969	1.031	0.003551	1.098585	0.002897	1.039	1.145	1.056	1.087
101201	0.1074	0.75748	1.233	0.004178	1.062	0.003597	--	--	1.078	1.255	1.106	1.160

TABLE W31 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
111201	0.1543	0.81831	1.357	0.004554	1.121	0.003764	--	--	1.152	1.424	1.195	1.277
121201	0.2184	0.89511	1.503	0.005029	1.177	0.003937	--	--	1.218	1.553	1.277	1.423
131201	0.3150	1.12619	1.887	0.006331	1.281	0.004298	--	--	1.339	1.754	1.430	1.707
141201	0.3743	1.34842	2.317	0.007827	1.423	0.004807	1.944107	0.005923	1.500	1.975	1.635	2.010
151201	0.4214	1.74188	2.967	0.010323	1.607	0.005593	2.123302	0.006707	1.707	1.847	1.908	2.356
11601	0.0730	0.78454	1.044	0.003624	1.028	0.003568	1.089538	0.002840	1.035	1.135	1.052	1.090
21601	0.0956	0.85561	1.146	0.003954	1.059	0.003655	--	--	1.075	1.249	1.102	1.145
31601	0.1439	0.92837	1.256	0.004299	1.112	0.003807	--	--	1.140	1.404	1.182	1.254
41501	0.2316	1.04435	1.453	0.004979	1.181	0.004045	--	--	1.223	1.570	1.286	1.446
51601	0.2901	1.18906	1.650	0.005688	1.262	0.004349	--	--	1.317	1.732	1.406	1.638
61601	0.3528	1.38300	1.943	0.006814	1.429	0.005011	1.914706	0.006049	1.507	2.002	1.651	1.965
71601	0.4097	1.53496	2.188	0.007799	1.581	0.005637	2.084551	0.006735	1.678	1.776	1.879	2.291
91501	0.0627	0.97307	1.105	0.003895	1.024	0.003611	1.079766	0.002798	1.030	1.123	1.046	1.077

TABLE W32 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
101601	0.0867	0.95584	1.104	0.003817	1.049	0.003629	-.-	-.-	1.062	1.217	1.037	1.126
111601	0.1147	1.05386	1.228	0.004207	1.097	0.003755	-.-	-.-	1.121	1.365	1.160	1.205
121601	0.1955	1.21653	1.438	0.004962	1.158	0.003994	-.-	-.-	1.195	1.522	1.253	1.369
131601	0.2550	1.32064	1.566	0.005505	1.239	0.004357	-.-	--	1.291	1.700	1.376	1.557
141601	0.3412	1.52849	1.818	0.006566	1.393	0.005030	1.857531	0.006035	1.465	1.968	1.606	1.896
151601	0.3773	1.69879	2.070	0.007542	1.509	0.005498	1.994635	0.006567	1.596	1.669	1.782	2.118
11901	0.0546	1.08217	1.033	0.003607	1.022	0.003570	1.071937	0.002706	1.028	1.114	1.043	1.077
21901	0.0942	1.14091	1.102	0.003786	1.046	0.003593	-.-	-.-	1.058	1.205	1.082	1.130
31901	0.1281	1.22270	1.195	0.004095	1.090	0.003735	-.-	--	1.114	1.350	1.152	1.213
41901	0.2138	1.46446	1.452	0.005104	1.165	0.004093	-.-	-.-	1.203	1.549	1.268	1.402
51901	0.2782	1.64450	1.444	0.005155	1.256	0.004484	1.706182	0.005467	1.310	1.745	1.409	1.610
61901	0.3344	1.69184	1.702	0.006252	1.356	0.004981	1.802800	0.005951	1.424	1.928	1.562	1.837
71901	0.3616	1.91966	1.965	0.007225	1.414	0.005200	1.877347	0.006212	1.490	2.021	1.654	1.968

TABLE W 33 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
12101	0.4386	0.02920	5.096	0.019479	1.292	0.004937	1.699432	0.006426	1.585	1.997	2.010	1.952
22101	0.4378	0.02949	5.237	0.019568	1.643	0.006140	--	--	2.089	3.275	2.859	2.370
32101	0.4444	0.03020	5.494	0.019872	2.340	0.008463	--	--	3.081	4.821	4.464	2.890
42101	0.4565	0.02992	5.520	0.019560	2.915	0.010331	--	--	4.017	6.097	5.941	3.216
52101	0.4537	0.02707	5.134	0.017522	3.580	0.012218	--	--	4.935	7.275	7.438	3.441
62101	--	--	--	--	4.993	0.016454	8.081751	0.026345	6.929	9.748	10.703	--
72101	--	--	--	--	6.411	0.020935	8.847575	0.028668	8.915	12.091	14.035	--
82101	--	--	--	--	8.530	0.027586	10.572834	0.034103	11.917	15.367	18.986	--
102101	0.2221	0.03148	2.241	0.007796	1.249	0.004344	1.459575	0.005128	1.354	1.730	1.495	1.515
112101	0.2224	0.03262	2.228	0.007546	1.514	0.005128	--	--	1.672	2.089	1.918	1.802
122101	--	--	--	--	1.938	0.006432	--	--	2.252	3.523	2.630	--
132101	--	--	--	--	2.239	0.007239	--	--	2.625	4.117	3.162	--
142101	--	--	--	--	3.072	0.009876	--	--	3.724	5.690	4.519	--

TABLE W34 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
152101	--	--	--	--	4.062	0.012912	5.733354	0.017708	5.072	7.462	6.188	--
162101	0.8202	0.07237	5.250	0.016398	5.019	0.015677	6.445532	0.019708	6.355	9.101	7.798	8.734
172101	0.8150	0.10019	7.251	0.022016	5.928	0.018000	7.236740	0.021641	7.517	10.548	9.287	8.842
12201	0.1743	0.03467	1.268	0.004291	1.186	0.004015	1.365989	0.004637	1.245	1.570	1.291	1.375
22201	0.3111	0.04516	1.686	0.005572	1.381	0.004564	--	--	1.479	1.887	1.560	1.817
32201	0.4339	0.03803	1.426	0.004576	1.480	0.005394	--	--	1.873	2.786	1.998	2.444
42201	0.5534	0.04972	1.907	0.005896	2.074	0.006412	--	--	2.339	3.585	2.518	3.345
52201	0.6673	0.07479	2.898	0.008778	2.908	0.008806	4.446336	0.012842	3.393	5.166	3.634	4.858
62201	0.7795	0.11422	4.532	0.013460	3.791	0.011258	5.009859	0.014319	4.550	6.762	4.884	7.201
72201	0.8152	0.14602	5.600	0.016314	4.892	0.014253	5.985116	0.016992	5.996	8.723	6.422	8.715
92201	0.1830	0.05356	1.278	0.004084	1.118	0.003573	1.309659	0.004147	1.192	1.476	1.232	1.307
102201	0.3015	0.06125	1.469	0.004594	1.283	0.004011	--	--	1.386	1.756	1.455	1.679
112201	0.4315	0.07191	1.749	0.005414	1.598	0.004946	--	--	1.751	2.475	1.873	2.359

TABLE W35 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
122201	0.5191	0.08587	2.132	0.006468	1.814	0.005503	-.-	--	2.002	2.922	2.158	2.932
132201	0.6236	0.08669	2.249	0.006340	2.375	0.006904	-.-	--	2.601	3.880	2.840	4.165
142201	0.7674	0.17058	4.429	0.012592	3.398	0.009660	4.387718	0.011887	3.873	5.664	4.202	6.897
152201	0.8038	0.26248	6.898	0.019442	4.025	0.011345	4.942887	0.013395	4.674	6.740	5.050	8.214
12301	0.1687	0.06599	1.161	0.003924	1.103	0.003730	1.238866	0.004181	1.174	1.448	1.209	1.273
22301	0.2879	0.07620	1.361	0.004447	1.234	0.004034	-.-	--	1.328	1.694	1.386	1.597
32301	0.4051	0.08757	1.630	0.005057	1.509	0.004690	-.-	--	1.597	2.013	1.703	2.194
42301	0.5102	0.11464	2.151	0.006588	1.833	0.005613	-.-	--	1.964	2.789	2.124	2.940
52301	0.6122	0.14256	2.735	0.008137	2.415	0.007186	3.521316	0.009828	2.651	3.848	2.886	4.101
62301	0.7276	0.22505	4.439	0.012967	3.090	0.009026	3.983253	0.011007	3.488	5.003	3.782	5.926
72301	0.7842	0.16227	3.314	0.009631	3.654	0.010619	4.539720	0.012603	4.198	6.025	4.600	7.456
92301	0.1560	0.07953	1.055	0.003400	1.116	0.003595	1.216878	0.003811	1.145	1.391	1.180	1.273
102301	0.2490	0.09307	1.258	0.003930	1.222	0.003817	-.-	-.-	1.271	1.607	1.326	1.521

TABLE W36 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
112301	0.3824	0.11210	1.517	0.004741	1.450	0.004531	--	--	1.530	1.946	1.630	2.062
122301	0.4981	0.13537	1.874	0.005760	1.726	0.005305	--	--	1.842	2.501	1.995	2.770
132301	0.6031	0.18952	2.646	0.008023	2.190	0.006641	3.183828	0.008996	2.381	3.352	2.613	3.840
142301	0.7228	0.22445	3.193	0.009492	2.756	0.008191	3.587086	0.010014	3.067	4.305	3.378	5.620
152301	0.7602	--	--	--	3.206	0.009435	4.013613	0.011181	3.629	5.036	3.999	6.623
12601	0.1485	0.11422	1.178	0.003813	1.097	0.003550	1.201283	0.003667	1.122	1.345	1.154	1.243
22601	0.2567	0.12395	1.300	0.004118	1.191	0.003772	--	--	1.235	1.555	1.286	1.497
32601	0.3414	0.14256	1.509	0.004737	1.358	0.004295	--	--	1.438	1.842	1.524	1.867
42601	0.4607	0.17090	1.830	0.005658	1.530	0.004886	--	--	1.677	2.098	1.805	2.455
52601	0.5832	0.21688	2.354	0.007225	1.916	0.005879	--	--	2.059	2.768	2.252	3.427
62601	0.6702	0.29546	3.267	0.009857	2.415	0.007288	3.208472	0.009028	2.650	3.612	2.926	4.650
72601	0.7371	--	--	--	2.909	0.008641	3.668508	0.010250	3.256	4.388	3.607	5.974
102601	0.1395	0.12431	1.083	0.003538	1.090	0.003563	1.193150	0.003620	1.114	1.329	1.145	1.225

TABLE W37 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHISM	DUCKLR
112601	0.2356	0.14444	1.277	0.004095	1.168	0.003747	--	--	1.208	1.512	1.255	1.438
122601	0.3321	0.16463	1.477	0.004654	1.329	0.004187	--	--	1.394	1.788	1.473	1.800
132601	0.4326	0.18832	1.709	0.005310	1.512	0.004699	--	--	1.5[illegible]	2.025	1.718	2.280
142601	0.5523	0.24352	2.240	0.006838	1.849	0.005645	--	--	1.982	2.582	2.168	3.171
152601	0.6824	--	--	--	2.471	0.007496	3.202056	0.009055	2.718	3.609	3.305	4.837
162601	0.7190	--	--	--	2.914	0.008718	3.654199	0.010282	3.261	4.295	3.632	5.678
12701	--	--	--	--	7.057	0.030192	9.416431	0.040052	11.576	14.747	16.312	--
22701	0.7087	0.01610	2.301	0.009460	11.073	0.045519	13.679273	0.056445	18.030	20.796	25.781	7.010
32701	0.7509	0.03504	5.173	0.020015	15.399	0.059582	18.661670	0.071114	24.378	26.029	35.292	9.483
42701	0.8094	0.05214	7.876	0.028941	19.891	0.073094	23.307357	0.085651	30.619	33.930	44.649	12.510
52701	0.8871	0.08885	13.415	0.047848	25.933	0.092494	30.787989	0.111496	39.159	47.447	56.870	19.023
62701	0.8956	0.12095	18.440	0.063805	29.484	0.102019	35.401177	0.124237	43.629	55.356	63.502	21.839
102701	0.8959	0.14710	18.784	0.079529	27.739	0.117445	35.871343	0.154020	47.217	60.733	62.895	20.657

TABLE W38 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
112701	0.9134	0.17228	22.941	0.090929	31.798	0.126034	41.131452	0.164592	51.516	65.967	69.928	24.917
12801	0.8359	0.08486	5.556	0.019828	5.477	0.019546	6.797522	0.023820	7.230	10.241	8.652	9.235
22801	0.8416	0.11097	7.340	0.025530	7.775	0.027043	9.055066	0.031279	10.301	13.772	12.599	10.095
13001	0.7999	0.14111	8.764	0.031606	10.643	0.038382	12.028512	0.043427	14.521	18.035	17.516	9.119
23001	0.8124	0.15583	10.298	0.034376	13.800	0.046066	15.088968	0.050566	18.514	21.937	22.878	10.603
33001	0.8467	0.15585	10.316	0.034296	17.674	0.058758	19.603593	0.064233	23.865	26.536	29.516	13.382
10502	0.8277	0.16908	9.635	0.035223	17.451	0.063801	19.625835	0.070727	24.432	26.584	28.818	12.377
20502	0.8640	0.17800	10.363	0.036425	19.607	0.068917	21.928131	0.076721	27.079	30.111	32.242	15.016
30502	0.8900	0.16017	9.074	0.031672	22.614	0.078929	25.478633	0.089731	31.123	35.906	36.898	18.268
10202	0.7857	0.15903	5.718	0.020036	5.611	0.019660	6.659024	0.022886	7.153	10.491	7.424	7.796
20202	0.8235	0.28743	10.615	0.036472	7.180	0.024670	8.284370	0.028190	9.184	12.983	9.709	9.431
30202	0.7966	0.44830	16.833	0.056463	9.761	0.032674	10.937944	0.036634	12.549	16.834	13.525	9.126
40202	0.7819	-.-	-.-	-.-	13.053	0.043077	14.254367	0.047244	16.992	21.398	18.435	9.651

TABLE W39 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
10602	0.8117	0.12762	4.526	0.016551	13.885	0.050783	15.277077	0.056072	18.703	22.752	19.837	10.664
20602	0.8467	0.16678	6.130	0.021621	15.758	0.055579	17.507674	0.061034	21.092	25.015	22.646	12.782
30502	0.8700	0.24853	8.768	0.030830	17.624	0.061969	19.748745	0.068482	23.560	27.355	25.536	14.857
70202	0.7381	0.17584	4.136	0.014209	3.993	0.013717	4.902756	0.016185	4.865	7.204	5.102	6.744
80202	0.8060	0.45203	10.776	0.036076	5.544	0.018561	6.540996	0.021458	6.911	10.065	7.328	8.532
90202	0.7375	--	--	--	6.856	0.022791	7.953250	0.026145	8.578	12.150	9.290	7.113
100202	0.7255	--	--	--	8.681	0.027581	9.593476	0.030323	10.586	14.513	11.786	7.469
110202	0.7801	0.14583	3.614	0.011396	10.823	0.034138	11.769855	0.037128	13.351	17.532	14.924	9.233
120202	0.8301	0.17956	4.547	0.014431	12.667	0.040200	13.709572	0.043682	15.734	20.097	17.686	11.495
10302	0.7804	0.18959	3.084	0.010722	3.823	0.013292	4.646046	0.015459	4.606	6.557	4.854	7.226
20302	0.7887	--	--	--	5.152	0.018061	6.103355	0.020878	6.382	9.002	6.777	7.905
30302	0.6912	--	--	--	7.044	0.023961	8.039096	0.027055	8.585	11.684	9.444	6.515
40302	0.7647	0.14972	2.602	0.008698	9.065	0.030298	10.018146	0.033353	11.146	14.527	12.399	8.371

TABLE W40 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
			VALUES OF TWO-PHASE FRICTION MULTIPLIER									
10902	0.8286	0.21319	4.735	0.017588	12.157	0.045162	13.440977	0.050118	16.013	20.132	17.298	10.877
20902	0.8607	0.34979	7.874	0.029211	14.233	0.052800	15.801258	0.058751	18.860	22.946	20.560	13.124
30902	0.7968	0.22985	3.916	0.013604	10.305	0.035796	11.329953	0.039339	12.825	16.341	14.294	9.552
40902	0.8183	0.29238	4.909	0.016887	10.891	0.037463	11.975376	0.041235	13.563	17.096	15.222	10.477
50902	0.8683	0.47964	8.189	0.028620	12.913	0.044780	14.098345	0.049483	16.106	19.795	18.233	13.622
60302	0.7537	0.31496	4.143	0.014267	3.534	0.012170	4.245741	0.013898	4.076	5.697	4.372	6.640
70302	0.7357	--	--	--	4.561	0.015453	5.382944	0.017648	5.407	7.394	5.844	6.677
80302	0.6677	--	--	--	6.009	0.020494	6.990417	0.023446	7.270	9.734	7.998	5.970
90302	0.7294	0.19068	2.555	0.008500	7.637	0.025404	8.588393	0.028331	9.290	11.932	10.347	7.298
100302	0.7814	0.23648	3.199	0.010652	8.832	0.029414	9.867478	0.032721	10.800	13.646	12.182	8.786
110302	0.8173	0.33585	4.680	0.015741	10.046	0.033791	11.170999	0.037543	12.368	15.440	14.054	10.280
120302	0.8574	0.59626	8.110	0.027971	11.404	0.039331	12.691361	0.043883	14.145	17.335	16.240	12.600
10402	0.7288	0.29763	3.178	0.010891	3.330	0.011411	4.017688	0.013036	3.810	5.177	4.110	6.066

TABLE W41 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
20402	0.6863	--	--	--	4.227	0.014577	5.033311	0.016713	4.972	6.585	5.411	5.768
30402	0.6358	--	--	--	5.341	0.018301	6.284078	0.021050	6.412	8.306	7.052	5.442
40402	0.6827	0.17707	1.904	0.006330	6.425	0.021363	7.353641	0.024105	7.780	9.731	8.611	6.272
11002	0.7499	0.28733	3.038	0.010723	7.471	0.026372	8.462845	0.029608	9.127	11.317	10.170	7.667
21002	0.7817	0.37501	3.970	0.013857	8.136	0.028397	9.195388	0.031893	9.949	12.216	11.216	8.621
31002	0.8198	0.59109	6.197	0.022005	8.993	0.031932	10.161431	0.035956	11.056	13.447	12.607	10.107
41002	0.8671	0.81831	8.780	0.031684	10.419	0.037597	11.755868	0.042456	12.906	15.537	14.908	12.965
60402	0.7096	0.37920	3.281	0.011184	2.905	0.009903	3.559839	0.011392	3.267	4.349	3.553	5.514
70402	0.6321	--	--	--	3.890	0.013363	4.678710	0.015391	4.529	5.879	4.969	5.013
80402	0.6154	--	--	--	4.665	0.016065	5.577235	0.018630	5.532	7.041	6.125	5.073
90402	0.6638	0.18553	1.694	0.005688	5.446	0.018293	6.353138	0.020876	6.532	8.072	7.244	5.804
11702	0.7120	0.29489	2.563	0.009359	6.610	0.024141	7.573119	0.027302	8.068	9.758	8.917	6.742
21702	0.7533	0.44332	3.896	0.014130	7.409	0.026872	8.464923	0.030434	9.053	10.875	10.173	7.733

TABLE W42 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
31702	0.7935	0.69078	6.079	0.022210	8.230	0.030071	9.402723	0.034164	10.089	12.052	11.514	8.994
41702	0.8347	0.93750	8.194	0.030049	8.987	0.032958	10.271140	0.037549	11.051	13.100	12.767	10.759
11802	0.6866	0.40027	3.069	0.010373	2.692	0.009100	3.331121	0.010525	2.998	3.964	3.274	5.056
21802	0.6299	-.-	-.-	-.-	3.773	0.013002	4.579694	0.015089	4.373	5.657	4.831	4.955
31802	0.6515	-.-	-.-	-.-	4.620	0.015497	5.550067	0.018052	5.460	6.801	6.094	5.454
41802	0.6975	0.36130	2.879	0.009501	5.827	0.019233	6.812251	0.022082	6.997	8.351	7.866	6.379
51802	0.7532	0.46292	3.732	0.012453	6.784	0.022639	7.869058	0.025959	8.191	9.685	9.330	7.646
61802	0.7730	0.59859	4.882	0.016421	7.350	0.024725	8.492698	0.028319	8.883	10.488	10.211	8.263
81802	0.6414	0.68450	3.353	0.011398	2.408	0.008185	3.009496	0.009502	2.646	3.359	2.929	4.348
91802	0.5075	-.-	-.-	-.-	3.060	0.010900	3.787624	0.012719	3.458	4.371	3.894	3.747
101802	0.6081	0.38098	1.927	0.006651	3.759	0.012976	4.580007	0.015115	4.352	5.200	4.874	4.744
111802	0.6812	0.51337	2.675	0.009127	4.640	0.015830	5.558023	0.018392	5.682	6.245	6.191	5.842
121802	0.7687	0.78218	4.010	0.013766	5.182	0.017791	6.196219	0.020778	6.175	6.815	7.034	6.406

TABLE W43 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
			VALUES OF TWO-PHASE FRICTION MULTIPLIER									
12702	0.7498	1.18988	5.610	0.022460	5.456	0.021842	6.492411	0.025462	6.595	7.312	7.432	7.201
22702	0.7833	1.41800	6.815	0.027161	5.990	0.023872	7.148709	0.028053	7.272	8.037	8.328	8.169
32702	0.7983	1.71450	8.220	0.033157	6.387	0.026570	7.883545	0.031444	8.024	8.825	9.352	8.778
12002	0.5174	-.-	-.-	-.-	2.264	0.008440	2.835531	0.009786	2.474	3.086	2.732	3.354
22002	0.5521	0.46819	1.690	0.006230	2.923	0.010777	3.604333	0.012487	3.288	3.946	3.686	3.960
32002	0.5952	0.64482	2.361	0.008532	3.392	0.012260	4.172809	0.014320	3.883	4.480	4.380	4.494
42002	0.6460	0.79288	2.946	0.010613	3.756	0.013529	4.573365	0.015749	4.348	4.883	4.933	5.123
10303	0.7143	1.40095	5.044	0.019858	4.407	0.017350	5.296899	0.020158	5.218	5.563	5.852	6.244
20303	0.7474	1.66456	5.823	0.023657	4.690	0.019053	5.730090	0.022627	5.533	5.783	6.416	6.955
30303	0.7726	1.98840	7.036	0.028908	5.171	0.021243	6.342015	0.025490	6.204	6.383	7.229	7.681
40303	0.8047	2.23242	8.310	0.034331	5.821	0.024046	7.148720	0.029078	7.034	7.299	8.328	8.811
12302	0.4884	-.-	-.-	-.-	1.999	0.007410	2.540901	0.008660	2.159	2.600	2.400	2.998
22302	0.5176	0.56217	1.640	0.006137	2.608	0.009762	3.246891	0.011342	2.894	3.413	3.253	3.580

TABLE W44 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
			VALUES OF TWO-PHASE FRICTION MULTIPLIER									
32302	0.5934	1.03367	3.022	0.011282	3.073	0.011473	3.821841	0.013461	3.476	3.932	3.958	4.341
42302	0.6486	1.28633	3.789	0.014138	3.477	0.012972	4.297050	0.015255	3.988	4.337	4.589	5.045
52302	0.6867	1.66259	4.992	0.018739	3.783	0.014201	4.709705	0.016941	4.378	4.645	5.104	5.640
62302	0.7160	1.97703	5.963	0.022759	4.281	0.016339	5.333896	0.019688	5.020	5.048	5.930	6.264
72302	0.7600	2.39376	7.301	0.028947	4.743	0.018803	5.942334	0.022955	5.618	5.442	6.696	7.279
102302	0.4677	--	--	--	1.841	0.006929	2.360266	0.008125	1.976	2.282	2.201	2.764
112302	0.5032	0.93397	1.954	0.007427	2.231	0.008482	2.824520	0.009936	2.434	2.817	2.767	3.258
122302	0.5878	1.47100	3.125	0.012089	2.666	0.010312	3.374739	0.012212	2.963	3.340	3.426	4.079
132302	0.6352	1.91018	4.094	0.015999	2.972	0.011613	3.747506	0.013797	3.345	3.663	3.916	4.667
142302	0.6958	2.59505	5.590	0.022731	3.301	0.013424	4.209370	0.016263	3.763	3.993	4.681	5.553
152302	0.7176	2.91920	6.328	0.026059	3.621	0.014911	4.644781	0.018309	4.170	4.239	5.022	6.037
162302	0.7442	3.22729	7.031	0.029227	3.876	0.016113	4.985776	0.019944	4.498	4.403	5.453	6.628
12402	0.4293	1.06867	1.673	0.006449	1.652	0.006369	2.133749	0.007472	1.759	1.938	1.939	2.429

TABLE W45 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
22402	0.5053	1.51187	2.456	0.009800	2.078	0.008290	2.655362	0.009766	2.252	2.572	2.573	3.146
32402	0.5811	2.09754	3.475	0.014146	2.463	0.010026	3.156491	0.011972	2.714	3.041	3.171	3.895
42402	0.6437	2.75133	4.652	0.019130	2.754	0.011326	3.536760	0.013650	3.071	3.353	3.662	4.624
52402	0.6815	3.47691	5.910	0.025273	3.090	0.013216	4.025664	0.016304	3.492	3.664	4.255	5.252
72402	0.4205	1.45432	1.935	0.007758	1.645	0.006598	2.131488	0.007761	1.752	1.918	1.951	2.393
82402	0.5051	1.94869	2.645	0.010817	1.962	0.008023	2.531841	0.009517	2.115	2.379	2.431	3.042
92402	0.5757	2.72181	3.806	0.015877	2.269	0.009469	2.950221	0.011420	2.479	2.774	2.929	3.713
12502	0.3712	1.47100	1.676	0.006741	1.530	0.006156	1.995180	0.007253	1.622	1.737	1.796	2.125
22502	0.4515	2.18366	2.310	0.010521	1.794	0.007520	2.332628	0.008937	1.921	2.170	2.199	2.655
32502	0.5730	3.16178	3.745	0.016068	2.130	0.009138	2.793607	0.011083	2.312	2.630	2.745	3.575
12602	0.3624	1.79902	1.779	0.007330	1.465	0.006038	1.912678	0.007102	1.549	1.649	1.709	2.030
22602	0.5066	2.56960	2.840	0.011836	1.816	0.007568	2.384706	0.009098	1.945	2.224	2.252	2.905
32602	0.5398	3.24637	3.451	0.014558	1.999	0.008434	2.642166	0.010272	2.157	2.486	2.567	3.256

TABLE W46 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRSS-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
12806	0.2111	0.01368	1.215	0.003491	1.082	0.003110	1.203883	0.003279	1.102	1.297	1.138	1.304
22806	0.2144	0.01125	1.008	0.002887	1.166	0.003340	1.293983	0.003673	1.201	1.495	1.264	1.405
32806	0.2146	0.01040	0.946	0.002711	1.348	0.003862	--	--	1.407	1.803	1.526	1.605
42806	0.2227	0.00940	0.866	0.002431	1.507	0.004231	--	--	1.582	2.001	1.750	1.778
52806	0.2661	0.01125	1.035	0.002904	1.824	0.005117	--	--	1.930	2.950	2.191	2.139
62806	0.2808	0.01097	1.024	0.002840	2.091	0.005801	--	--	2.229	3.495	2.570	2.363
72806	0.3709	0.02080	1.947	0.005398	2.528	0.007008	2.994871	0.007710	2.733	4.324	3.188	2.886
12906	0.1019	0.04088	2.236	0.006485	1.068	0.003097	1.181950	0.003112	1.084	1.258	1.108	1.152
22906	0.1164	0.05733	3.191	0.009215	1.128	0.003258	1.217625	0.003424	1.157	1.416	1.193	1.241
32906	0.1481	0.04172	2.325	0.006728	1.306	0.003778	--	--	1.360	1.747	1.431	1.464
42906	0.2069	0.04399	2.477	0.007094	1.533	0.004391	--	--	1.610	2.041	1.728	1.774
52906	0.2951	0.04740	2.800	0.007947	1.799	0.005107	--	--	1.902	2.866	2.071	2.187
62906	0.3813	0.06017	3.585	0.010122	2.116	0.005975	2.550510	0.006621	2.258	3.510	2.488	2.675

TABLE W47 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
72906	0.3924	0.06954	4.160	0.011673	2.363	0.006631	2.822522	0.007329	2.541	3.981	2.810	2.873
92906	0.0349	0.04995	2.046	0.005968	1.053	0.003071	1.161870	0.002956	1.066	1.212	1.086	1.082
102906	0.0602	0.04683	1.938	0.005666	1.105	0.003229	1.199196	0.003293	1.129	1.362	1.161	1.158
112906	0.1249	0.04428	1.860	0.005411	1.249	0.003633	--	--	1.296	1.659	1.359	1.376
122906	0.2068	0.05478	2.301	0.006647	1.419	0.004100	--	--	1.485	1.910	1.584	1.665
132906	0.2835	0.06045	2.544	0.007358	1.639	0.004739	--	--	1.725	2.478	1.872	2.022
142906	0.3339	0.07351	3.130	0.009040	1.858	0.005367	--	--	1.967	2.939	2.160	2.335
152906	0.4115	0.08912	3.865	0.011087	2.100	0.006024	2.542965	0.006706	2.239	3.418	2.479	2.770
13006	0.0277	0.04768	1.521	0.004751	1.048	0.003071	1.152212	0.002889	1.059	1.196	1.079	1.071
23006	0.0573	0.04598	1.582	0.004634	1.092	0.003199	1.187797	0.003197	1.113	1.330	1.144	1.142
33006	0.1235	0.04456	1.545	0.004565	1.210	0.003574	--	--	1.252	1.594	1.307	1.335
43006	0.2041	0.05080	1.767	0.005160	1.355	0.003957	--	--	1.414	1.828	1.502	1.596
53006	0.3030	0.05733	2.013	0.005829	1.571	0.004550	--	--	1.651	2.098	1.790	2.001

TABLE W48 COMPARISON OF FRICTION PRESSURE DROP DATA

VALUES OF TWO-PHASE FRICTION MULTIPLIER

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
63006	0.3542	0.06216	2.192	0.006317	1.760	0.005072	--	--	1.858	2.700	2.041	2.308
73006	0.4305	0.08912	3.174	0.009166	2.015	0.005819	2.459486	0.006516	2.142	3.212	2.380	2.777
93006	0.0217	0.06092	1.472	0.004414	1.040	0.003120	1.135329	0.002815	1.050	1.174	1.068	1.058
103006	0.0553	0.05499	1.339	0.004010	1.079	0.003232	1.171542	0.003121	1.098	1.299	1.127	1.127
113006	0.1177	0.06537	1.626	0.004876	1.177	0.003531	--	--	1.214	1.539	1.267	1.294
123006	0.1880	0.07995	1.994	0.005962	1.310	0.003919	--	--	1.365	1.777	1.450	1.525
133006	0.2717	0.09222	2.330	0.006949	1.459	0.004351	--	--	1.529	1.986	1.653	1.823
143006	0.3962	0.12902	3.363	0.009860	1.663	0.004875	--	--	1.751	2.445	1.928	2.339
10107	0.0186	0.04345	0.854	0.002597	1.029	0.003129	1.113790	0.002678	1.035	1.134	1.051	1.044
20107	0.0496	0.04203	0.834	0.002499	1.064	0.003187	1.156540	0.002990	1.079	1.258	1.106	1.107
30107	0.1230	0.04834	0.983	0.002940	1.171	0.003502	--	--	1.207	1.533	1.263	1.294
40107	0.2079	0.07144	1.467	0.004335	1.276	0.003770	--	--	1.326	1.729	1.412	1.518
60107	0.2636	0.10973	2.164	0.006921	1.392	0.004453	--	--	1.455	1.923	1.567	1.737

TABLE W49 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
70107	0.2803	0.18710	3.733	0.011925	1.534	0.004901	--	--	1.611	2.161	1.764	1.916
80107	0.2757	0.36943	7.435	0.023575	1.695	0.005374	2.124231	0.006115	1.787	2.504	1.991	2.055
90107	0.0284	0.05884	0.959	0.002762	1.030	0.002964	1.113532	0.002532	1.036	1.136	1.053	1.053
100107	0.0459	0.06129	1.012	0.002936	1.060	0.003075	1.150456	0.002646	1.074	1.245	1.102	1.099
10207	0.0985	0.06350	1.014	0.003266	1.134	0.003652	--	--	1.163	1.463	1.210	1.227
20207	0.1689	0.08801	1.430	0.004563	1.232	0.003929	--	--	1.276	1.671	1.351	1.415
30207	0.1778	0.13621	2.231	0.007130	1.334	0.004263	--	--	1.391	1.848	1.497	1.534
40207	0.2297	--	--	--	1.459	0.004689	--	--	1.529	2.031	1.676	1.744
50207	0.3029	--	--	--	1.602	0.005207	2.029632	0.005969	1.685	2.290	1.884	2.031
70207	0.0230	0.06871	0.893	0.002830	1.028	0.003256	1.103421	0.002703	1.034	1.136	1.051	1.047
80207	0.0482	0.06960	0.916	0.002883	1.056	0.003322	1.139836	0.002993	1.069	1.240	1.096	1.097
90207	0.1130	0.09490	1.261	0.004014	1.120	0.003565	--	--	1.147	1.433	1.193	1.228
100207	0.1764	0.12340	1.661	0.005309	1.195	0.003818	--	--	1.234	1.608	1.305	1.386

TABLE W50 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
110207	0.1742	--	--	--	1.317	0.004251	--	--	1.372	1.833	1.482	1.512
120207	0.2566	--	--	--	1.406	0.004619	--	--	1.471	1.979	1.615	1.739
130207	--	--	--	--	1.512	0.005165	1.928757	0.005917	1.586	2.114	1.774	--
10507	0.0126	0.07793	0.872	0.002812	1.021	0.003293	1.085537	0.002607	1.025	1.109	1.039	1.031
20507	0.0424	0.07898	0.893	0.002894	1.047	0.003384	1.127385	0.002963	1.058	1.213	1.083	1.083
30507	0.0992	0.08229	0.954	0.003136	1.110	0.003648	--	--	1.135	1.415	1.181	1.203
40507	0.1608	0.16758	1.949	0.006464	1.179	0.003911	--	--	1.217	1.588	1.236	1.349
50507	0.1647	--	--	--	1.285	0.004325	--	--	1.337	1.801	1.464	1.466
60507	0.2469	--	--	--	1.374	0.004720	--	--	1.436	1.955	1.578	1.688
70507	0.2981	--	--	--	1.463	0.005083	1.874229	0.005853	1.535	2.094	1.717	1.883
90507	0.7102	0.00185	4.458	0.012396	1.538	0.004278	1.929556	0.005316	1.616	2.024	2.966	3.944
100507	0.7102	0.00256	5.703	0.015674	1.994	0.005481	2.190887	0.006069	2.121	3.336	4.414	4.706
110507	0.7129	0.00456	10.670	0.029109	3.252	0.008871	--	--	3.605	5.562	8.713	5.849

TABLE W51 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
120507	0.7107	0.00385	9.133	0.024104	4.663	0.012306	--	--	5.329	7.793	13.583	6.372
130507	0.7172	0.00328	8.168	0.021441	7.023	0.018443	--	--	8.160	11.262	22.077	7.063
140507	0.7076	0.00328	8.019	0.020676	8.280	0.021348	--	--	9.586	12.909	26.247	7.134
150507	0.7168	0.00299	7.052	0.018319	9.889	0.025689	10.235758	0.026499	11.497	15.055	31.672	7.659
10607	0.6251	0.00499	4.742	0.013155	1.313	0.003643	1.588982	0.004394	1.368	1.738	1.906	2.818
20607	0.6258	0.00285	2.791	0.007534	1.628	0.004394	1.844463	0.004918	1.714	2.580	2.752	3.362
30607	0.6174	0.00214	2.001	0.005347	2.423	0.006476	--	--	2.611	4.133	4.800	4.180
40607	0.6185	0.00299	2.794	0.007336	3.176	0.008339	--	--	3.506	5.429	6.770	4.650
50607	0.6197	0.00527	4.903	0.012755	4.474	0.011639	--	--	5.090	7.507	10.204	5.120
60607	0.6215	0.00584	5.427	0.014082	5.344	0.013865	--	--	6.148	8.839	12.525	5.353
70607	0.6232	0.00584	5.455	0.014082	6.708	0.017316	7.248912	0.018432	7.757	10.831	16.206	5.667
90607	0.5421	0.00071	0.352	0.000967	1.222	0.003355	1.443047	0.004004	1.266	1.591	1.551	2.253
100607	0.5374	0.00385	1.871	0.005107	1.452	0.003962	1.616982	0.004388	1.521	1.921	2.058	2.599

TABLE W52 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
110607	0.5399	0.00071	0.347	0.000935	2.007	0.005401	--	--	2.135	3.362	3.269	3.278
120607	0.5388	0.00057	0.281	0.000752	2.576	0.006892	--	--	2.790	4.413	4.520	3.706
130607	0.5419	0.00100	0.505	0.001323	3.473	0.009094	--	--	3.865	5.926	6.538	4.148
140607	0.5396	0.00085	0.423	0.001098	3.992	0.010361	--	--	4.497	6.759	7.657	4.300
150607	0.5436	0.00114	0.565	0.001445	5.083	0.012989	5.661819	0.014047	5.820	8.455	10.109	4.611
10707	0.4606	0.02137	6.468	0.018107	1.165	0.003265	1.371852	0.003858	1.201	1.488	1.358	1.894
20707	0.4611	0.02208	6.668	0.018435	1.356	0.003749	1.494524	0.004160	1.416	1.800	1.742	2.174
30707	0.4603	0.01895	5.728	0.015677	1.781	0.004873	--	--	1.882	2.910	2.555	2.680
40707	0.4591	0.01624	5.033	0.013565	2.263	0.006091	--	--	2.426	3.852	3.494	3.080
50707	0.4641	0.01553	4.824	0.012926	2.970	0.007958	--	--	3.259	5.104	4.865	3.487
60707	0.4641	0.01439	4.500	0.011945	3.543	0.009405	--	--	3.953	6.058	5.995	3.700
70707	0.4680	0.01339	4.183	0.011059	4.215	0.011144	4.769496	0.012093	4.774	7.140	7.322	3.915
90707	0.4064	0.03049	6.855	0.019042	1.148	0.003190	1.343760	0.003719	1.181	1.450	1.305	1.730

TABLE W53 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
100707	0.4094	0.02920	6.624	0.018258	1.290	0.003557	1.431031	0.003989	1.342	1.704	1.557	1.935
110707	0.4103	0.02849	6.521	0.017892	1.670	0.004581	--	--	1.760	2.677	2.245	2.390
120707	0.4088	0.02849	6.560	0.017769	2.104	0.005699	--	--	2.244	3.557	3.016	2.763
130707	0.4115	0.02920	6.787	0.018304	2.648	0.007140	--	--	2.875	4.553	3.992	3.100
140707	0.4061	0.02949	6.725	0.017988	3.186	0.008520	--	--	3.519	5.478	4.941	3.305
150707	0.4036	0.02892	6.522	0.017444	3.813	0.010197	4.351202	0.011082	4.283	6.514	6.061	3.496
10807	0.3460	0.03276	5.324	0.014860	1.124	0.003138	1.287930	0.003562	1.152	1.398	1.237	1.570
20807	0.3501	0.03276	5.317	0.014763	1.241	0.003444	1.384449	0.003873	1.287	1.626	1.435	1.731
30807	0.3495	0.03362	5.492	0.015132	1.565	0.004312	--	--	1.645	2.055	1.967	2.107
40807	0.3513	0.03390	5.561	0.015232	1.913	0.005240	--	--	2.029	3.172	2.529	2.429
50807	0.3543	0.03262	5.371	0.014589	2.415	0.006559	--	--	2.602	4.126	3.364	2.769
60807	0.3554	0.03248	5.383	0.014569	2.902	0.007853	--	--	3.178	4.992	4.147	3.001
70807	0.3620	0.03177	5.330	0.014326	3.446	0.009262	3.967845	0.010088	3.835	5.918	5.062	3.220

TABLE W54 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
90807	0.2921	0.03148	4.005	0.011086	1.106	0.003060	1.227409	0.003370	1.130	1.352	1.191	1.451
100807	0.2953	0.03177	4.044	0.011168	1.209	0.003337	1.356398	0.003746	1.250	1.570	1.357	1.585
110807	0.2987	0.03077	3.970	0.010881	1.498	0.004106	--	--	1.571	1.980	1.805	1.918
120307	0.2982	0.03205	4.160	0.011367	1.797	0.004908	--	--	1.899	2.918	2.260	2.193
130807	0.3015	0.03134	4.070	0.011040	2.237	0.006069	--	--	2.396	3.783	2.931	2.508
140807	0.3029	0.03006	3.993	0.010744	2.603	0.007005	--	--	2.821	4.455	3.506	2.704
150807	--	--	--	--	3.107	0.008255	3.612403	0.009019	3.421	5.331	4.292	--
10907	0.2494	0.03547	3.821	0.010541	1.097	0.003027	1.218799	0.003280	1.120	1.331	1.169	1.375
20907	0.2447	0.03618	3.835	0.010569	1.194	0.003291	1.337595	0.003668	1.234	1.544	1.318	1.483
30907	0.2463	0.03462	3.486	0.010153	1.451	0.003995	--	--	1.519	1.927	1.596	1.765
40907	0.2493	0.03533	3.807	0.010451	1.716	0.004712	--	--	1.810	2.736	2.033	2.015
50907	--	--	--	--	2.131	0.005809	--	--	2.274	3.569	2.683	--
60907	--	--	--	--	2.518	0.006836	--	--	2.722	4.285	3.250	--

TABLE W55 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
70907	---	---	---	---	2.905	0.007791	3.394131	0.008518	3.179	4.970	3.817	---
11207	0.7275	0.00356	9.663	0.026595	10.571	0.029093	10.863990	0.029848	12.465	15.939	35.623	7.971
21207	0.7303	0.00399	12.167	0.033194	18.827	0.051360	19.143972	0.051423	22.608	25.280	67.133	10.705
31207	0.7290	0.00513	10.679	0.028921	20.778	0.056274	21.107708	0.056654	24.919	27.263	66.815	11.556
41207	0.7437	0.01040	21.218	0.057571	28.943	0.078529	30.046505	0.082763	36.867	40.957	92.038	16.258
51207	0.7711	0.01026	21.074	0.057318	34.452	0.093703	36.997154	0.101910	41.633	52.176	108.834	20.273
61207	0.7979	0.01325	27.432	0.074879	39.865	0.108816	44.303597	0.121644	48.331	64.425	125.084	24.673
71207	0.8558	0.01724	30.695	0.084652	42.315	0.116699	47.845331	0.132291	51.540	68.513	127.377	27.896
11307	0.6048	0.00228	1.984	0.005536	6.741	0.018806	7.262398	0.019951	7.874	10.920	16.122	5.457
21307	0.6168	0.00356	2.954	0.008155	10.885	0.030049	11.198548	0.030885	12.837	16.382	26.888	6.575
31307	0.6264	0.00527	4.461	0.012306	13.703	0.037801	13.907295	0.038522	16.293	19.787	34.517	7.571
41307	0.6610	0.00826	6.345	0.018869	17.910	0.049375	18.330655	0.049783	21.424	24.437	45.265	9.569
51307	0.6929	0.01068	8.460	0.023466	20.523	0.056923	21.052540	0.057861	24.608	27.107	51.452	11.112

Values of two-phase friction multiplier (spanning Experimental through DUCKLR columns).

TABLE W 56 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
61307	0.7249	0.01453	11.836	0.032765	23.675	0.065538	24.331261	0.067696	28.407	31.828	59.752	13.090
71307	0.8110	0.02009	16.083	0.045034	27.826	0.077919	29.144247	0.082809	33.531	39.701	69.932	16.977
91307	0.5405	-.-	-.-	-.-	5.087	0.014291	5.634243	0.015364	5.873	8.508	10.032	4.567
101307	0.5460	0.00185	0.888	0.002472	8.098	0.022535	8.588614	0.023698	9.447	12.812	16.958	5.282
111307	0.5675	0.00556	2.559	0.007113	10.403	0.028924	10.784280	0.029925	12.236	15.832	22.021	6.055
121307	0.6089	0.00584	2.668	0.007450	13.126	0.036659	13.423068	0.037323	15.574	19.192	28.184	7.253
131307	0.6540	0.00997	4.475	0.012519	15.342	0.042923	15.645711	0.043903	18.269	21.760	33.050	8.471
141307	0.7301	0.01838	8.123	0.022931	17.662	0.049861	18.250766	0.050764	21.118	24.284	38.147	10.349
151307	0.7790	0.02237	9.817	0.028047	19.952	0.057004	20.695341	0.058502	23.942	26.627	43.260	12.298
11407	0.4555	0.02635	7.834	0.022197	4.313	0.012221	4.847705	0.013188	4.918	7.321	7.450	3.864
21407	0.4712	0.02080	6.239	0.017579	6.738	0.018987	7.302405	0.020277	7.866	10.984	12.335	4.514
31407	0.5468	0.01553	4.642	0.013100	9.134	0.025777	9.633135	0.027049	10.679	14.273	17.214	5.568
41407	0.5614	0.01610	4.808	0.013542	10.353	0.029159	10.808383	0.030385	12.152	15.862	19.699	6.020

TABLE W57 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
51407	0.6633	--	--	--	12.657	0.035691	13.043875	0.036896	14.976	18.720	24.223	7.631
61407	0.6896	0.02308	4.602	0.018947	13.941	0.040011	14.381280	0.041453	16.560	20.290	26.850	8.400
81407	0.4082	0.02521	5.627	0.015780	3.776	0.010589	4.295198	0.011460	4.250	6.467	5.988	3.499
91407	0.4273	0.02251	5.067	0.014199	5.693	0.015967	6.286886	0.017224	6.610	9.494	9.556	4.061
101407	0.5044	0.02080	4.683	0.013145	7.674	0.021544	8.240901	0.022908	8.948	12.323	13.257	4.929
111407	0.5739	0.01866	4.147	0.011620	9.823	0.027528	10.341854	0.028893	11.480	15.235	17.287	5.964
121407	0.6402	0.02237	4.957	0.014080	11.251	0.031956	11.764135	0.033428	13.223	17.107	20.055	6.972
131407	0.7125	0.02650	5.917	0.016931	12.730	0.036428	13.240519	0.038017	15.024	18.942	22.945	8.375
141407	0.7701	0.03077	6.840	0.019981	14.682	0.042893	15.284680	0.044816	17.419	21.270	26.770	10.181
11507	0.3475	0.02969	4.780	0.013615	3.411	0.009716	3.913477	0.010534	3.803	5.882	4.974	3.152
21507	0.4157	0.03199	5.212	0.014812	5.171	0.014696	5.763930	0.015924	5.972	8.743	7.946	3.886
131507	0.4754	0.03120	5.180	0.014592	6.936	0.019540	7.523782	0.020918	8.091	11.359	11.006	4.590
41507	0.5748	0.02151	3.610	0.010385	8.377	0.024100	8.989776	0.025683	9.750	13.455	13.653	5.591

TABLE W58 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
51507	0.6158	0.02051	3.323	0.008783	10.265	0.027135	10.541670	0.027795	12.021	15.573	16.316	6.384
61507	0.6350	0.03049	4.931	0.014485	10.837	0.031832	11.474517	0.033698	12.734	16.838	17.979	7.424
71507	0.7463	0.03333	5.338	0.016001	12.135	0.036378	12.824443	0.038549	14.333	18.533	20.341	8.870
92007	0.3028	0.03162	4.068	0.011224	3.082	0.008505	3.573953	0.009261	3.397	5.302	4.220	2.898
102007	--	--	--	--	4.295	0.011918	4.878946	0.013005	4.882	7.362	6.131	--
82807	0.2161	0.35431	6.311	0.021277	1.676	0.005649	2.096449	0.006410	1.767	2.454	1.959	1.915
92807	0.3865	--	--	--	2.159	0.007602	2.691232	0.008742	2.309	3.472	2.654	2.723
102807	0.4686	--	--	--	2.487	0.008905	3.102272	0.010338	2.689	4.116	3.142	3.267
112807	0.5436	0.00271	0.052	0.000195	3.006	0.011293	3.772064	0.013359	3.309	5.149	3.947	3.968
122807	0.5801	0.01581	0.308	0.001186	3.312	0.012751	4.177289	0.015270	3.682	5.759	4.442	4.375
12907	0.2435	--	--	--	1.601	0.005491	2.011551	0.006238	1.685	1.000	1.864	1.904
22907	0.4079	--	--	--	1.867	0.006741	2.359046	0.007792	1.979	2.905	2.262	2.570
32907	0.4873	--	--	--	2.484	0.009474	3.135732	0.011139	2.687	4.118	3.182	3.357

TABLE W59 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
42907	0.5124	--	--	--	2.704	0.010501	3.425765	0.012461	2.947	4.547	3.529	3.621
52907	C.5555	0.01467	C.240	0.000959	2.987	0.011915	3.806644	0.014325	3.287	5.103	3.989	4.042
72907	0.2771	--	--	--	1.531	0.005393	1.936036	0.006151	1.608	2.155	1.732	1.905
82907	0.4075	--	--	--	1.958	0.007194	2.486156	0.008386	2.081	3.075	2.412	2.646
92907	C.4745	--	--	--	2.359	0.009126	3.013109	0.010827	2.540	3.890	3.036	3.217
102907	C.5143	0.01311	C.183	0.000729	2.610	0.010408	3.353957	0.012509	2.834	4.387	3.443	3.581
13007	C.2918	--	--	--	1.524	0.005613	1.940719	0.006445	1.601	2.162	1.787	1.930
23007	C.3981	--	--	--	1.881	0.007261	2.412795	0.008533	1.995	2.950	2.325	2.549
33007	C.4699	--	--	--	2.160	0.008523	2.779812	0.010138	2.310	3.513	2.759	3.054
43007	0.5113	0.00598	C.073	0.000299	2.407	0.009911	3.123852	0.011975	2.596	4.025	3.168	3.437
112007	--	--	--	--	5.994	0.016841	6.650295	0.018325	6.951	10.161	8.837	--
122007	C.5576	0.02023	2.644	0.007561	7.638	0.021837	8.325735	0.023579	8.879	12.617	11.656	5.294
132007	C.6206	0.01880	2.469	0.007135	8.722	0.025201	9.415591	0.027053	10.132	14.170	13.506	6.110

TABLE W 60 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
142007	0.6883	0.02151	2.810	0.008288	9.867	0.029101	10.574954	0.031113	11.534	15.776	15.472	7.229
152007	0.7344	0.03291	4.290	0.012516	11.133	0.032482	11.754812	0.034342	13.077	17.351	17.485	8.342
12107	--	--	--	--	2.852	0.008143	3.318245	0.008854	3.123	4.903	3.729	--
22107	--	--	--	--	4.267	0.012500	4.866360	0.013691	4.859	7.417	5.873	--
32107	--	--	--	--	5.880	0.016862	6.529794	0.018348	6.827	10.067	8.339	--
42107	0.5230	--	--	--	6.708	0.019571	7.409177	0.021316	7.815	11.391	9.675	4.829
52107	0.6379	0.01681	1.792	0.005291	7.917	0.023370	8.646374	0.025316	9.216	13.204	11.607	6.100
62107	0.6762	0.02208	2.366	0.007124	8.764	0.026391	9.528497	0.028542	10.218	14.468	13.040	6.784
72107	0.7228	0.02365	2.541	0.007880	9.856	0.030561	10.703240	0.033120	11.549	16.092	14.946	7.815
132207	--	--	--	--	2.778	0.007997	3.235858	0.008691	3.035	4.762	3.518	--
142207	--	--	--	--	3.825	0.010977	4.373538	0.011958	4.311	6.605	5.020	--
152207	0.4566	--	--	--	5.497	0.013764	6.144023	0.017201	6.363	9.491	7.515	4.161
162207	0.5616	0.00783	0.751	0.002223	6.696	0.019828	7.428992	0.021697	7.801	11.491	9.441	5.104

TABLE W61 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
172207	0.6103	0.01567	1.503	0.004434	7.513	0.022172	8.250478	0.024111	8.752	12.690	10.690	5.718
182207	0.6758	0.02123	1.993	0.006100	8.315	0.025449	9.145502	0.027810	9.671	14.027	12.012	6.684
192207	0.7173	0.02564	2.405	0.007601	9.117	0.028815	10.020425	0.031547	10.661	15.280	13.380	7.538
102307	--	--	--	--	2.514	0.007194	2.956660	0.007850	2.721	4.229	2.969	--
12607	--	--	--	--	3.330	0.009256	3.792737	0.009939	3.705	5.591	3.973	--
22607	0.4343	--	--	--	4.252	0.013195	4.935549	0.014727	4.841	7.599	5.391	3.755
32607	0.5332	0.00085	0.050	0.000156	5.162	0.016005	5.924230	0.017892	5.959	9.450	6.673	4.551
42607	0.5984	0.01595	0.948	0.002993	5.770	0.018228	6.610501	0.020476	6.700	10.622	7.593	5.223
62607	0.4274	0.04767	2.088	0.006221	2.200	0.006554	2.652781	0.007285	2.355	3.648	2.609	2.902
72607	0.4267	--	--	--	2.939	0.008893	3.502613	0.009939	3.225	5.076	3.622	3.299
82607	0.4605	--	--	--	3.632	0.011311	4.320095	0.012807	4.067	6.456	4.619	3.714
92607	0.5305	0.02554	1.137	0.003544	4.430	0.013803	5.232426	0.015745	5.042	7.973	5.771	4.366
102607	0.6172	0.02214	1.000	0.003162	5.176	0.016369	6.062640	0.018702	5.958	9.446	6.857	5.283

TABLE W62 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER									
			EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
112607	0.6601	--	--	--	5.606	0.018727	6.622618	0.021697	6.484	10.412	7.610	5.884
12707	0.4290	0.11768	5.167	0.014402	2.382	0.006639	2.799017	0.007215	2.566	3.844	2.782	3.025
22707	0.3268	--	--	--	3.027	0.009475	3.606664	0.010608	3.334	5.309	3.747	2.956
32707	0.4397	--	--	--	3.602	0.011544	4.290201	0.013081	4.035	6.462	4.582	3.600
42707	0.5417	0.00456	0.198	0.000663	4.401	0.014767	5.252642	0.017026	5.021	8.127	5.797	4.434
12807	0.2435	0.28803	7.234	0.022902	1.867	0.005911	2.301858	0.006656	1.979	2.895	2.195	2.121
22807	0.4073	--	--	--	2.479	0.008226	3.036492	0.009362	2.680	4.121	3.064	2.996
32807	0.5041	--	--	--	3.004	0.010250	3.679514	0.011812	3.306	5.148	3.835	3.720
42807	0.5517	--	--	--	3.416	0.010984	4.107503	0.012528	3.803	5.714	4.357	4.197
52807	0.6022	0.01937	0.501	0.002504	3.118	0.015574	4.231097	0.020094	3.449	6.222	4.508	4.475
62807	0.6244	0.02208	0.573	0.002126	4.068	0.015098	5.040046	0.018016	4.610	7.324	5.524	5.054

TABLE W63 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES.-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
12109	0.2065	0.00209	0.186	0.000536	1.080	0.003102	1.202671	0.003267	1.099	1.291	1.135	1.295
22109	0.2044	0.00204	0.183	0.000521	1.159	0.003299	1.287751	0.003631	1.193	1.483	1.256	1.384
32109	0.2065	0.00198	0.179	0.000509	1.389	0.003947	--	--	1.452	1.860	1.584	1.634
42109	0.1023	0.00183	0.107	0.000295	1.060	0.002924	1.178566	0.002933	1.074	1.230	1.097	1.153
52109	0.1087	0.00172	0.101	0.000284	1.129	0.003162	1.220991	0.003350	1.158	1.418	1.197	1.234
62109	0.3056	0.00157	0.221	0.000600	1.412	0.003835	--	--	1.476	1.879	1.695	1.841
72109	0.3052	0.00162	0.229	0.000619	1.680	0.004544	--	--	1.770	2.690	2.116	2.109
82109	0.3107	0.00167	0.237	0.000641	2.075	0.005620	--	--	2.210	3.499	2.735	2.432
92109	0.3108	0.00209	0.302	0.000814	2.776	0.007489	3.263254	0.008217	3.025	4.792	3.853	2.805
12309	0.7007	-0.00016	-0.332	-0.000925	1.457	0.004053	1.843081	0.005076	1.527	1.934	2.618	3.681
22309	0.7030	0.00005	0.107	0.000297	3.098	0.008550	--	--	3.418	5.330	7.970	5.610
32309	0.7016	0.00021	0.416	0.001146	4.613	0.012693	--	--	5.279	7.770	12.904	6.198
42309	0.7040	0.00057	1.171	0.003204	7.397	0.020237	--	--	8.623	11.840	22.354	6.873

VALUES OF TWO-PHASE FRICTION MULTIPLIER

TABLE W64 COMPARISON OF FRICTION PRESSURE DROP DATA

VALUES OF TWO-PHASE FRICTION MULTIPLIER

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
52309	0.7079	0.00089	1.803	0.004904	9.456	0.025723	9.865121	0.026720	11.044	14.580	29.265	7.382
62309	0.5305	0.00073	0.333	0.000918	1.214	0.003346	1.431525	0.003990	1.256	1.580	1.523	2.196
72309	0.5242	0.00047	0.212	0.000587	1.909	0.005281	--	--	2.025	3.188	3.030	3.097
82309	0.5293	0.00073	0.333	0.000918	3.236	0.008909	--	--	3.584	5.380	5.900	3.969
92309	0.5324	0.00104	0.482	0.001324	4.836	0.013273	5.415467	0.014387	5.548	8.153	9.467	4.461
102309	0.4590	0.00073	0.224	0.000602	1.172	0.003145	1.380551	0.003730	1.208	1.498	1.383	1.898
112309	0.4657	0.00073	0.224	0.000603	1.778	0.004776	--	--	1.878	2.915	2.565	2.699
122309	0.4621	0.00052	0.160	0.000432	2.921	0.007878	--	--	3.200	5.047	4.778	3.457
132309	0.4677	0.00110	0.335	0.000905	4.282	0.011562	4.854594	0.012588	4.859	7.288	7.454	3.930
152309	0.4046	-0.00021	-0.045	-0.000130	1.143	0.003302	1.334973	0.003833	1.175	1.447	1.294	1.718
162309	0.4083	-0.00021	-0.046	-0.000133	1.613	0.004658	--	--	1.698	2.567	2.139	2.323
172309	0.4124	0.00031	0.069	0.000199	2.687	0.007761	--	--	2.927	4.665	4.042	3.121
182309	0.4122	0.00115	0.251	0.000727	3.712	0.010743	4.244579	0.011676	4.175	6.415	5.883	3.498

TABLE W 65 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
192309	0.3469	0.00042	0.069	0.000193	1.121	0.003145	1.284296	0.003572	1.148	1.393	1.234	1.567
202309	0.3499	0.00031	0.052	0.000145	1.507	0.004236	--	--	1.581	2.000	1.881	2.046
212309	0.3570	0.00057	0.095	0.000267	2.375	0.006700	--	--	2.557	4.087	3.298	2.753
222309	0.3565	0.00172	0.286	0.000806	3.336	0.009404	3.856710	0.010261	3.707	5.784	4.898	3.163
232309	0.2984	0.00052	0.068	0.000184	1.107	0.003011	1.229760	0.003333	1.131	1.357	1.196	1.463
242309	0.2980	0.00026	0.034	0.000093	1.480	0.004055	--	--	1.551	1.965	1.785	1.898
252309	0.3019	0.00037	0.048	0.000131	1.822	0.004966	--	--	1.927	2.984	2.310	2.223
262309	0.3049	0.00110	0.144	0.000393	2.318	0.006324	--	--	2.488	3.953	3.070	2.565
272309	0.2581	0.00037	0.040	0.000108	1.096	0.002978	1.219680	0.003237	1.119	1.330	1.170	1.386
282309	0.2384	0.00031	0.031	0.000093	1.233	0.003377	--	--	1.277	1.616	1.381	1.550
292309	0.2518	0.00031	0.034	0.000093	1.473	0.004024	--	--	1.543	1.957	1.738	1.798
302309	0.2540	0.00057	0.063	0.000171	1.665	0.004530	--	--	1.754	2.639	2.021	1.982
100810	0.0000	0.00042	0.952	0.002729	3.942	0.011297	--	--	4.462	6.719	11.055	0.000

TABLE W66 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	BUCKLR
			VALUES OF TWO-PHASE FRICTION MULTIPLIER									
110810	0.0000	0.00047	0.396	0.001121	2.762	0.007819	--	--	3.016	4.761	5.575	0.000
120810	0.0000	0.00047	0.229	0.000642	2.349	0.006588	--	--	2.527	4.027	4.025	0.000
130810	0.0000	0.00057	0.176	0.000498	2.059	0.005838	--	--	2.194	3.490	3.106	0.000
140810	0.0000	0.00052	0.116	0.000331	1.895	0.005388	--	--	2.010	3.159	2.643	0.000
150810	0.0000	0.00042	0.067	0.000190	1.750	0.004982	--	--	1.849	2.854	2.265	0.000
160810	0.0000	0.00042	0.053	0.000151	1.663	0.004731	--	--	1.755	2.654	2.061	0.000
170810	0.0000	0.00057	0.062	0.000177	1.508	0.004585	--	--	1.692	2.515	1.931	0.000
180810	0.0000	0.00047	1.095	0.003063	6.682	0.018695	--	--	7.805	10.849	20.679	0.000
190810	0.0000	0.00052	0.462	0.001289	4.602	0.012835	--	--	5.271	7.760	10.434	0.000
200810	0.0000	0.00057	0.272	0.000751	3.656	0.010237	--	--	4.103	6.269	6.875	0.000
210810	0.0000	0.00078	0.175	0.000495	2.740	0.007770	--	--	2.988	4.753	4.144	0.000
220810	0.0000	0.00057	0.171	0.000485	3.033	0.008585	--	--	3.342	5.250	4.970	0.000
230810	0.0000	0.00125	0.201	0.000565	2.499	0.007016	--	--	2.702	4.309	3.482	0.000

TABLE W67 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
-240810	0.0000	0.00141	0.182	0.000515	2.337	0.006632	-:-	-:-	2.513	3.998	3.088	0.000
250810	0.0000	0.00099	2.292	0.006381	9.787	0.027251	10.168286	0.028212	11.499	15.004	31.532	0.000
260810	0.0000	0.00130	1.156	0.003194	6.506	0.017985	7.057114	0.019191	7.582	10.615	15.586	0.000
270810	0.0000	0.00141	0.686	0.001889	5.096	0.014042	5.670885	0.015173	5.871	8.544	10.169	0.000
280810	0.0000	0.00172	0.524	0.001435	4.224	0.011568	4.787099	0.012577	4.793	7.198	7.331	0.000
290810	0.0000	0.00198	0.448	0.001242	3.774	0.010461	4.316510	0.011389	4.242	6.490	6.022	0.000
300810	0.0000	0.00235	0.382	0.001081	3.345	0.009466	3.859330	0.010310	3.719	5.791	4.884	0.000
12409	0.7419	0.00151	2.675	0.007745	16.243	0.047024	16.460511	0.047662	19.649	22.573	50.602	9.930
22409	0.6268	0.00251	2.090	0.006018	11.687	0.033650	12.001465	0.034602	13.910	17.412	29.307	6.907
32409	0.5713	0.00381	1.815	0.005210	9.208	0.026422	9.672179	0.027619	10.812	14.334	19.595	5.747
42409	0.6230	0.00736	3.524	0.010145	12.398	0.035690	12.749860	0.036796	14.754	18.346	27.043	7.122
52409	0.6582	0.00726	1.778	0.016456	15.711	0.044748	15.979653	0.045608	18.849	22.094	39.487	8.639
62409	0.7363	0.00590	11.892	0.033329	24.627	0.069024	25.301857	0.071495	29.845	33.476	79.199	13.715

TABLE W68 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
72409	0.7661	0.00715	13.528	0.038053	30.675	0.085905	32.472554	0.092337	37.299	45.096	96.429	17.785
82409	0.6980	0.00861	6.881	0.019361	19.804	0.055720	20.390975	0.056690	23.792	26.403	49.969	10.841
92409	0.6474	0.00788	3.523	0.009971	14.942	0.042289	15.288772	0.043430	17.798	21.344	32.242	8.271
102409	0.7101	0.00887	3.995	0.011349	16.773	0.047649	17.304910	0.048599	20.031	23.371	35.449	9.705
112409	0.7323	0.00736	5.991	0.016869	22.572	0.063554	23.269269	0.065537	27.145	30.146	57.294	12.642
122409	0.7765	0.00338	9.690	0.026903	33.905	0.094134	36.599936	0.102941	41.089	51.737	104.303	20.117
142409	0.4801	--	--	--	7.774	0.023280	8.338003	0.024737	9.125	12.497	14.443	4.823
152409	0.4708	--	--	--	7.007	0.020820	7.601573	0.022297	8.214	11.449	12.001	4.581
162409	0.5220	--	--	--	8.390	0.024895	8.973048	0.026439	9.813	13.378	14.669	5.221
172409	0.5533	--	--	--	7.735	0.023035	8.375416	0.024711	9.051	12.626	12.431	5.266
182409	0.5506	--	--	--	9.770	0.027970	10.266840	0.029298	11.470	15.139	18.305	5.778
192409	0.6131	--	--	--	11.657	0.033536	12.130102	0.034944	13.772	17.569	22.312	6.830
202409	0.6119	--	--	--	10.334	0.030036	10.897055	0.031620	12.147	15.975	13.341	6.430

Table heading: VALUES OF TWO-PHASE FRICTION MULTIPLIER

TABLE W69 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
212409	0.5896	-.-	-.-	-.-	8.790	0.025690	9.455829	0.027482	10.247	14.129	14.345	5.831
10510	0.0000	0.00459	9.776	0.027796	20.929	0.059504	21.415381	0.060442	25.414	27.350	68.610	0.000
20510	0.0000	0.00546	11.384	0.032251	26.167	0.074133	27.050896	0.077572	31.906	36.385	35.023	0.000
30510	0.0000	0.00600	12.584	0.035480	29.511	0.083201	31.024237	0.088823	36.006	42.803	95.531	0.000
40510	0.0000	0.00884	18.301	0.051628	35.929	0.101360	39.378705	0.112262	43.996	56.523	114.760	0.000
50510	0.0000	0.00546	4.403	0.012159	12.543	0.034642	12.814952	0.035487	14.853	18.454	31.101	0.000
60510	0.0000	0.00742	6.011	0.016592	16.125	0.044507	16.356891	0.045182	19.220	22.562	40.462	0.000
70510	0.0000	0.00994	7.924	0.021922	18.500	0.051179	19.012855	0.051785	22.106	25.098	46.418	0.000
80510	0.0000	0.01419	11.242	0.031383	22.340	0.062365	22.999974	0.064198	26.786	29.673	56.173	0.000
10610	0.0000	0.00338	1.580	0.004427	7.416	0.021719	7.952469	0.023034	8.699	11.941	15.413	0.000
20610	0.0000	0.00644	2.950	0.008619	9.477	0.027685	9.938233	0.028911	11.170	14.700	20.074	0.000
30610	0.0000	0.00797	3.639	0.010562	12.312	0.035734	12.683174	0.036903	14.660	18.257	26.506	0.000
40510	0.0000	0.00906	4.246	0.012229	14.687	0.042301	15.031905	0.043467	17.569	21.028	32.159	0.000

TABLE W70 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
50610	0.0000	0.01201	5.226	0.015161	16.360	0.047457	16.847577	0.048640	19.629	22.903	35.371	0.000
60610	0.0000	0.00502	1.479	0.004180	8.618	0.024363	9.148422	0.025696	10.050	13.603	16.118	0.000
70610	0.0000	0.00731	2.173	0.006134	10.170	0.028716	10.656639	0.030022	11.929	15.660	19.336	0.000
80610	0.0000	0.00742	2.224	0.006302	11.421	0.032357	11.874403	0.033668	13.458	17.231	21.957	0.000
90610	0.0000	0.00994	2.971	0.008431	13.321	0.038030	13.761575	0.039444	15.784	19.572	25.877	0.000
110610	0.0000	-0.00109	-0.237	-0.000709	6.750	0.020210	7.343604	0.021672	7.915	11.085	11.509	0.000
120610	0.0000	0.00393	0.848	0.002537	8.878	0.026565	9.451756	0.028125	10.430	14.039	15.550	0.000
130610	0.0000	0.00939	2.051	0.006122	10.016	0.029896	10.564662	0.031456	11.823	15.534	17.774	0.000
140610	0.0000	0.01430	2.979	0.008987	11.463	0.034579	12.031365	0.036334	13.605	17.412	20.378	0.000
150610	0.0000	0.01507	2.412	0.007187	8.942	0.026648	9.596188	0.028450	10.466	14.330	14.607	0.000
160610	0.0000	0.01430	2.274	0.006803	9.847	0.029453	10.495313	0.031309	11.571	15.552	16.197	0.000
170610	0.0000	0.01245	1.539	0.004651	8.756	0.026519	9.487801	0.028581	10.232	14.325	13.482	0.000
180610	0.0000	0.01223	1.513	0.004503	7.918	0.023574	8.635910	0.025500	9.232	13.117	12.049	0.000

TABLE W71 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	TUCKLR
10710	0.0000	0.01015	0.901	0.002874	6.265	0.019990	7.004972	0.021984	7.333	10.978	8.708	0.000
20710	0.0000	0.01146	1.027	0.003239	7.063	0.022283	7.840050	0.024449	8.274	12.195	9.953	0.000
30710	0.0000	0.01179	1.058	0.003356	7.635	0.024216	8.446813	0.026553	8.939	13.082	10.870	0.000
40710	0.0000	0.01605	0.937	0.002994	5.273	0.016838	6.076106	0.018952	6.102	9.797	6.875	0.000
50710	0.0000	0.01758	1.031	0.003331	5.771	0.018647	6.535608	0.021028	6.707	10.701	7.627	0.000
60710	0.0000	0.01856	1.112	0.003650	6.226	0.020432	7.149940	0.023102	7.256	11.495	8.331	0.000
80710	0.0000	0.01004	0.419	0.001439	4.415	0.015161	5.182495	0.017176	5.058	8.045	5.707	0.000
90710	0.0000	0.01146	0.485	0.001679	4.730	0.016384	5.556236	0.018655	5.449	8.716	6.190	0.000
100710	0.0000	0.01256	0.526	0.001853	4.961	0.017464	5.851034	0.020048	5.733	9.246	6.577	0.000
110710	0.0000	0.01441	0.488	0.001656	3.826	0.012982	4.590051	0.014896	4.315	6.815	4.955	0.000
120710	0.0000	0.01507	0.515	0.001776	4.167	0.014377	5.009740	0.016637	4.737	7.521	5.486	0.000
130710	0.0000	0.01583	0.547	0.001903	4.372	0.015203	5.265405	0.017689	4.988	7.959	5.813	0.000
10810	0.0000	0.01070	0.256	0.000941	3.042	0.011172	3.716755	0.012855	3.359	5.270	3.880	0.000

TABLE W72 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
20810	0.0000	0.01365	0.332	0.001233	3.409	0.012658	4.165993	0.014688	3.809	5.971	4.429	0.000
30810	0.0000	0.01397	0.344	0.001291	3.611	0.013540	4.438866	0.015878	4.056	6.396	4.756	0.000
40810	0.0000	0.01430	0.266	0.000996	2.783	0.010428	3.477566	0.012213	3.043	4.707	3.591	0.000
50810	0.0000	0.01507	0.283	0.001072	2.974	0.011271	3.731982	0.013321	3.272	5.085	3.898	0.000
60810	0.0000	0.01649	0.310	0.001192	3.133	0.012039	3.947554	0.014346	3.464	5.401	4.161	0.000
70810	0.0000	0.01135	0.153	0.000586	2.221	0.008516	2.840534	0.010083	2.379	3.621	2.831	0.000
80810	0.0000	0.01288	0.175	0.000576	2.362	0.009149	3.024324	0.010887	2.542	3.893	3.049	0.000

(Column group heading over EXPERIMENTAL to DUCKLR: VALUES OF TWO-PHASE FRICTION MULTIPLIER)

TABLE W73 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
12109	0.2065	0.02350	2.099	0.006030	1.080	0.003102	1.202671	0.003267	1.099	1.291	1.135	1.295
22109	0.2044	0.02379	2.140	0.006090	1.159	0.003299	1.287751	0.003631	1.193	1.483	1.256	1.384
32109	0.2065	0.02507	2.266	0.006438	1.389	0.003947	--	--	1.452	1.860	1.584	1.634
42109	0.1023	0.02849	1.670	0.004606	1.060	0.002924	1.178566	0.002933	1.074	1.230	1.097	1.153
52109	0.1087	0.02963	1.744	0.004884	1.129	0.003162	1.220991	0.003350	1.158	1.418	1.197	1.234
62109	0.3056	0.02165	3.054	0.008295	1.412	0.003835	--	--	1.476	1.879	1.695	1.861
72109	0.3052	0.02137	3.023	0.008178	1.680	0.004544	--	--	1.770	2.690	2.116	2.109
82109	0.3107	0.02123	3.006	0.008141	2.075	0.005620	--	--	2.210	3.499	2.735	2.432
92109	0.3108	0.02137	3.089	0.008333	2.776	0.007489	3.263254	0.008217	3.025	4.792	3.853	2.805
12309	0.7007	0.01040	22.034	0.061439	1.457	0.004063	1.843081	0.005076	1.527	1.934	2.618	3.681
22309	0.7030	0.01040	21.421	0.059119	3.098	0.008550	--	--	3.418	5.330	7.970	5.610
32309	0.7016	0.01011	20.165	0.055490	4.613	0.012693	--	--	5.279	7.770	12.904	6.198
42309	0.7040	0.01026	20.923	0.057242	7.397	0.020237	--	--	8.623	11.840	22.354	6.873

TABLE W74 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	CUCKLR
52309	0.7079	0.01040	21.127	0.057475	9.456	0.025723	9.865121	0.026720	11.044	14.580	29.265	7.382
62309	0.5305	0.01524	6.949	0.019151	1.214	0.003346	1.431525	0.003990	1.256	1.580	1.523	2.196
72309	0.5242	0.01496	6.821	0.018866	1.909	0.005281	--	--	2.025	3.188	3.030	3.097
82309	0.5293	0.01467	6.694	0.018431	3.236	0.008909	--	--	3.584	5.580	5.900	3.969
92309	0.5324	0.01496	6.910	0.018966	4.836	0.013273	5.415467	0.014387	5.548	8.153	9.467	4.461
102309	0.4590	0.01667	5.117	0.013731	1.172	0.003145	1.380551	0.003730	1.208	1.498	1.383	1.898
112309	0.4657	0.01667	5.120	0.013755	1.778	0.004776	--	--	1.878	2.915	2.565	2.699
122309	0.4621	0.01652	5.068	0.013638	2.921	0.007878	--	--	3.200	5.047	4.778	3.457
132309	0.4677	0.01595	4.880	0.013178	4.282	0.011562	4.854594	0.012588	4.859	7.288	7.454	3.930
152309	0.4046	0.01738	3.761	0.010860	1.143	0.003302	1.334973	0.003833	1.175	1.447	1.294	1.718
162309	0.4083	0.01724	3.792	0.010951	1.613	0.004658	--	--	1.698	2.567	2.139	2.323
172309	0.4124	0.01724	3.798	0.010969	2.687	0.007761	--	--	2.927	4.665	4.042	3.121
182309	0.4122	0.01695	3.707	0.010728	3.712	0.010743	4.244579	0.011676	4.175	6.415	5.883	3.498

TABLE W75 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
192309	0.3469	0.01980	3.257	0.009140	1.121	0.003145	1.284296	0.003572	1.148	1.393	1.234	1.567
202309	0.3499	0.01923	3.176	0.008928	1.507	0.004236	--	--	1.581	2.000	1.881	2.046
212309	0.3570	0.01895	3.128	0.008825	2.375	0.006700	--	--	2.557	4.087	3.298	2.755
222309	0.3565	0.01823	3.028	0.008536	3.336	0.009404	3.856710	0.010261	3.707	5.784	4.898	3.163
232309	0.2984	0.02123	2.755	0.007495	1.107	0.003011	1.229760	0.003333	1.131	1.357	1.196	1.463
242309	0.2980	0.02080	2.719	0.007451	1.480	0.004055	--	--	1.551	1.965	1.785	1.898
252309	0.3019	0.02037	2.673	0.007284	1.822	0.004966	--	--	1.927	2.984	2.310	2.223
262309	0.3049	0.01994	2.619	0.007146	2.318	0.006324	--	--	2.488	3.953	3.070	2.565
272309	0.2581	0.02208	2.396	0.006507	1.096	0.002978	1.219680	0.003237	1.119	1.330	1.170	1.386
282309	0.2534	0.02251	2.447	0.006705	1.233	0.003377	--	--	1.277	1.616	1.391	1.550
292309	0.2518	0.02165	2.364	0.006458	1.473	0.004024	--	--	1.543	1.957	1.738	1.798
302309	0.2540	0.02265	2.483	0.006754	1.665	0.004530	--	--	1.754	2.639	2.021	1.982
100810	0.0000	0.01054	24.033	0.068881	3.942	0.011297	--	--	4.462	6.719	11.055	0.000

TABLE W 76 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
110810	0.0000	0.01453	12.248	0.034573	2.762	0.007819	-.-	--	3.016	4.761	5.575	0.000
120810	0.0000	0.01681	8.190	0.022972	2.349	0.006588	-.-	--	2.527	4.027	4.025	0.000
130810	0.0000	0.01795	5.491	0.015368	2.059	0.005838	-.-	--	2.194	3.490	3.106	0.000
140810	0.0000	0.01994	4.446	0.012639	1.895	0.005388	-.-	--	2.010	3.169	2.643	0.000
150810	0.0000	0.02137	3.408	0.009701	1.750	0.004982	-.-	--	1.849	2.854	2.265	0.000
160810	0.0000	0.02237	2.854	0.008107	1.665	0.004731	-.-	--	1.755	2.654	2.061	0.000
170810	0.0000	0.02265	2.451	0.006991	1.608	0.004585	-.-	--	1.692	2.515	1.931	0.000
180810	0.0000	0.01182	27.560	0.077103	6.682	0.018695	-.-	--	7.805	10.849	20.679	0.000
190810	0.0000	0.01481	13.122	0.036596	4.602	0.012835	-.-	--	5.271	7.760	10.484	0.000
200810	0.0000	0.01667	7.890	0.022089	3.656	0.010237	-.-	--	4.103	6.269	6.875	0.000
210810	0.0000	0.01966	4.382	0.012427	2.740	0.007770	-.-	--	2.988	4.753	4.144	0.000
220810	0.0000	0.01809	5.404	0.015294	3.033	0.008585	-.-	--	3.342	5.250	4.970	0.000
230810	0.0000	0.02137	3.434	0.009641	2.499	0.007016	-.-	--	2.702	4.309	3.482	0.000

TABLE W77 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
240810	0.0000	0.02222	2.863	0.008125	2.337	0.006632	--	--	2.513	3.998	3.088	0.000
250810	0.0000	0.01311	30.289	0.084335	9.787	0.027251	10.168286	0.028212	11.499	15.004	31.532	0.000
260810	0.0000	0.01496	13.245	0.036611	6.506	0.017985	7.037114	0.019191	7.582	10.615	15.536	0.000
270810	0.0000	0.01709	8.319	0.022920	5.096	0.014042	5.670885	0.015173	5.871	8.544	10.169	0.000
280810	0.0000	0.01852	5.632	0.015425	4.224	0.011568	4.787099	0.012577	4.793	7.198	7.331	0.000
290810	0.0000	0.01966	4.442	0.012314	3.774	0.010461	4.316510	0.011389	4.242	6.490	6.022	0.000
300810	0.0000	0.02108	3.429	0.009703	3.345	0.009466	3.859330	0.010310	3.719	5.791	4.834	0.000
12409	0.7419	0.01083	19.136	0.055398	16.243	0.047024	16.460511	0.047662	19.649	22.573	50.602	9.930
22409	0.6268	0.01225	10.218	0.029429	11.687	0.033650	12.001465	0.034602	13.910	17.412	29.307	6.907
32409	0.5713	0.01339	6.380	0.018308	9.208	0.026422	9.672179	0.027619	10.812	14.334	19.595	5.747
42409	0.6230	0.01510	7.231	0.020815	12.398	0.035690	12.749860	0.036796	14.754	18.346	27.043	7.122
52409	0.6582	0.01083	8.622	0.024558	15.711	0.044748	15.979653	0.045608	18.849	22.094	39.487	8.639
62409	0.7363	0.00855	17.233	0.048298	24.627	0.069024	25.301857	0.071495	29.845	33.476	79.199	13.715

TABLE W78 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER: EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
72409	0.7661	0.01125	21.326	0.059891	30.675	0.085905	32.472554	0.092337	37.299	45.096	96.429	17.785
82409	0.6980	0.01111	8.878	0.024978	19.804	0.055720	20.390975	0.056690	23.792	26.403	49.969	10.841
92409	0.6474	0.01581	7.068	0.020004	14.962	0.042289	15.288772	0.043430	17.798	21.344	32.262	8.271
102409	0.7101	0.00356	1.603	0.004555	16.773	0.047649	17.304910	0.048699	20.031	23.371	36.449	9.706
112409	0.7323	0.01156	9.409	0.026491	22.572	0.063554	23.269269	0.065587	27.145	30.146	57.294	12.642
122409	0.7765	0.00499	8.986	0.024950	33.905	0.094134	36.599936	0.102941	41.089	51.737	104.303	20.117
142409	0.4801	0.01823	5.265	0.015766	7.774	0.023280	8.333003	0.024737	9.125	12.497	14.443	4.823
152409	0.4708	0.02066	4.502	0.013376	7.007	0.020820	7.601573	0.022297	8.214	11.449	12.001	4.581
162409	0.5220	0.02635	5.789	0.017177	8.390	0.024895	8.973048	0.026439	9.813	13.378	14.669	5.221
172409	0.5533	0.03105	4.950	0.014742	7.735	0.023035	8.375416	0.024711	9.051	12.626	12.431	5.266
182409	0.5506	0.02479	6.995	0.020027	9.770	0.027970	10.266840	0.029298	11.470	15.139	18.305	5.778
192409	0.6131	0.02293	6.626	0.019064	11.657	0.033536	12.130102	0.034944	13.772	17.569	22.312	6.830
202409	0.6119	0.01182	2.583	0.007508	10.334	0.030036	10.897055	0.031620	12.147	15.975	18.341	6.430

TABLE W79 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
212409	0.5896	0.01581	2.554	0.007463	8.790	0.025690	9.455829	0.027482	10.247	14.129	14.345	5.831
10510	0.0000	0.01211	25.816	0.073401	20.929	0.059504	21.415381	0.060442	25.414	27.350	68.610	0.000
20510	0.0000	0.01325	27.627	0.078269	26.167	0.074133	27.050896	0.077572	31.906	36.385	85.023	0.000
30510	0.0000	0.01681	35.229	0.099325	29.511	0.083201	31.024237	0.088823	36.006	42.803	95.531	0.000
40510	0.0000	0.01054	21.815	0.061542	35.929	0.101360	39.378705	0.112262	43.996	56.523	114.750	0.000
50510	0.0000	0.01595	12.868	0.035338	12.543	0.034642	12.814952	0.035487	14.853	18.454	31.101	0.000
60510	0.0000	0.01823	14.764	0.040751	16.125	0.044507	16.356891	0.045182	19.220	22.562	40.462	0.000
70510	0.0000	0.01909	15.225	0.042119	18.500	0.051179	19.012855	0.051785	22.106	25.098	46.418	0.000
80510	0.0000	0.01581	12.525	0.034963	22.340	0.062365	22.999974	0.064198	26.786	29.673	56.173	0.000
10610	0.0000	0.01823	8.512	0.024931	7.416	0.021719	7.952469	0.023034	8.699	11.941	15.413	0.000
20610	0.0000	0.01781	8.155	0.023825	9.477	0.027685	9.938233	0.028911	11.170	14.700	20.074	0.000
30610	0.0000	0.02450	11.187	0.032470	12.312	0.035734	12.683174	0.036903	14.660	18.257	26.566	0.000
40610	0.0000	0.02279	10.680	0.030759	14.687	0.042301	15.031905	0.043467	17.569	21.028	32.159	0.000

TABLE W80 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
50610	0.0000	0.01766	7.687	0.022300	16.360	0.047457	16.847577	0.048640	19.629	22.903	35.371	0.000
60610	0.0000	0.02165	6.375	0.018022	8.618	0.024363	9.148422	0.025696	10.050	13.503	15.118	0.000
70610	0.0000	0.02678	7.954	0.022450	10.170	0.028716	10.656639	0.030022	11.929	15.660	19.336	0.000
80610	0.0000	0.02621	7.853	0.022249	11.421	0.032357	11.874403	0.033668	13.458	17.251	21.957	0.000
90610	0.0000	0.00655	1.959	0.005594	13.321	0.038030	13.761575	0.039444	15.784	19.572	25.877	0.000
110610	0.0000	0.02536	5.503	0.016474	6.750	0.020210	7.343604	0.021672	7.915	11.085	11.509	0.000
120610	0.0000	0.02592	6.455	0.019314	8.878	0.026565	9.451756	0.028125	10.430	14.039	15.550	0.000
130610	0.0000	0.02707	5.913	0.017648	10.016	0.029896	10.564662	0.031456	11.823	15.534	17.774	0.000
140610	0.0000	-0.01240	-2.582	-0.007789	11.463	0.034579	12.031365	0.036334	13.605	17.412	20.378	0.000
150610	0.0000	0.00953	1.526	0.004547	8.942	0.026648	9.596188	0.028450	10.466	14.330	14.607	0.000
160610	0.0000	-0.01795	-2.854	-0.008536	9.847	0.029453	10.495313	0.031309	11.571	15.532	16.197	0.000
170610	0.0000	-0.01866	-2.308	-0.006989	8.756	0.026519	9.487801	0.028581	10.232	14.325	13.482	0.000
180610	0.0000	-0.02165	-2.678	-0.007974	7.918	0.023574	8.635910	0.025500	9.232	13.117	12.059	0.000

TABLE W81 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
10710	0.0000	-0.00570	-0.505	-0.001613	6.265	0.019990	7.004972	0.021984	7.333	10.978	8.708	0.000
20710	0.0000	-0.01781	-1.595	-0.005031	7.063	0.022283	7.840050	0.024449	8.274	12.195	9.953	0.000
30710	0.0000	-0.01824	-1.637	-0.005192	7.635	0.024216	8.446813	0.026553	8.939	13.082	10.870	0.000
40710	0.0000	-0.01980	-1.155	-0.003694	5.273	0.016858	6.076106	0.018952	6.102	9.797	6.875	0.000
50710	0.0000	-0.01923	-1.128	-0.003645	5.771	0.018647	6.635608	0.021028	6.707	10.701	7.627	0.000
60710	0.0000	-0.01795	-1.075	-0.003530	6.226	0.020432	7.149940	0.023102	7.256	11.495	8.331	0.000
80710	0.0000	-0.02536	-1.058	-0.003633	4.415	0.015161	5.182495	0.017176	5.058	8.045	5.707	0.000
90710	0.0000	-0.02265	-0.953	-0.003318	4.730	0.016384	5.556236	0.018665	5.449	8.716	6.190	0.000
100710	0.0000	-0.02037	-0.854	-0.003006	4.961	0.017464	5.851034	0.020048	5.733	9.246	6.577	0.000
110710	0.0000	-0.02593	-0.878	-0.002980	3.826	0.012982	4.590051	0.014896	4.315	6.815	4.955	0.000
120710	0.0000	-0.02393	-0.818	-0.002821	4.167	0.014377	5.009740	0.016637	4.737	7.521	5.486	0.000
130710	0.0000	-0.02208	-0.763	-0.002655	4.372	0.015203	5.265405	0.017689	4.988	7.959	5.813	0.000
10810	0.0000	-0.02707	-0.648	-0.002381	3.042	0.011172	3.716735	0.012855	3.359	5.270	3.880	0.000

TABLE W82 COMPARISON OF FRICTION PRESSURE DROP DATA

TEST RUN NO	VOID FRCTN	TWO-PHASE FRICTION PRES-GRAD KN/M3	VALUES OF TWO-PHASE FRICTION MULTIPLIER EXPERIMENTAL		HOMOG MODEL		LOCK-MART		CH-MRT	BAROCZY	CHLSM	DUCKLR
20810	0.0000	-0.02834	-0.690	-0.002561	3.409	0.012658	4.165993	0.014688	3.809	5.971	4.429	0.000
30810	0.0000	-0.02148	-0.529	-0.001983	3.611	0.013540	4.438866	0.015878	4.056	6.396	4.766	0.000
40810	0.0000	-0.02609	-0.485	-0.001816	2.783	0.010428	3.477566	0.012213	3.043	4.707	3.591	0.000
50810	0.0000	-0.02461	-0.462	-0.001752	2.974	0.011271	3.731982	0.013321	3.272	5.085	3.898	0.000
60810	0.0000	-0.02050	-0.386	-0.001482	3.133	0.012039	3.947554	0.014346	3.464	5.401	4.161	0.000
70810	0.0000	-0.02854	-0.384	-0.001472	2.221	0.008516	2.840536	0.010083	2.379	3.621	2.831	0.000
80810	0.0000	-0.02764	-0.374	-0.001450	2.362	0.009149	3.024324	0.010887	2.542	3.893	3.049	0.000

TABLE W83 COMPARISON OF FRICTION PRESSURE DROP DATA

APPENDIX X FOURIER ANALYSIS AND SOME RELATED SUBJECTS

APPENDIX X FOURIER ANALYSIS AND SOME RELATED SUBJECTS

X.1 FOURIER ANALYSIS

Given a periodic function x(t) with a period T, then one can express x(t) as an infinite trigonometric series known as Fourier Series of the form,

$$x(t) = a_o + \sum_{k=1}^{\infty} \left(a_k \cos \frac{2\pi kt}{T} + b_k \frac{2\pi kt}{T}\right) \qquad \text{(X1)}$$

where a_o, a_k and b_k are constant Fourier coefficients given by

$$a_o = \frac{1}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\, dt$$

$$a_k = \frac{2}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} x(t) \cos\left(\frac{2\pi kt}{T}\right) dt \qquad k \geqslant 1 \qquad \text{(X2)}$$

$$b_k = \frac{2}{T} \int_{-\frac{T}{2}}^{\frac{T}{2}} x(t) \sin\left(\frac{2\pi kt}{T}\right) dt \qquad k \geqslant 1$$

The mathematical conditions for the convergence of equation (X1) are extremely general, however an important restriction is that at discontinuities the series gives the average value of x(t) at the disoontinuity.

When one attempts to analyse random signals, which are not periodic ($T \rightarrow \infty$) the Fourier coefficients merge together and the function x(t) can no longer be analysed into discrete frequency components. Subject to certain conditions (N4), the same approach can be adopted except that the Fourier series, equation (X1) turns into a Fourier integral and the Fourier coefficient, equation (X2) turns into a continuous function of frequency called Fourier transform.

Substituting equation (X2) into equation (X1), allowing the period $T \rightarrow \infty$, and the $\sum$ to become integral, we get,

$$x(t) = \int_{-\infty}^{\infty} A(w) \cos wt \, dw + \int_{-\infty}^{\infty} B(w) \sin wt \, dw \tag{X3}$$

where

$$A(w) = \frac{1}{2\pi} \int_{-\infty}^{\infty} x(t) \cos wt \, dt$$

$$B(w) = \frac{1}{2\pi} \int_{-\infty}^{\infty} x(t) \sin wt \, dt \tag{X4}$$

$w = 2\pi f$ is the angular frequency and f is the frequency. Defining a quantity X(w) such that

$$X(w) = A(w) - j\,B(w)$$

From equation (X4),

$$X(w) = \frac{1}{2\pi} \int_{-\infty}^{\infty} x(t)\, e^{-jwt} \, dt \tag{X5}$$

and is the Fourier transform of x(t). By a simple manipulation of equation (X3), it can be shown that

$$x(t) = \int_{-\infty}^{\infty} X(w) \; e^{jwt} \, dt \tag{X6}$$

Equations (X5) and (X6) are the continuous Fourier transform pair such that each is the inverse transform of the other.

The above development follows that of Newland (N4) which, although not completely rigorous, does point out the logic which turns a discrete Fourier series representation into a Fourier integral. An important point to notice here is that the classical Fourier analysis theory requires that

$$\int_{-\infty}^{\infty} |x(t)| \, dt < \infty$$

is satisfied for equations (X3) and (X4) to be true. For a stationary process where x(t) is defined everywhere, the above condition is not satisfied. However, by allowing generalized functions to be used, this restriction may be lifted.

The above difficulty can also be overcome by Fourier analysing the autocorrelation function $R_x(\tau)$ of the process rather than the sample function itself. The logic behind this approach is that the auto-correlation function gives information about the frequencies present in a random process indirectly. Furthermore if the random process x(t) is adjusted to give a mean value of zero (mean value subtracted from data), and that no strictly periodic component is present, then it can be shown that

$$\lim_{\tau \to \infty} R_x(\tau) = 0$$

and the condition

$$\int_{-\infty}^{\infty} |R_x(\tau)| \, d\tau < \infty$$

is satisfied.

For the case where the continuous time series is not known and only equally spaced data from a finite record length are available, then equation (X5) is reduced to (for the kth harmonic),

$$X_k = \frac{1}{T} \sum_{r=0}^{N-1} x_r \, e^{-j(\frac{2\pi k}{T}) r \Delta t} \, , \Delta t$$

where $t = r\Delta t$, and Δt is the sampling interval. Since $T = N\Delta t$, then

$$X_k = \frac{1}{N} \sum_{r=0}^{N-1} x_r \, e^{-j \frac{2\pi kr}{N}} \qquad k=0,1,\ldots N-1 \qquad \text{(X7)}$$

and consequently

$$x_r = \sum_{k=0}^{N-1} X_k \, e^{+j \frac{2\pi kr}{N}} \qquad r=0,1,\ldots N-1 \qquad \text{(X8)}$$

Equating (X7) and (X8) are the discrete Fourier transform pair.

X.2 CONVOLUTION AND CORRELATION THEOREMS

An important relationship in diverse scientific fields is the convolution integral defined as

$$y(t) = \int_{-\infty}^{\infty} x(\tau) \, h(t-\tau) \, d\tau = x(t)*h(t) \qquad \text{(X9)}$$

where (*) stands for convolution.

However a very useful and powerful result is the relationship between equation (X9) and its Fourier transform. By forming the Fourier transform of both sides of equation (X9), i.e.

$$\frac{1}{2\pi} \int_{-\infty}^{\infty} y(t)\, e^{-jwt}\, dt = \frac{1}{2\pi} \int_{-\infty}^{\infty} \left[\int_{-\infty}^{\infty} x(\tau)\, h(t-\tau)\, d\tau \right] e^{-jwt}\, dt$$

and by simple manipulation we get (B16),

$$Y(f) = H(f)\, X(f) \qquad \text{(X10)}$$

i.e. convolution in the time domain is equivalent to multiplication in the frequency domain. In other words the Fourièr transform of the cónvolution of two functions in the time domain is obtained by multiplying the two Fourier transforms of the functions.

It is also easily shown that the convolution of the two functions H(f) and X(f) in the frequency domain is equivalent to the Fourier transform of the product of the functions x(t) and h(t) in the time domain.

A closely related integral to convolution is that of the correlation (auto or cross correlation) i.e.

$$R_{xy}(\tau) = \int_{-\infty}^{\infty} x(t)\, y(t+\tau)\, dt$$

By taking the Fourier transform of both sides we arrive at (B16),

$$S_{xy}(f) = \int_{-\infty}^{\infty} R_{xy}(\tau)\, e^{-jwt}\, d \quad = X(f)\, Y(f)^{*} \qquad \text{(X11)}$$

where (*) stands for complex multiplication.

X.3 THE BOXCAR FUNCTION

The Boxcar function $u_B(t)$ is defined as

$$u_B(t) = \begin{cases} 0 & t \geqslant -\infty \\ 1 & -T \leqslant t \leqslant T \\ 0 & t \leqslant \infty \end{cases} \qquad \text{(X12)}$$

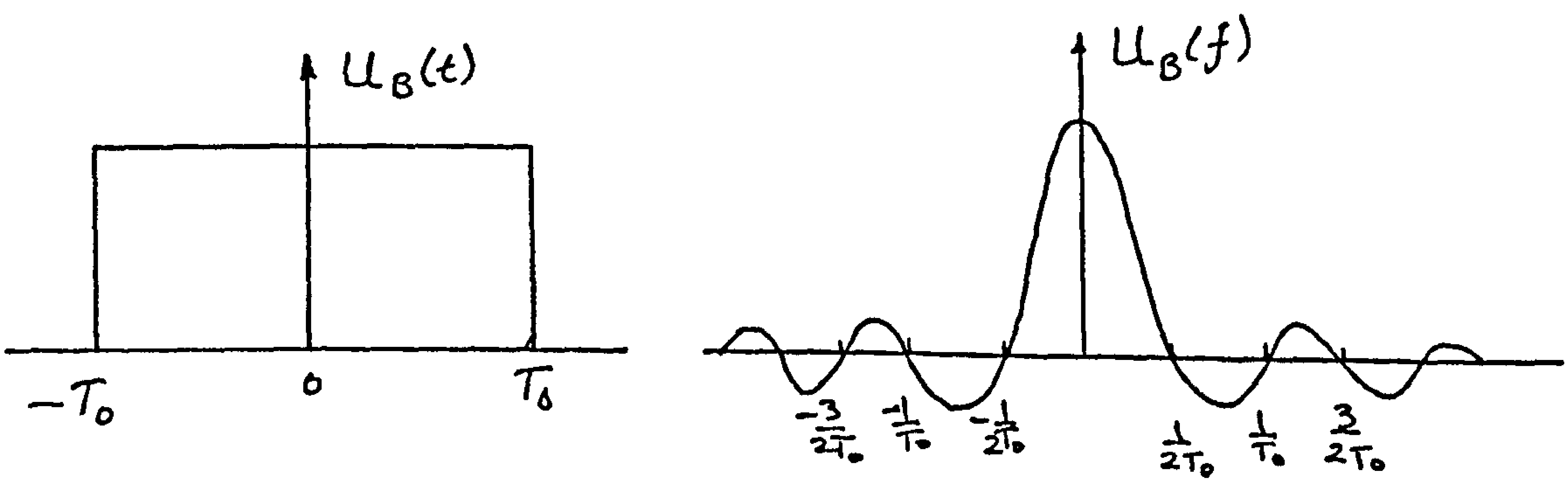
Its Fourier transform is given by

$$u_B(f) = \int_{-T}^{T} e^{-jwt}\, dt$$

$$= \int_{-T}^{T} \cos wt\, dt - j \int_{-T}^{T} \sin wt\, dt$$

$$\therefore \quad u_B(f) = 2T\,\frac{\sin wT}{wT} \qquad \text{(X13)}$$

The shape of the Boxcar fluid and its Fourier transform are shown below.



The importance of this function will be explained in the next section.

X.4 LEAKAGE

Visualise a random and stationary process x(t), which has an auto correlation function $R_x(\tau)$. The actual power density $S_x(f)$ is by definition,

$$S_x(f) = \int_{-\infty}^{\infty} R_x(\tau)\, e^{-jw\tau}\, d\tau \qquad -\infty < f < \infty \tag{X14}$$

However we only observe x(t) over the finite interval (-T,T) and hence, the observed power density $S_x(f)$ will be

$$\hat{S}_x(f) = \int_{-T}^{T} \hat{R}_x(\tau)\, e^{-jw\tau}\, d\tau \qquad -T < \tau < T \tag{X15}$$

where the hat ($\wedge$) stands for observed or predicted values of the function.

This time domain truncation is equivalent to multiplying the original infinite process x(t) by a Boxcar function $U_B(\tau)$ of the form

$$U_B(\tau) = \begin{cases} 1 & |\tau| \leqslant T \\ 0 & T \leqslant |\tau| \leqslant \infty \end{cases} \tag{X16}$$

Equation (X15) can be written over the whole range (i.e. $-\infty, \infty$) as

$$S_x(f) = \int_{-\infty}^{\infty} R_x(\tau)\, U_B(\tau)\, e^{-jw\tau}\, d\tau \tag{X17}$$

By applying the frequency convolution theorem, namely that the Fourier transform of the multiplication of two functions in the time domain is equivalent to convolving the two Fourier transforms of the functions in the frequency domain, or

$$\hat{S}_x(f) = S_x(f) * U_B(f)$$

where (*) stands for convolution, then

$$\hat{S}_x(f) = \int_{-\infty}^{\infty} S_x(f')\, U_B(f-f')\, df' \tag{X18}$$

where $\hat{S}_x(f)$ and $\mathcal{U}_B(f)$ are the Fourier transforms of the actual $R_x(f)$, and the function $\mathcal{U}_B(\tau)$ respectively. Substituting for $\mathcal{U}_B(f)$ from equation (X13) gives

$$\hat{S}_x(f) = 2 \int_{-\infty}^{\infty} S(f') \frac{\sin\left[2\pi T(f-f')\right]}{\left[2\pi T(f-f')\right]} df' \qquad \text{(X19)}$$

and the spectral estimates are modified in such a way that instead of an impulse function (vertical line) appears at the frequency f, a sin z/z function is now centred on each impulse. This effect is termed leakage.

X.5 CHI-SQUARE DISTRIBUTION

Assume that x_1, x_2, ... x_n are independent (uncorrelated) Gaussian variables with zero mean and unit variance. Define a new variable χ^2_n by

$$\chi^2_n = \sum_{i=1}^{n} x_i^2$$

then χ^2_n is obviously positive, followed by definition a chi-square distribution with n degrees of freedom. The coefficient of variation of χ^2_n, i.e. the ratio of RMS (Root mean square) deviation to average value is $(2/n)^{\frac{1}{2}}$ so that as n increases, χ^2_n becomes relatively less variable. A convenient description of the stability of any positive estimate is its equivalent number of degrees of freedom, n of that χ^2_n some multiple of which it resembles. Hence

$$n = \frac{2(\text{average})^2}{\text{variance}} = \frac{2}{(\text{coefficient of variation})^2}$$

If N samples of a process x_i are used to calculate the sample variance σ^2, then the probability is (1-p) that the true variance is between two limits,

$$B_1 \leqslant \sigma^2 \leqslant B_2$$

where the limits B_1 and B_2 are defined by

$$B_1 = \frac{n\,\sigma^2}{\chi^2_{n,\,1-\frac{h}{2}}} \qquad h = 1-p$$

$$B_2 = \frac{n\;{}^{2}}{\chi^2_{n,\,\frac{h}{2}}} \qquad n = N-1 \tag{X20}$$

The interval (B_1, B_2) is referred to as the confidence interval and one speaks of (1-p)100% confidence interval.

The main use of this distribution in time series analysis is in discussing the variability of the sample variance and the power spectral density estimates.

X.6 USEFUL RELATIONSHIPS FOR USE WITH DIGITAL COMPUTERS

Let x_i be the ith data point in a record which contains N data points. Then

(i) the mean $\bar{x} = \frac{1}{N} \sum_{i=0}^{N-1} x_i$ (X21)

(ii) the variance $\sigma^2 = \frac{1}{N} \sum_{i=0}^{N-1} (x_i - \bar{x})^2$ (X22)

and is a biased estimate. The unbiased estimate is

$$\sigma^2 = \frac{1}{N-1} \sum_{i=0}^{N-1} (x_i - \bar{x})^2 \tag{X23}$$

which is almost the same as equation (X22) for large N. The standard deviation is simply σ.

(iii) if the total number of data points found to lie in the interval $(x_o, x_o+\Delta x)$ is n_o, then the probability that x_i will have a value in this range is

$$P(xo) = \frac{n_o}{N} \qquad (X24)$$

and the probability density function is, by definition,

$$p(xo) = \frac{1}{\Delta x}\frac{n_o}{N} \qquad (X25)$$

(iv) to calculate the power spectral density, the mean should be calculated as in (i) and removed from the data, i.e.

$$x_i \Big|_{new} = x_i \Big|_{old} - \bar{x} \qquad (X26)$$

If another record y_i is to be cross correlated to x_i, the mean value $\bar{y}$ should also be calculated and removed.

A - The Blackman-Tukey method

(A1) the sample autocorrelation function of x_i is computed for (m+1) lag values, i.e.

$$R_{xr} = \frac{1}{N-r}\sum_{i=1}^{N-r} x_i\, x_{i+r} \qquad r=0,1,\ldots m \qquad (X27)$$

the value of m is determined by the bandwith required and statistical reliability.

For the cross spectra we get

$$R_{xyr} = \frac{1}{N-r}\sum_{i=1}^{N-r} x_i\, y_{i+r} \qquad (X28)$$

$$R_{yxr} = \frac{1}{N-r}\sum_{i=1}^{N-r} y_i\, x_{i+r} \qquad r=0,1,\ldots m \qquad (X29)$$

(A2) An appropriate lag window is selected such as

Hanning $\quad {}_1u_{mr} = 0.5 + 0.5 \cos \frac{\pi r}{m} \qquad r=0,1,..m$

$\qquad\qquad\qquad = 0 \qquad\qquad\qquad\qquad r > m$ (X30)

Hamming $\quad {}_2u_{mr} = 0.54 + 0.46 \cos \frac{\pi r}{m} \qquad r=0,1,..m$

$\qquad\qquad\qquad = 0 \qquad\qquad\qquad\qquad r > m$ (X31)

Parzen $\quad {}_3u_{mr} = (1 - 6 \frac{r}{m})^2 (1 - \frac{r}{m}) \qquad r < m/2$

$\qquad\qquad\qquad = 2(1 - \frac{r}{m})^3 \qquad r \geqslant m/2$

$\qquad\qquad\qquad = 0 \qquad\qquad\qquad r > m$ (X32)

and applied to equations (X27) or equations (X28) and (X29). The result is a modified correlation function, or

$$\tilde{R}_{xr} = R_{xr} \cdot {}_{\ell}u_{mr} \tag{X33}$$

and for the cross spectra

$$\tilde{R}_{xyr} = R_{xyr} \cdot {}_{\ell}u_{mr} \tag{X34}$$

$$\tilde{R}_{yxr} = R_{yxr} \cdot {}_{\ell}u_{mr} \qquad r=0,1,...m \tag{X35}$$

the value of ℓ could be 1, 2 or 3.

(A3) The power spectral density is calculated using trapezoidal integration,

$$\hat{S}_{xk} = 2\Delta t\left[\tilde{R}_{xo} + 2\sum_{r=1}^{m-1} \tilde{R}_{xr} \cos \frac{\pi rk}{m} + \tilde{R}_{xm} \cos \pi k\right] \qquad k=0,1,...m \tag{X36}$$

and the corresponding set of frequencies is

$$f_k = \frac{k}{2m\Delta t} \qquad k = 0, 1, \ldots m \tag{X37}$$

For the cross spectra, we first calculate

$$A_{xyr} = \tilde{R}_{xyr} + \tilde{R}_{yxr} \tag{X38}$$

$$B_{xyr} = \tilde{R}_{xyr} - \tilde{R}_{yxr} \qquad r = 0, 1, \ldots m \tag{X39}$$

The cospectra C_{xyk} (real part of S) and quadspectra Q_{xyk} (imaginary part of S) are calculated by

$$\hat{C}_{xyk} = \Delta t (A_{xy_o} + 2 \sum_{r=1}^{m-1} A_{xyr} \cos \frac{\pi rk}{m} + A_{xym} \cos \pi k) \tag{X40}$$

$$Q_{xyk} = \Delta t (B_{xy_o} + 2 \sum_{r=1}^{m-1} B_{xyr} \sin \frac{\pi rk}{m} + B_{xym} \sin \pi k) \tag{X41}$$

and the corresponding set of frequencies are,

$$f_k = \frac{k}{2m\Delta t} \qquad k = 0,\ 1,\ ,\ldots\ m \tag{X42}$$

There are various ways of displaying the results for the cross spectra, in terms of

(a) the modulus

$$|\hat{S}_{xy}| = \left[\hat{C}_{xyk}^{\,2} + \hat{Q}_{xyk}^{\,2} \right]^{\frac{1}{2}} \tag{X43}$$

(b) the phase angle (in radians),

$$\hat{\theta}_{xyk} = -\arctan\left[\frac{Q_{xyk}}{C_{xyk}}\right] \tag{X44}$$

A normalising procedure could be adopted. For the calculations carried in this project the power in the band ($o < f < f_c$) was normalised such that the total power sums to 100.

(A4) The same result may be obtained by deleting step (A2). Instead a smoothing procedure is applied after equation (X36) or equations (X40) and (X41), which consists of weighing (averaging) the power spectral estimates in the manner given by equation (7.18). For the parzen window the smoothing is simply done by multiplying the estimates by the function

$$_3U_k(f) = \frac{3}{4} m \frac{\text{Sin}\left[\frac{\pi}{2} m \left(\frac{k}{m}\right)\right]}{\left[\frac{\pi}{2} m \frac{k}{m}\right]} , \quad k = 0, 1, \ldots m \tag{X45}$$

B - The FFT Method

(B1) Modify the record x_i such that $N = 2^p$, where p is an integer. This could be achieved by truncation or by adding zeros to one end of the record. Calculate the mean and remove it from the data. For cross spectra, the same is carried on y_i such that the two record lengths are equal.

(B2) Apply an appropriate window as in (A2). The tapering procedure by Bingham et al (B19) is recommended, i.e.

$$
{}_4U_{Nr} = \begin{cases} \frac{1}{2}\left[1 - \cos\frac{\pi r}{0.1N}\right] & 0 \leqslant r \leqslant 0.1N \\ 1 & 0.1N < r < 0.9N \\ \frac{1}{2}\left[1 - \cos\frac{(N-r)}{0.1\ N}\right] & 0.9N \leqslant r \leqslant N \\ 0 & r > N \end{cases} \qquad \text{(X46)}
$$

(B3) Compute the Fourier transform of the complex data sequence z_i to give

$$
Z_k = \frac{1}{N}\sum_{i=0}^{N-1} z_i \ e^{-j\frac{2\pi nk}{N}} \qquad n = 0, 1, \ldots N-1 \qquad \text{(X47)}
$$

For auto spectra, the actual data is put into the real part of Z_i, while zeros are put into the imaginary part, or

$$
\tilde{Z}_{xk} = \frac{1}{N}\sum_{i=0}^{N-1} (x_i + j0) e^{-j\frac{2\pi nk}{N}} \qquad n=0, 1, ..N-1
$$

$$
= \tilde{X}_k \qquad \text{(X48)}
$$

For the cross spectra, one function say x_i is put into the real part while the other function, say y_i is put into the imaginary part, or

$$
\tilde{Z}_{xyk} = \sum_{i=0}^{N-1} (x_i + i\ y_i)\ e^{-j\frac{2\pi nk}{N}} \qquad n=0, 1, ..N-1
$$

$$
= \tilde{X}_k + j\ \tilde{Y}_k \qquad \text{(X49)}
$$

(B4) If step (B2) was deleted, apply one of the smoothing procedures discussed above in (A4). The net result is a modified Fourier transform X_k and Y_k.

(B5) The raw power spectral density is given by

$$\hat{S}_{xk} = \frac{2\Delta t}{N}\left[\tilde{X}_k \tilde{X}_k^*\right] \qquad k = 0, 1, \ldots N-1 \qquad (X50)$$

For the cross spectra

$$\tilde{S}_{xyk} = \frac{2\Delta t}{N}\left[\tilde{X}_k \tilde{Y}_k^*\right] \qquad (X51)$$

$$= \tilde{C}_{xyk} - j\,\tilde{Q}_{xyk} \qquad k = 0, 1, \ldots N-1$$

where (*) stands for complex multiplication and $\tilde{C}_{xyk}$ and $\tilde{Q}_{xyk}$ are the cospectra and quadspectra respectively.

The forresponding set of frequencies are

$$f_k = \frac{k}{N\Delta t} \qquad k = 0, 1, \ldots N-1 \qquad (X52)$$

(B6) These estimates are smoothed (averaged) again over, say M points, to increase statistical reliability, or

$$\hat{S}_{xk} = \frac{1}{M}\sum_{\ell=1}^{M} \tilde{S}_{x(k+\ell)} \qquad k=0, 1, \ldots N-1 \qquad (X53)$$

For the cross spectra

$$\hat{S}_{xyk} = \frac{1}{M}\sum_{\ell=1}^{M} \tilde{S}_{xy(k+\ell)} \qquad k=0, 1, \ldots N-1$$

$$= \frac{1}{M}\sum_{\ell=1}^{M} \tilde{C}_{xy(k+\ell)} - j\sum_{=1}^{M} \tilde{Q}_{xy(k+\ \ )}$$

$$= \tilde{C}_{xyk} - j\,\tilde{Q}_{xyk} \qquad (X54)$$

and the corresponding set of frequencies are

$$f_k = \frac{1}{2}\left(\frac{kM}{N\Delta t}\right) \qquad k=1, 2, \ldots N \qquad (X55)$$

For the cross spectra, the results could be displayed as, in terms of the modulus,

$$\left| \hat{S}_{xyk} \right| = \left[\hat{C}_{xyk}^{\,2} + \hat{Q}_{xyk}^{\,2} \right]^{\frac{1}{2}} \tag{X56}$$

or in terms of the phase angle,

$$\hat{\Theta}_{xyk} = - \arctan \left[\frac{\hat{Q}_{xyk}}{\hat{C}_{xyk}} \right] \tag{X57}$$

or both.

X.7 NARROW BAND PROCESS

Also known as band limited process; in which the process is limited to a narrow band of frequencies. A band limited white noise is, by definition, a random process with constant power density, or

$$\begin{aligned} S_x(f) &= a \qquad 0 \leq f_o - \frac{B}{2} \leq f \leq f_o + \frac{B}{2} \\ &= 0 \qquad \text{otherwise} \end{aligned} \tag{X58A}$$

where f_o is the centre frequency, B is the bandwidth and 'a' is a constant.

The autocorrelation function is

$$R_x(\quad) = \int_0^{\infty} S(f) \cos 2\pi f\tau \; df \tag{X59A}$$

$$= \int_{f_o-\frac{B}{2}}^{f_o+\frac{B}{2}} a \cos 2\pi f\tau \; df = a\,B \left(\frac{\sin \pi B\tau}{\pi B \tau} \right) \cos 2\pi f_o \tau$$

For the special case where $f_o = B/2$, then the above equations become

$$S_x(f) = a \qquad 0 \leq f \leq B$$
$$= 0 \qquad \text{otherwise} \tag{X58B}$$

and

$$R_x(\tau) = aB\left(\frac{\sin 2\pi B\tau}{2\pi B\tau}\right) \tag{X59B}$$

Hence the autocorrelation of a band limited white noise is expected to show the familiar sin z/z behaviour. Obviously the same results are obtained for the cross-correlation function if the cross power density obeys the conditions of equation (X58).

COMPUTER PROGRAMS USED

(i) Power Density Calculation Program for Pressure Signals

Nomenclature

ISKIPØ, ISKIPI ISKPCR, ISKPCN ISKPTH	Parameters calculated in Subroutine 'PLOT' to facilitate plotting the results by line printer.
XREALØ, XIMAGØ	Real and imaginary parts of the first signal, also its Fourier transform later.
XREAL, XIMAG	Real and imaginary part of the second signal, also its Fourier transform later.
XXCR, YYCR	Real and imaginary parts of the unsmoothed power density
THETA	Phase angle
TMLAG	Time Lag
VCRCOR	Cross correlation coefficients
N, NU	Total no. of points truncated later to $N = 2^{NU}$
VØ, VI	Smoothed power density estimates for the first signal and the second signal

VCR Smoothed cross power density

MN Number of power density terms calculated

SUBROUTINE CROSCOR : used to calculate cross correlation coefficients.

(ii) Power Density and Probability Density Calculation Program for Void Fraction Signal

The program (i) was used with SUBROUTINE PDFVOID for carrying the probability density calculations. Important parameters are explained in the program.

(iii) Probability Density Calculation for Pressure

Important parameters are explained in the program.

Listing of the Programs

(i)

```
      PROGRAM(FAST)
      INPUT 5=CRØ
      OUTPUT6=LPØ
      END
      MASTER FAST
C
C     THIS PROGRAM READS DATA FROM A FILE,CONVERTS IT
C     INTO A ZERO MEAN DATA,FOURIER TRANSFORM IT ,THEN
C     WINDOW THE RESULTS TO REDUCE LEAKAGE. SMOOTHING
C     IS THEN PERFORMED OVER A PRE-SELECTED NUMBER OF
C     POINTS. THE POWER DENSITY RESULTS ARE THEN PLOTTED
C      VS FREQUENCY USING THE LINE PRINTER.
C
      DIMENSION VØ(6ØØ),V1(6ØØ),VCR(6ØØ),ISKIPØ(6ØØ),ISKIP1(6ØØ)
     1,ISKPCR(6ØØ),XREALØ(5ØØØ),XIMAGØ(5ØØØ),XXCR(41ØØ),
     2YYCR(41ØØ),THETA(6ØØ),ISKPTH(6ØØ),VCRCOR(6ØØ),
     3ISKPCN(6ØØ),TMLAG(6ØØ),XREAL(5ØØØ),XIMAG(5ØØØ)
      COMMON FF(6ØØ),N,KI,MH,KN,KL,
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,NTH,NCR,PI
      DATA IDASH/1H-/,ISTAR/1H*/,ISPACE/1H /
      PI=3.14159265
C
C     THE COUNTERS NCR ,KN,KL,AND NTH CONTROLS THE EXCUTION
C     OF CERTAIN  STATEMENTS IN SUBSEQUENT SUBROUTINES .
C
```

```
      MH=17Ø
      MH=MH+1
      KN=1
      KL=Ø
      NTH=Ø
      NCR=Ø
10    CALL READF(XREALØ,XIMAGØ,5ØØØ)
      NØ=N
      NUØ=NU
      CALL READF(XREAL,XIMAG,5ØØØ)
      IF(NØ.LT.N)N=NØ
      IF(NØ.LT.N)NU=NUØ
      WRITE(6,15)
15    FORMAT(15X,'THE NEW AVERAGE AND TOTAL NO. OF POINTS',
     1' FOR PØ-DATA',//)
      CALL AVERG(XREALØ,5ØØØ)
      WRITE(6,25)
25    FORMAT(15X,'THE NEW AVERAGE AND TOTAL NO. OF POINTS'
     1,' FOR P1-DATA',//)
      CALL AVERG(XREAL,5ØØØ)
      CALL CROSCOR(VCRCOR,TMLAG,6ØØ,XREALØ,XREAL,5ØØØ)
      CALL CROSCOR(VCR,TMLAG,6ØØ,XREAL,XREALØ,5ØØØ)
      GO TO 5
      IF(KN.GT.Ø)GO TO 95
      CALL FFT(XREALØ,XIMAGØ,5ØØØ)
95    CALL WINDOW(XREALØ,XIMAGØ,5ØØØ)
      IF(KN.LT.1)GO TO 1ØØ
      CALL FFT(XREALØ,XIMAGØ,5ØØØ)
1ØØ   IF(KN.GT.Ø) GO TO 1Ø5
      CALL FFT(XREAL,XIMAG,5ØØØ)
1Ø5   CALL WINDOW(XREAL,XIMAG,5ØØØ)
      IF(KN.LT.1)GO TO 11Ø
      CALL FFT(XREAL,XIMAG,5ØØØ)
11Ø   DO 2Ø I=1,N
      XXCR(I)=XREAL(I)*XREALØ(I)+XIMAG(I)*XIMAGØ(I)
      YYCR(I)=XREAL(I)*XIMAGØ(I)-XREALØ(I)*XIMAG(I)
2Ø    CONTINUE
      CONST=2.Ø/(F*FLOAT(N))
C
C     SETTING A FREQUENCY BAND FOR SMOOTHING
C     ,E.G.'W'.CALCULATING NO. OF POINTS ON
C     WHICH SMOOTHING IS TO BE PERFORMED,E.G.'FR'.
C
      SS=1Ø.Ø
      FX=F/FLOAT(N)
      W=SS*FX
      FR=W/FX
      MN=(N/(IFIX(FR))/2
      IF(MN.GT.MH.OR.MN.LT.MH)MN=MH
      CALL SMOOTH(V1,6ØØ,XREAL,XIMAG,5ØØØ)
      CALL SMOOTH(VØ,6ØØ,XREALØ,XIMAGØ,5ØØØ)
      CC=36Ø.Ø/PI
      DO 3Ø I=1,N
      XREAL(I)=XXCR(I)
      XIMAG(I)=YYCR(I)
      XXCR(I)=CC*ATAN(XIMAG(I)/XREAL(I))
      YYCR(I)=Ø.Ø
3Ø    CONTINUE
      NCR=1
      CALL SMOOTH(VCR,6ØØ,XREAL,XIMAG,5ØØØ)
      NTH=1
      CALL SMOOTH(THETA,6ØØ,XXCR,YYCR,41ØØ)
```

```
      DO 165 I=1,MN
      J=IFIX(FR/2.Ø)*(I-1)
      FF(I)=(FLOAT(J)+(SS/2.Ø))*FX
165   CONTINUE
      CALL PLOT(VØ,ISKIPØ,6ØØ,MN,WMAXVØ,WMINVØ,45.Ø)
      CALL PLOT(V1,ISKIP1,6ØØ,MN,WMAXV1,WMINV1,45.Ø)
      CALL PLOT(VCR,ISKPCR,6ØØ,MN,WMAXCR,WMINCR,45.Ø)
      CALL PLOT(THETA,ISKPTH,6ØØ,MN,WMAXTH,WMINTH,45.Ø)
C
C     PLOTTING THE POWER DENSITY VS FREQNCY RESULTS
C     FOR PØ AND P1 DATA,USING LINE PRINTER.
C
      WRITE(6,35)
35    FORMAT(1H1,/,3X,'PWR PØ',1X,'FRQCY',5X,'POWER ',
     1'DENSTY VS FRQNCY FOR PØ-5 DATA',1ØX,'PWR P1',6X,'POWER ',
     2'DENSTY VS FRQNCY FOR P1-5 DATA',//)
      DO 45 I=1,MN
      NSKIP=47-ISKIPØ(I)
      WRITE(6,4Ø)VØ(I),FF(I),(IDASH,J=1,ISKIPØ(I)),ISTAR,
     1(ISPACE,JK=1,NSKIP),V1(I),(IDASH,K=1,ISKIP1(I)),ISTAR
4Ø    FORMAT(1X,F7.2,F7.3,1X,48A1,F7.2,2X,47A1)
45    CONTINUE
C
C     PLOTTING THE CROSS POWER DENSITY VS FREQNCY,
C     ALSO THE PHASE ANGLE VS FREQNCY,USING LINE PRINTER.
C
      WRITE(6,5Ø)
5Ø    FORMAT(1H1,/,2X,'CS PWR',1X,'FRQCY',4X,'CROSS '
     1,'SPECTRA VS FRQNCY OF PØ AND P1',9X,
     2'PHS ANGL',8X,'PHASE ANGL VS FRQNCY',//)
      IF(WMINTH.LT.Ø.Ø)GO TO 7Ø
      DO 55 I=1,MN
      NSKIP=47-ISKPCR(I)
      WRITE(6,6Ø)VCR(I),FF(I),(IDASH,J=1,ISKPCR(I)),ISTAR
     1,(ISPACE,JK=1,NSKIP),THETA(I),
     2(IDASH,J=1,ISKPTH(I)),ISTAR
55    CONTINUE
      GO TO 75
7Ø    WSCALE=45.Ø/(WMAXTH-WMINTH)
      DO 75 I=1,MN
      NSKIP=47-ISKPCR(I)
      NZERO=IFIX(ABS(WMINTH)*WSCALE)
      IF(THETA(I).GT.Ø)GO TO 8Ø
      NZRSKP=NZERO-ISKPTH(I)+1
      IF(ISKPTH(I).LT.1)NZRSKP=NZERO
      WRITE(6,6Ø)VCR(I),FF(I),(IDASH,J=1,ISKPCR(I)),ISTAR
     1,(ISPACE,JK=1,NSKIP),THETA(I),(ISPACE,KL=1,NZRSKP)
     2,ISTAR,(IDASH,KJ=1,ISKPTH(I))
      GO TO 75
8Ø    NZERO=NZERO+1
      WRITE(6,6Ø)VCR(I),FF(I),(IDASH,J=1,ISKPCR(I)),ISTAR
     1,(ISPACE,JK=1,NSKIP),THETA(I),(ISPACE,K=1,NZERO)
     2,(IDASH,KJ=1,ISKPTH(I)),ISTAR
75    CONTINUE
6Ø    FORMAT(1X,F6.2,F7.3,1X,48A1,F7.2,1X,48A1)
C
C     PLOTTING THE CROSS CORRELATION FUNCTION AND THE
C     CROSS POWER DENSITY FUNCTION,THE LATTER IS
C     TERMINATED AT FREQUENCY LESS THAN 1Ø CPS.
C
5     CALL PLOT(VCRCOR,ISKPCN,6ØØ,MH,WMAXCN,WMINCN,43.Ø)
      CALL PLOT(VCR,ISKPCR,6ØØ,MH,WMAXCR,WMINCR,43.Ø)
      WRITE(6,125)
125   FORMAT(1H1,/,1X,'CS PWR',1X,'FRQCY',4X,'CROSS ',
     1'SPECTRA VS FRQNCY OF  PØ AND P1',6X,'CRS COR',
     21X,'LAGG',8X,'CROSS CORLN FUNCTION OF PØ AND P1',//)
```

```
      IF(WMINCN.LT.0.0)GO TO 150
      DO 130 I=1,MH
      NSKIP=45-ISKPCR(I)
      WRITE(6,140)VCR(I),FF(I),(IDASH,J=1,ISKPCR(I)),ISTAR,
     1(ISPACE,JK=1,NSKIP),VCRCOR(I),TMLAG(I),
     2(IDASH,J=1,ISKPCN(I)),ISTAR
140   FORMAT(1X,F5.2,F7.3,1X,46A1,F7.3,F6.3,1X,46A1)
130   CONTINUE
      GO TO 155
150   WSCALE=43.0/(WMAXCN-WMINCN)
      DO 155 I=1,MH
      NSKIP=45-ISKPCR(I)
      NZERO=IFIX(ABS(WMINCN)*WSCALE)
      IF(VCRCOR(I).GT.0)GO TO 160
      NZRSKP=NZERO-ISKPCN(I)+1
      IF(ISKPCN(I).LT.1)NZRSKP=NZERO
      WRITE(6,140)VCR(I),FF(I),(IDASH,J=1,ISKPCR(I)),ISTAR,
     1(ISPACE,JK=1,NSKIP),VCRCOR(I),TMLAG(I),(ISPACE,K=1,NZRSKP)
     2,ISTAR,(IDASH,KJ=1,ISKPCN(I))
      GO TO 155
160   NZERO=NZERO+1
      WRITE(6,140)VCR(I),FF(I),(IDASH,J=1,ISKPCR(I)),
     1ISTAR,(ISPACE,JK=1,NSKIP),VCRCOR(I),TMLAG(I),(ISPACE,
     2K=1,NZERO),(IDASH,KJ=1,ISKPCN(I)),ISTAR
155   CONTINUE
      STOP
      END
      SUBROUTINE READF(XREALF,XIMAGF,IN)
C
C     THIS SUBROUTINE READS DATA FROM A FILE,CONVERTS IT
C     INTO ZERO MEAN DATA. TRUNCATE THE DATA SO THAT
C     THE NUMBER IS A MULTIPLE OF  2 .
C
      DIMENSION IP(20),XREALF(IN),XIMAGF(IN)
      COMMON FF(600),N,KI,MH,KN,KL,
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,NTH,NCR,PI
      WRITE(6,100)
100   FORMAT(1H1,7X,'TOTLE NO',5X,'PATERN',4X,'IBV',
     17X,'IBX',4X,'CONFTR',6X,'RPS',/)
      READ(5,200)N,KI,IBV,IBX,CONFTR,F
      WRITE(6,110)N,KI,IBV,IBX,CONFTR,F
110   FORMAT(4X,4I10,2F10.2,////)
200   FORMAT(4I0,2F0.0)
      PT=0.0
      MM=N/15
      N=MM*15
      KK=0
C
C     READING DATA FROM MM X 15 MATRIX,CONVERTING INTO
C     N X 1 MATRIX,CALCULATING THE AVERAGE.WRITING DATA
C     IN MM X 15 MATRIX.PRINT OUT THE AVERAGE AND KK.
C
      DO 20 J=1,MM
      READ(5,210)(IP(I),I=1,15)
      DO 30 K=1,15
      KK=KK+1
      XREALF(KK)=FLOAT(IP(K))
      XIMAGF(KK)=0.0
      PT=PT+XREALF(KK)
30    CONTINUE
20    CONTINUE
210   FORMAT(15I0)
```

```
      PAV=PT/FLOAT(KK)
      WRITE(6,120)(XREALF(I),I=1,KK)
120   FORMAT(15F6.0)
      WRITE(6,40)
40    FORMAT(////,23X,'AVERAGE',4X,'TOTL NO. OF POINTS',/)
      WRITE(6,130)PAV,KK
130   FORMAT(/,20X,F10.2,4X,I10,////)
C
C     DATA IS TRUNCATED SO THAT TOTAL NO OF POINTS
C     IS A MULTIPLE OF 2 ,OR N=2**NU.
C
      IF(N.GE.4096)GO TO 50
      N=2048
      NU=11
      GO TO 55
50    N=4096
      NU=12
55    CONTINUE
      RETURN
      END
      SUBROUTINE AVERG(XREALF,IN)
C
C     THIS SUBROUTINE CONVERTS 'FINITE MEAN' DATA OF P
C     INTO 'ZERO MEAN' DATA OF P OR OF (P-PAV)**2 ,DEPENDING
C     WHETHER KL IS ZERO OR ONE RESPECTIVELY .
C
      DIMENSION XREALF(IN)
      COMMON FF(600),N,KI,MH,KN,KL,
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,NTH,NCR,PI
      PT=0.0
      DO 50 J=1,N
      PT=PT+XREALF(J)
50    CONTINUE
      PAV=PT/FLOAT(N)
      WRITE(6,55)PAV,N,NU
55    FORMAT(////,20X,F10.2,2(4X,I10),////)
      PT=0.0
      DO 40 J=1,N
      XREALF(J)=XREALF(J)-PAV
      IF(KL.LT.1)GO TO 40
      XREALF(J)=XREALF(J)**2
      PT=PT+XREALF(J)
40    CONTINUE
      IF(KL.LT.1)GO TO 45
      P2AV=PT/FLOAT(N)
      DO 45 I=1,N
      XREALF(I)=XREALF(I)-P2AV
45    CONTINUE
      RETURN
      END
      SUBROUTINE FFT(XREALF,XIMAGF,IN)
C
C     THIS SUBROUTINE AND THE FOLLOWING FUNCTION DO THE
C      ''FAST FOURIER TRANSFORMATION '' OF THE DATA.
C     REF: E.O.BRIGHAM,'THE FAST FOURIER TRANSFORM',
C     PRENTICE - HALL PUBLICATION, 1974 .
C
      DIMENSION XREALF(IN),XIMAGF(IN)
      COMMON FF(600),N,KI,MH,KN,KL,
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,NTH,NCR,PI
      N2=N/2
      NU1=NU-1
```

```
      K=0
      DO 100 L=1,NU
102   DO 101 I=1,N2
      KE=K/(2**NU1)
      P=IBITR(KE,NU)
      ARG=6.2831853*P/FLOAT(N)
      C=COS(ARG)
      S=SIN(ARG)
      K1=K+1
      K1N2=K1+N2
      TREAL=XREALF(K1N2)*C+XIMAGF(K1N2)*S
      TIMAG=XIMAGF(K1N2)*C-XREALF(K1N2)*S
      XREALF(K1N2)=XREALF(K1)-TREAL
      XIMAGF(K1N2)=XIMAGF(K1)-TIMAG
      XREALF(K1)=XREALF(K1)+TREAL
      XIMAGF(K1)=XIMAGF(K1)+TIMAG
101   K=K+1
      K=K+N2
      IF(K.LT.N)GO TO 102
      K=0
      NU1=NU1-1
100   N2=N2/2
      DO 103 K=1,N
      KX=K-1
      I=IBITR(KX,NU)+1
      IF(I.LE.K)GO TO 103
      TREAL=XREALF(K)
      TIMAG=XIMAGF(K)
      XREALF(K)=XREALF(I)
      XIMAGF(K)=XIMAGF(I)
      XREALF(I)=TREAL
      XIMAGF(I)=TIMAG
103   CONTINUE
      RETURN
      END
      FUNCTION IBITR(J,NU)
      J1=J
      IBITR=0
      DO 200 I=1,NU
      J2=J1/2
      IBITR=IBITR*2+(J1-(2*J2))
200   J1=J2
      RETURN
      END
      SUBROUTINE WINDOW(XREALF,XIMAGF,IN)
C
C     THIS SUBROUTINE DOES EITHER SMOOTHING OF THE RESULTS
C     AFTER TRANSFORMATION,HAMMING WINDOW IS BEING USED
C     AS CAN BE SEEN FROM THE VALUES OF  AA  AND  BB ,
C     OR WINDOW THE INPUT DATA USING COSINE TAPER
C     FUNCTION, DEPENDING ON THE VALUE OF  KN  ,WHETHER
C     ZERO OR ONE , RESPECTIVELY .
C
      DIMENSION XREALF(IN),XIMAGF(IN)
      COMMON FF(600),N,KI,MH,KN,KL,
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,NTH,NCR,PI
      IF(KN.GT.0)GO TO 100
      AA=0.54
      BB=0.23
      LL=N-1
      XREALF(1)=AA*XREALF(1)+2.0*BB*XREALF(2)
      XREALF(N)=AA*XREALF(N)+2.0*BB*XREALF(LL)
      XIMAGF(1)=AA*XIMAGF(1)+2.0*BB*XIMAGF(2)
      XIMAGF(N)=AA*XIMAGF(N)+2.0*BB*XIMAGF(LL)
```

```
      DO 200 I=2,LL
      K=I+1
      J=I-1
      XREALF(I)=BB*(XREALF(J)+XREALF(K))+AA*XREALF(I)
      XIMAGF(I)=BB*(XIMAGF(J)+XIMAGF(K))+AA*XIMAGF(I)
200   CONTINUE
      GO TO 250
100   NN=N/10
      LL=N-NN
      II=1
50    DO 150 I=II,NN
      J=I-1
      AA=(SIN(5.0*PI*FLOAT(J)/FLOAT(N)))**2
      XREALF(I)=XREALF(I)*AA
150   CONTINUE
      IF(NN.GT.N)GO TO 250
      II=LL
      NN=N+1
      GO TO 50
250   CONTINUE
      RETURN
      END
      SUBROUTINE SMOOTH(V,IL,XREALF,XIMAGF,IN)
C
C     THIS SUBROUTINE DOES THE SMOOTHING ,I.E., AVERAGING
C     OF THE RESULTS OVER A GIVEN NUMBER OF POINTS .
C
      DIMENSION V(IL),XREALF(IN),XIMAGF(IN)
      COMMON FF(600),N,KI,MH,KN,KL,
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,NTH,NCR,PI
      IF=IFIX(FR)
      IF(NTH.GT.0)GO TO 400
      DO 350 I=1,N
      XREALF(I)=XREALF(I)**2+XIMAGF(I)**2
      IF(NCR.GT.0)GO TO 350
      XREALF(I)=CONST*XREALF(I)
350   CONTINUE
400   PTT=0.0
      DO 250 I=1,MN
      PT=0.0
      K=IFIX(FR/2.0)*(I-1)
      DO 300 J=1,IF
      KK=J+K
      PT=PT+XREALF(KK)
300   CONTINUE
      V(I)=PT/FLOAT(IF)
      PTT=PTT+V(I)
250   CONTINUE
      IF(NTH.GT.0)GO TO 150
      DO 150 I=1,MN
      V(I)=V(I)/PTT
      V(I)=V(I)*100.0
150   CONTINUE
      RETURN
      END
      SUBROUTINE PLOT(V,ISKIP,LI,MN,WMAX,WMIN,WIDTH)
C
C     THIS SUBROUTINE DETERMINES THE SIZE OF THE PLOT,
C     AND THE COORDINATE OF EACH POINT .
C
      DIMENSION V(LI),ISKIP(LI)
      WMAX=0.0
      WMIN=0.0
```

```
      DO 35 I=1,MN
      IF(V(I).GT.WMAX)WMAX=V(I)
      IF(V(I).LT.WMIN)WMIN=V(I)
35    CONTINUE
      WSCALE=WIDTH/(WMAX-WMIN)
      IF(WMIN.LT.Ø.Ø)GO TO 65
      DO 25 I=1,MN
      ISKIP(I)=IFIX((V(I)-WMIN)*WSCALE)+1
25    CONTINUE
      GO TO 45
65    DO 45 I=1,MN
      ISKIP(I)=IFIX(ABS(V(I))*WSCALE)
45    CONTINUE
      RETURN
      END
      SUBROUTINE CROSCOR(VCRCOR,TMLAG,IN,XREALF,XREALP,IM)
      DIMENSION VCRCOR(IN),XREALF(IM),XREALP(IM),TMLAG(IN)
      COMMON FF(6ØØ),N,KI,MH,KN,KL,
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,NTH,NCR,PI
      PTT=Ø.Ø
      DO 5 J=1,MH
      PP=Ø.Ø
      K=J-1
      NN=N-K
      DO 1Ø I=1,NN
      LL=I+K
      PJ=XREALF(I)*XREALP(LL)
      PP=PP+PJ
1Ø    CONTINUE
      A=1.Ø/(FLOAT(N-K))
      VCRCOR(J)=A*PP
      PTT=PTT+VCRCOR(J)
5     CONTINUE
      DO 15 I=1,MH
      J=I-1
      VCRCOR(I)=VCRCOR(I)/PTT
      VCRCOR(I)=VCRCOR(I)*1ØØ.Ø
      TMLAG(I)=FLOAT(J)/(F)
15    CONTINUE
      RETURN
      END
      FINISH
21.4Ø.2Ø-
```

(ii)

```
      PROGRAM(FAST)
      INPUT 5=CRØ
      OUTPUT6=LPØ
      END
      MASTER FAST
C
C     THIS PROGRAM READS DATA FROM A FILE,CONVERTS IT
C     INTO A ZERO MEAN DATA,FOURIER TRANSFORM IT ,THEN
C     WINDOW THE RESULTS TO REDUCE LEAKAGE. SMOOTHING
C     IS THEN PERFORMED OVER A PRE-SELECTED NUMBER OF
C     POINTS. THE POWER DENSITY RESULTS ARE THEN PLOTTED
C      VS FREQUENCY USING THE LINE PRINTER.
C
      DIMENSION V1(6ØØ),ISKIP1(6ØØ),XREAL(5ØØØ),XIMAG(5ØØØ)
     1,ISKPVD(2ØØ)
      COMMON FF(6ØØ),N,KI,MH,KN,KL,VDD(2ØØ),PDF(2ØØ),
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,PI
      DATA IDASH/1H-/,ISTAR/1H*/,ISPACE/1H /
      PI=3.14159265
C
C     THE COUNTERS  KN,KL, CONTROLS THE EXCUTION
C     OF CERTAIN  STATEMENTS IN SUBSEQUENT SUBROUTINES .
C
      MH=17Ø
      MH=MH+1
      KN=1
      KL=Ø
1Ø    CALL PDFVOID(XREAL,XIMAG,5ØØØ)
      WRITE(6,25)
25    FORMAT(/////15X,'THE AVERAGE AND TOTAL NO. OF POINTS'
     1,' FOR VOID-DATA',//)
      CALL AVERG(XREAL,5ØØØ)
1ØØ   IF(KN.GT.Ø) GO TO 1Ø5
      CALL FFT(XREAL,XIMAG,5ØØØ)
1Ø5   CALL WINDOW(XREAL,XIMAG,5ØØØ)
      IF(KN.LT.1)GO TO 11Ø
      CALL FFT(XREAL,XIMAG,5ØØØ)
11Ø   CONST=2.Ø/(F*FLOAT(N))
C
C     SETTING A FREQUENCY BAND FOR SMOOTHING
C     ,E.G.'W'.CALCULATING NO. OF POINTS ON
C     WHICH SMOOTHING IS TO BE PERFORMED,E.G.'FR'.
C
      SS=1Ø.Ø
      FX=F/FLOAT(N)
      W=SS*FX
      FR=W/FX
      MN=(N/IFIX(FR))/2
      IF(MN.GT.MH.OR.MN.LT.MH)MN=MH
      CALL SMOOTH(V1,6ØØ,XREAL,XIMAG,5ØØØ)
      DO 165 I=1,MN
      J=IFIX(FR/2.Ø)*(I-1)
      FF(I)=(FLOAT(J)+(SS/2.Ø))*FX
165   CONTINUE
      CALL PLOT(V1,ISKIP1,6ØØ,MN,WMAXV1,WMINV1,43.Ø)
      CALL PLOT(PDF,ISKPVD,2ØØ,MH,WMAXVD,WMINVD,43.Ø)
C
C     PLOTTING THE POWER DENSITY VS FREQNCY RESULTS
C     FOR PØ AND P1 DATA,USING LINE PRINTER.
C
```

```
      WRITE(6,35)
35    FORMAT(1H1,/,2X,'PWR VD',1X,'FRQCY',5X,'POWER ',
     1'DENSTY VS FRQNCY FOR VOID DATA',6X,'PDF VD',2X,'VDFRCTN'
     2,4X,'POWER DENSTY FUNCTION FOR VOID DATA',//)
      DO 45 I=1,MN
      NSKIP=45-ISKIP1(I)
      WRITE(6,40)V1(I),FF(I),(IDASH,J=1,ISKIP1(I)),ISTAR,
     1(ISPACE,JK=1,NSKIP),PDF(I),VDD(I),(IDASH,K=1,ISKPVD(I)),
     1ISTAR
40    FORMAT(1X,F6.2,F7.3,1X,46A1,F6.2,F6.3,1X,46A1)
45    CONTINUE
      STOP
      END
      SUBROUTINE PDFVOID(VDF,XIMAGF,IKK)
      DIMENSION JJ(200),IGMT(20),VDF(IKK),GMI(5000),XIMAGF(IKK)
      COMMON FF(600),N,KI,MH,KN,KL,VDD(200),PDF(200),
     1IBV,IBX,CONFTR,NU,CONST,MN,W,FR,FX,F,PI
      WRITE(6,120)
120   FORMAT(8X,'TOTL NO.',6X,'PATERN',4X,'GI',8X,'FI',
     18X,'SR',/)
      READ(5,60)N,KI,GI,FI,SR,F
      WRITE(6,90)N,KI,GI,FI,SR,F
90    FORMAT(4X,2I10,4F10.2,////)
60    FORMAT(2I0,4F0.0)
C
C     N   =TOTAL NO. OF POINTS.
C     KI  =FLOW PATTERN.
C     GI  =TUBE EMPTY RATEMETER READING IN PPS.
C     FI  =TUBE FULL RATEMETER READING IN PPS.
C     SR  =MAX. SCALE READING OF RATEMETER
C          DURING TESTING IN KPPS.
C     VDD =AVERAGE VOID FRACTION.
C     PDF =PROBABILITY DENSITY FUNCTION.
C     GMI =MIXTURE RATEMETER READING AT A GIVEN TIME.
C     IVDN=TOTAL NO. OF VOID FRACTION INCREMENTS.
C     VDN =VOID FRACTION INCREMENT.
C     VDF =INSTANTANEOUS VOID FRACTION.
C
      IVDN=80
      VDIN=0.02
      LL=IVDN+2
      FFT=ALOG(GI/FI)
C
C     SETTING VOID AND COUNTER MATRICES TO ZERO
C     ALSO READ AND PRINT DATA.
C
      DO 50 I=1,MH
      JJ(I)=0
      VDD(I)=0.0
      PDF(I)=0.0
50    CONTINUE
      KK=0
      MM=N/15
      N=MM*15
      DO 130 K=1,MM
      READ(5,70)(IGMT(I),I=1,15)
      DO 10 J=1,15
      KK=KK+1
      GMI(KK)=FLOAT(IGMT(J))
      XIMAGF(KK)=0.0
10    CONTINUE
130   CONTINUE
70    FORMAT(15I0)
```

```
      WRITE(6,110)(GMI(I),I=1,KK)
110   FORMAT(15F6.0)
C
C     START OF PROBABILITY DENSITY CALCULATIONS.
C
      VD2=-(2.0*(FLOAT(IVDN)/1000.0)+2.0*VDIN)
      DO 15 J=1,N
      GMI(J)=GMI(J)*SR
      VDF(J)=(ALOG(GMI(J)/FI))/FFT
      VD1=VD2+VDIN
      DO 20 I=1,LL
      IF(VDF(J).GT.VD1)GO TO 30
      VDD(I)=VDD(I)+VDF(J)
      JJ(I)=JJ(I)+1
      GO TO 15
30    VD1=VD1+VDIN
20    CONTINUE
15    CONTINUE
      VD1=VD2+VDIN
      DO 40 I=1,LL
      IF(JJ(I).LT.1)GO TO 140
      VDD(I)=VDD(I)/FLOAT(JJ(I))
      GO TO 150
140   VDD(I)=VD1
150   VD1=VD1+VDIN
      PDF(I)=FLOAT(JJ(I))/FLOAT(N)
      PDF(I)=PDF(I)/VDIN
40    CONTINUE
C
C     DATA IS TRUNCATED SO THAT TOTAL NO. OF
C     POINTS IS A MULTIPLE OF 2,OR N=2**NU
C
      IF(N.GE.4096)GO TO 35
      N=2048
      NU=11
      GO TO 45
35    N=4096
      NU=12
45    CONTINUE
      RETURN
      END
```

(iii)

```
      PROGRAM(PDFSTP)
      INPUT 5=CRØ
      OUTPUT6=LPØ
      COMPACT
      END
      MASTER PDFSTP
      DIMENSION PB(2ØØ),PA(2ØØ),A(2ØØ),B(2ØØ),P(5ØØØ),IP(5ØØØ)
     1,ISKPSP(2ØØ),ISKPVP(2ØØ)
      DATA IDASH/1H-/,ISTAR/1H*/,ISPACE/1H /
      N=Ø
5     WRITE(6,22Ø)
22Ø   FORMAT(//////,8X,'TOTL NO',6X,'PATERN',6X,'IBV',
     14X,'IBX',4X,'CONFTR',/)
      READ(5,2Ø)M,KI,IBV,IBX,CONFTR
      WRITE(6,2ØØ)M,KI,IBV,IBX,CONFTR
2ØØ   FORMAT(4X,4I1Ø,F1Ø.2,////)
2Ø     FORMAT(4IØ,FØ.Ø)
C
C     PA   = PRESSURE DIFF.,'PA-PAV'
C     A    = PROBABILITY OF 'P'
C     P    = IP(INTEGER), PRESSURE VALUE AT A GIVEN TIME
C     M    = TOTAL NO. OF PRESSURE DATA POINTS
C     KI   = FLOW PATTERN
C     IBV = MAX. OUTPUT READING FROM TRANSDUSER AT
C           ATMOSPHERIC CONDITIONS.
C     IBX = MIN.OUTPUT READING FROM TRANSDUSER AT
C           ATMOSPHERIC CONDITIONS.
C     CONFTR = SLOPE OF PRESSURE - VOLTAGE CHARACTERISTICS
C              OF PRESSURE TRANSDUSER IN (N/M2)/MV
C     PB   = SQUARE OF 'P-PAV',RATIO TO SQUARE OF INC.
C     B    = PROBABILTY OF PB
C     INC = PRESSURE INCREMENT.
C
      IPT=Ø
      MM=M/15
      M=MM*15
      KK=Ø
      INC=5
      LL=16Ø
      BA=FLOAT(IBV)-FLOAT(IBX)
      BA=BA/2.Ø
      BB=(BA)**2
      DO 19Ø J=1,MM
      READ(5,11Ø)(IP(I),I=1,15)
      DO 1ØØ K=1,15
      KK=KK+1
      IP(KK)=IP(K)
1ØØ   CONTINUE
19Ø   CONTINUE
11Ø   FORMAT(15IØ)
      WRITE(6,21Ø)(IP(I),I=1,KK)
21Ø   FORMAT(15I5)
C
C     DETERMINING THE HEIGHEST AND
C     LOWEST PRESSURE VALUE,ALSO THE AVERAGE.
C
      IPMAX=IP(1)
      IPMIN=IP(1)
```

```
      DO 10 J=1,M
      IPP=IP(J)+IPT
      IPT=IPP
      IF(IP(J).LT.IPMAX)GO TO 30
      IPMAX=IP(J)
      GO TO 10
30    IF(IP(J).GT.IPMIN)GO TO 10
      IPMIN=IP(J)
10    CONTINUE
      PAV=FLOAT(IPT)/FLOAT(M)
      WRITE(6,170)
170   FORMAT(1H1,/////8X,'IPMAX',8X,'IPMIN',9X,'LL',5X,'PAV',//)
      WRITE(6,160)IPMAX,IPMIN,LL,PAV
160   FORMAT(3I12,F12.3)
C
C     SETTING PRESSURE AND PROBABILTY MATRICES
C     OF ORDER 1 X LL TO ZERO.
C
      DO 130 I=1,LL
      PA(I)=0.0
      PB(I)=0.0
      A(I)=0.0
      B(I)=0.0
130   CONTINUE
C
C     START OF PROBABILITY DENSITY CALCULATIONS ,FIRST
C     PROBABILTY PARAMETERS OF P.
C
      PMIN=FLOAT(IPMIN)
      DO 40 J=1,M
      P(J)=FLOAT(IP(J))
      PNN=PMIN-FLOAT(4*INC)
      DO 50 I=1,LL
      IF(P(J).GT.PNN)GO TO 60
      PA(I)=PA(I)+P(J)
      A(I)=A(I)+1.0
      GO TO 40
60    PNN=PNN+INC
50    CONTINUE
40    CONTINUE
C
C     DETERMINING PROBABILTY PARAMETERS OF (P-PAV)**2.
C
      DP=(FLOAT(INC))**2
      DO 250 I=1,M
      PY=(P(I)-PAV)**2
      PX=0.0
      DO 290 J=1,LL
      PX=PX+DP
      IF(PY.GT.PX)GO TO 290
      PB(J)=PB(J)+PY
      B(J)=B(J)+1.0
      GO TO 250
290   CONTINUE
250   CONTINUE
C
C     FINAL CALCULATIONS OF PROBABILTY DENSITY FOR
C     'P' AND (P-PAV)**2.
C
      PNN=PMIN-FLOAT(4*INC)
      DO 150 I=1,LL
      IF(B(I).LT.1.0)GO TO 230
      PB(I)=PB(I)/B(I)
      PB(I)=PB(I)/DP
```

```
      GO TO 240
230   PB(I)=FLOAT(I)*DP
      PB(I)=PB(I)/DP
240   IF(A(I).LT.1.0)GO TO 280
      PA(I)=PA(I)/A(I)
      PA(I)=PA(I)-PAV
      GO TO 270
280   PA(I)=PNN+FLOAT(I*INC)
      PA(I)=PA(I)-PAV
270   A(I)=A(I)/FLOAT(M)
      A(I)=A(I)/FLOAT(INC)
      A(I)=A(I)*100.
      B(I)=B(I)/FLOAT(M)
      B(I)=B(I)/FLOAT(INC)
      B(I)=B(I)*100.
      PA(I)=PA(I)*(CONFTR/1000.)
      PB(I)=PB(I)*((CONFTR/1000.)**2)
150   CONTINUE
C
C     PLOTTING THE PROBABLTY DENSTY FUNCTION FOR 'P'
C     AND '(P-PAV)**2' AGAINST 'P' AND '(P-PAV)**2'
C     RESPECTIVELY .
C
      CALL PLOT(A,ISKPSP,200,LL,43.0)
      CALL PLOT(B,ISKPVP,200,LL,43.0)
      WRITE(6,140)
140   FORMAT(1H1,//,1X,'PDF P',1X,'PRESR',4X,'PROBABLTY '
     1,'DENSTY FUNCTION OF STP VS STP',5X,'PDF V',3X,'MVRNC',
     22X,'PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC',/)
      DO 120 I=1,LL
      NSKIP=45-ISKPSP(I)
      WRITE(6,70)A(I),PA(I),(IDASH,J=1,ISKPSP(I)),ISTAR,
     1(ISPACE,JK=1,NSKIP),B(I),PB(I),(IDASH,J=1,ISKPVP(I))
     2,ISTAR
70    FORMAT(F5.2,F7.2,1X,46A1,F7.3,F7.4,1X,46A1)
120   CONTINUE
      N=N+1
      IF(N.LE.1)GO TO 5
      STOP
      END
      SUBROUTINE PLOT(V,ISKIP,LI,MN,WIDTH)
C
C     THIS SUBROUTINE DETERMINES THE SIZE OF THE PLOT,
C     AND THE COORDINATE OF EACH POINT
C
      DIMENSION V(LI),ISKIP(LI)
      WMAX=0.0
      WMIN=0.0
      DO 35 I=1,MN
      IF(V(I).GT.WMAX)WMAX=V(I)
      IF(V(I).LT.WMIN)WMIN=V(I)
35    CONTINUE
      WSCALE=WIDTH/(WMAX-WMIN)
      IF(WMIN.LT.0.0)GO TO 65
      DO 25 I=1,MN
      ISKIP(I)=IFIX((V(I)-WMIN)*WSCALE)+1
25    CONTINUE
      GO TO 45
65    DO 45 I=1,MN
      ISKIP(I)=IFIX(ABS(V(I))*WSCALE)
45    CONTINUE
      RETURN
      END
      FINISH
21.29.58-
```

APPENDIX Y STATISTICAL ANALYSIS OF PRESSURE AND VOID FRACTION PULSATION RESULTS FOR PHASE 2

APPENDIX Y STATISTICAL ANALYSIS OF PRESSURE AND VOID FRACTION PULSATION RESULTS FOR PHASE 2

CONTENTS

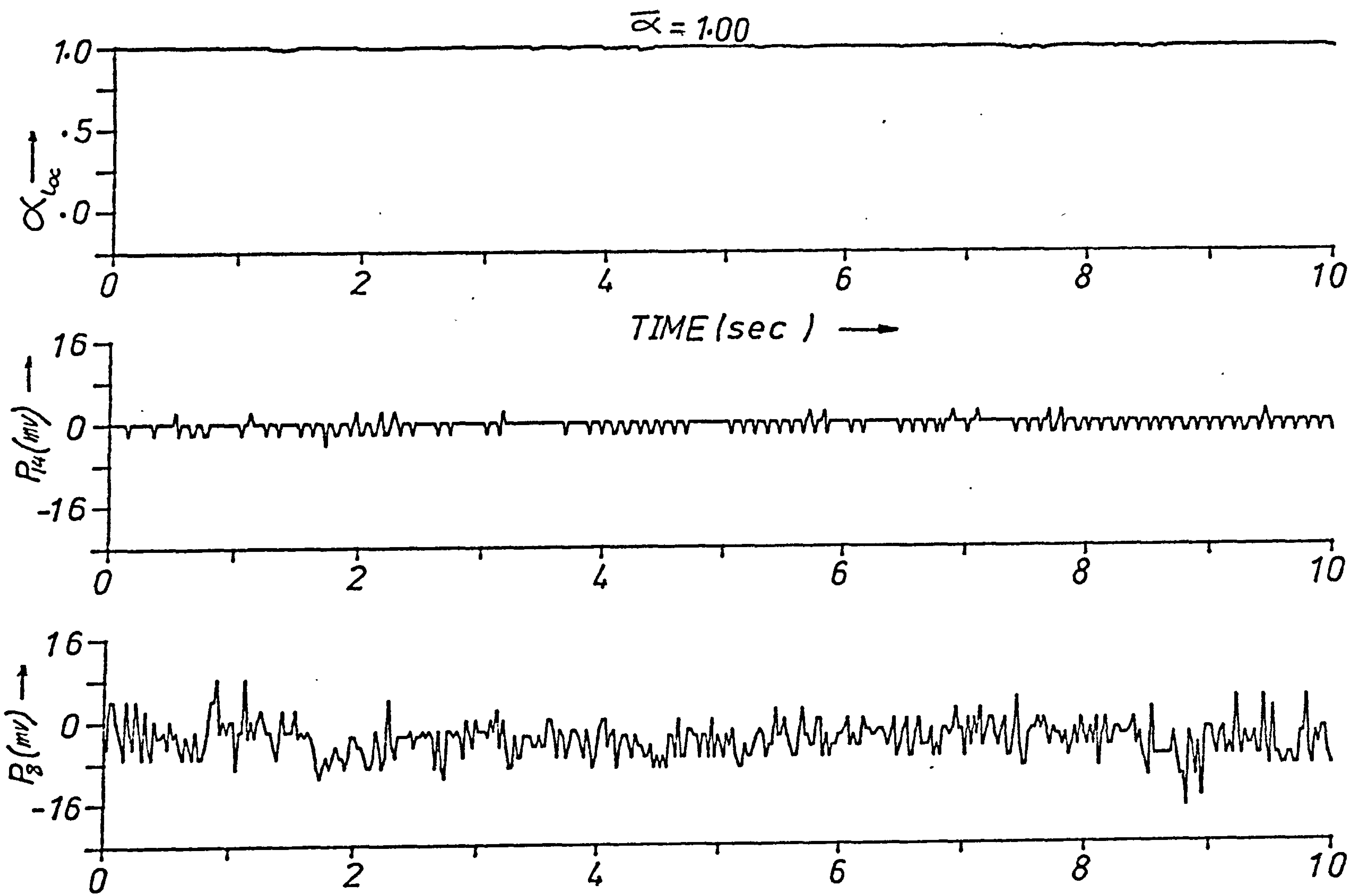


FIG. Y1 TEST RUN 051405 (ALL GAS) CODE (Q)

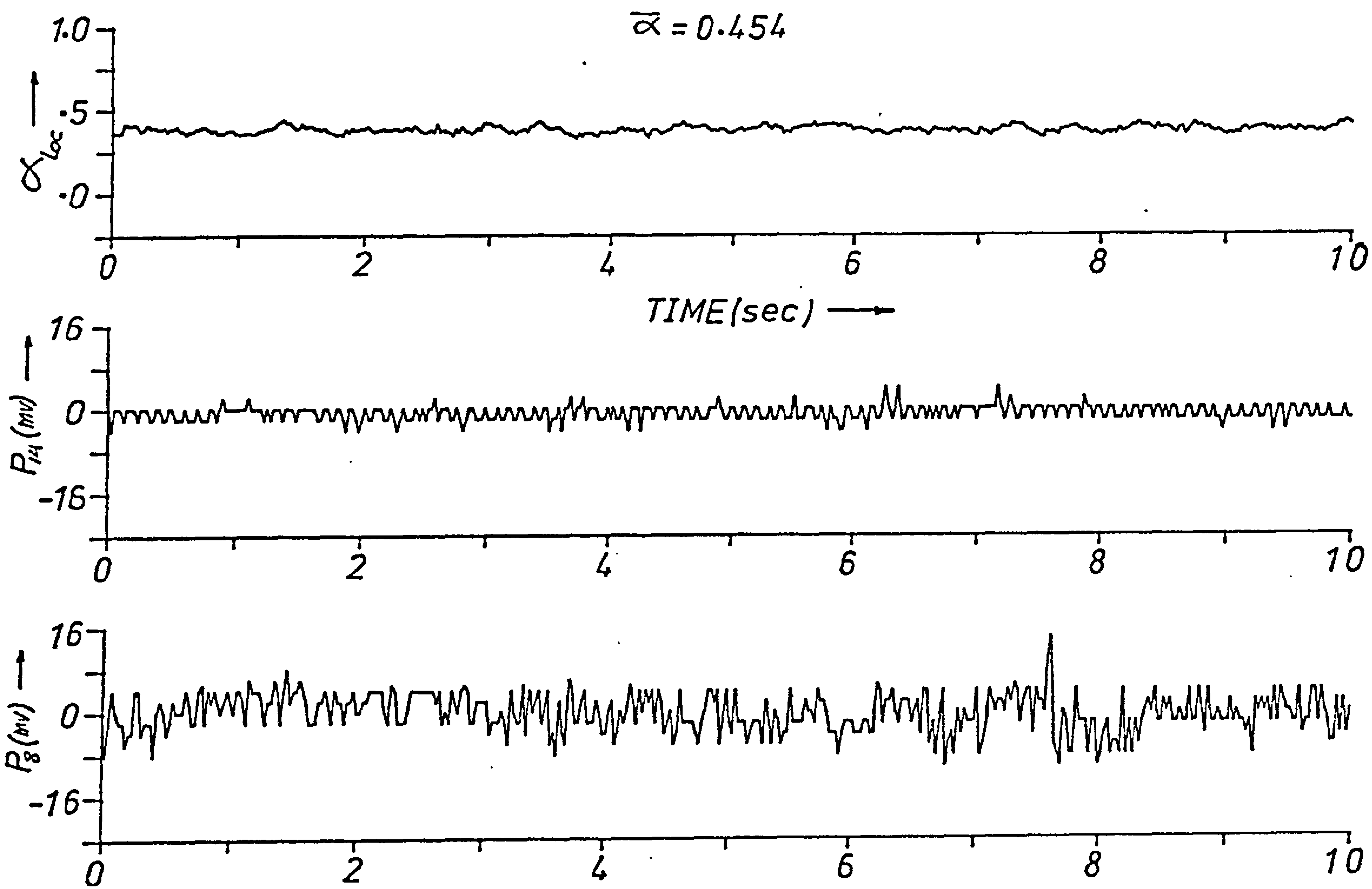


FIG.Y2 TEST RUN 081305 (STRATIFIED)
CODE(H)

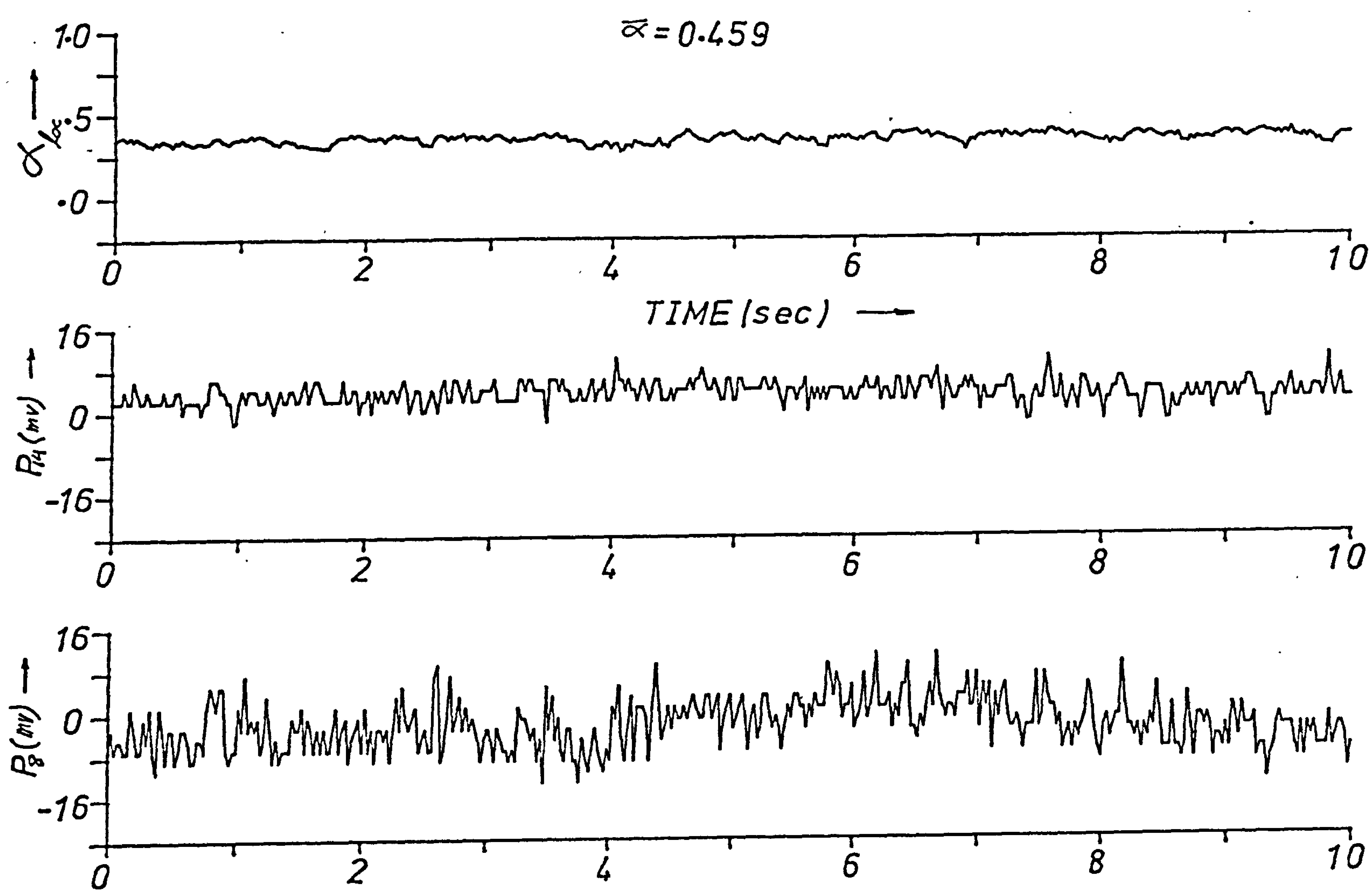


FIG.Y3 TEST RUN 091305 (WAVY)
CODE(I)

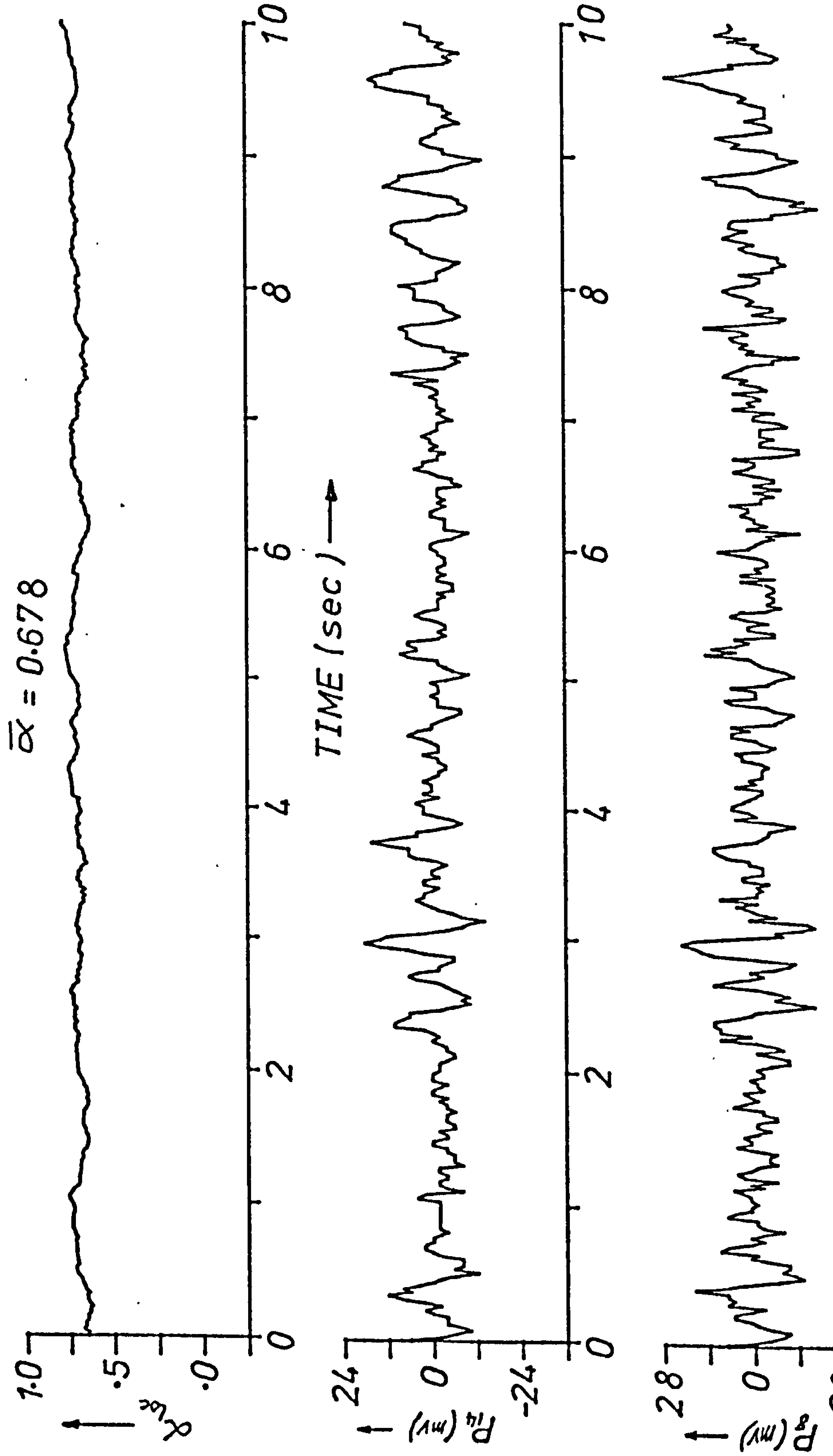


FIG.Y4 TEST RUN 011405 (WAVY)
CODE (M)

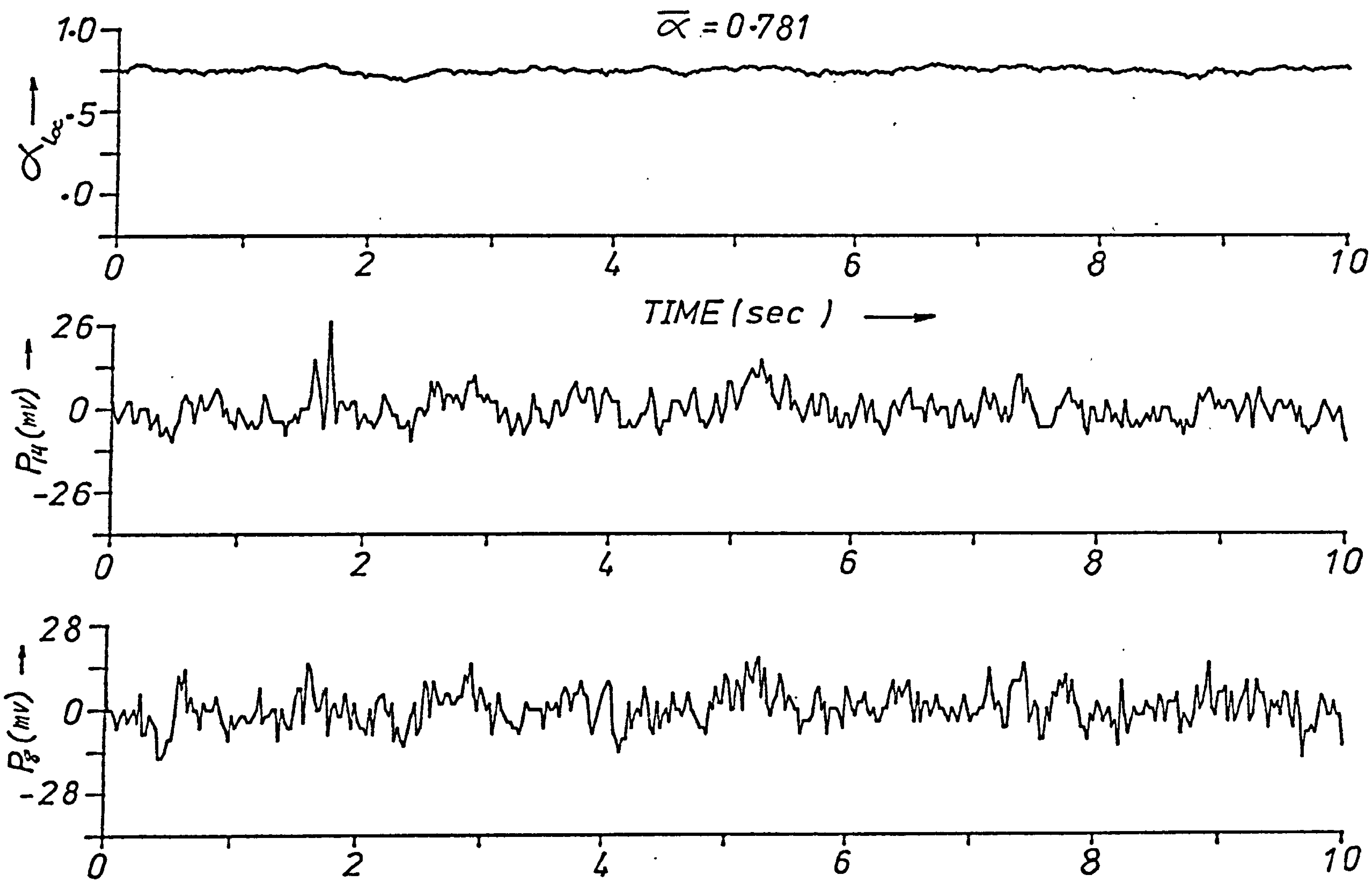


FIG. Y5 TEST RUN 021405 (WAVY)
CODE(N)

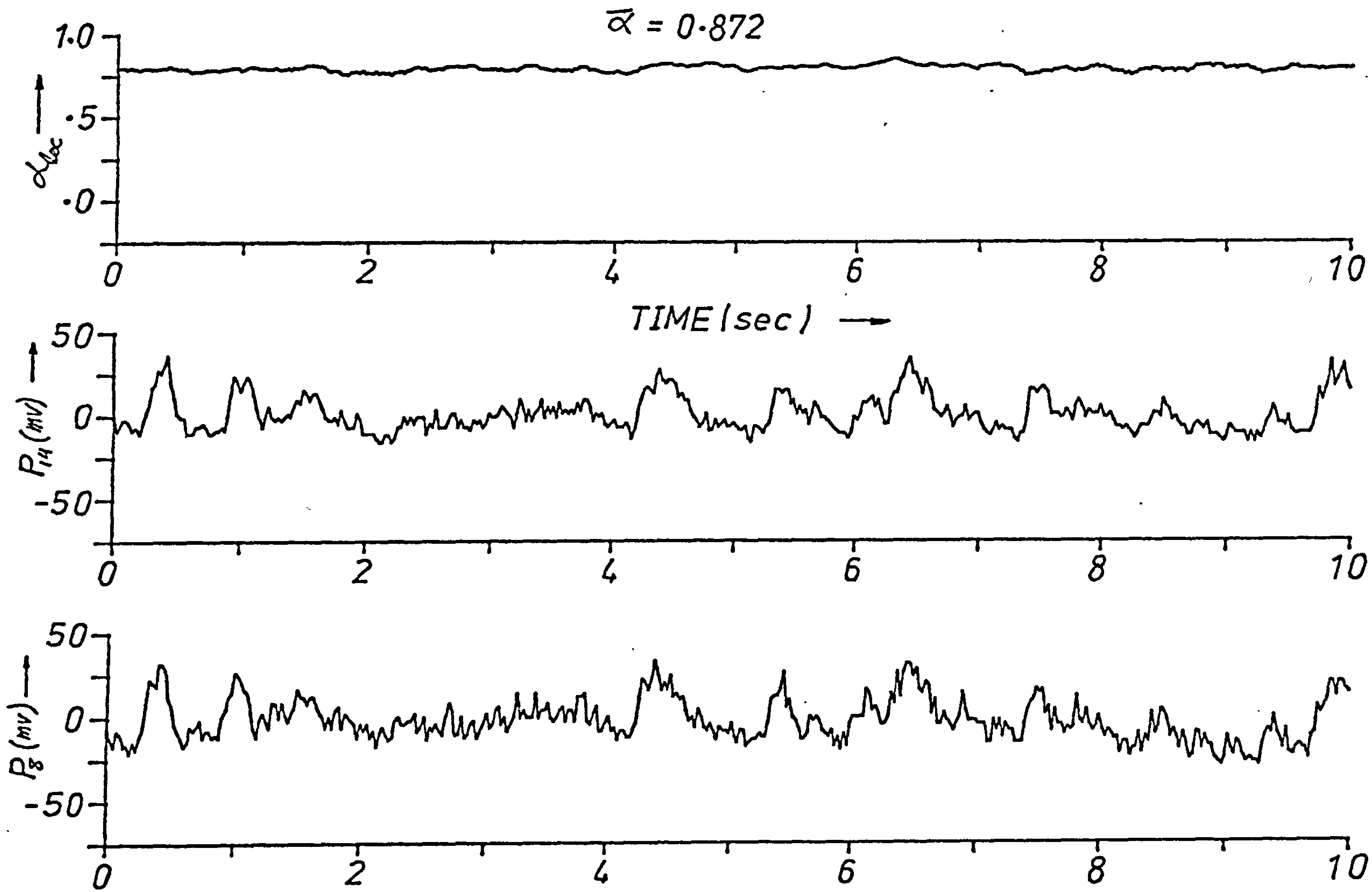


FIG.Y6 TEST RUN 031405 (WAVY/ANNULAR) CODE (0)

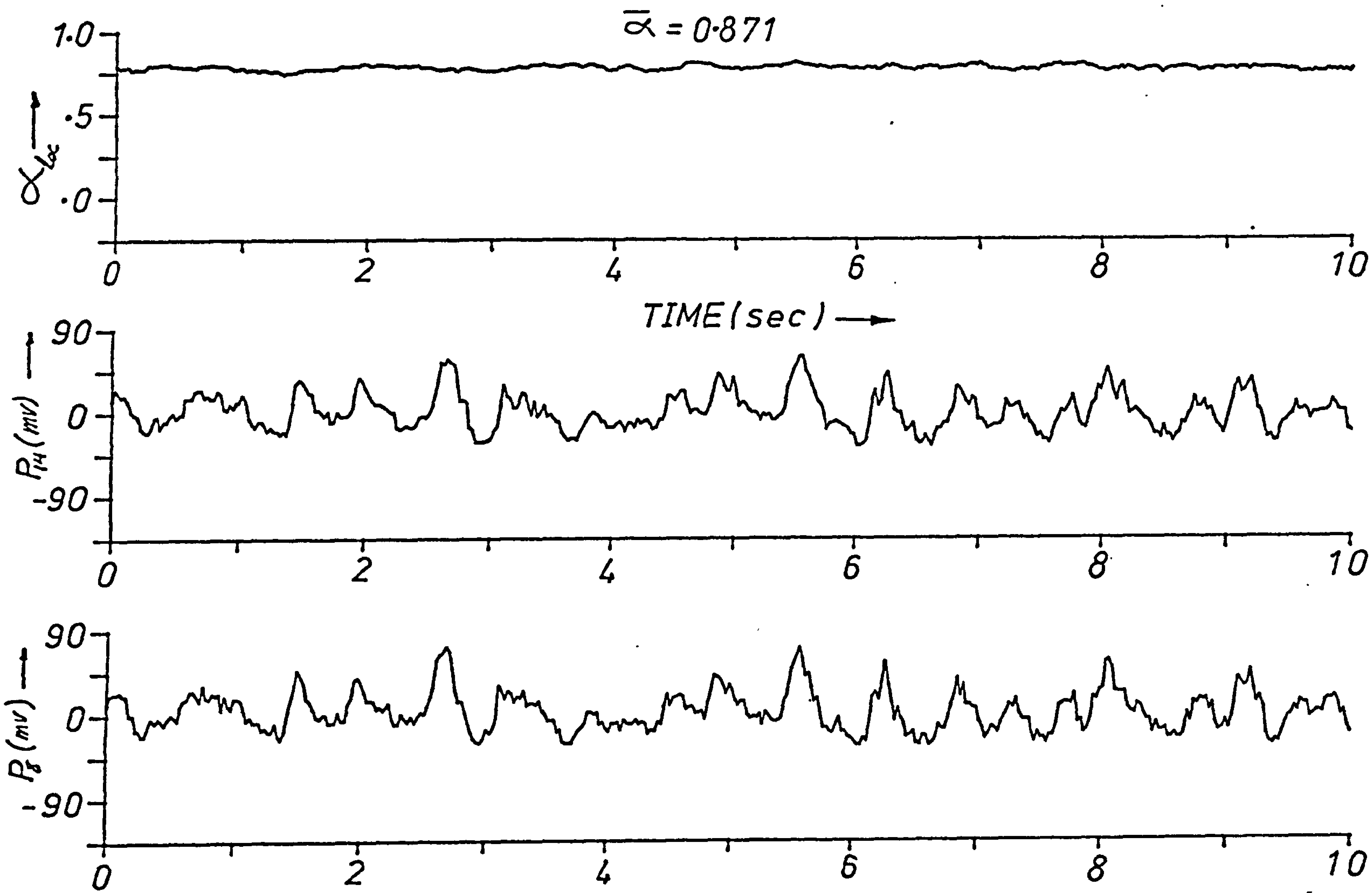


FIG.Y 7 TEST RUN 061405 (ANNULAR) CODE(R)

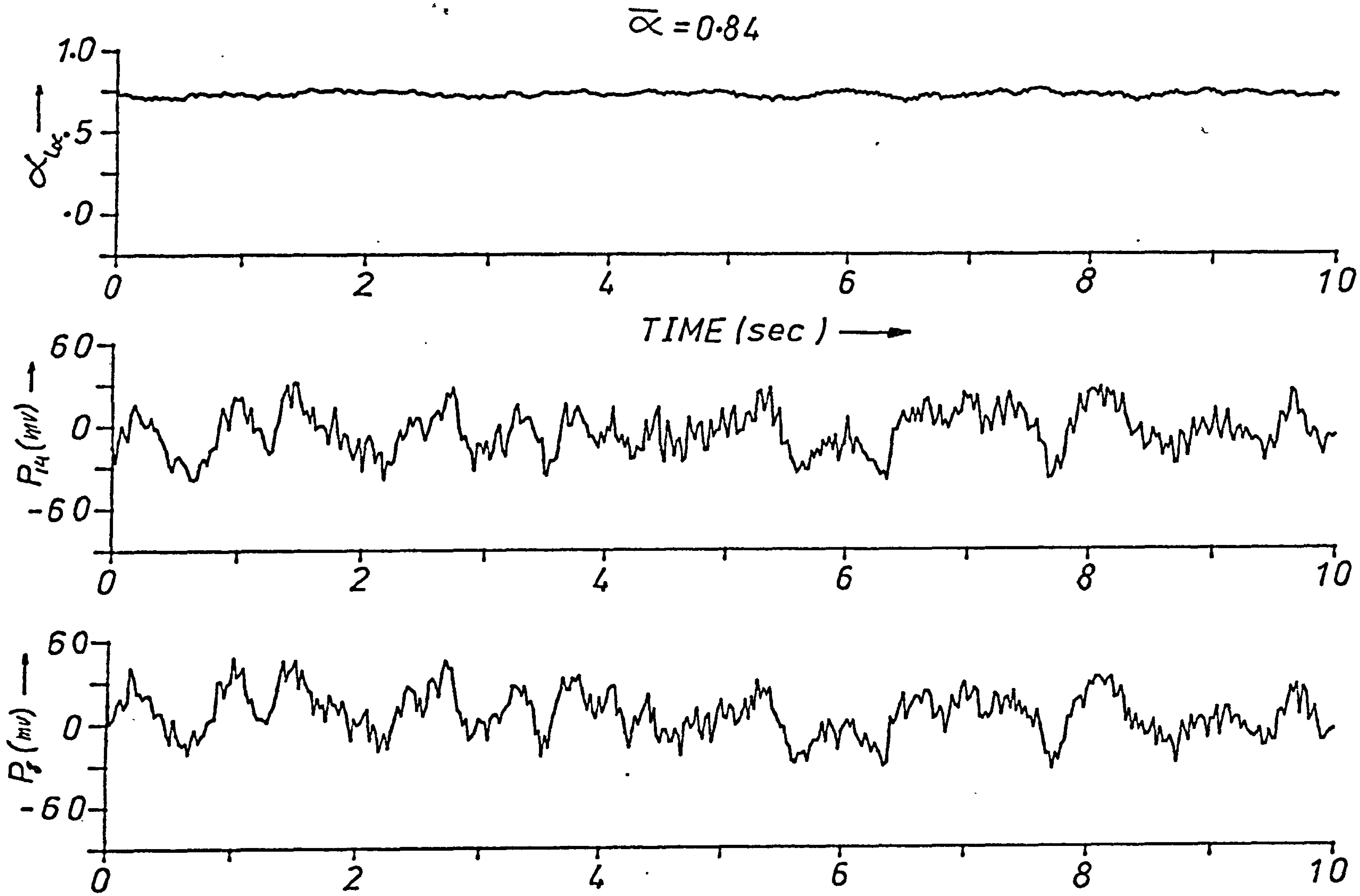


FIG. Y 8 TEST RUN 081405 (ANNULAR) CODE(T)

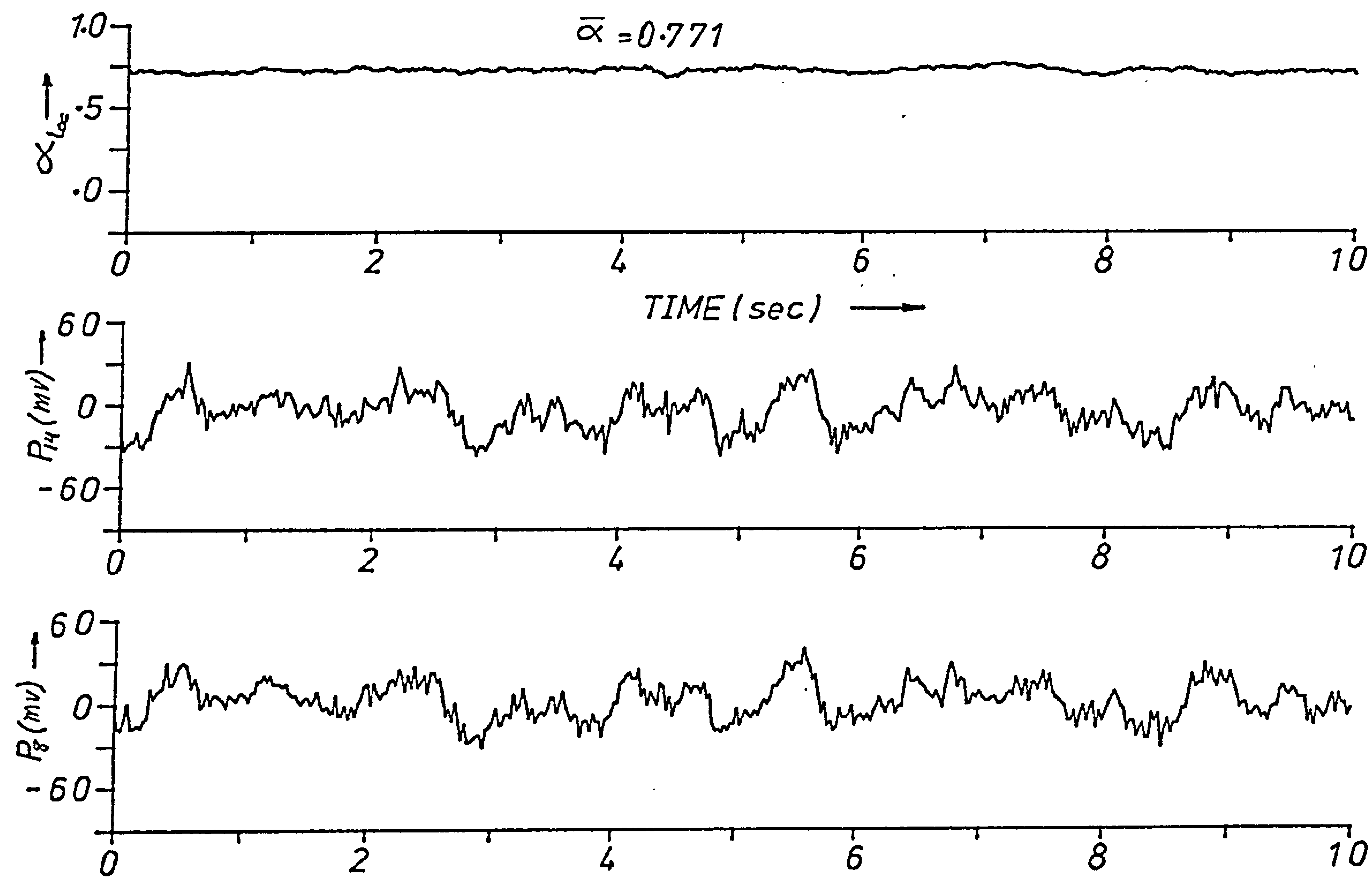
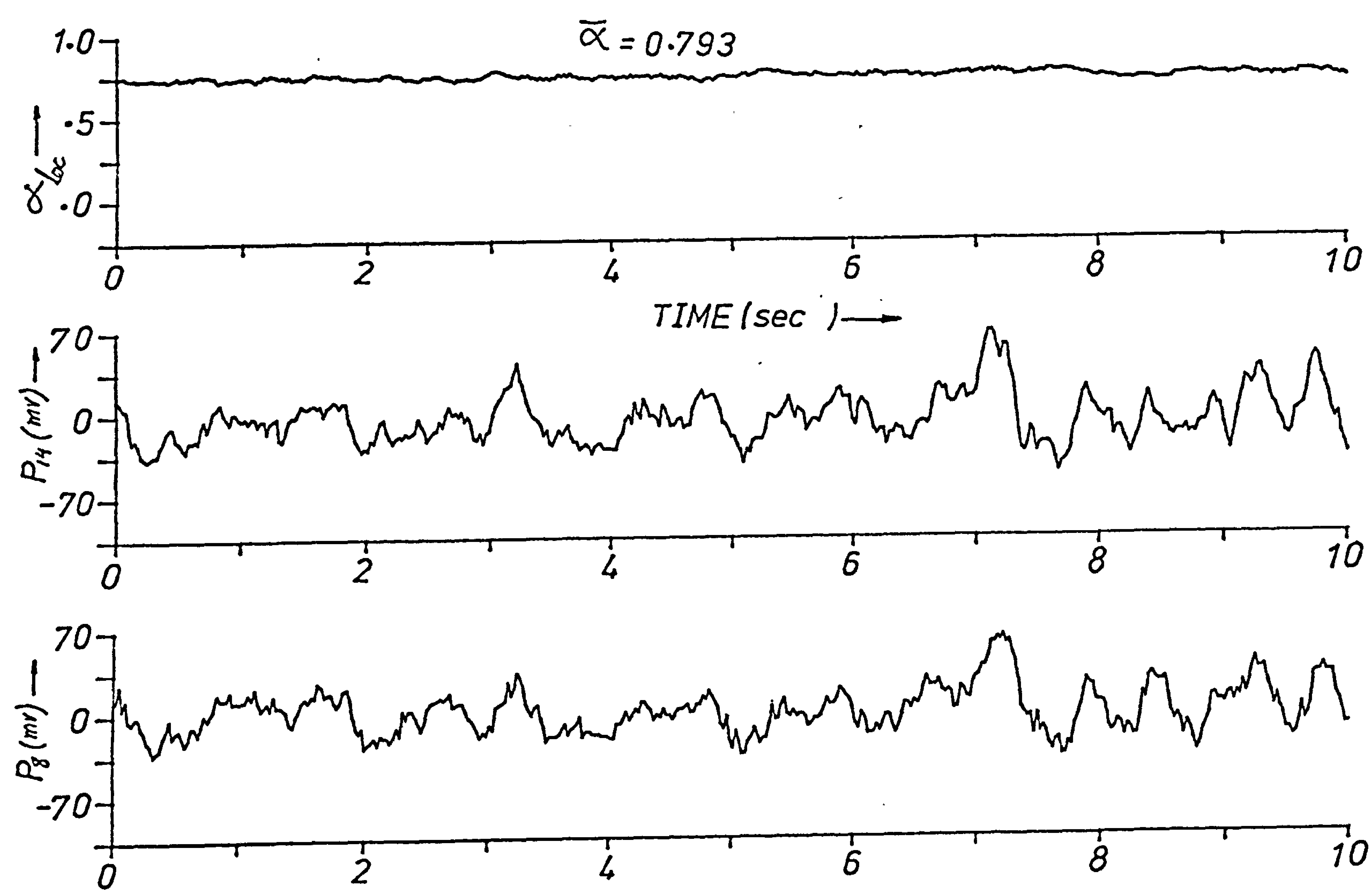


FIG.Y9 TEST RUN 091405 (ANNULAR) CODE(U)



FIG·Y10 TEST RUN 111405 (ANNULAR)
CODE (W)

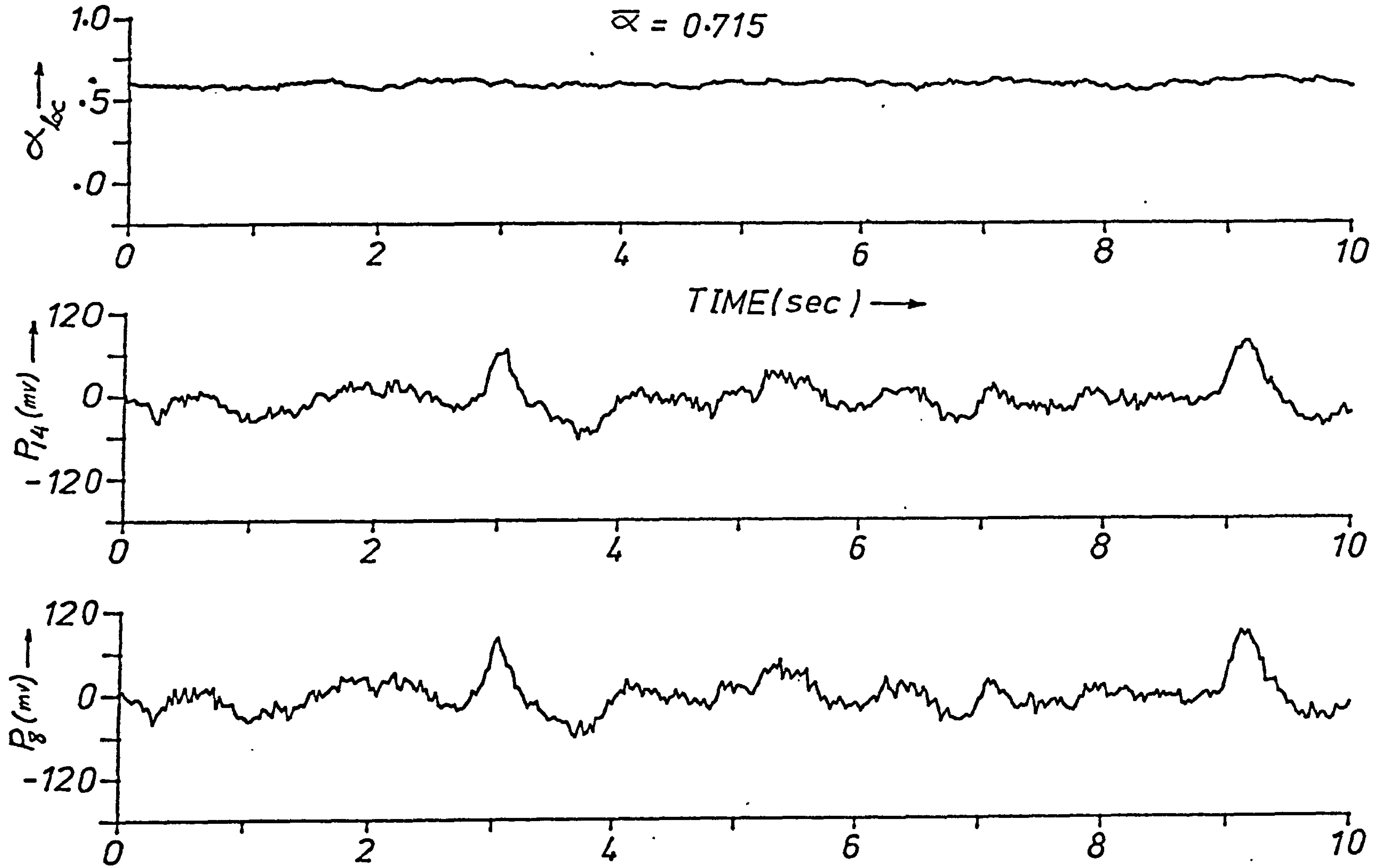


FIG.Y11 TEST RUN 131405 (SLUG / ANNULAR) CODE(Y)

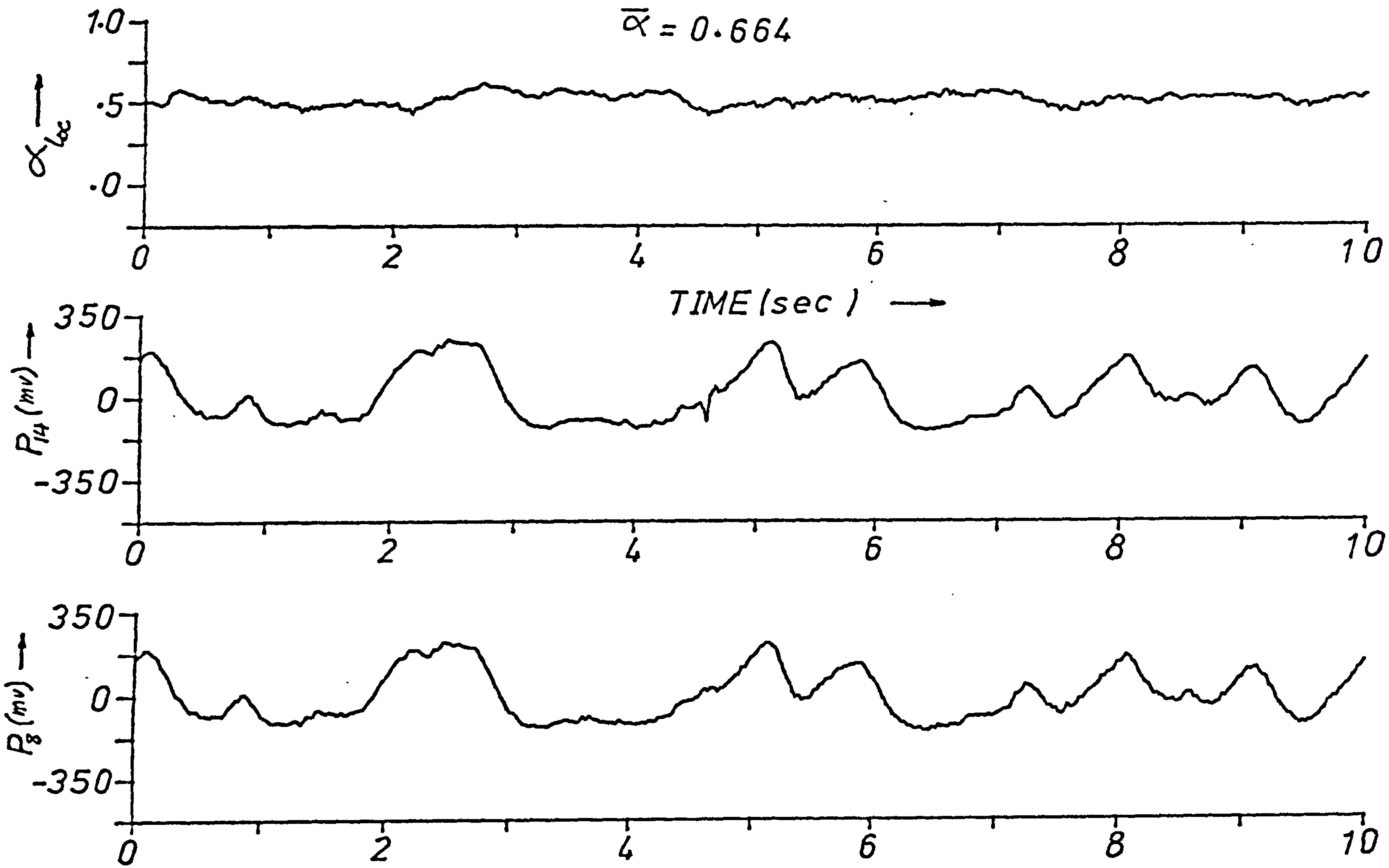


FIG.Y12 TEST RUN 121405 (SLUG)
CODE(X)

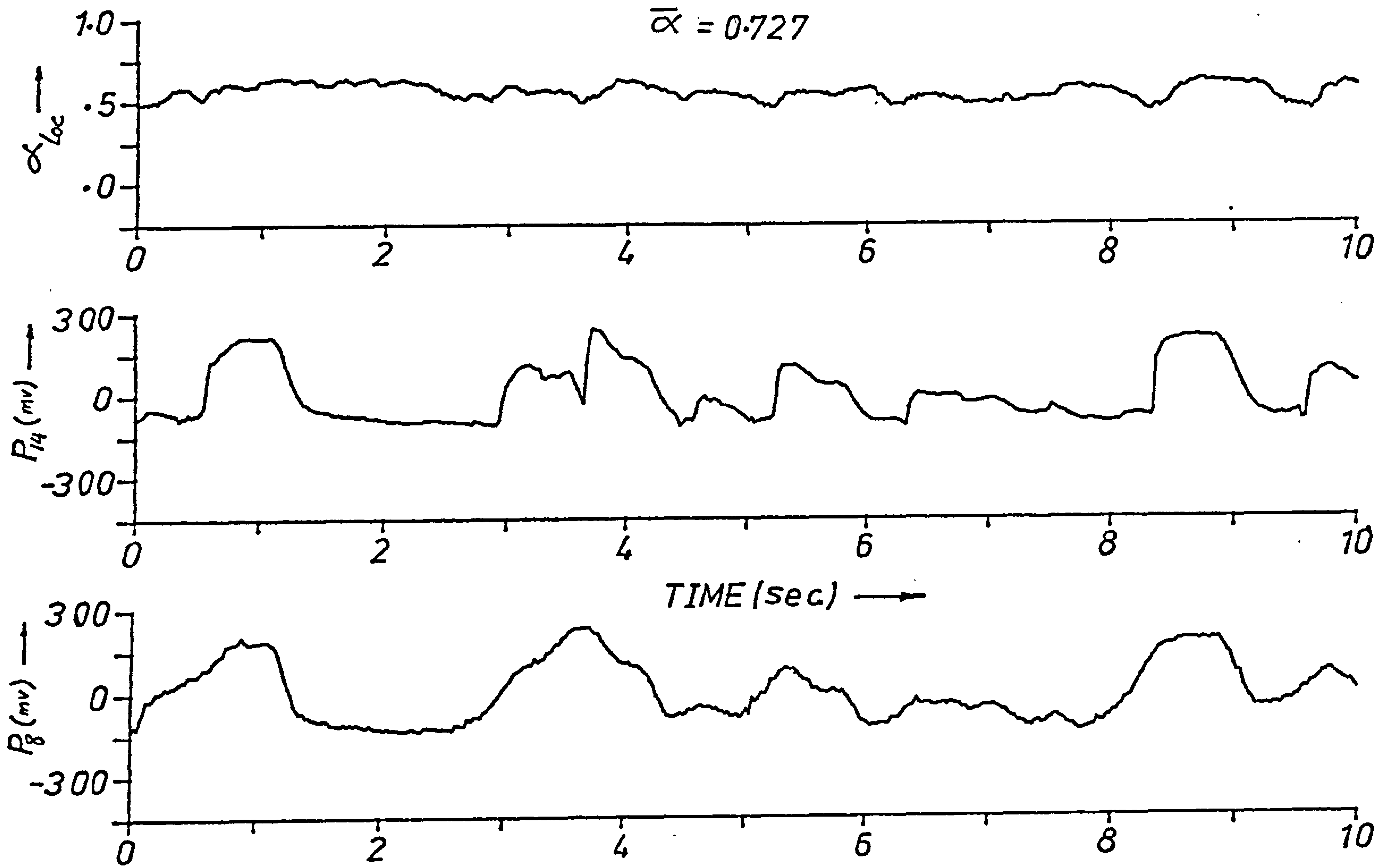


FIG.Y13 TEST RUN 141405 (SLUG)
CODE(Z)

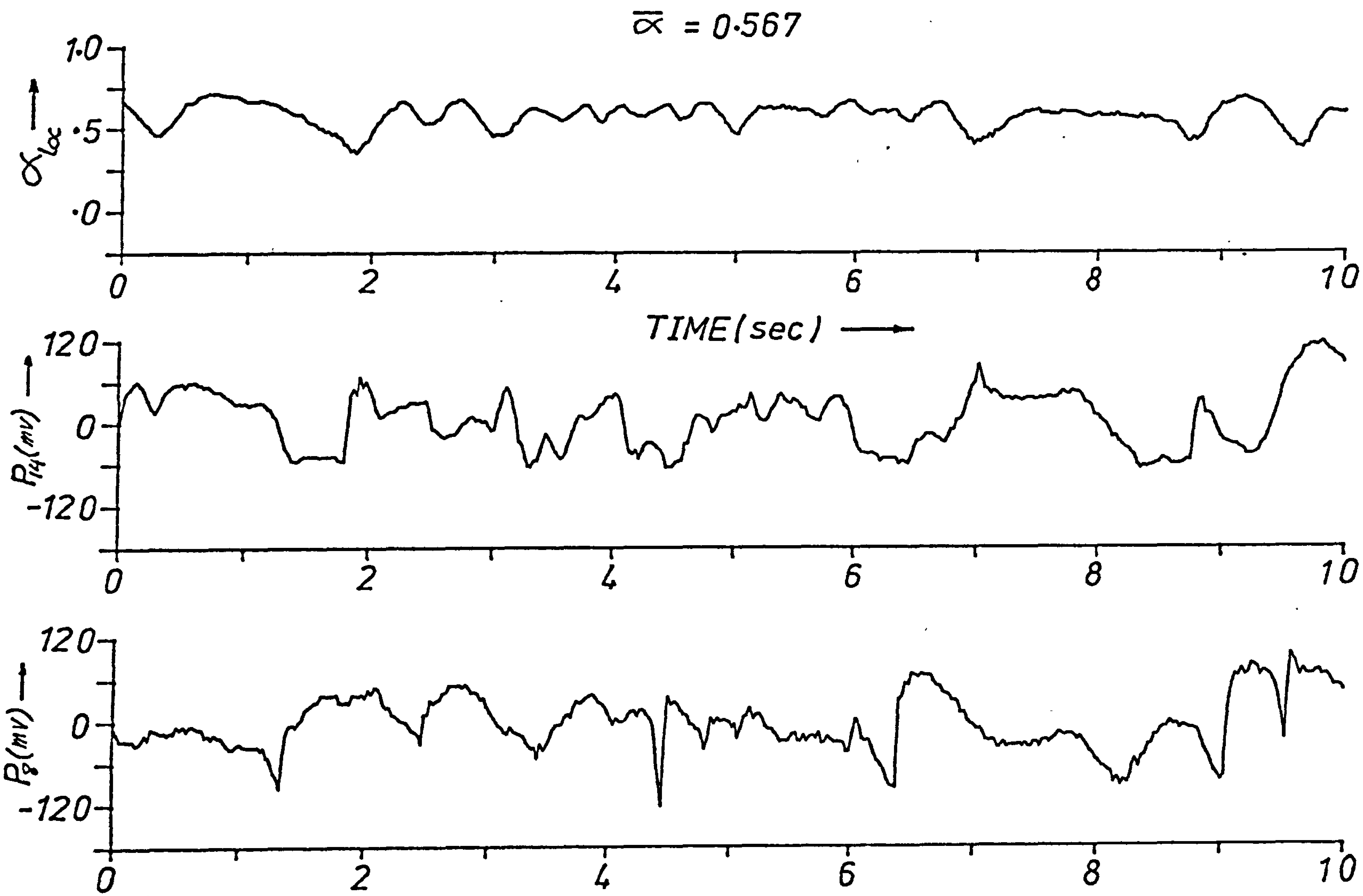


FIG. Y 14 TEST RUN 031305 (SLUG)
CODE (C)

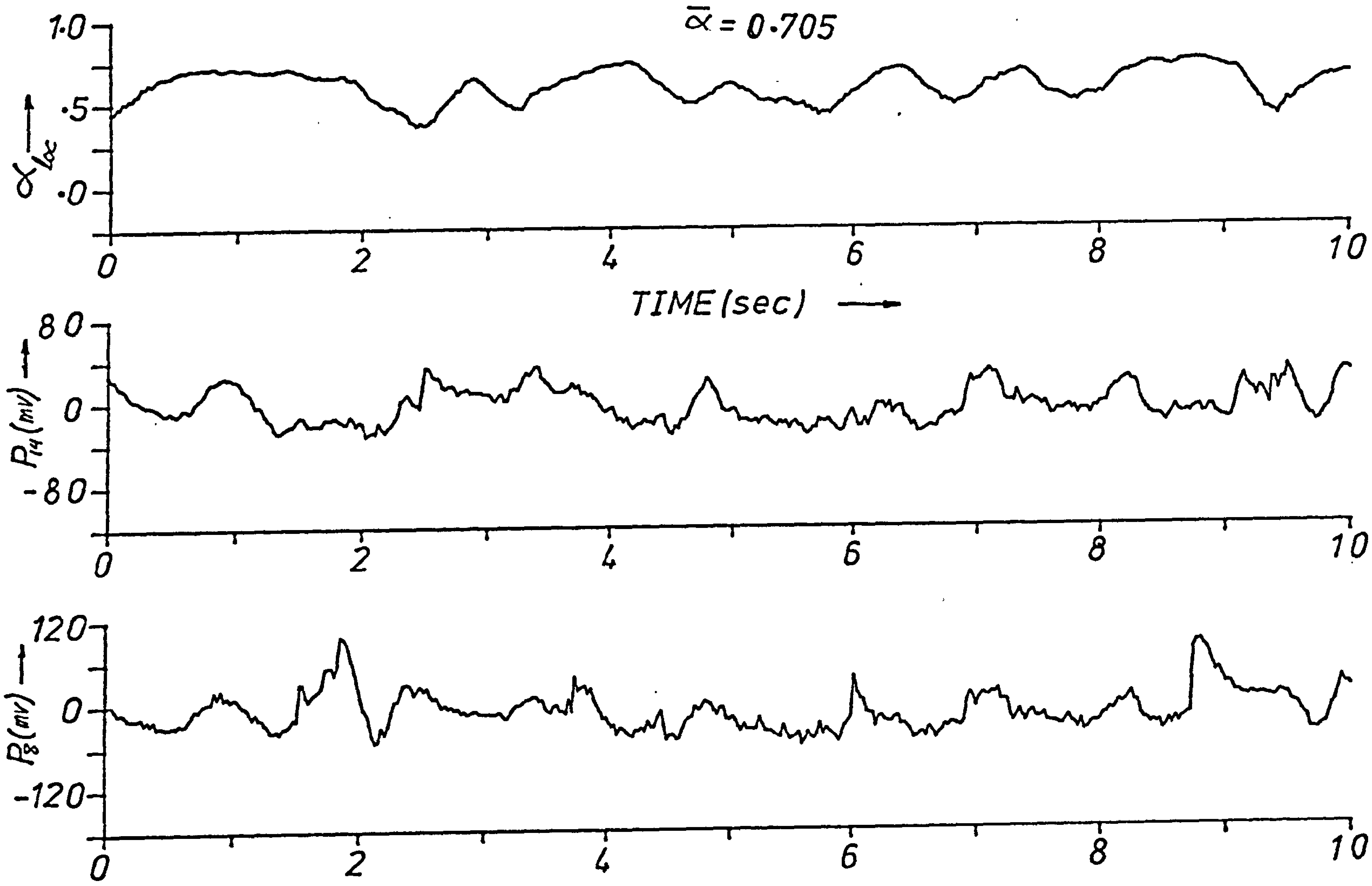


FIG.Y15 TEST RUN 111305 (SLUG) CODE (K)

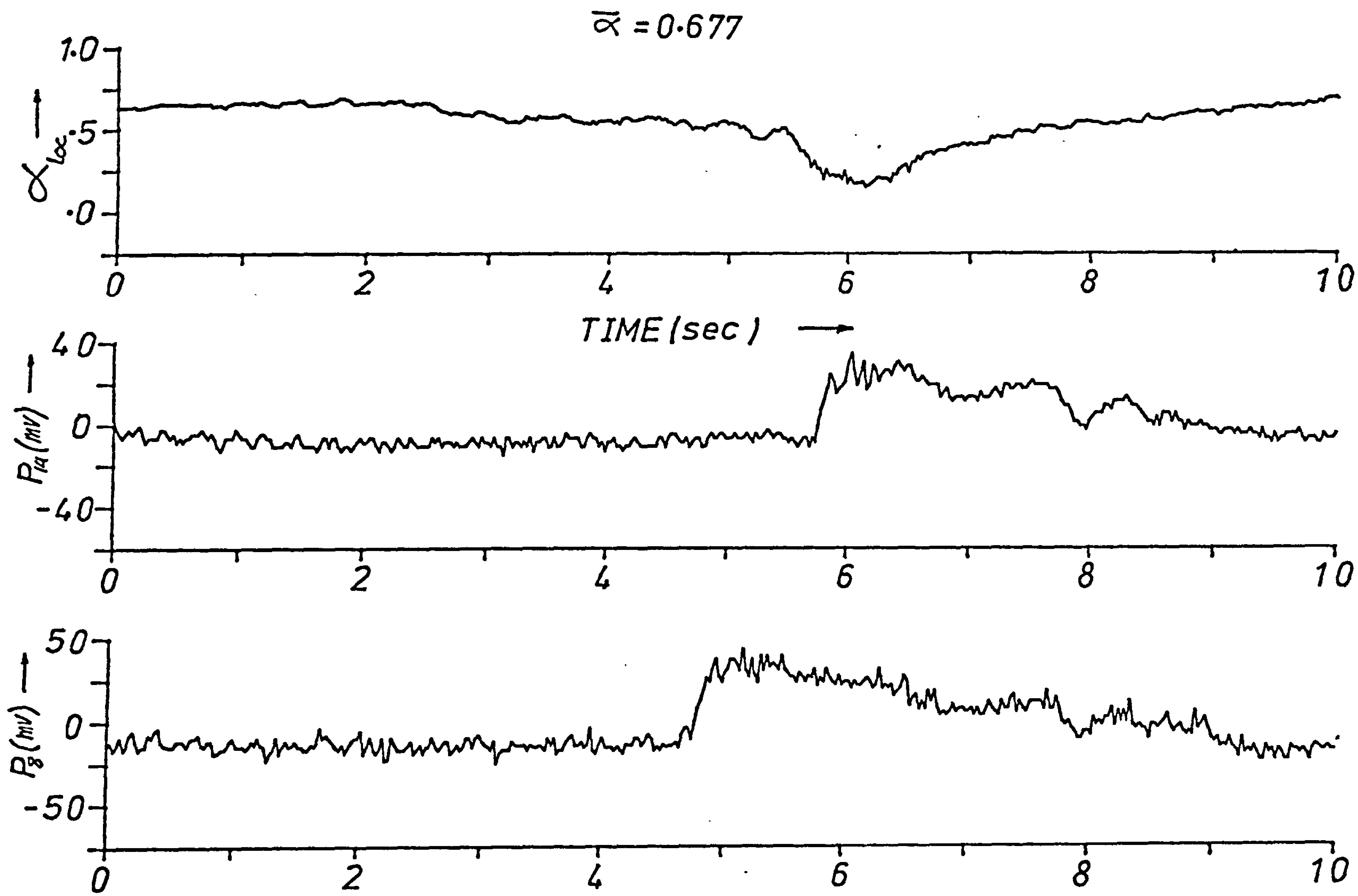


FIG. Y16 TEST RUN 101305 (SLUG)
CODE (J)

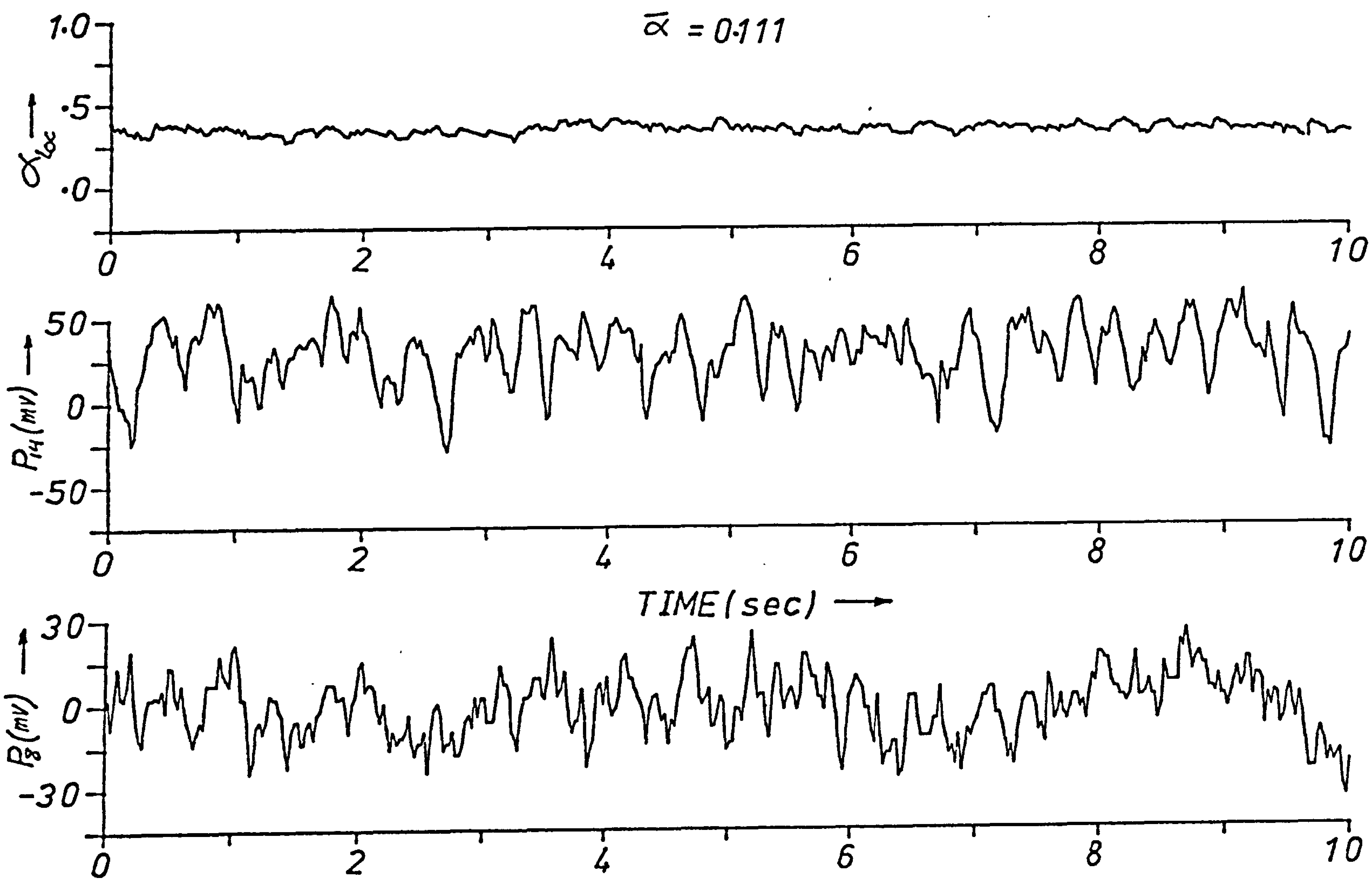


FIG.Y17 TEST RUN 071305(SLUG) CODE(G)

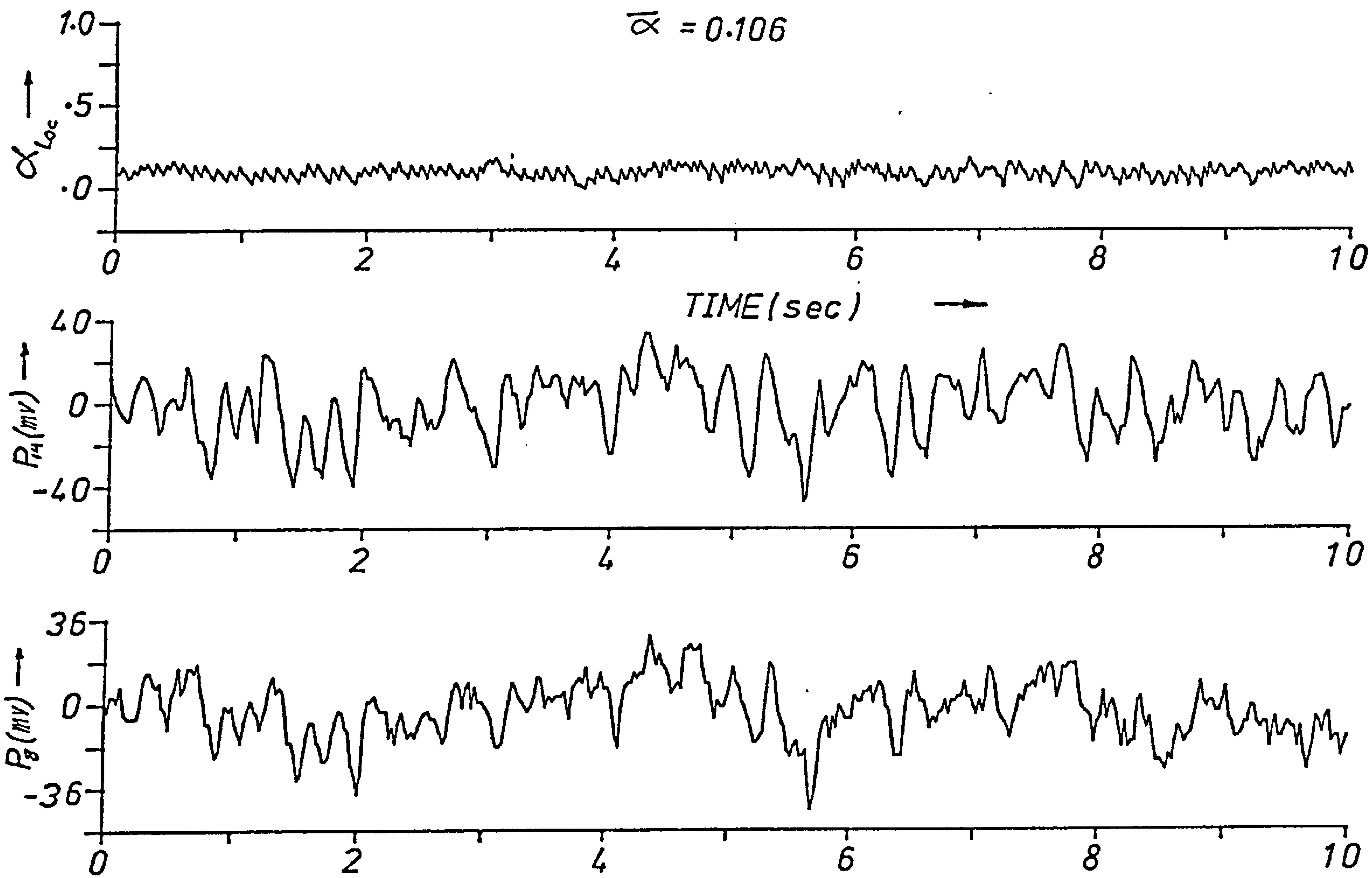


FIG.Y18 TEST RUN 061305 (BUBBLY/SLUG)
CODE(F)

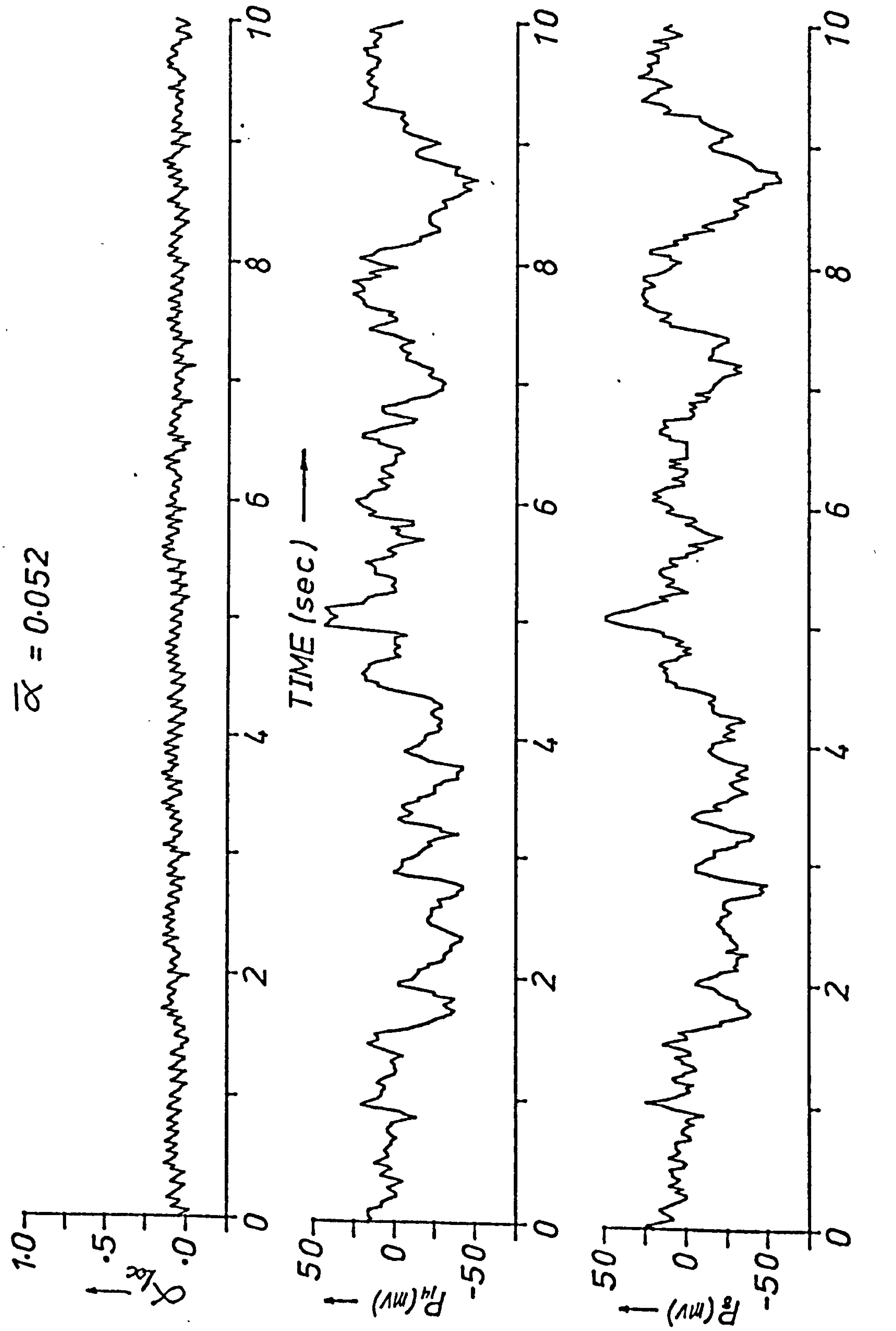


FIG.Y19 TEST RUN 041305 (BUBBLY)
CODE (D)

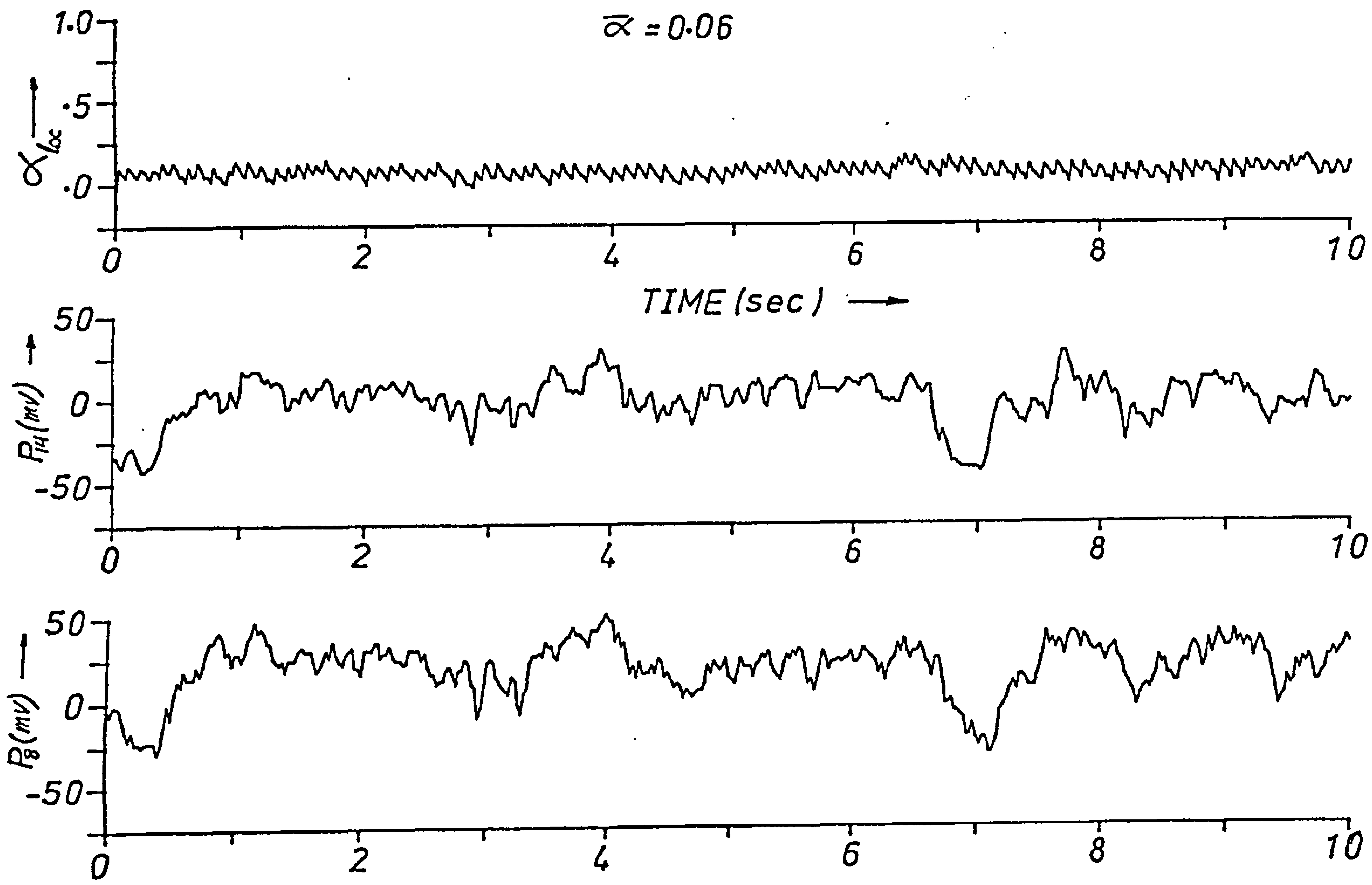


FIG.Y20 TEST RUN 051305 (BUBBLY)
CODE (E)

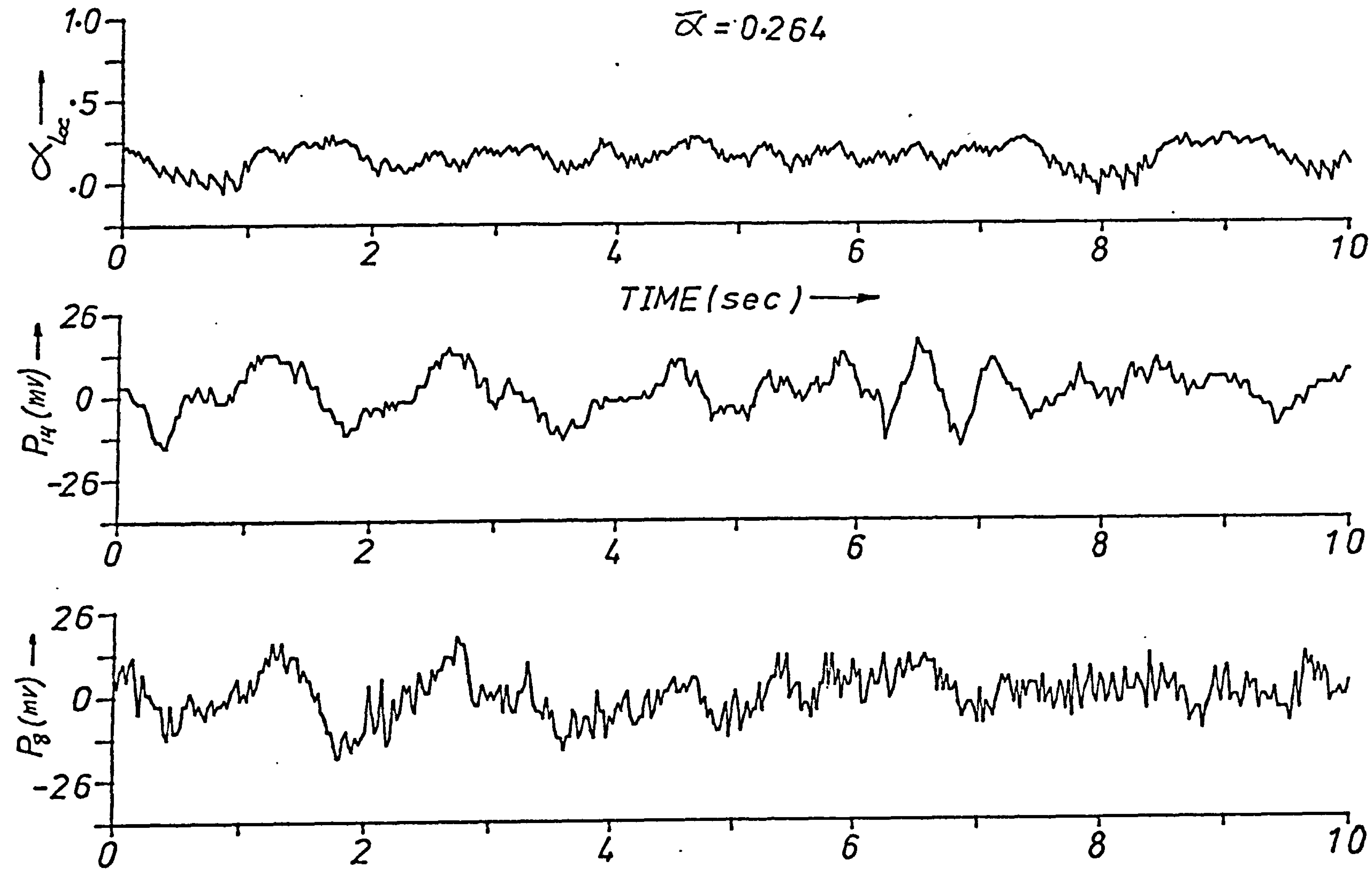


FIG.Y21 TEST RUN 121305 (PLUG)
CODE (L)

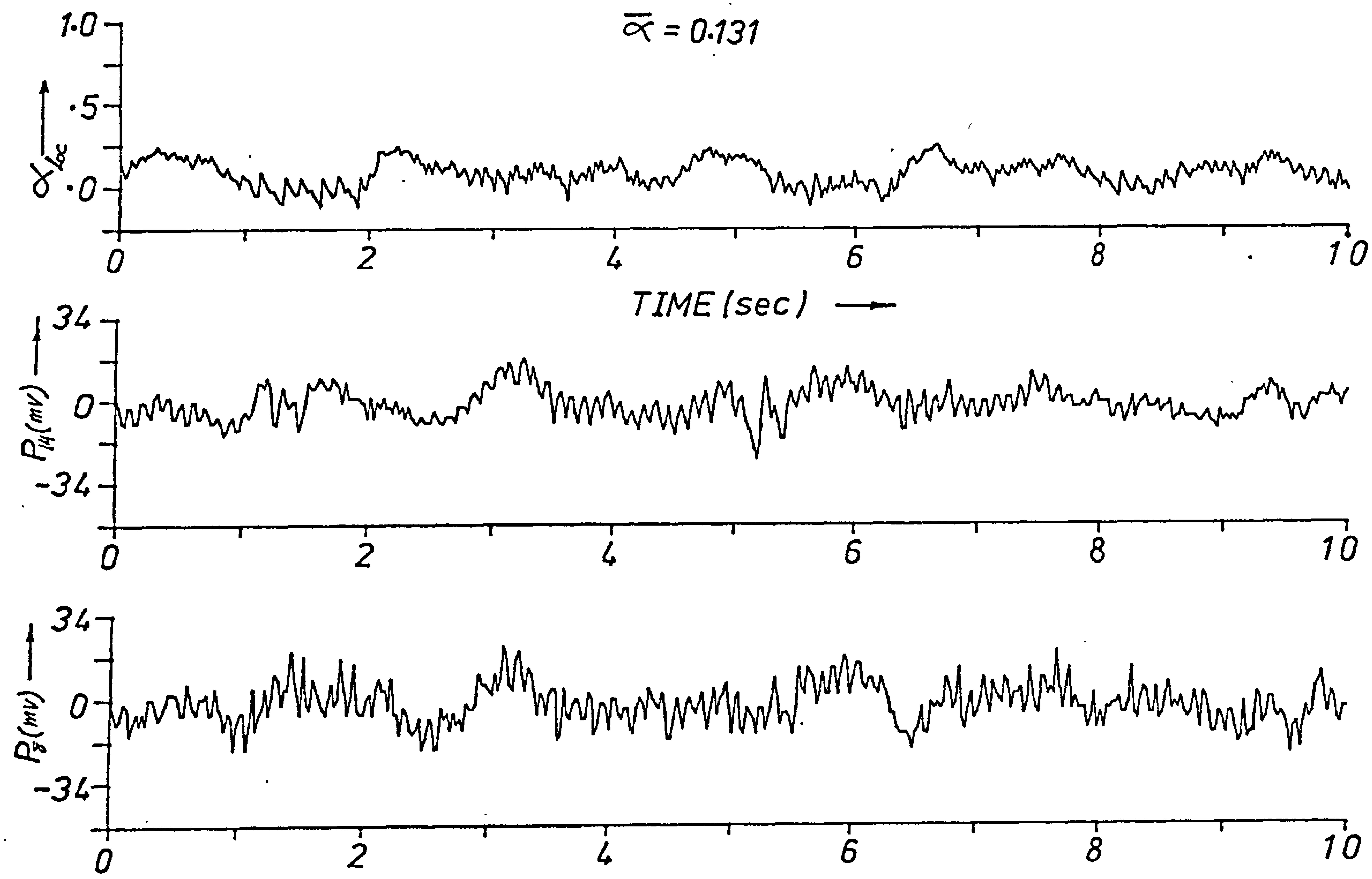


FIG. Y22 TEST RUN CODE (B) 021205 (PLUG)

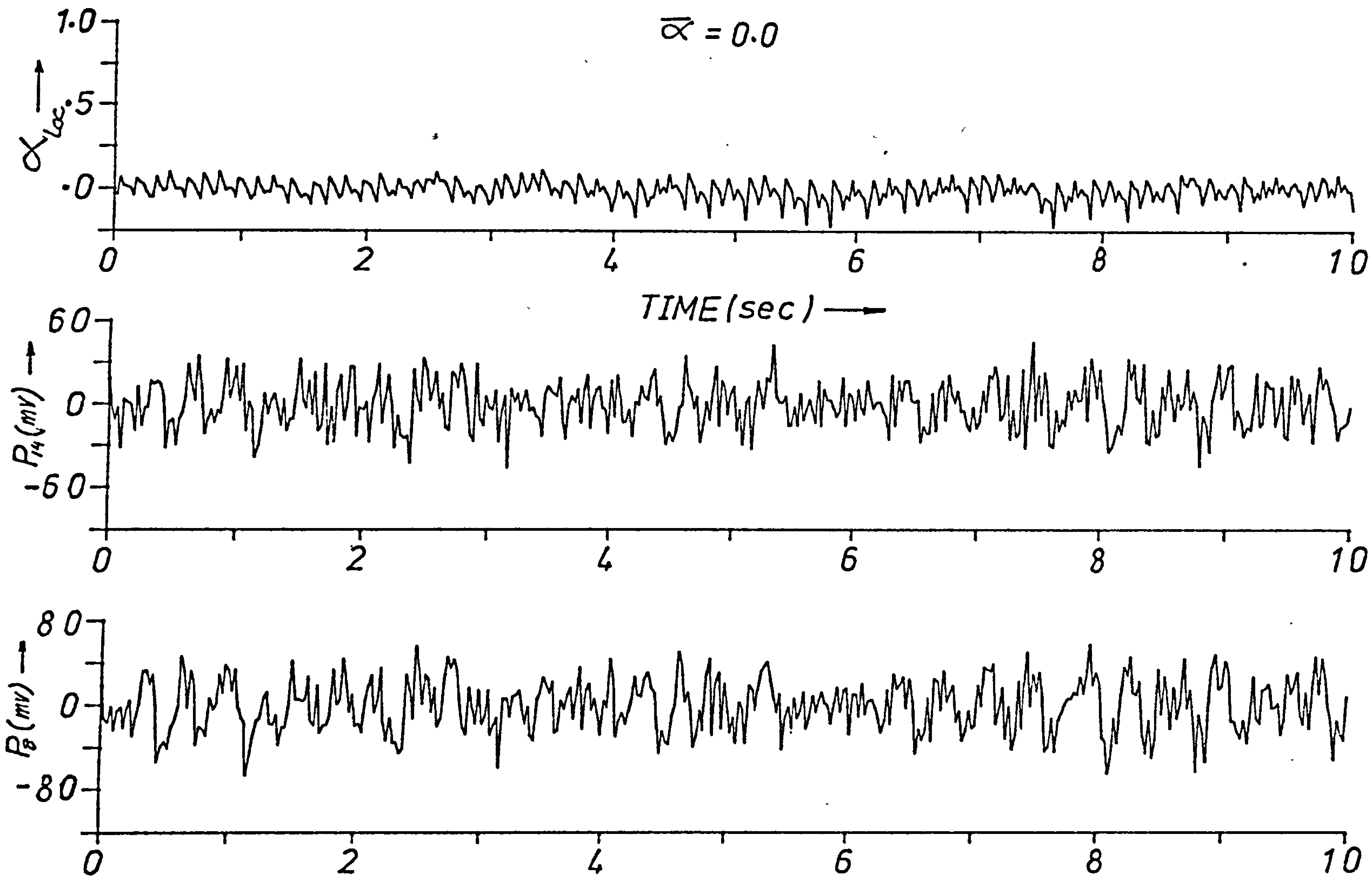


FIG. Y23 TEST RUN 011205 (ALL LIQUID)
CODE (A)

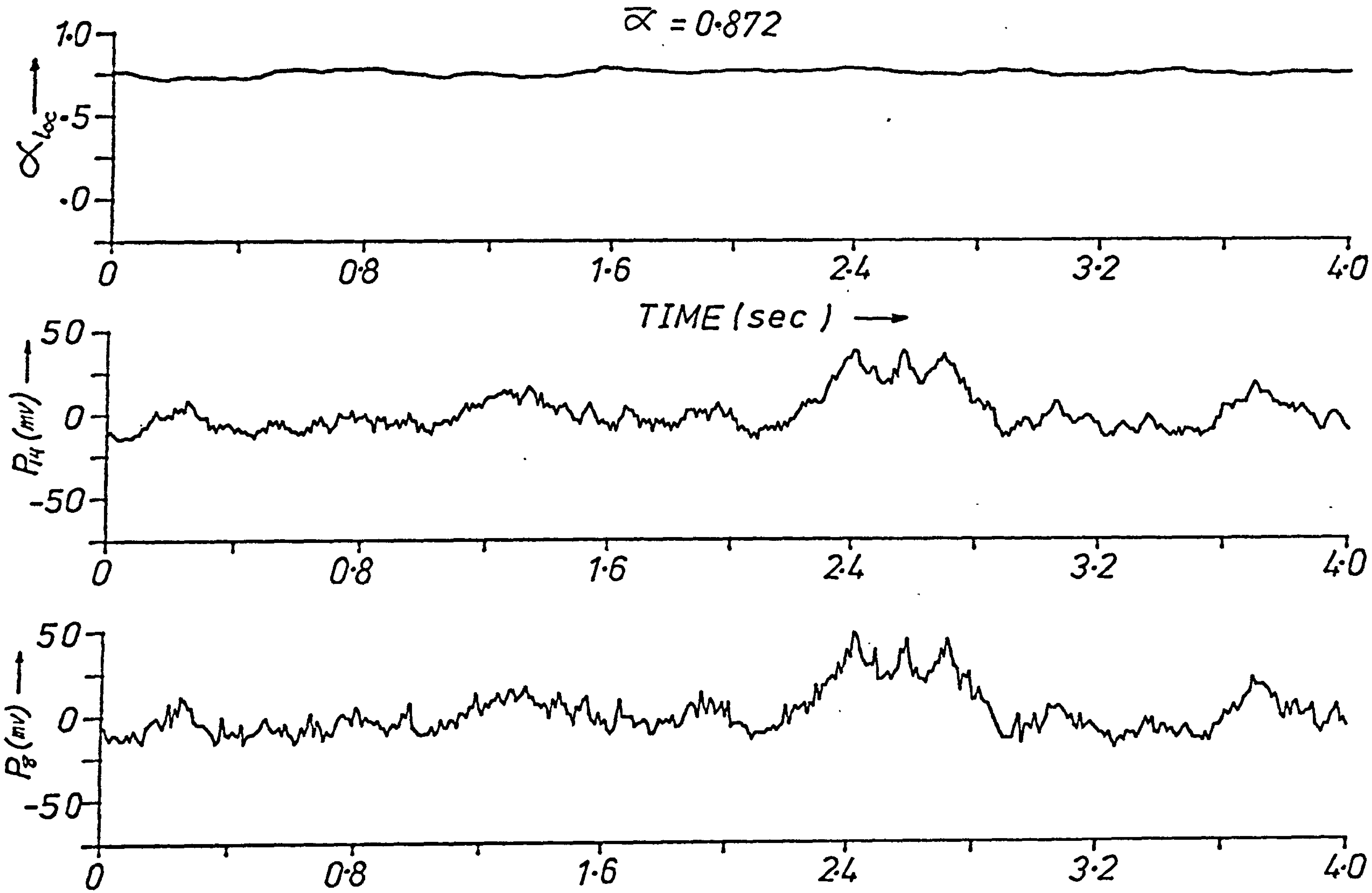


FIG.Y24 TEST RUN 041405 (WAVY / ANNULAR) CODE (P)

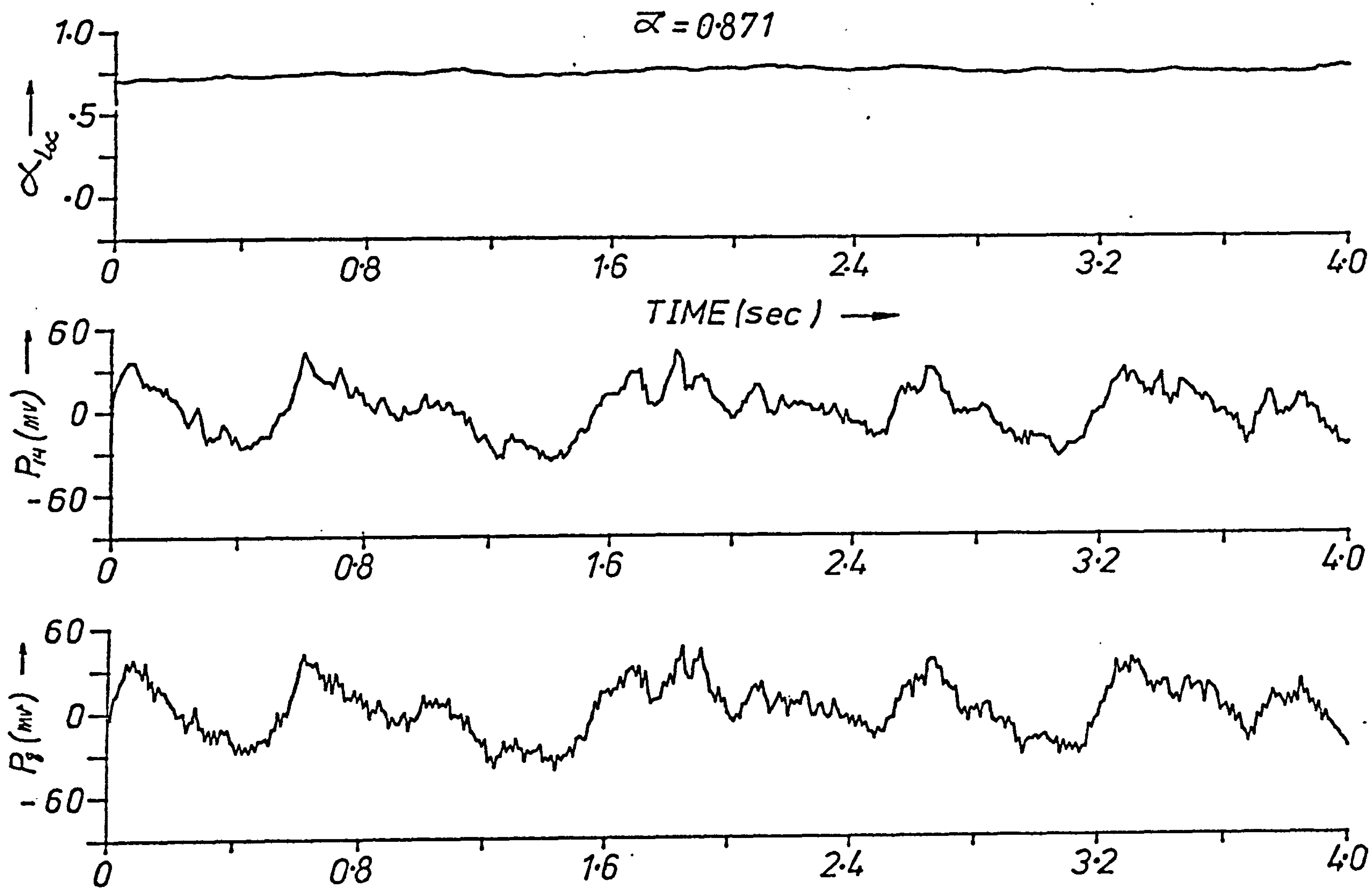


FIG.Y25 TEST RUN 071405 (ANNULAR)
CODE (S)

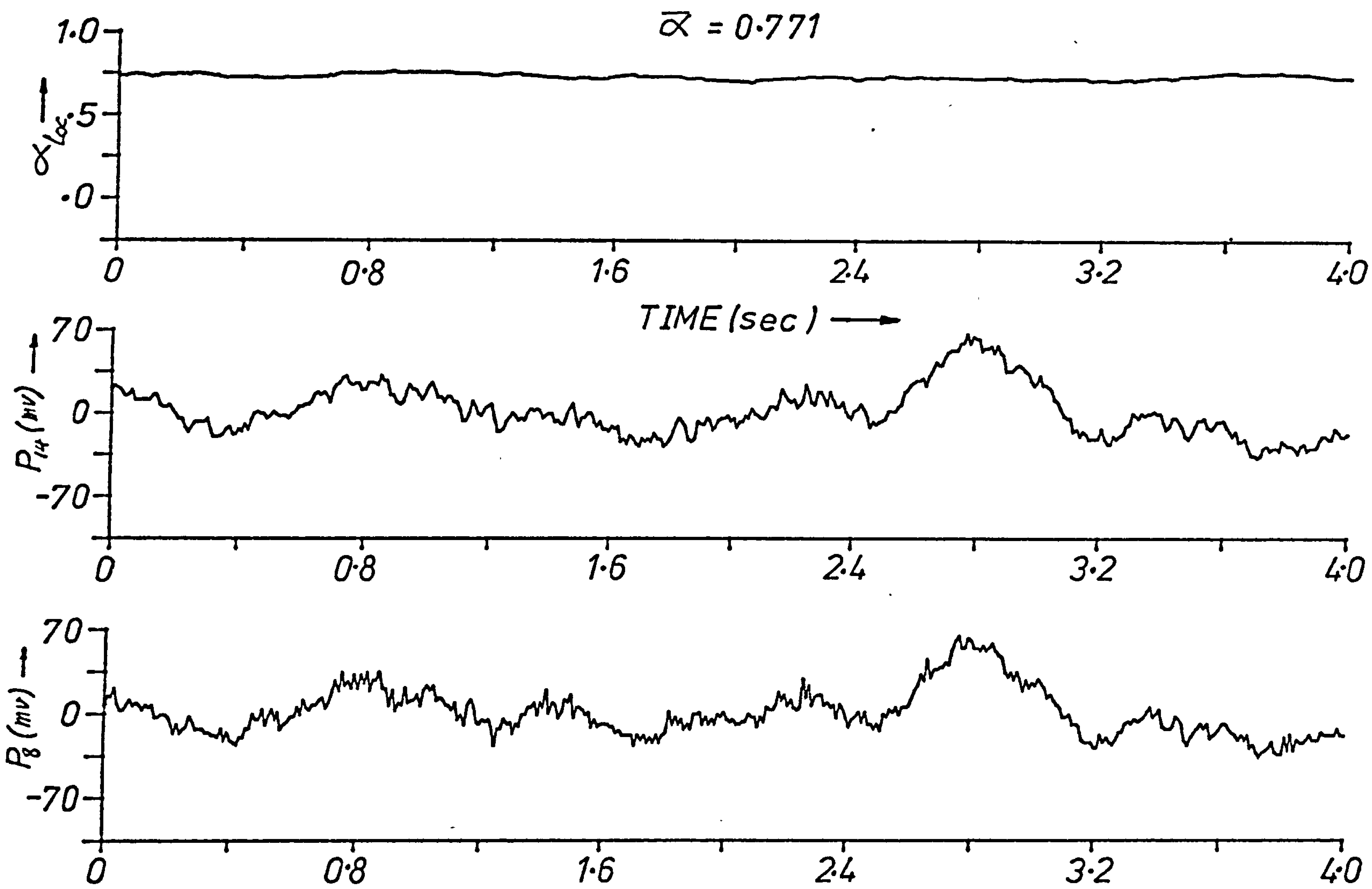


FIG.Y26 TEST RUN 101405 (ANNULAR)
CODE (V)

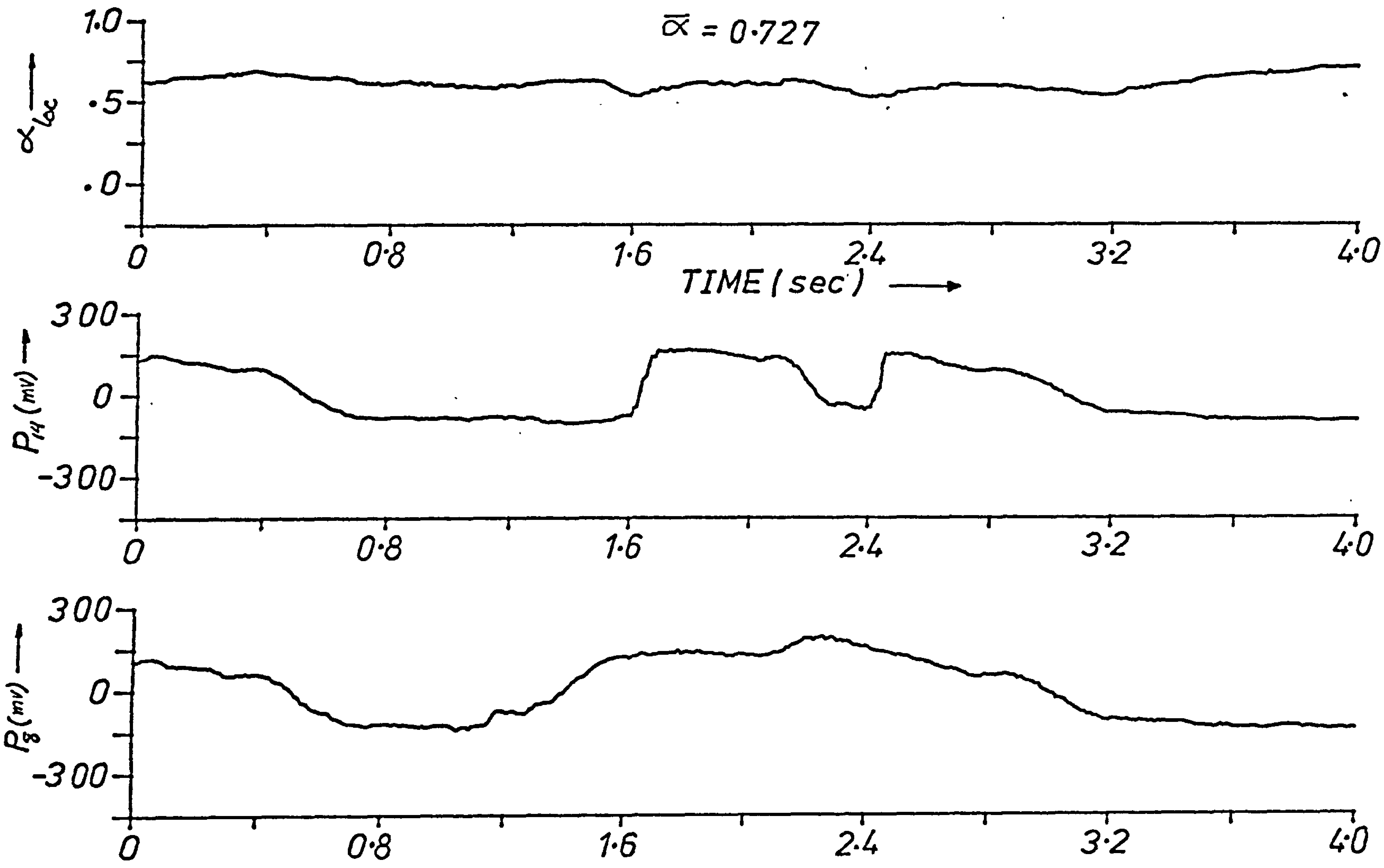


FIG.Y27 TEST RUN 151405 (SLUG)
CODE (AA)

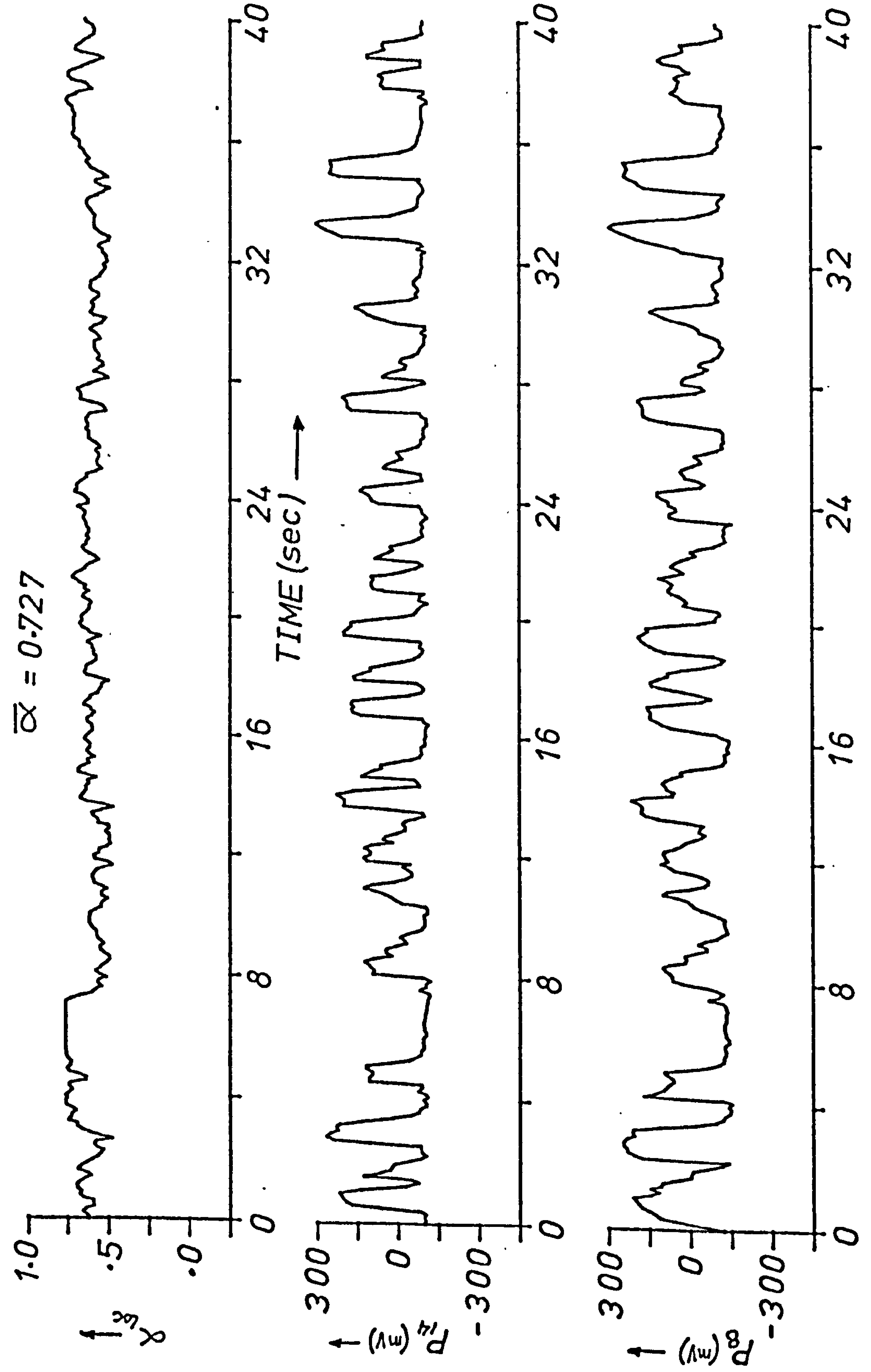
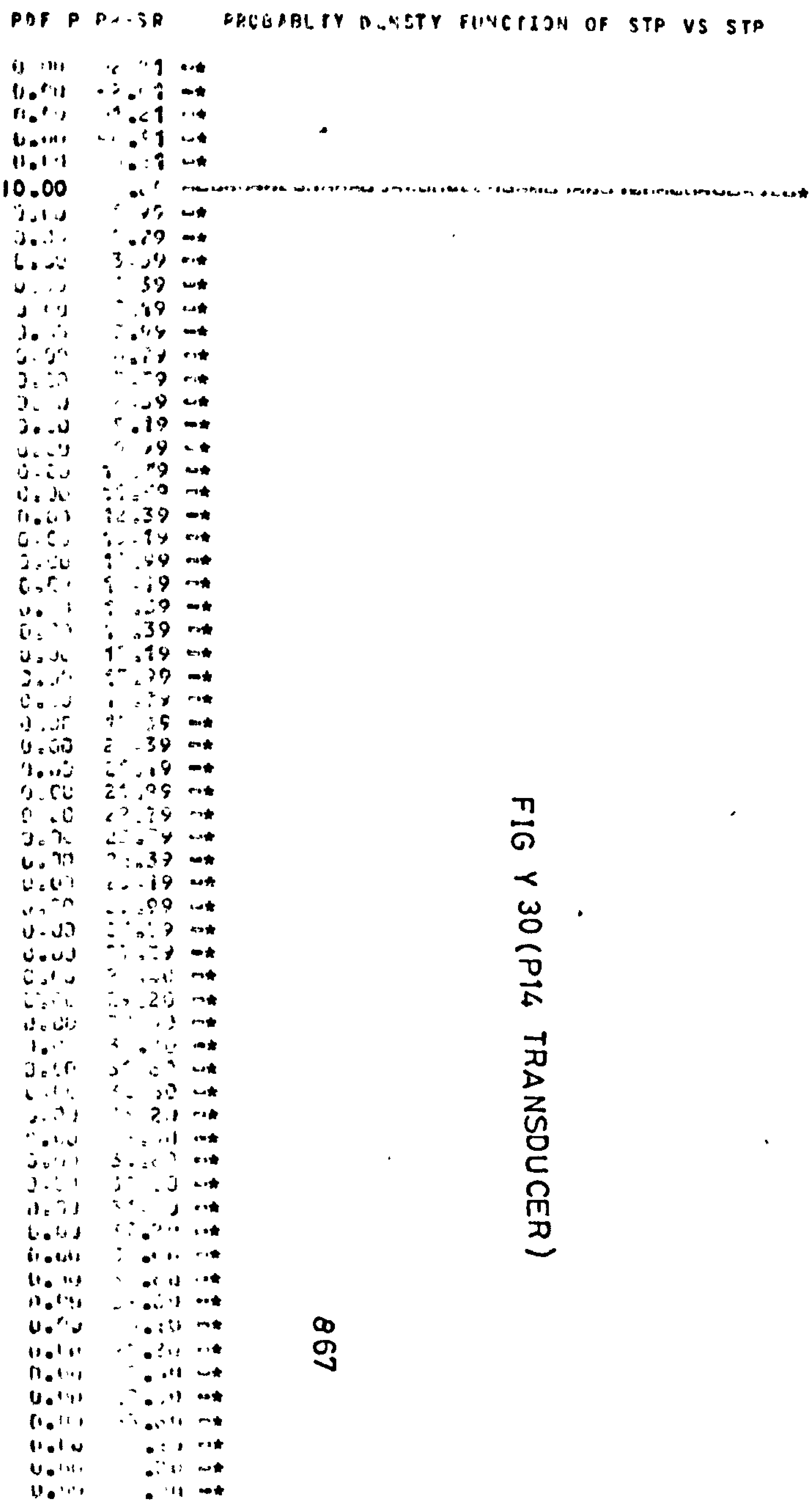


FIG.Y28 TEST RUN 161405 (SLUG)
CODE (BB)

DISTORTED PAGES IN ORIGINAL



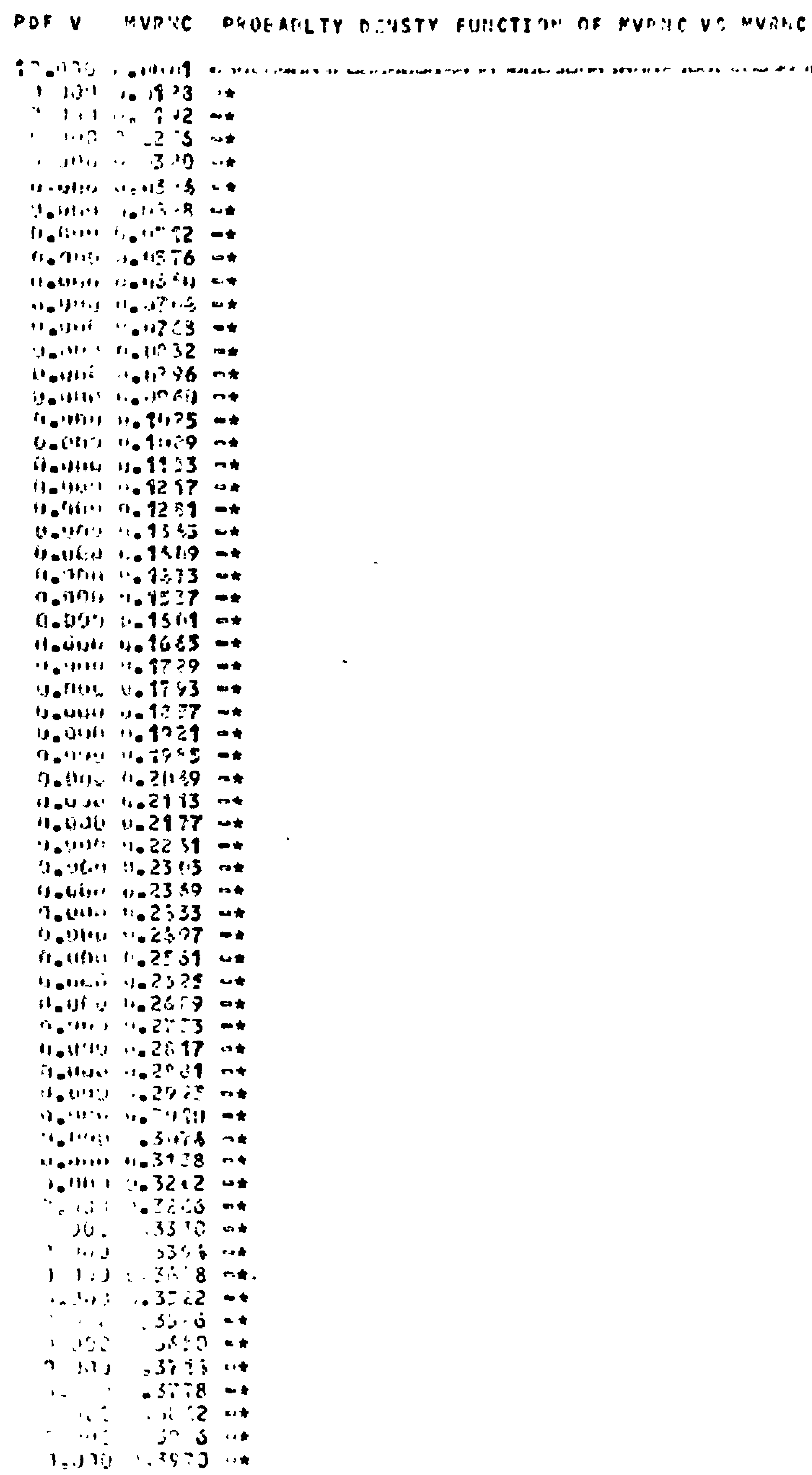


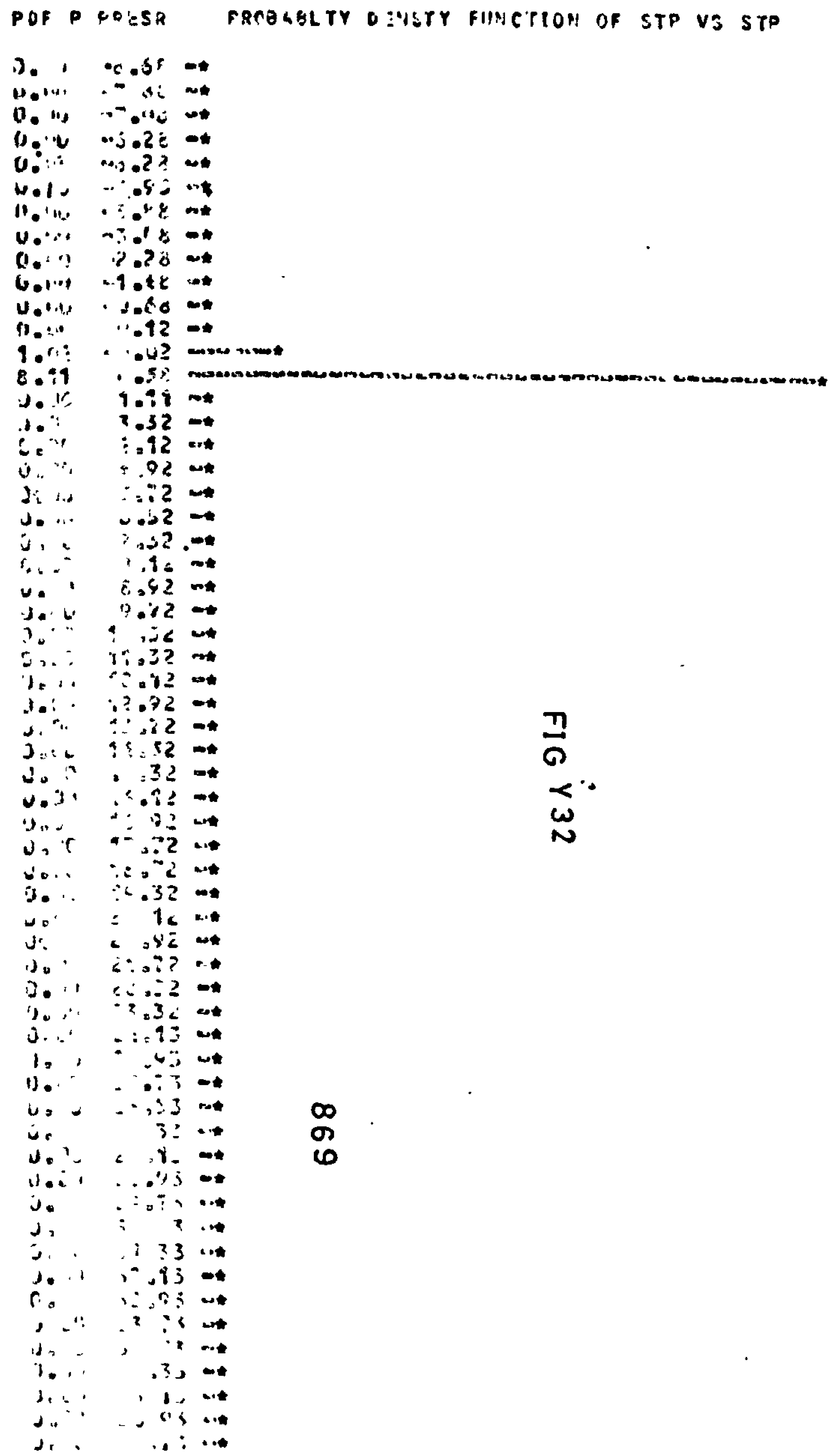
FIG Y 30 (P14 TRANSDUCER)

PDF P	PRESR	PROBAPLTY DENSTY FUNCTION OF STP VS STP
0.0[illegible]	[illegible]2.70	-*
0.0[illegible]	[illegible]1.90	-*
0.00	[illegible].10	-*
0.00	[illegible].30	-*
0.0[illegible]	[illegible].30	-*
9.92	[illegible]	--*
0.0[illegible]	[illegible].10	-*
0.00	[illegible].90	-*
0.00	[illegible].70	-*
0.00	[illegible].50	-*
0.00	[illegible].31	-*
0.00	[illegible].11	-*
0.00	[illegible].91	-*
0.00	[illegible].71	-*
0.00	[illegible].51	-*
0.00	9.31	-*
0.00	1[illegible].11	-*
0.00	1[illegible].91	-*
0.00	1[illegible].71	-*
0.00	[illegible]1	-*
0.00	[illegible]51	-*
0.00	[illegible]11	-*
0.00	1[illegible]91	-*
0.00	[illegible].71	-*
0.00	[illegible].51	-*
0.00	1[illegible].31	-*
0.00	[illegible].11	-*
0.00	1[illegible].91	-*
0.00	[illegible].71	-*
0.00	2[illegible].51	-*
0.0[illegible]	2[illegible].31	-*
0.00	[illegible] 11	-*
0.00	2[illegible].91	-*
0.0[illegible]	2[illegible].71	-*
0.00	[illegible].51	-*
0.00	[illegible].31	-*
0.00	[illegible].11	-*
0.00	[illegible].91	-*
0.00	[illegible].71	-*
[illegible]	[illegible]1	-*
[illegible]	[illegible].31	-*
0.00	3[illegible].11	-*
0.0[illegible]	[illegible].91	-*
0.0[illegible]	3[illegible].71	-*
0.0[illegible]	[illegible]1	-*
0.[illegible]	3[illegible]1	-*
0.[illegible]	[illegible]11	-*
0.00	[illegible]91	-*
[illegible]	[illegible].71	-*
[illegible]	[illegible]1	-*
[illegible]	[illegible]31	-*
[illegible]	[illegible]11	-*
[illegible]	[illegible]1	-*
[illegible]	[illegible]1	-*
[illegible]	[illegible]11	-*
[illegible]	[illegible]1	-*
[illegible]	[illegible]11	-*
[illegible]	[illegible]91	-*
[illegible]	[illegible]	-*

PDF V	MVRNC	PROBAPLTY DENSTY FUNCTION OF MVRNC VS MVRNC
10.000	0.0001	--*
[illegible]	[illegible]128	-*
[illegible]000	[illegible]192	-*
0.000	[illegible]0256	-*
0.000	0.0320	-*
0.000	[illegible]0384	-*
0.000	[illegible]448	-*
0.000	0.0512	-*
0.000	0.0576	-*
0.000	0.0640	-*
0.000	0.0704	-*
0.000	0.0768	-*
0.000	0.0832	-*
0.000	0.0895	-*
0.000	0.0960	-*
0.000	0.1023	-*
0.000	0.1089	-*
0.000	0.1153	-*
0.000	0.1217	-*
0.000	0.1281	-*
0.000	0.1345	-*
0.000	0.1409	-*
0.000	0.1473	-*
0.000	0.1537	-*
0.000	0.1601	-*
0.000	0.1665	-*
0.000	0.1729	-*
0.000	0.1793	-*
0.000	0.1857	-*
0.000	0.1921	-*
0.000	0.1985	-*
0.000	0.2049	-*
0.000	0.2113	-*
0.000	0.2177	-*
0.000	0.2241	-*
0.000	0.2305	-*
0.000	0.2369	-*
0.000	0.2433	-*
0.000	0.2497	-*
0.000	0.2561	-*
0.000	0.2625	-*
0.000	0.2689	-*
0.000	0.2753	-*
0.000	0.2817	-*
0.000	0.2881	-*
0.000	0.2945	-*
0.000	0.3010	-*
[illegible]	0.3073	-*
0.000	0.3138	-*
[illegible]	0.3202	-*
0.000	0.3266	-*
0.000	0.3330	-*
0.000	0.3394	-*
0.000	0.3458	-*
0.000	0.3522	-*
0.000	[illegible]3586	-*
0.000	0.3650	-*
0.000	0.3714	-*
0.000	0.3778	-*

FIG. Y31

868


PDF P PRESR
PROBABLTY DENSTY FUNCTION OF STP VS STP

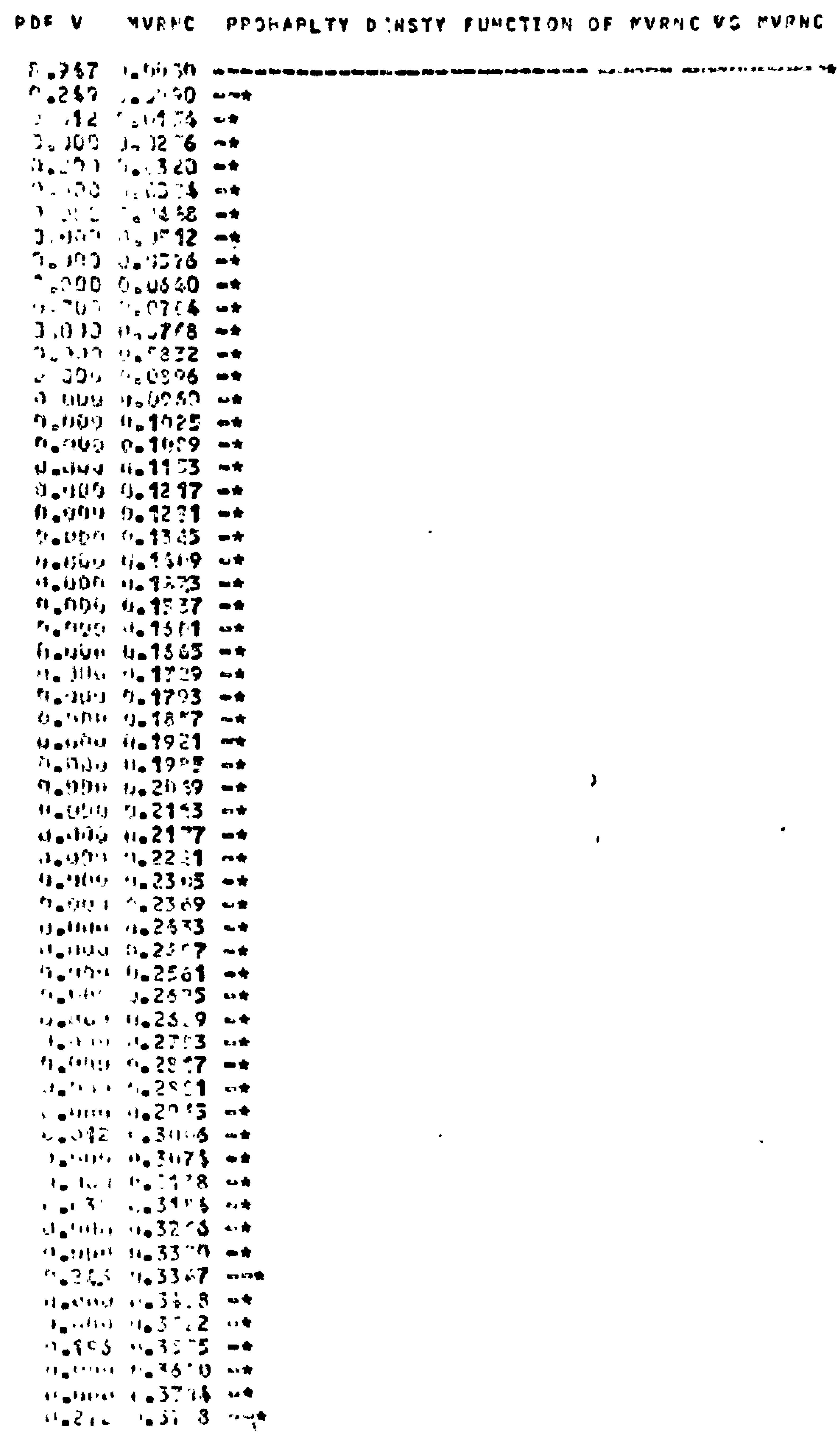

PDF V
MVRNC
PROBAPLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y32

PDF P	PRESR	PROBABLTY DENSTY FUNCTION OF STP VS STP
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
1.75	[illegible]	---------------*
6.73	[illegible]	--*
[illegible]	.71	--------*
0.11	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible].36	-*
[illegible]	[illegible].15	-*
[illegible]	[illegible]	-*
[illegible]	6.76	-*
[illegible]	[illegible]	-*
[illegible]	.37	-*
[illegible]	[illegible].17	-*
[illegible]	[illegible].97	-*
[illegible]	[illegible].77	-*
[illegible]	[illegible]	-*
[illegible]	12.37	-*
[illegible]	[illegible].17	-*
[illegible]	[illegible].77	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible].37	-*
[illegible]	[illegible].17	-*
[illegible]	[illegible].97	-*
[illegible]	[illegible].77	-*
[illegible]	[illegible]	-*
[illegible]	[illegible].37	-*
[illegible]	[illegible].17	-*
[illegible]	21.97	-*
[illegible]	[illegible].77	-*
[illegible]	[illegible]	-*
[illegible]	[illegible].37	-*
[illegible]	[illegible].17	-*
[illegible]	[illegible].97	-*
[illegible]	[illegible].77	-*
[illegible]	[illegible]	-*
[illegible]	[illegible].37	-*
[illegible]	[illegible].17	-*
[illegible]	[illegible].97	-*
[illegible]	[illegible].77	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*

FIG Y 33

870

PDF V	MVRNC	PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC
9.381	[illegible]	--*
0.408	[illegible]	--*
[illegible]	[illegible]0170	-*
0.033	0.0228	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
[illegible]	[illegible]	-*
0.000	[illegible]	-*
0.000	0.0575	-*
0.000	0.0640	-*
0.000	[illegible]	-*
0.000	0.0768	-*
0.000	0.0832	-*
0.000	0.0896	-*
0.000	0.0960	-*
0.000	0.1025	-*
0.000	0.1089	-*
0.000	0.1153	-*
0.000	0.1217	-*
0.000	0.1281	-*
0.000	0.1345	-*
0.000	0.1409	-*
0.000	0.1473	-*
0.000	0.1537	-*
0.000	0.1601	-*
0.000	0.1665	-*
0.000	0.1729	-*
0.000	0.1793	-*
0.000	0.1857	-*
0.000	0.1921	-*
0.000	0.1985	-*
0.000	0.2049	-*
0.000	0.2113	-*
0.000	0.2177	-*
0.000	0.2241	-*
0.000	0.2305	-*
0.000	0.2369	-*
0.000	0.2433	-*
0.000	0.2497	-*
0.000	0.2561	-*
0.000	0.2625	-*
0.000	0.2689	-*
0.000	0.2753	-*
0.000	0.2817	-*
0.000	0.2881	-*
0.000	0.2945	-*
0.000	0.3010	-*
0.000	0.3074	-*
0.000	0.3138	-*
0.000	0.3202	-*
0.000	0.3266	-*
0.000	0.3330	-*
0.000	0.3394	-*
0.000	0.3458	-*
0.000	0.3522	-*
0.000	0.3586	-*
0.000	0.3650	-*
0.000	0.3714	-*
0.000	0.3778	-*

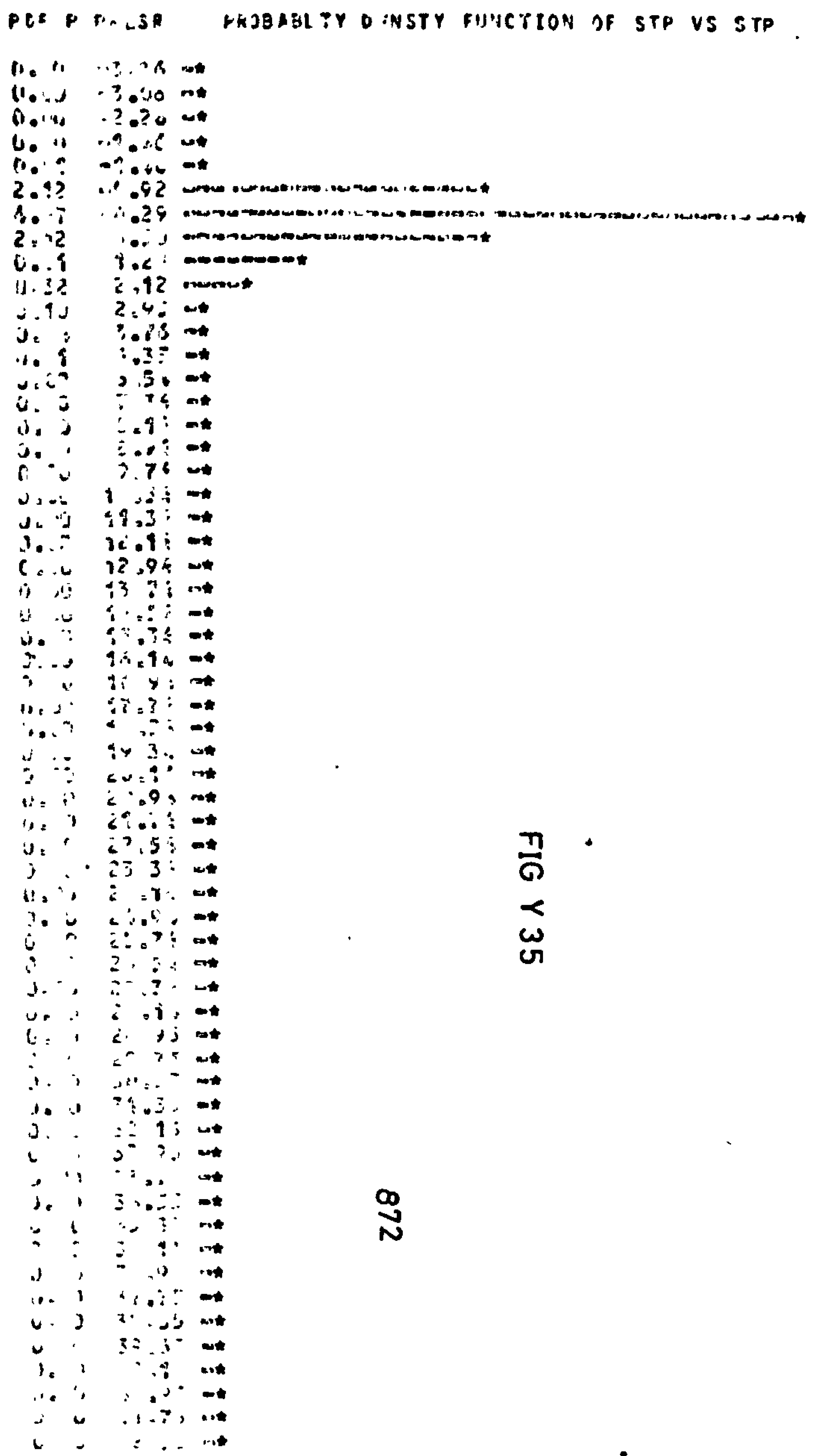
PDF P	PRESR
0.[illegible]	-3.36
0.[illegible]	-2.55
0.[illegible]	-1.74
0.00	[illegible].94
0.[illegible]	[illegible].93
4.50	[illegible].34
4.[illegible]	[illegible].21
0.31	[illegible].95
0.[illegible]	1.[illegible]
0.[illegible]	3.83
0.[illegible]	[illegible].00
0.[illegible]	[illegible].35
0.[illegible]	[illegible].26
0.[illegible]	7.[illegible]
0.00	[illegible]
0.[illegible]	[illegible].60
0.[illegible]	9.[illegible]7
0.[illegible]	1[illegible].27
0.[illegible]	11.[illegible]7
0.00	1[illegible].[illegible]7
0.00	12.[illegible]7
0.[illegible]	13.[illegible]7
0.[illegible]	1[illegible].27
0.[illegible]	1[illegible]
0.[illegible]	1[illegible].[illegible]7
0.0[illegible]	15.67
0.[illegible]	1[illegible].47
0.[illegible]	1[illegible].[illegible]7
0.[illegible]	19.[illegible]7
0.[illegible]	19.87
0.[illegible]	2[illegible].[illegible]7
0.[illegible]	21.47
0.[illegible]	2[illegible].27
0.[illegible]	2[illegible].07
0.[illegible]	2[illegible].[illegible]7
0.[illegible]	2[illegible].07
0.[illegible]	2[illegible]
0.[illegible]	2[illegible].27
0.[illegible]	2[illegible]7
0.[illegible]	2[illegible].[illegible]7
0.[illegible]	2[illegible].[illegible]7
0.[illegible]	2[illegible].[illegible]7
0.[illegible]	[illegible].27
0.[illegible]	3[illegible]7
0.[illegible]	3[illegible].[illegible]7
0.[illegible]	3[illegible].[illegible]7
0.[illegible]	[illegible]7
0.[illegible]	3[illegible]7
0.[illegible]	[illegible]7
0.[illegible]	3[illegible].[illegible]7
0.[illegible]	[illegible].[illegible]7
0.[illegible]	3[illegible]7
0.[illegible]	[illegible]27
0.[illegible]	[illegible].[illegible]7
0.[illegible]	[illegible]7
0.[illegible]	[illegible]7
0.[illegible]	[illegible]
0.[illegible]	[illegible]
0.[illegible]	[illegible]

FROBAELTY DENSTY FUNCTION OF STP VS STP

PDF V	MVRNC
9.550	0.0011
[illegible].362	0.[illegible]77
[illegible].120	0.[illegible]149
0.023	0.0238
0.008	0.0290
0.002	0.0377
0.002	0.[illegible]
0.002	0.0[illegible]77
0.000	0.0[illegible]76
0.000	0.0[illegible]40
0.000	0.07[illegible]4
0.000	0.0768
0.000	0.0832
0.000	0.0896
0.000	0.0960
0.000	0.1025
0.000	0.1089
0.000	0.1153
0.000	0.1217
0.000	0.1281
0.000	0.1345
0.000	0.1409
0.000	0.1473
0.000	0.1537
0.000	0.1601
0.000	0.1665
0.000	0.1729
0.000	0.1793
0.000	0.18[illegible]7
0.000	0.1921
0.000	0.1985
0.000	0.2049
0.000	0.2113
0.000	0.2177
0.000	0.2241
0.000	0.2305
0.000	0.2369
0.000	0.2433
0.000	0.2497
0.000	0.2561
0.000	0.2625
0.000	0.2689
0.000	0.2753
0.000	0.2817
0.000	0.2881
0.000	0.2945
0.000	0.3009
0.000	0.3074
0.000	0.3138
0.000	0.3202
0.000	0.3266
0.000	0.3330
0.000	0.3394
0.000	0.3458
0.000	0.3522
0.000	0.3586
0.000	0.3650
0.000	0.3715
0.000	0.3778

PROPABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y 34


PDF P PULSR PROBABLTY DENSTY FUNCTION OF STP VS STP

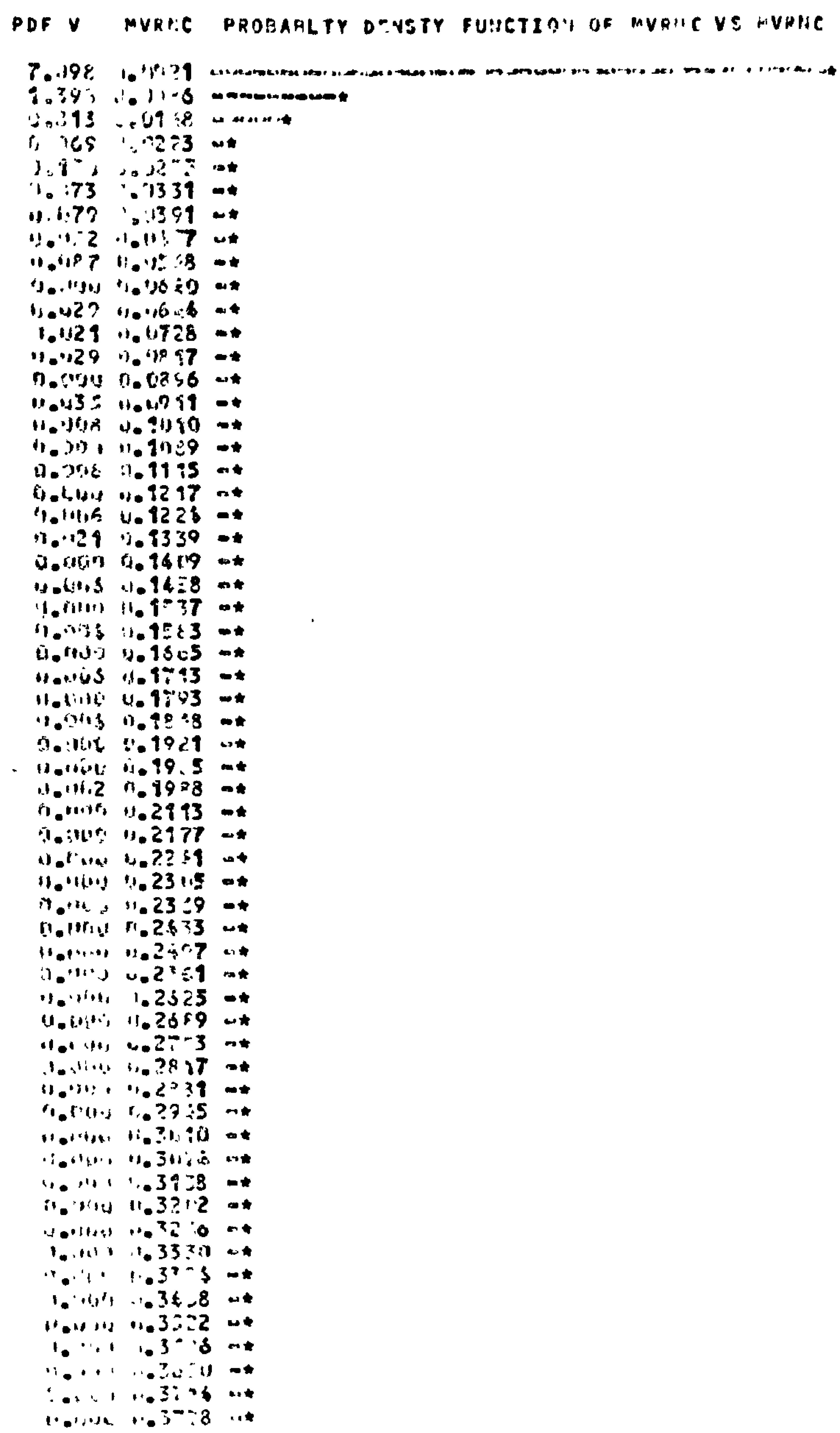
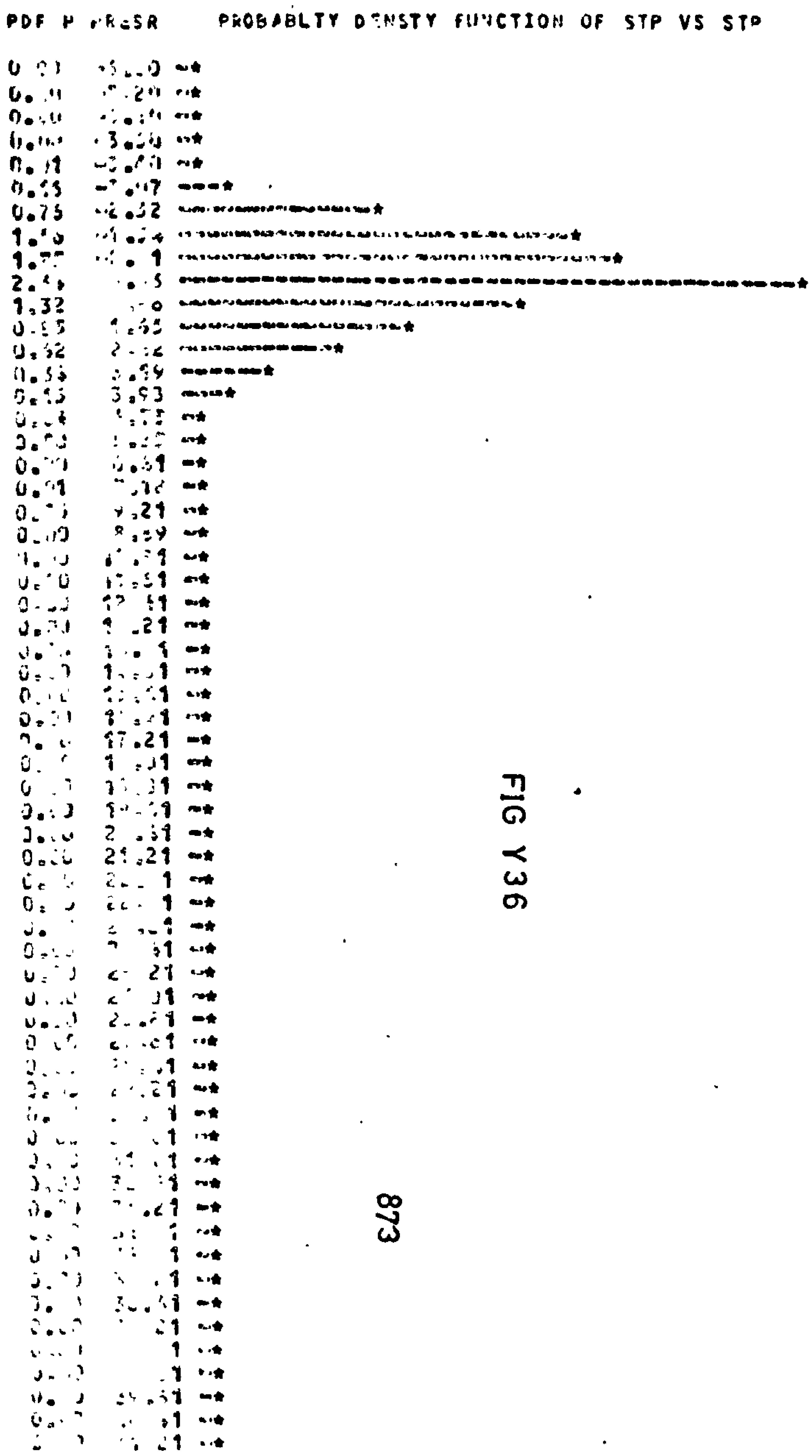

PDF V MVRNC PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y 35


PDF P PRESR PROBABLTY DENSTY FUNCTION OF STP VS STP

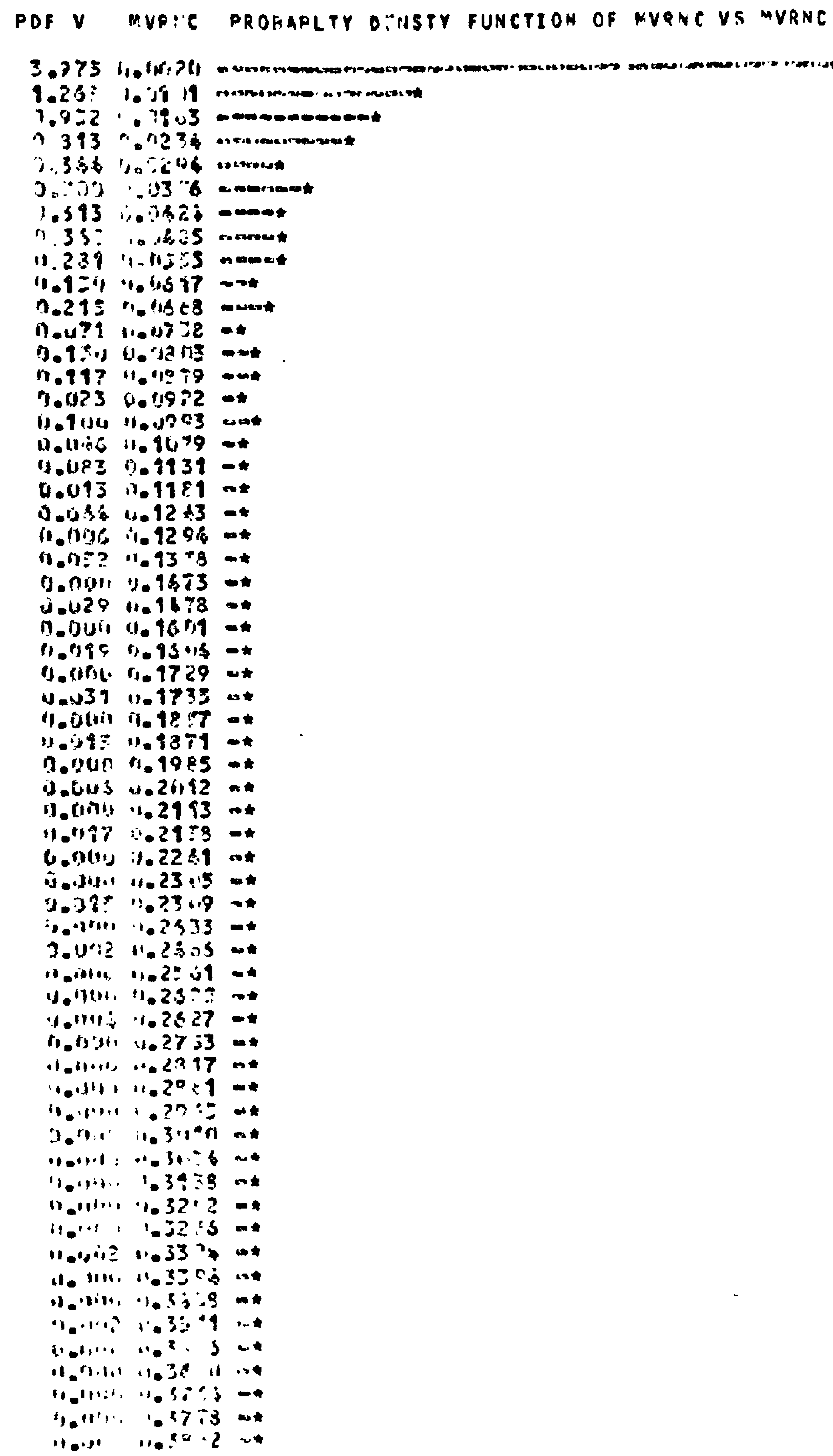
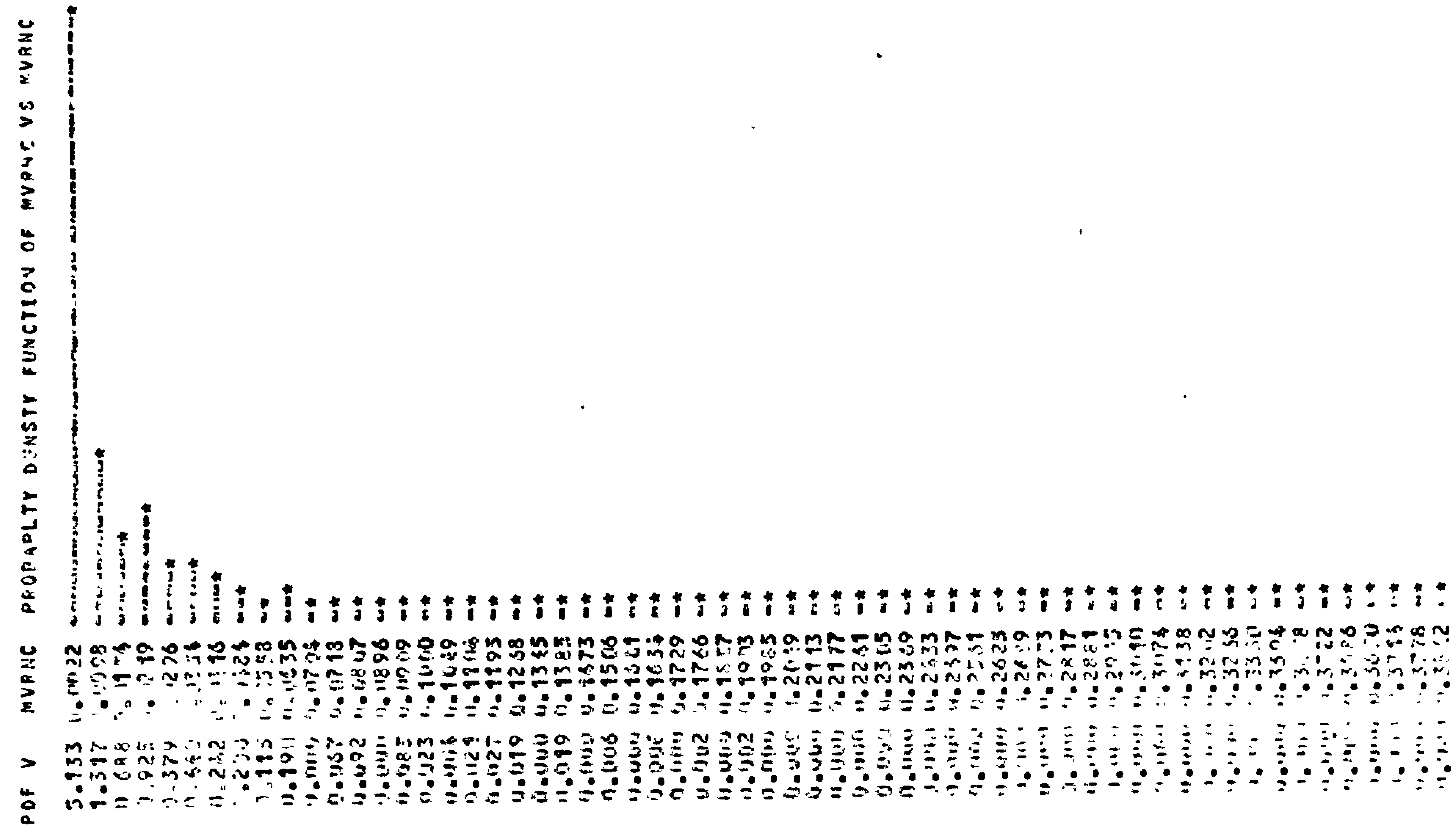

PDF V MVRNC PROBAPLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y36

873



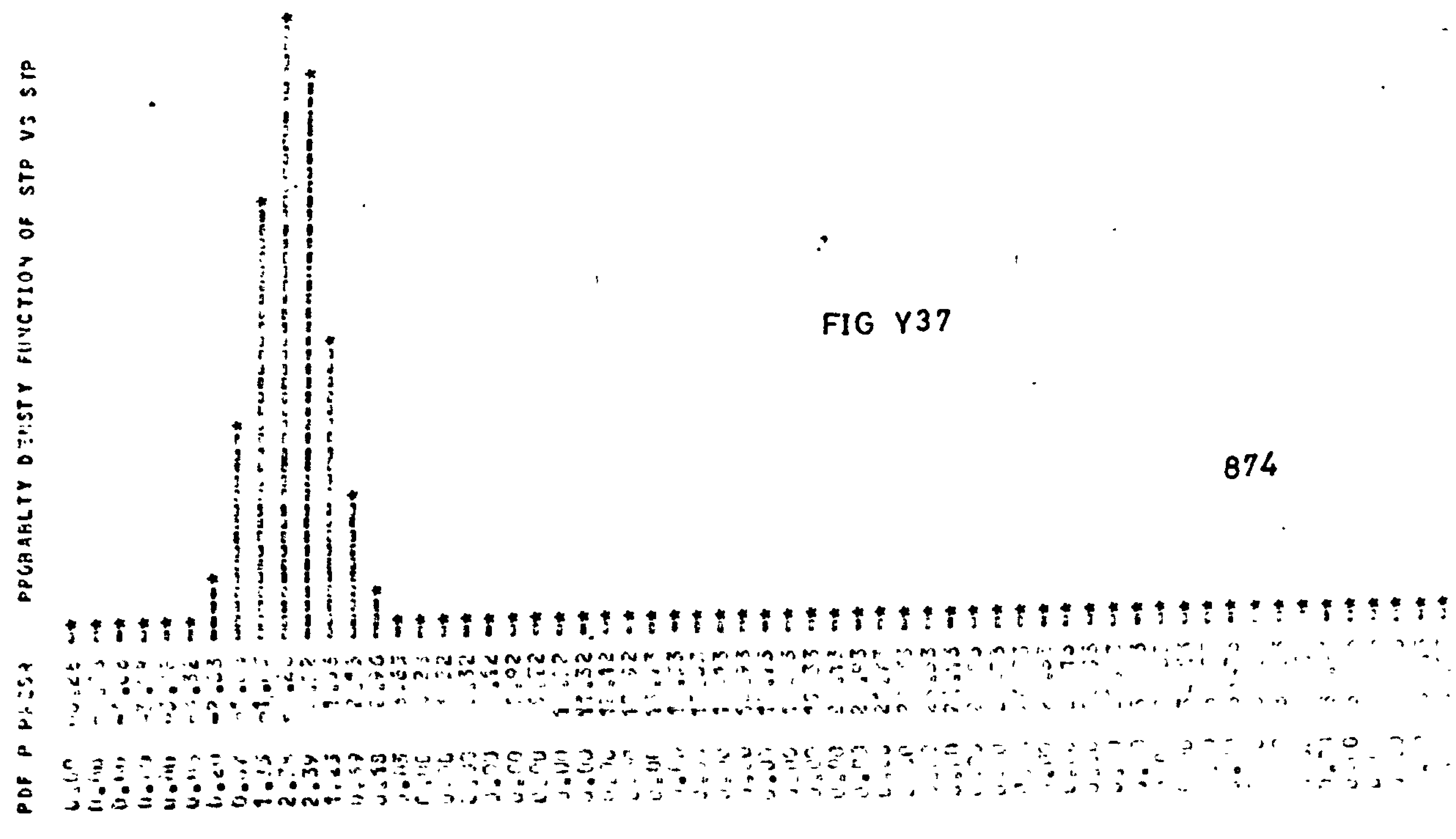


FIG Y37

PDF P	PPLSR
0.00	-[illegible].95
0.00	[illegible].15
0.00	-[illegible].37
0.00	-3.[illegible]
0.01	-3.[illegible]5
0.05	-3.07
0.23	-2.23
1.09	-[illegible].47
2.37	-[illegible].71
3.26	[illegible].[illegible]7
1.66	[illegible]
0.74	[illegible].37
0.23	2.44
0.10	[illegible].22
0.01	[illegible]
0.00	[illegible]
0.00	6.35
0.00	7.[illegible]
0.00	[illegible]
0.00	9.2[illegible]
0.00	1[illegible]
0.00	1[illegible]
0.00	[illegible]
0.00	[illegible].37
0.00	13.23
0.00	1[illegible]
0.00	1[illegible]
0.00	[illegible]
0.00	1[illegible].[illegible]5
0.00	1[illegible].23
0.00	[illegible]
0.00	[illegible].[illegible]5
0.00	1[illegible].65
0.00	[illegible].45
0.00	2[illegible]
0.00	[illegible]
0.00	2[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible].[illegible]5
0.00	2[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]

PROBABLTY DENSTY FUNCTION OF STP VS STP

PDF V	MVRNC
5.990	0.0032
1.232	0.0104
0.371	0.0156
0.737	0.0212
0.371	0.0296
0.223	0.0353
0.223	0.0417
0.383	0.0466
0.117	0.0528
0.098	0.0635
0.000	0.0706
0.056	0.0721
0.025	0.0856
0.015	0.0896
0.023	0.0903
0.033	0.1003
0.000	0.1039
0.050	0.1111
0.006	0.1162
0.015	0.1266
0.000	0.1345
0.002	0.1390
0.000	0.1473
0.002	0.1532
0.000	0.1601
0.000	0.1655
0.000	0.1729
0.095	0.1771
0.000	0.1857
0.000	0.1921
0.000	0.1985
0.000	0.2039
0.000	0.2113
0.000	0.2177
0.000	0.2241
0.000	0.2305
0.095	0.2351
0.000	0.2333
0.000	0.2497
0.000	0.2561
0.000	0.2625
0.000	0.2659
0.000	0.2753
0.000	0.2817
0.000	0.2881
0.000	0.2945
0.000	0.3010
0.000	0.3076
0.000	0.3138
0.000	0.3202
0.000	0.3266
[illegible]	[illegible].3330
0.000	0.3394
0.000	0.3458
0.000	0.3522
0.000	0.3585
0.000	0.3650
0.000	0.3714
0.000	0.3778
0.000	0.3842

PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y38

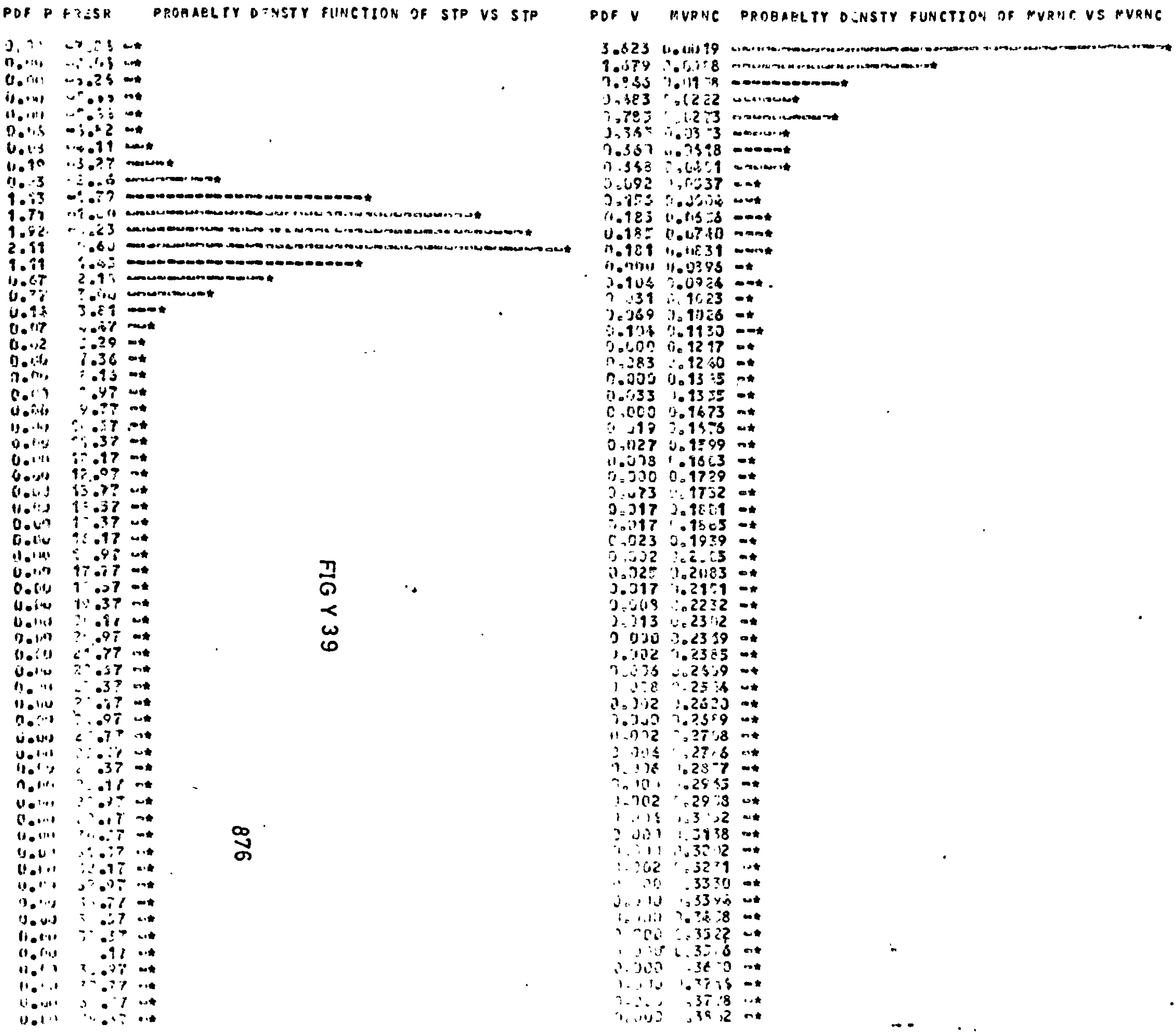

PDF P PRESR
PROBABLTY DENSTY FUNCTION OF STP VS STP
PDF V
MVRNC
PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y 39

876

PDF P	PRESR
0.00	-7.44
0.00	-6.63
0.00	-5.24
0.00	-5.04
0.01	[illegible].04
0.05	-4.35
0.11	-3.65
0.30	[illegible].56
0.77	-2.19
1.77	-1.39
1.57	[illegible].65
2.36	0.20
1.21	1.0[illegible]
0.73	1.78
0.43	2.35
0.22	3.33
[illegible]	[illegible].10
[illegible]	[illegible]
0.02	[illegible].16
0.01	6.56
0.01	7.60
0.01	[illegible].35
0.00	[illegible].16
0.01	[illegible].95
0.00	[illegible]
0.00	12.55
0.00	13.36
0.00	14.16
0.00	[illegible].95
0.00	1[illegible].75
0.00	[illegible].55
0.00	17.36
0.00	[illegible].16
0.00	[illegible].96
0.00	[illegible].76
0.00	[illegible]
0.00	2[illegible].37
0.00	22.17
0.00	22.97
[illegible]	2[illegible].77
0.00	2[illegible].57
0.00	2[illegible].37
0.00	2[illegible].17
[illegible]	[illegible].97
0.00	[illegible].77
0.00	[illegible].57
0.00	[illegible].37
[illegible]	[illegible].17
0.00	[illegible].97
0.00	[illegible].77
0.00	32.[illegible]7
0.00	3[illegible].[illegible]7
0.00	3[illegible].17
0.00	3[illegible].97
0.00	3[illegible].77
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible].97
[illegible]	[illegible]

PROBABLTY DENSTY FUNCTION OF STP VS STP

PDF V	MVRNC
3.773	0.0019
1.729	0.0097
1.025	0.0158
0.510	0.0216
0.638	0.0238
0.421	0.03[illegible]8
0.302	0.0415
0.183	0.0496
0.166	0.0538
0.233	0.0[illegible]89
0.210	0.0579
0.092	0.0730
0.117	0.0786
0.085	0.0877
0.000	0.0960
0.137	0.0974
0.085	0.1076
0.000	0.1153
0.056	0.1184
0.000	0.1281
0.083	0.1297
0.000	0.1409
0.060	0.1414
0.000	0.1537
0.096	0.1551
0.000	0.1663
0.006	0.1666
0.027	0.1731
0.025	0.1799
0.019	0.1837
0.006	0.1937
0.019	0.2008
0.010	0.2081
0.015	0.2154
0.000	0.2231
0.017	0.2365
0.000	0.2369
0.000	0.2533
0.015	0.2561
0.005	0.2542
0.008	0.2622
0.000	0.2699
0.000	0.2753
0.006	0.2779
0.000	0.2881
0.000	0.2935
0.002	0.2950
0.000	0.3024
0.000	0.3138
0.000	0.3202
0.000	0.3266
0.012	0.3319
0.000	0.3356
0.000	0.3438
0.004	0.3506
0.000	0.3556
0.000	0.3670
0.006	0.3698
0.000	0.3778
0.060	0.3822

PROPABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y40

877

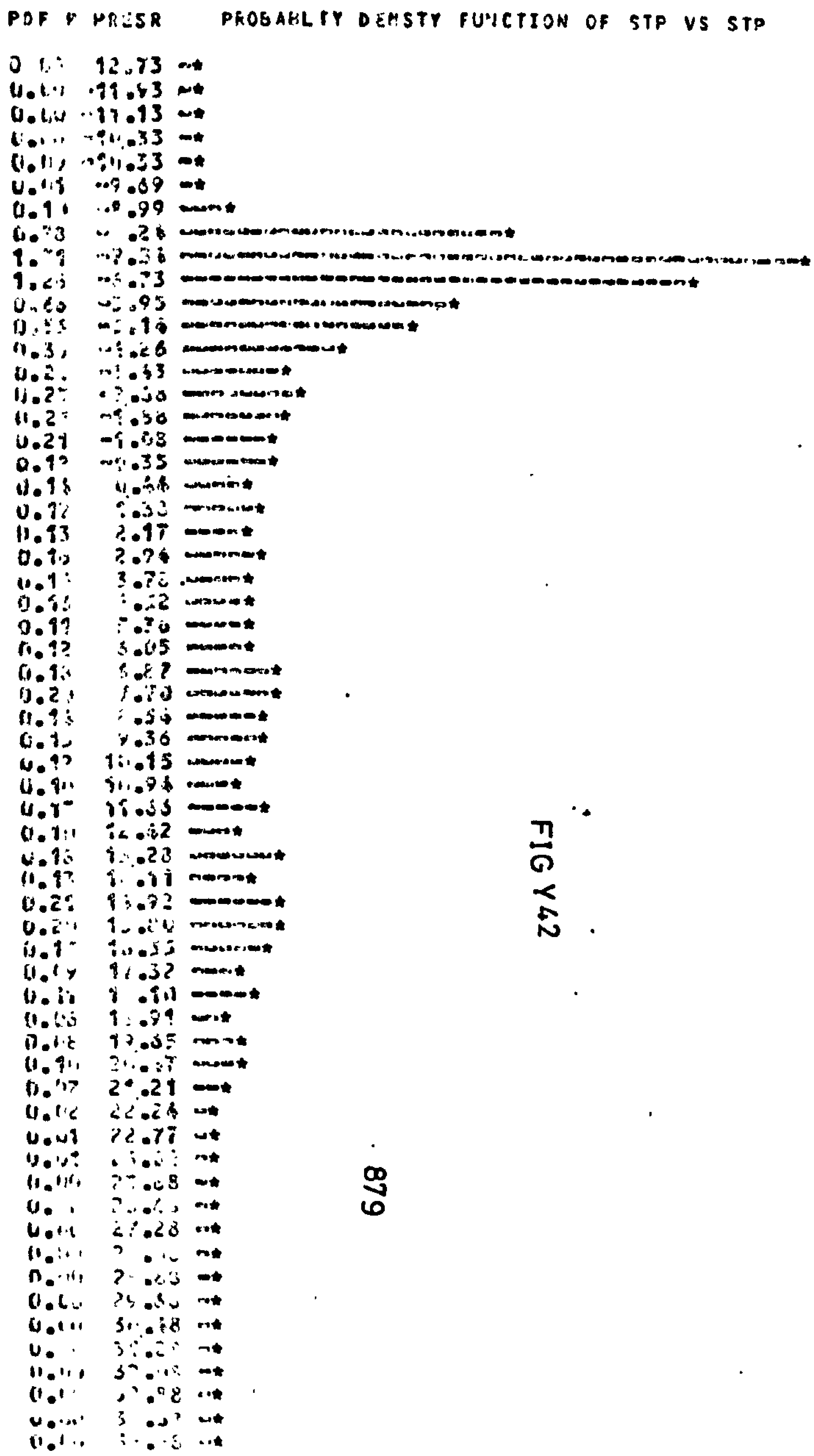
PDF P	PRESR
0.00	-17.92
0.00	-17.12
0.00	[illegible]
0.00	[illegible]
0.00	-13.52
0.02	[illegible]
0.04	-12.23
0.10	-11.37
0.25	-10.52
0.35	-9.84
0.53	-9.13
0.68	-8.31
0.77	[illegible]
0.77	[illegible]
0.50	[illegible]
0.45	-5.05
0.35	[illegible]
0.31	[illegible]
0.23	-2.73
0.24	-1.94
0.22	-1.04
0.21	[illegible]
0.19	[illegible]
0.20	1.41
0.18	2.18
0.18	2.97
0.17	[illegible]
0.17	4.51
0.17	[illegible]
0.17	[illegible]
0.15	[illegible]
0.14	[illegible]
0.12	[illegible]
0.13	[illegible]
0.14	[illegible]
0.14	[illegible]
0.13	[illegible]
0.11	[illegible]
0.15	[illegible]
0.10	[illegible]
0.09	[illegible]
0.11	[illegible]
0.08	[illegible]
0.09	[illegible]
0.11	[illegible]
0.09	[illegible]
0.10	[illegible]
0.10	[illegible]
0.06	[illegible]
0.07	[illegible]
0.06	[illegible]
[illegible]	[illegible]
0.02	[illegible]
0.02	[illegible]
0.01	[illegible]
0.01	[illegible]
0.00	[illegible]
0.01	[illegible]
0.00	[illegible]
[illegible]	[illegible]

PROBABLTY DENSTY FUNCTION OF STP VS STP

PDF V	MVRNC
0.435	0.0026
0.155	0.0099
0.087	0.0162
0.123	0.0231
0.110	0.0293
0.081	0.0355
0.094	0.0423
[illegible]	[illegible]
0.096	0.0559
0.025	0.0619
0.050	0.0674
0.060	0.0736
0.094	0.0813
0.056	0.0881
0.071	0.0923
0.048	0.1019
0.045	0.1030
0.113	0.1128
0.000	0.1217
0.125	0.1239
0.000	0.1345
0.127	0.1364
0.000	0.1473
0.104	0.1511
0.000	0.1611
0.098	0.1637
0.100	0.1729
0.106	0.1775
0.000	0.1827
0.029	0.1874
0.032	0.1930
0.035	0.2015
0.098	0.2073
0.025	0.2162
0.085	0.2221
0.000	0.2305
0.048	0.2313
0.110	0.2375
0.021	0.2449
0.046	0.2533
0.000	0.2575
0.019	0.2631
0.092	0.2697
0.046	0.2708
0.123	0.2865
0.000	0.2915
0.050	0.2970
0.083	0.3040
0.000	0.3138
0.031	0.3177
0.137	0.3219
[illegible]	0.3329
0.000	0.3394
0.131	0.3403
0.060	0.3545
[illegible]	0.3576
[illegible]	0.3592
0.031	0.3708
0.000	0.3778
0.113	0.3786

PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y41


PDF P PRESR
PROBABLTY DENSTY FUNCTION OF STP VS STP

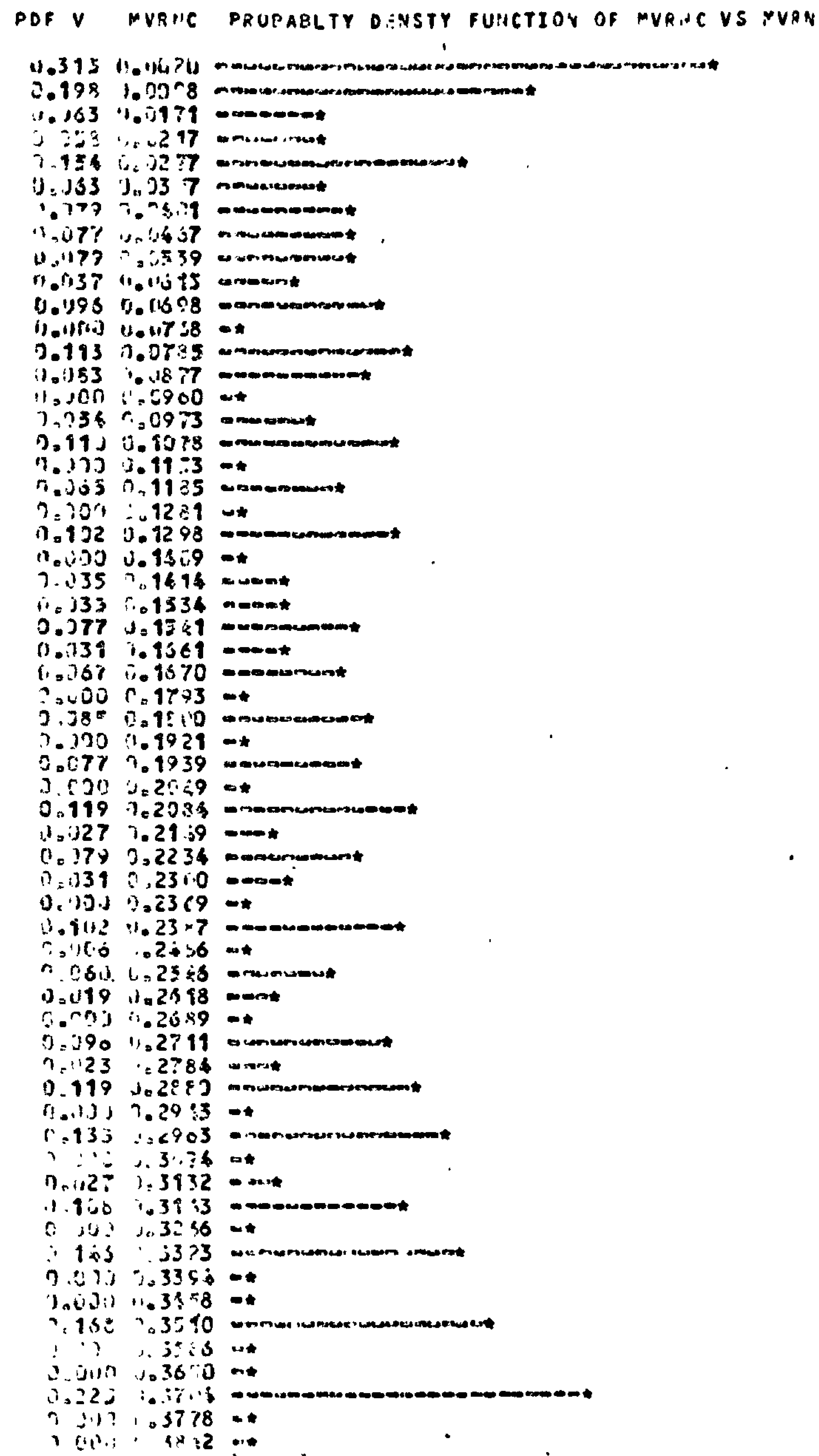
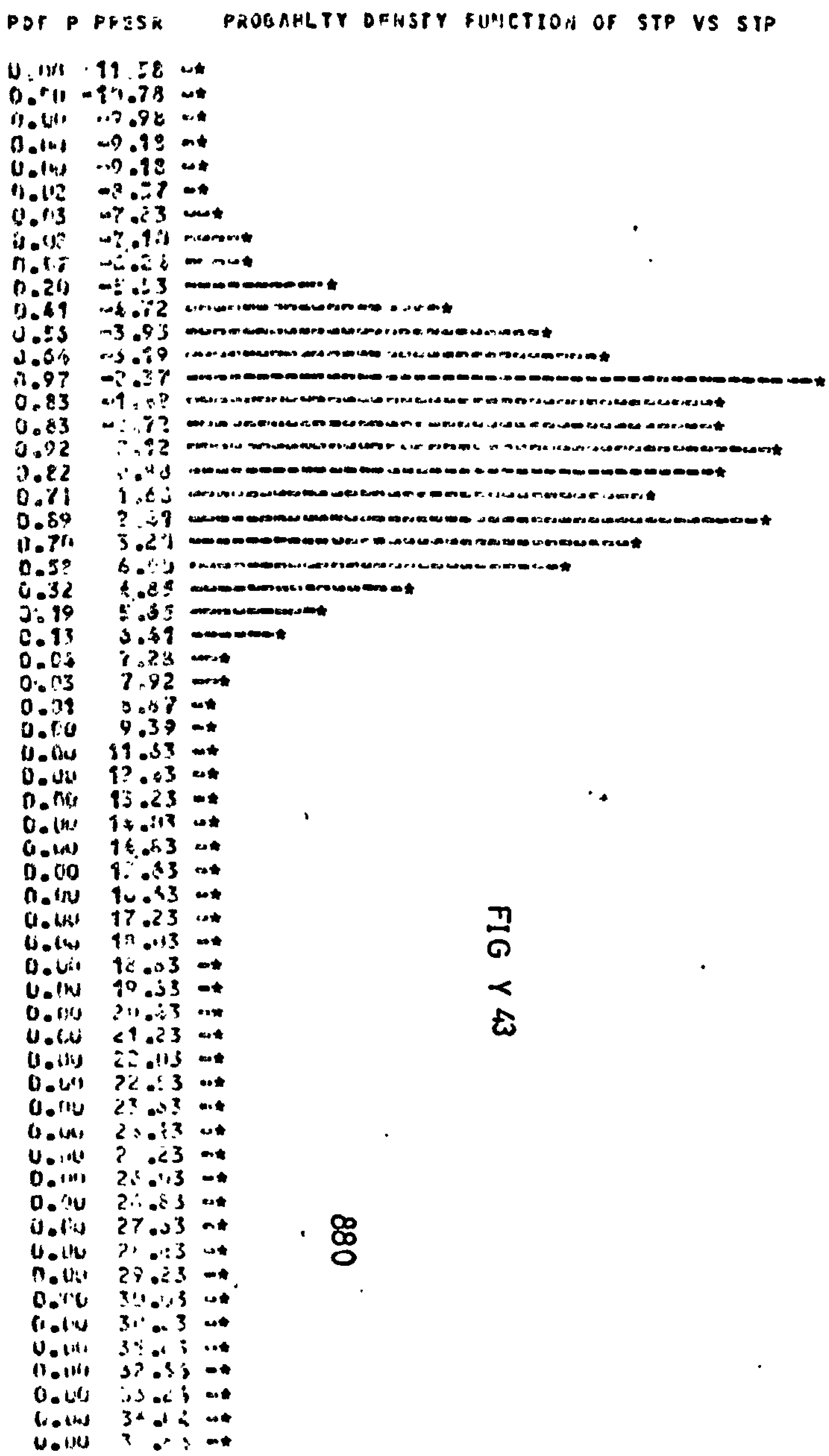

PDF V
MVRNC
PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y42

879


PDF P PRESR
PROBAHLTY DENSTY FUNCTION OF STP VS STP

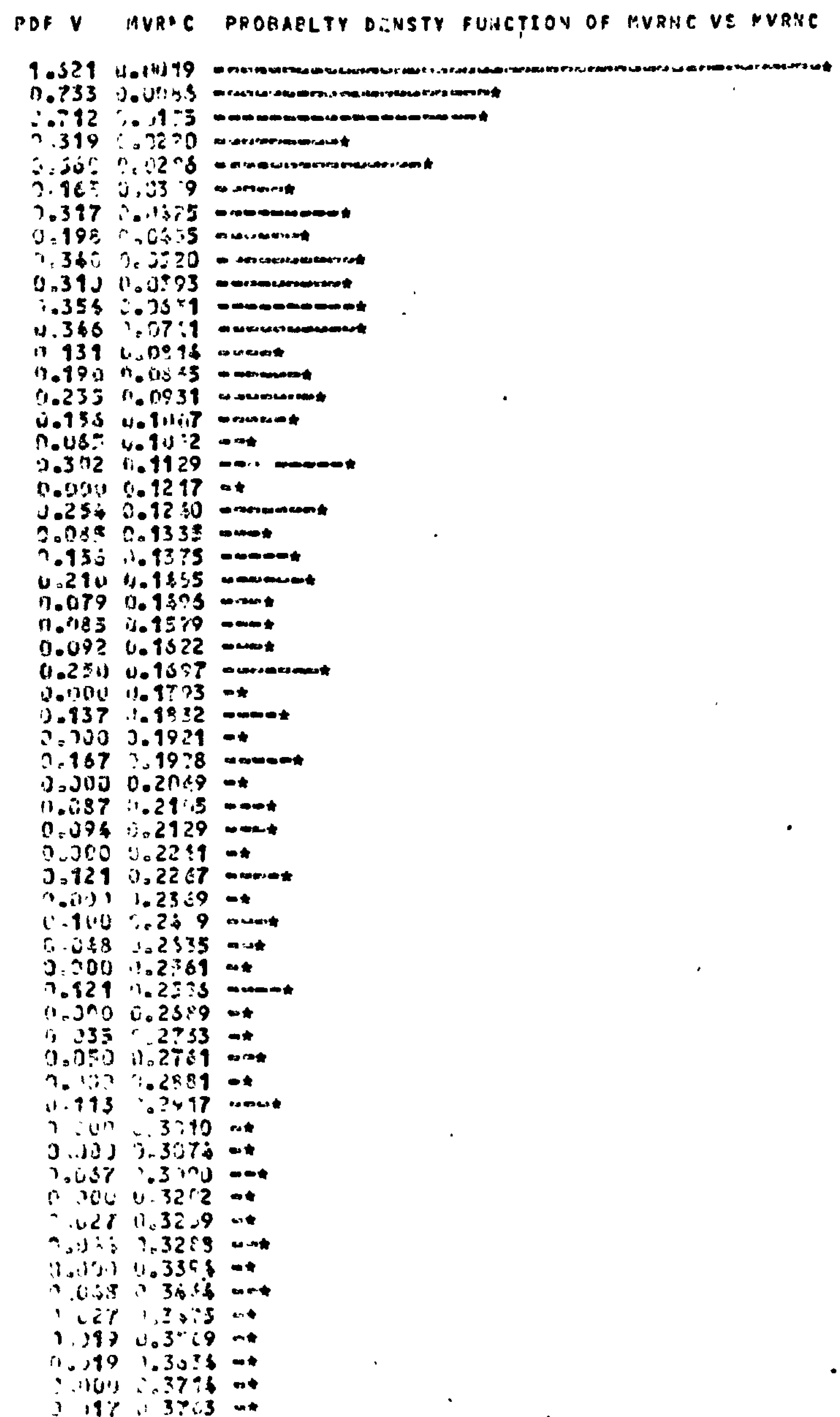

PDF V
MVRNC
PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y 43

880

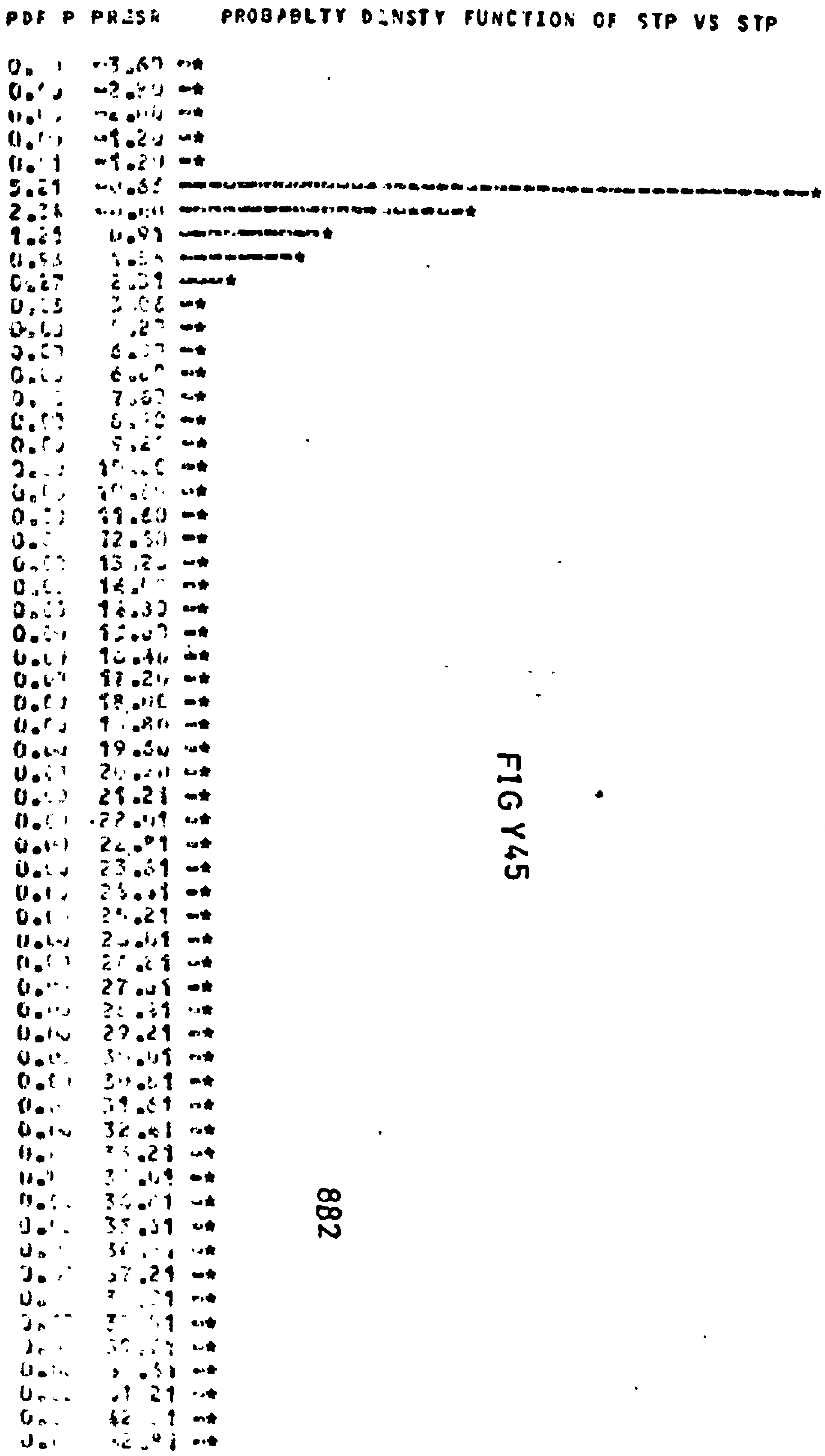
PDF P	PRESR
0.00	-5.33
0.00	-4.56
0.00	-[illegible].26
0.00	-3.06
0.00	-3.05
0.02	-3.54
0.26	-2.67
1.87	-2.01
2.17	-1.26
1.63	-[illegible].48
1.0[illegible]	[illegible].42
0.95	1.23
0.73	1.98
0.43	2.[illegible]
0.30	3.53
0.20	3.27
0.13	5.11
0.11	5.94
0.04	6.54
0.01	7.57
0.01	8.30
0.00	10.54
0.00	11.13
0.00	11.94
0.00	12.76
0.00	13.54
0.00	14.34
0.00	15.14
0.00	15.94
0.00	16.74
0.00	17.55
0.00	18.34
0.00	19.14
0.00	19.94
0.00	20.74
0.00	21.54
0.00	22.34
0.00	23.15
0.00	23.97
0.00	24.73
0.00	25.55
0.00	2[illegible].35
0.00	[illegible].15
0.00	[illegible].95
0.00	[illegible].15
0.00	29.[illegible]
0.00	[illegible]
0.00	31.17
0.00	31.95
0.00	32.[illegible]
0.00	[illegible]
0.00	33.55
0.00	35.15
0.00	35.95
0.00	36.[illegible]
0.00	3[illegible].55
0.00	[illegible].35
0.00	3[illegible].15
0.00	39.95

PROBABLTY DENSTY FUNCTION OF STP VS STP

PDF V	MVRNC
2.573	0.0027
1.223	0.0108
0.959	0.0165
0.950	0.0221
0.530	0.0350
0.688	0.0356
0.515	0.0419
0.352	0.0490
0.434	0.0561
0.087	0.0625
0.123	0.0646
0.221	0.0716
0.096	0.0800
0.071	0.0858
0.123	0.0934
0.019	0.1012
0.079	0.1037
0.042	0.1139
0.000	0.1217
0.071	0.1253
0.096	0.1283
0.055	0.1370
0.000	0.1373
0.060	0.1450
0.005	0.1601
0.042	0.1618
0.000	0.1729
0.028	0.1748
0.000	0.1857
0.058	0.1884
0.000	0.1983
0.037	0.2025
0.000	0.2113
0.006	0.2172
0.000	0.2231
0.000	0.2305
0.033	0.2324
0.000	0.2433
0.013	0.2491
0.000	0.2561
0.000	0.2625
0.060	0.2643
0.000	0.2773
0.021	0.2810
0.000	0.2881
0.000	0.2943
0.049	0.2952
0.000	0.3074
0.000	0.3138
0.017	0.3159
0.000	0.3226
0.000	0.3330
0.027	0.3362
0.000	0.3438
0.000	0.3522
0.021	0.3529
0.000	0.3610
0.000	0.3714
0.027	0.3722

PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y 44


PDF P PRESR PROBABLTY DENSTY FUNCTION OF STP VS STP

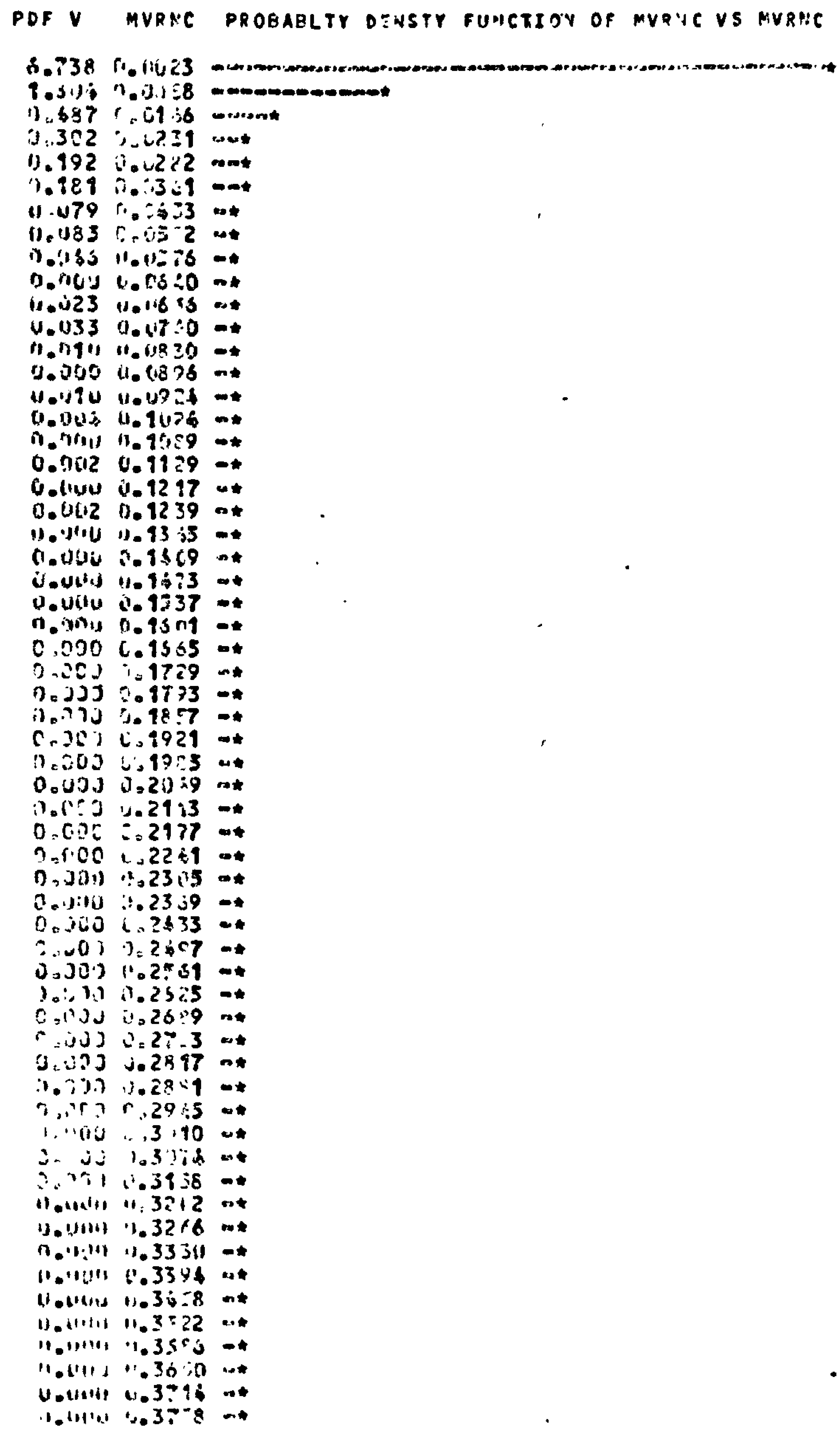

PDF V MVRNC PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y45

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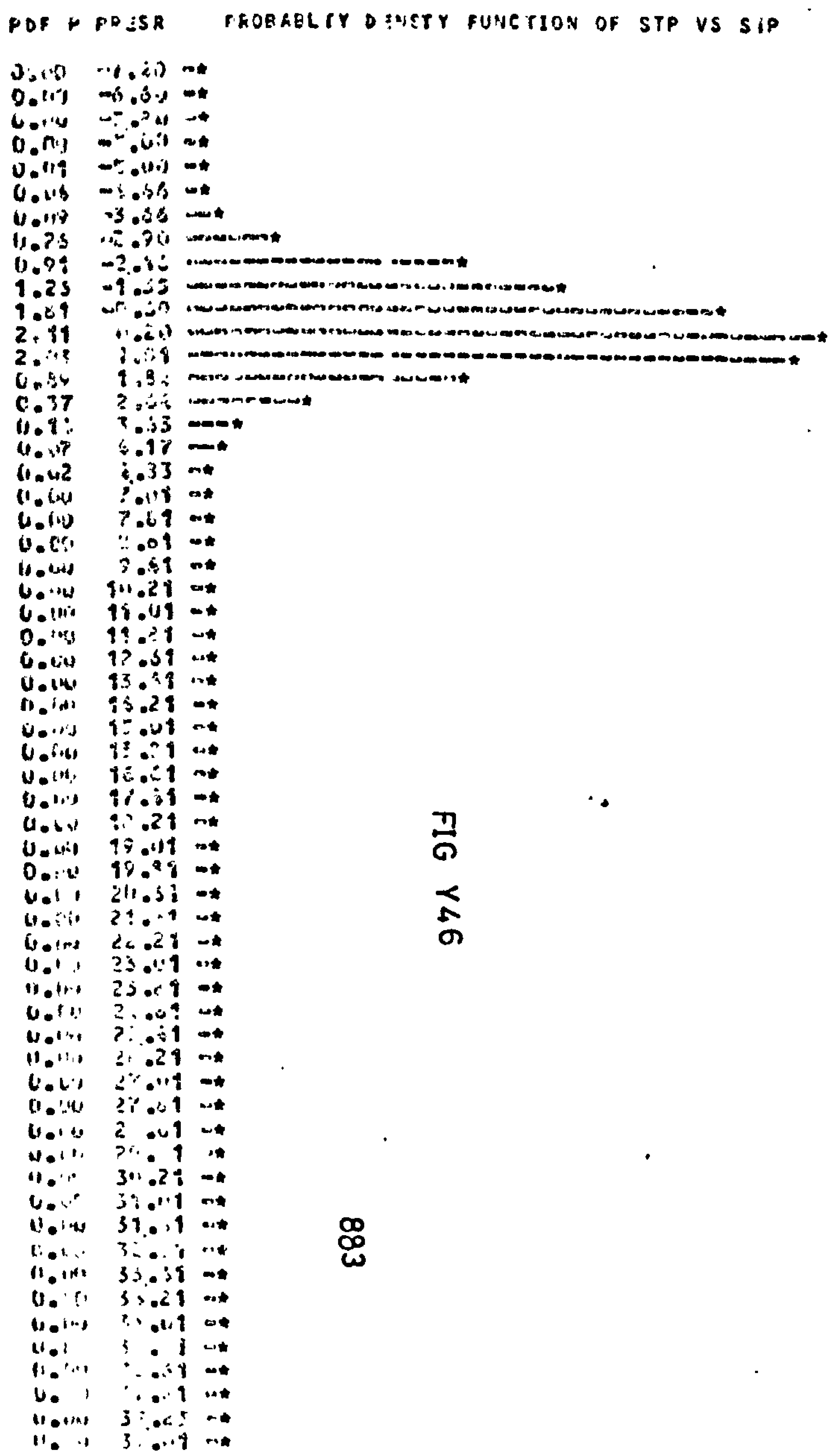
PDF P PRESR
PROBABLTY DENSTY FUNCTION OF STP VS SIP

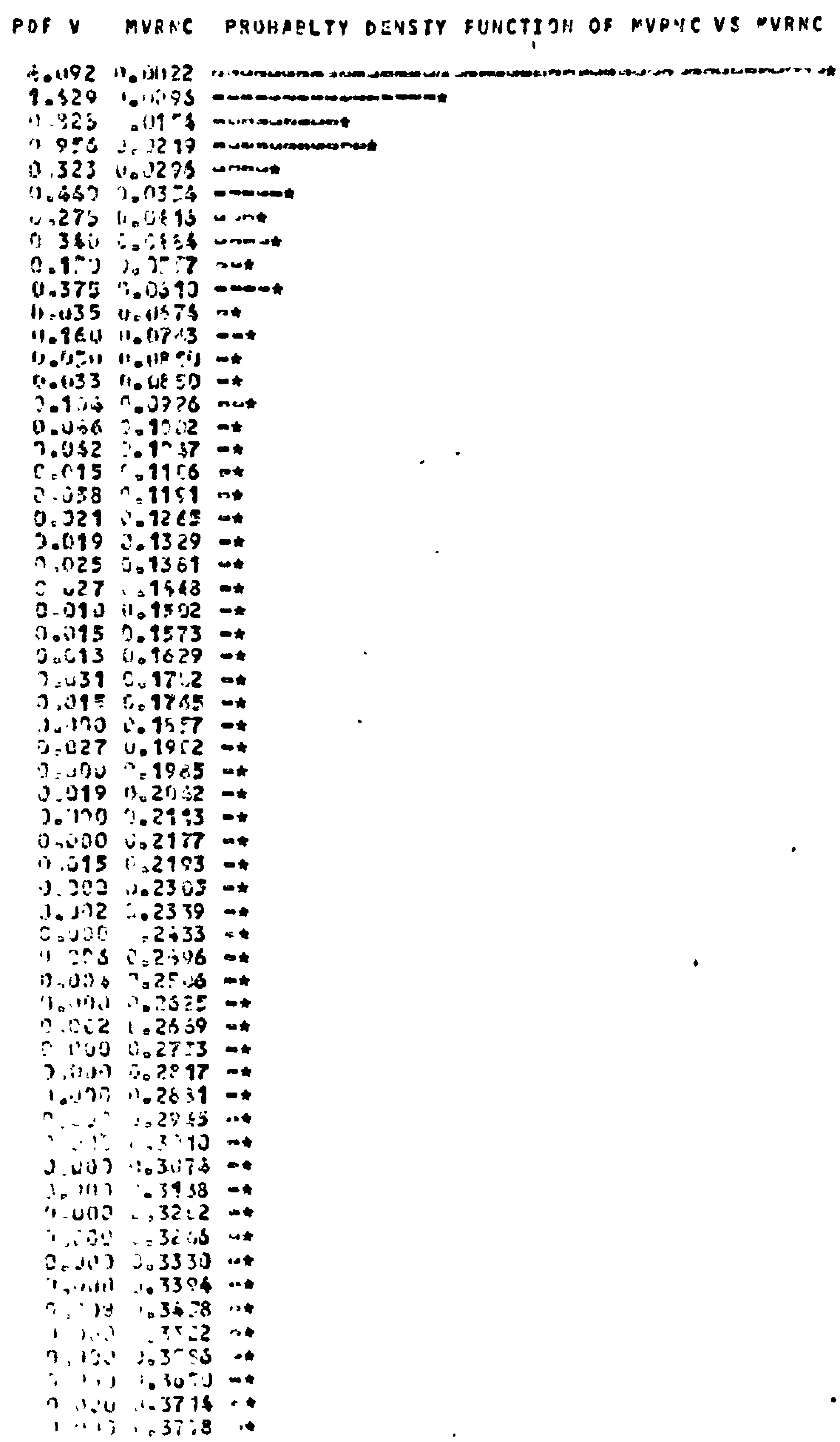
PDF V
MVRNC
PROBABLTY DENSITY FUNCTION OF MVRNC VS MVRNC

FIG Y46

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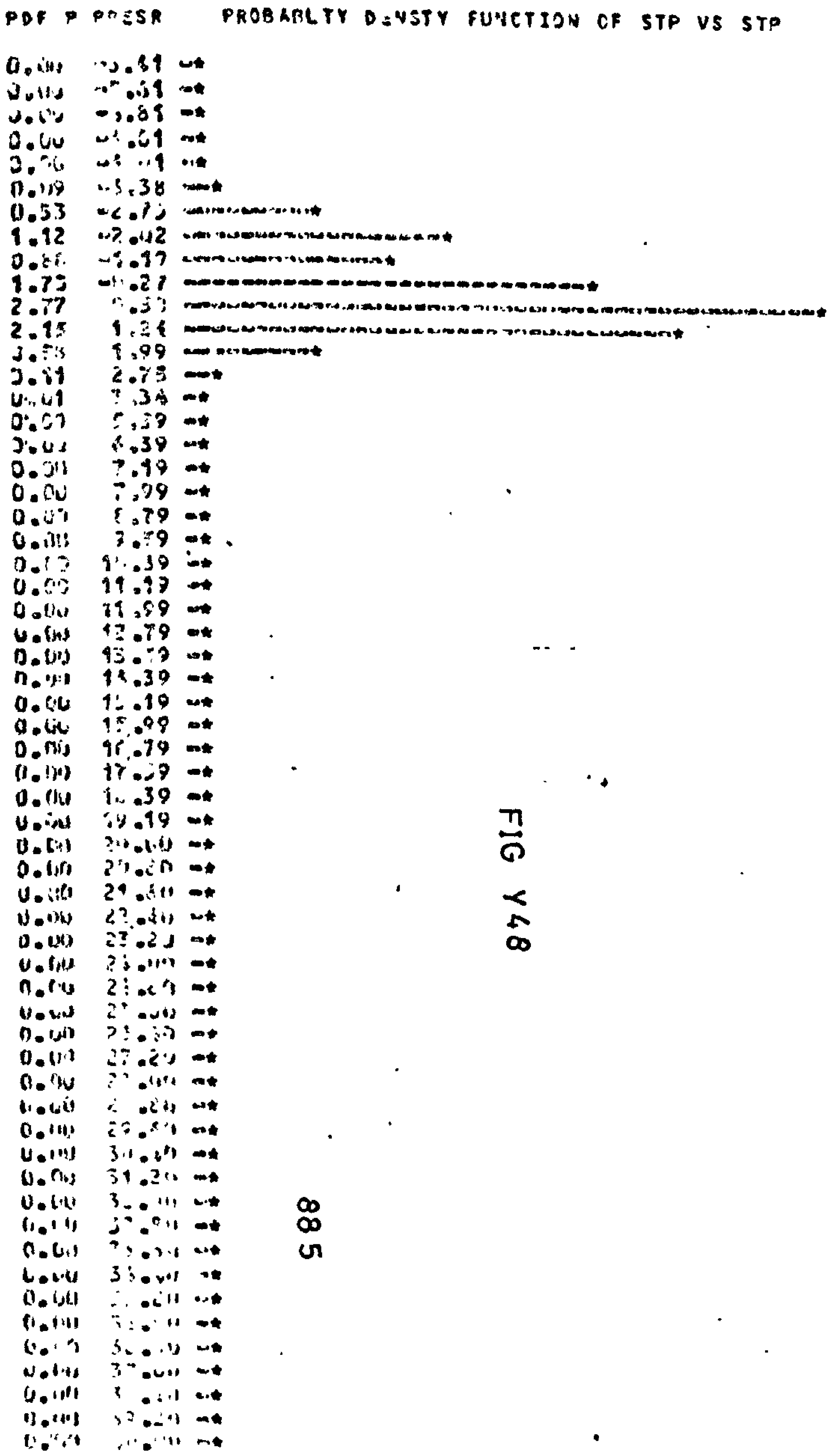
FIG Y 47

PDF P PRESR PROBABLTY DENSTY FUNCTION OF STP VS STP

PDF P	PRESR
0.00	-[illegible].19
0.00	-[illegible].39
0.00	-3.59
0.00	-3.79
0.00	-3.7[illegible]
0.07	-3.13
0.20	-2.57
0.94	-1.74
1.34	-0.97
2.41	-0.17
2.98	0.36
1.66	1.35
0.37	2.16
0.04	3.02
0.00	[illegible]
0.00	5.51
0.00	[illegible]
0.00	7.21
0.00	[illegible].21
0.00	9.01
0.00	9.81
0.00	[illegible]
0.00	11.41
0.00	12.21
0.00	13.01
0.00	13.81
0.00	[illegible]
0.00	[illegible]
0.00	[illegible].21
0.00	17.01
0.00	17.[illegible]2
0.00	1[illegible].62
0.00	1[illegible].42
0.00	2[illegible].22
0.00	21.[illegible]2
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible].22
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible].22
0.00	29.[illegible]2
0.0[illegible]	[illegible]
0.00	[illegible]
0.00	31.[illegible]2
0.00	3[illegible].22
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
0.00	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

PDF V MVRNC PROBAPLTY DENSTY FUNCTION OF MVRNC VS MVRNC

PDF V	MVRNC
4.429	0.0020
1.550	0.0090
1.292	0.01[illegible]
0.496	0.0220
0.477	0.0268
0.579	0.0330
0.206	0.0413
0.152	0.0456
0.294	0.0517
0.240	0.0605
0.027	0.0592
0.085	0.0724
0.060	0.0301
0.036	0.0889
0.003	0.0925
0.017	0.0992
0.005	0.1057
0.006	0.1096
0.013	0.1184
0.000	0.1281
0.005	0.1318
0.000	0.1409
0.002	0.1437
0.000	0.1537
0.000	0.1501
0.000	0.1665
0.000	0.1729
0.000	0.1793
0.000	0.1857
0.000	0.1921
0.000	0.1935
0.000	0.2049
0.000	0.2113
0.000	0.2177
0.000	0.2241
0.000	0.2305
0.000	0.2369
0.000	0.2433
0.000	0.2497
0.000	0.2561
0.000	0.2625
0.000	0.2669
0.000	0.2733
0.000	0.2817
0.000	0.2981
0.000	0.2975
0.000	0.3010
0.000	0.3074
0.000	0.3138
0.000	0.3202
0.000	0.3266
0.000	0.3330
0.000	0.3394
0.000	0.3378
0.000	0.3[illegible]72
0.000	0.35[illegible]6
0.000	0.36[illegible]0
0.000	0.3714
0.000	0.3778


PDF P PRESR PROBABLTY DENSTY FUNCTION OF STP VS STP

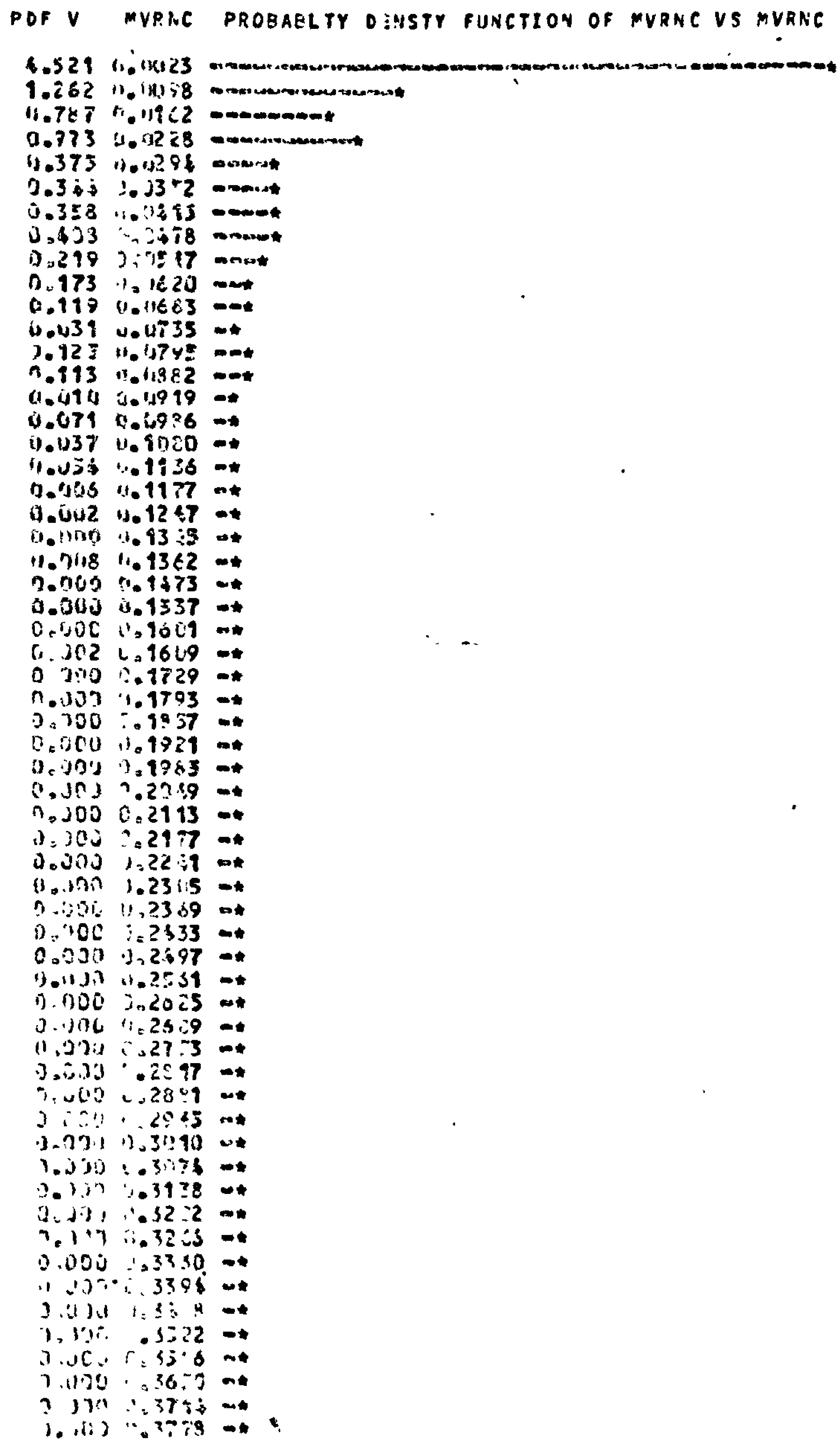

PDF V MVRNC PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y48

885

PDF P	PRESR
0.00	-7.08
0.00	-6.28
0.00	-5.48
0.00	-4.68
0.00	-3.69
0.10	-3.99
0.37	-3.52
0.39	-2.73
0.52	-1.37
0.76	-0.99
2.73	-0.17
3.03	0.59
1.43	1.33
0.23	2.06
0.01	2.73
0.00	4.93
0.00	5.73
0.00	6.53
0.00	7.33
0.00	8.13
0.00	8.93
0.00	9.73
0.00	10.53
0.00	11.33
0.00	12.13
0.00	12.93
0.00	13.73
0.00	14.53
0.00	15.33
0.00	16.13
0.00	16.93
0.00	17.73
0.03	18.53
0.01	19.33
0.00	20.13
0.00	20.93
0.00	21.73
0.06	22.53
0.10	23.33
0.00	24.13
0.00	24.93
0.00	25.73
0.00	26.53
0.00	27.33
0.00	28.13
0.00	28.93
0.00	29.73
0.00	30.53
0.00	31.33
0.00	32.13
0.00	32.93
0.00	33.73
0.00	34.53
0.00	35.33
0.00	36.13
0.00	36.93
0.00	37.73
0.00	38.53
0.00	39.33

PROBABLTY DENSTY FUNCTION OF STP VS STP

PDF V	MVRNC
5.952	0.0021
1.550	0.0599
0.275	0.0114
0.719	0.0218
0.233	0.0297
0.162	0.0334
0.146	0.0416
0.096	0.0381
0.087	0.0557
0.050	0.0634
0.000	0.0734
0.104	0.0717
0.093	0.0803
0.000	0.0896
0.096	0.0898
0.058	0.0957
0.000	0.1089
0.150	0.1100
0.053	0.1219
0.000	0.1281
0.075	0.1323
0.033	0.1392
0.000	0.1473
0.052	0.1563
0.000	0.1601
0.033	0.1630
0.000	0.1729
0.005	0.1752
0.000	0.1877
0.004	0.1898
0.000	0.1955
0.002	0.2041
0.000	0.2113
0.000	0.2177
0.006	0.2168
0.000	0.2305
0.000	0.2369
0.000	0.2433
0.000	0.2497
0.000	0.2561
0.000	0.2625
0.000	0.2559
0.000	0.2753
0.000	0.2817
0.000	0.2881
0.000	0.2945
0.000	0.3010
0.000	0.3074
0.000	0.3138
0.000	0.3202
0.003	0.3266
0.003	0.3330
0.000	0.3394
0.000	0.3458
0.000	0.3522
0.000	0.3586
0.011	0.3650
0.000	0.3714
0.000	0.3778

PROPABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y49

886

PDF P	PRESR
0.00	[illegible].03
0.00	-3.24
0.00	-2.44
0.00	-1.63
0.01	-1.03
0.53	-0.96
4.37	-0.30
4.31	0.28
0.83	0.91
0.00	1.55
0.00	3.97
0.00	4.77
0.00	5.57
0.00	6.37
0.00	7.17
0.00	7.97
0.00	8.77
0.00	9.57
0.00	10.37
0.00	11.17
0.00	11.97
0.00	12.77
0.00	13.57
0.00	14.37
0.00	15.17
0.00	15.97
0.00	16.77
0.00	17.57
0.00	18.37
0.00	19.17
0.00	19.97
0.00	20.77
0.00	21.57
0.00	22.37
0.00	23.17
0.00	23.97
0.00	24.77
0.00	25.57
0.00	26.37
0.00	27.17
0.00	27.97
0.00	28.77
0.00	29.57
0.00	30.37
0.00	31.17
0.00	31.97
0.00	32.77
0.00	33.57
0.00	34.37
0.00	35.17
0.00	35.97
0.00	36.77
0.00	37.57
0.00	38.38
0.00	39.18
0.00	39.98
0.00	40.78
0.00	41.58
0.00	42.38

PROBABLTY DENSTY FUNCTION OF STP VS STP

PDF V	MVRNC
[illegible].721	0.0012
1.056	0.0082
0.142	0.0149
0.023	0.0218
0.008	0.0268
0.000	0.0384
0.000	0.0448
0.000	0.0512
0.000	0.0576
0.000	0.0640
0.000	0.0704
0.000	0.0768
0.000	0.0832
0.000	0.0896
0.000	0.0960
0.000	0.1025
0.000	0.1089
0.000	0.1153
0.000	0.1217
0.000	0.1281
0.000	0.1345
0.000	0.1409
0.000	0.1473
0.000	0.1537
0.000	0.1601
0.000	0.1665
0.000	0.1729
0.000	0.1793
0.000	0.1857
0.000	0.1921
0.000	0.1985
0.000	0.2049
0.000	0.2113
0.000	0.2177
0.000	0.2241
0.000	0.2305
0.000	0.2369
0.000	0.2433
0.000	0.2497
0.000	0.2561
0.000	0.2625
0.000	0.2689
0.000	0.2753
0.000	0.2817
0.000	0.2881
0.000	0.2945
0.000	0.3010
0.000	0.3074
0.000	0.3138
0.000	0.3202
0.000	0.3266
0.000	0.3330
0.000	0.3394
0.000	0.3458
0.000	0.3522
0.000	0.3586
0.000	0.3650
0.000	0.3714
0.000	0.3778

PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y50

PDF P	PRESR
0.00	-4.29
0.00	-3.49
0.00	-2.69
0.00	-1.39
0.00	-1.89
0.17	-1.17
2.36	-0.36
5.83	0.07
1.46	.73
0.16	1.47
0.00	2.19
0.00	4.31
0.00	5.31
0.00	6.11
0.00	6.91
0.00	7.71
0.00	8.32
0.00	9.32
0.00	10.12
0.00	10.92
0.00	11.72
0.00	12.52
0.00	13.32
0.00	14.12
0.00	14.92
0.00	15.72
0.00	16.52
0.00	17.32
0.00	18.12
0.00	18.92
0.00	19.72
0.00	20.52
0.00	21.32
0.00	22.12
0.00	22.92
0.00	23.72
0.00	24.52
0.00	25.32
0.00	26.12
0.00	26.92
0.00	27.72
0.00	28.52
0.00	29.32
0.00	30.12
0.00	30.92
0.00	31.72
0.00	32.52
0.00	33.32
0.00	34.12
0.00	34.92
0.00	[illegible]
0.00	36.52
0.00	37.32
0.00	38.12
0.00	[illegible]
0.00	39.72
0.00	[illegible]
0.00	41.32
0.00	42.12

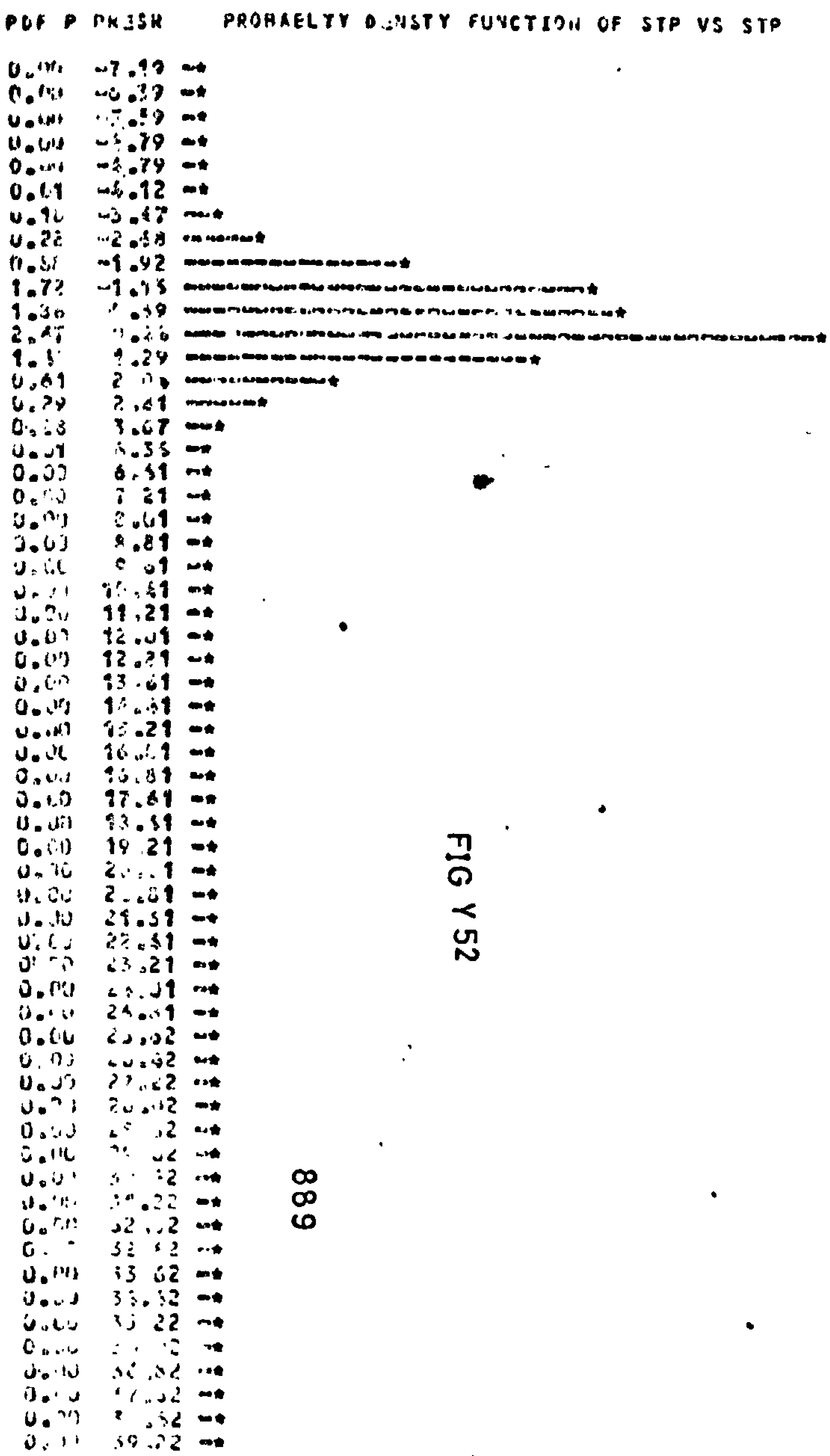
PROBABLTY DENSTY FUNCTION OF STP VS STP

FIG Y 51

888

PDF V	MVRNC
9.213	0.0045
0.573	0.0101
0.135	0.0136
0.363	0.0206
0.096	0.0292
0.004	0.0356
0.000	0.0448
0.002	0.0451
0.000	0.0576
0.000	0.0650
0.000	0.0704
0.000	0.0768
0.000	0.0832
0.000	0.0896
0.000	0.0960
0.000	0.1025
0.000	0.1089
0.000	0.1153
0.000	0.1217
0.000	0.1281
0.000	0.1345
0.000	0.1409
0.000	0.1473
0.000	0.1537
0.000	0.1601
0.000	0.1665
0.000	0.1729
0.000	0.1793
0.000	0.1857
0.000	0.1921
0.000	0.1985
0.000	0.2049
0.000	0.2113
0.000	0.2177
0.000	0.2241
0.000	0.2305
0.000	0.2369
0.000	0.2433
0.000	0.2497
0.000	0.2561
0.000	0.2625
0.000	0.2689
0.000	0.2753
0.000	0.2817
0.000	0.2881
0.000	0.2945
0.000	0.3010
0.000	0.3074
0.000	0.3138
0.000	0.3202
0.000	0.3266
0.000	0.3330
0.000	0.3394
0.000	0.3458
0.000	0.3522
0.000	0.3586
0.000	0.3650
0.000	0.3714
0.000	0.3778

PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC


PDF P PRESR PROBAELTY DENSTY FUNCTION OF STP VS STP

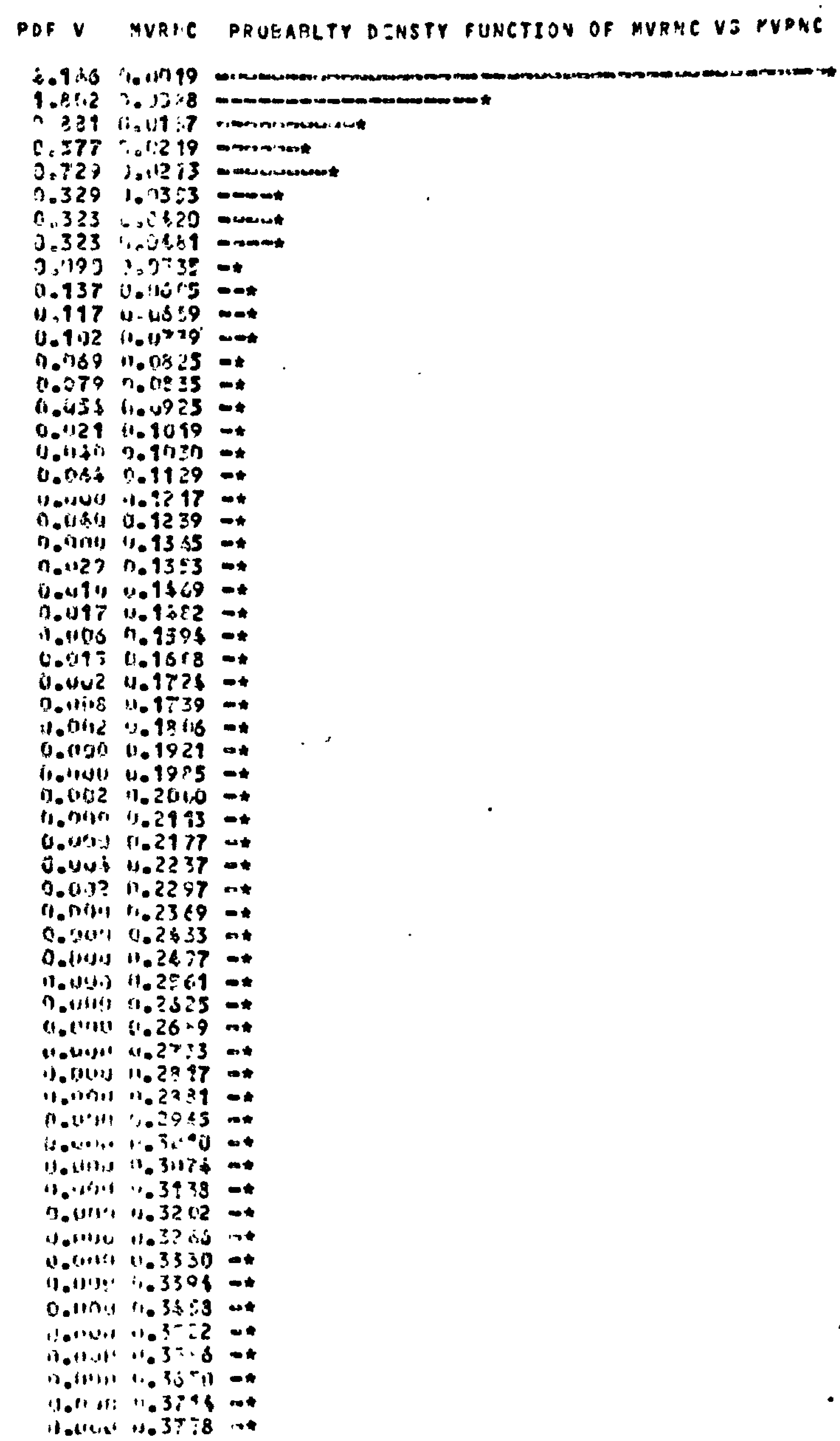

PDF V MVRNC PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y 52

889

PDF P PPLSR   PROBABLTY DENSTY FUNCTION OF STP VS STP

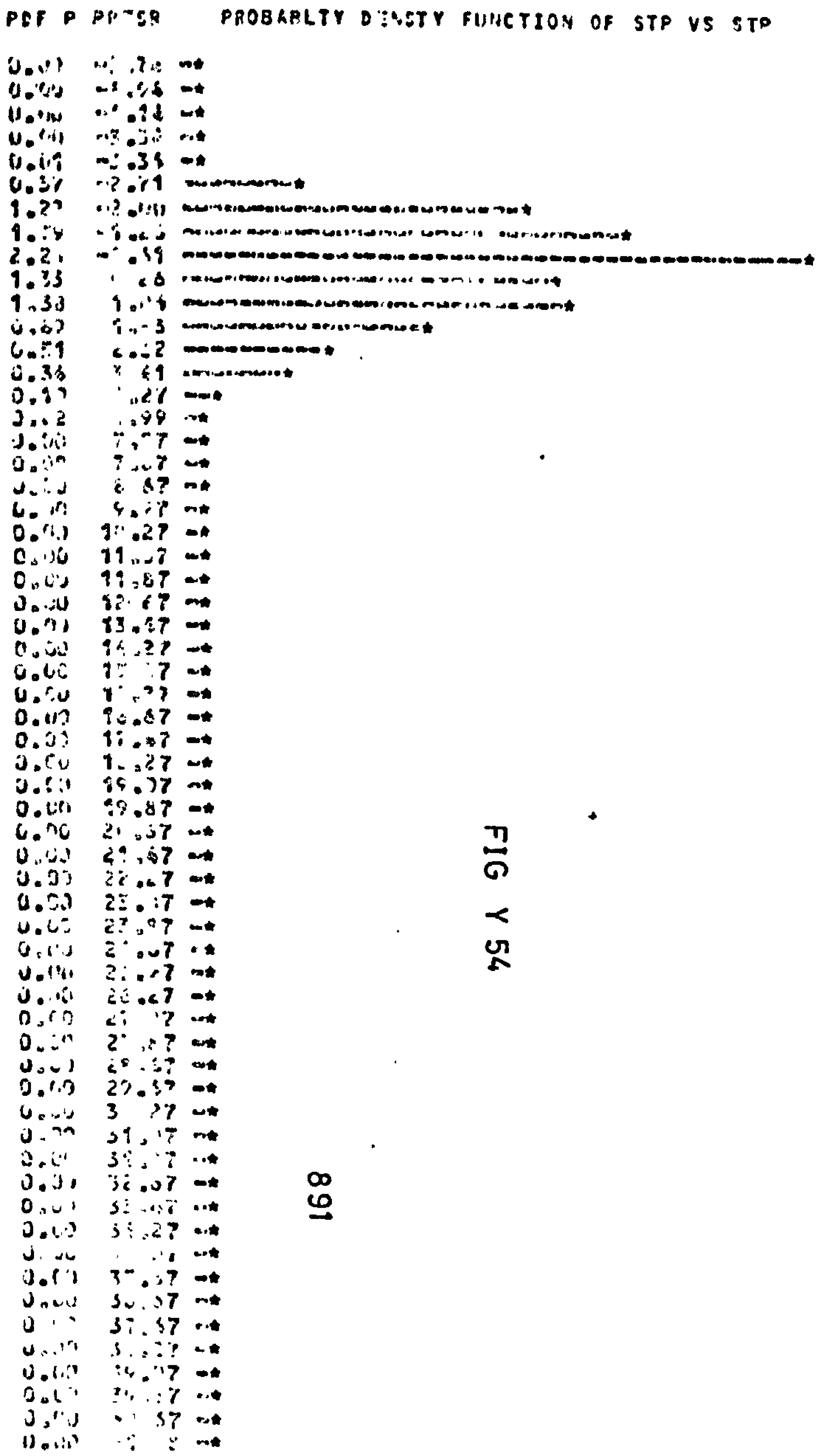
PDF P	PPLSR
[illegible]	-3.89
[illegible]	-3.09
[illegible]	-2.29
[illegible]	-1.49
[illegible]	-0.69
2.[illegible]	[illegible]
4.[illegible]	[illegible].32
2.[illegible]	[illegible].46
1.[illegible]	[illegible].24
0.3[illegible]	2.[illegible]
[illegible]	2.61
[illegible]	[illegible].91
[illegible]	[illegible].71
[illegible]	[illegible].31
[illegible]	7.31
[illegible]	[illegible].11
[illegible]	[illegible].91
[illegible]	9.71
[illegible]	1[illegible].51
[illegible]	11.31
[illegible]	12.11
[illegible]	12.91
[illegible]	13.71
[illegible]	14.51
[illegible]	1[illegible].31
[illegible]	1[illegible].11
[illegible]	1[illegible].91
[illegible]	17.[illegible]1
[illegible]	1[illegible].71
[illegible]	19.51
[illegible]	2[illegible].11
[illegible]	2[illegible].91
[illegible]	21.71
[illegible]	22.52
[illegible]	2[illegible].32
[illegible]	2[illegible].12
[illegible]	2[illegible].92
[illegible]	2[illegible].72
[illegible]	26.52
[illegible]	27.32
[illegible]	28.12
[illegible]	28.92
[illegible]	2[illegible].72
[illegible]	3[illegible].[illegible]2
[illegible]	31.32
[illegible]	32.12
[illegible]	32.92
[illegible]	33.72
[illegible]	[illegible].[illegible]2
[illegible]	35.32
[illegible]	[illegible].12
[illegible]	3[illegible].92
[illegible]	[illegible].72
[illegible]	3[illegible].[illegible]2
[illegible]	[illegible].12
[illegible]	[illegible]92
[illegible]	[illegible].72
[illegible]	[illegible].52

FIG Y 53

890

PDF V   MVRNC   PROBAPLTY DENSTY FUNCTION OF MVRNC VS MVRNC

PDF V	MVRNC
7.630	0.0023
1.623	0.0093
0.331	0.0156
0.184	0.0216
0.129	0.0266
0.156	0.0331
0.059	0.0435
0.062	0.0470
0.037	0.0572
0.023	0.0630
0.000	0.0704
0.042	0.0713
0.023	0.0801
0.023	0.0894
0.000	0.0960
0.005	0.0992
0.000	0.1069
0.000	0.1153
0.000	0.1217
0.000	0.1281
0.000	0.1345
0.000	0.1409
0.000	0.1473
0.000	0.1537
0.000	0.1601
0.000	0.1665
0.000	0.1729
0.000	0.1793
0.000	0.1857
0.000	0.1921
0.000	0.1985
0.000	0.2049
0.000	0.2113
0.000	0.2177
0.000	0.2241
0.000	0.2305
0.000	0.2369
0.000	0.2433
0.000	0.2497
0.000	0.2561
0.000	0.2625
0.000	0.2689
0.000	0.2753
0.000	0.2817
0.000	0.2881
0.000	0.2945
0.000	0.3010
0.000	0.3074
0.000	0.3138
0.000	0.3202
0.000	0.3266
0.000	0.3330
0.000	0.3394
0.000	0.3458
0.000	0.3522
0.000	0.3586
0.000	0.3650
0.000	0.3714
0.000	0.3778


PDF P PPTSR
PROBABLTY DENSTY FUNCTION OF STP VS STP

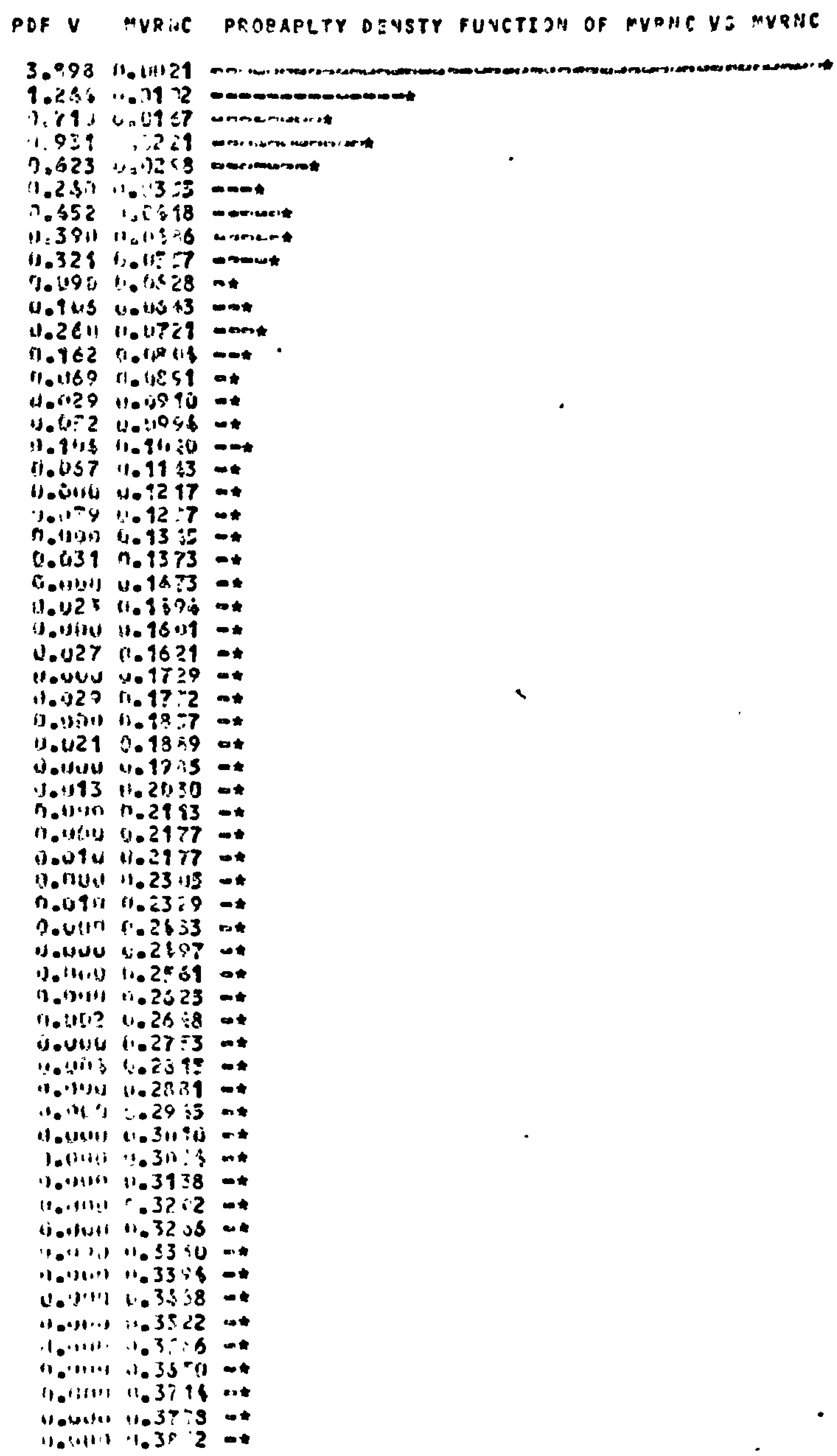
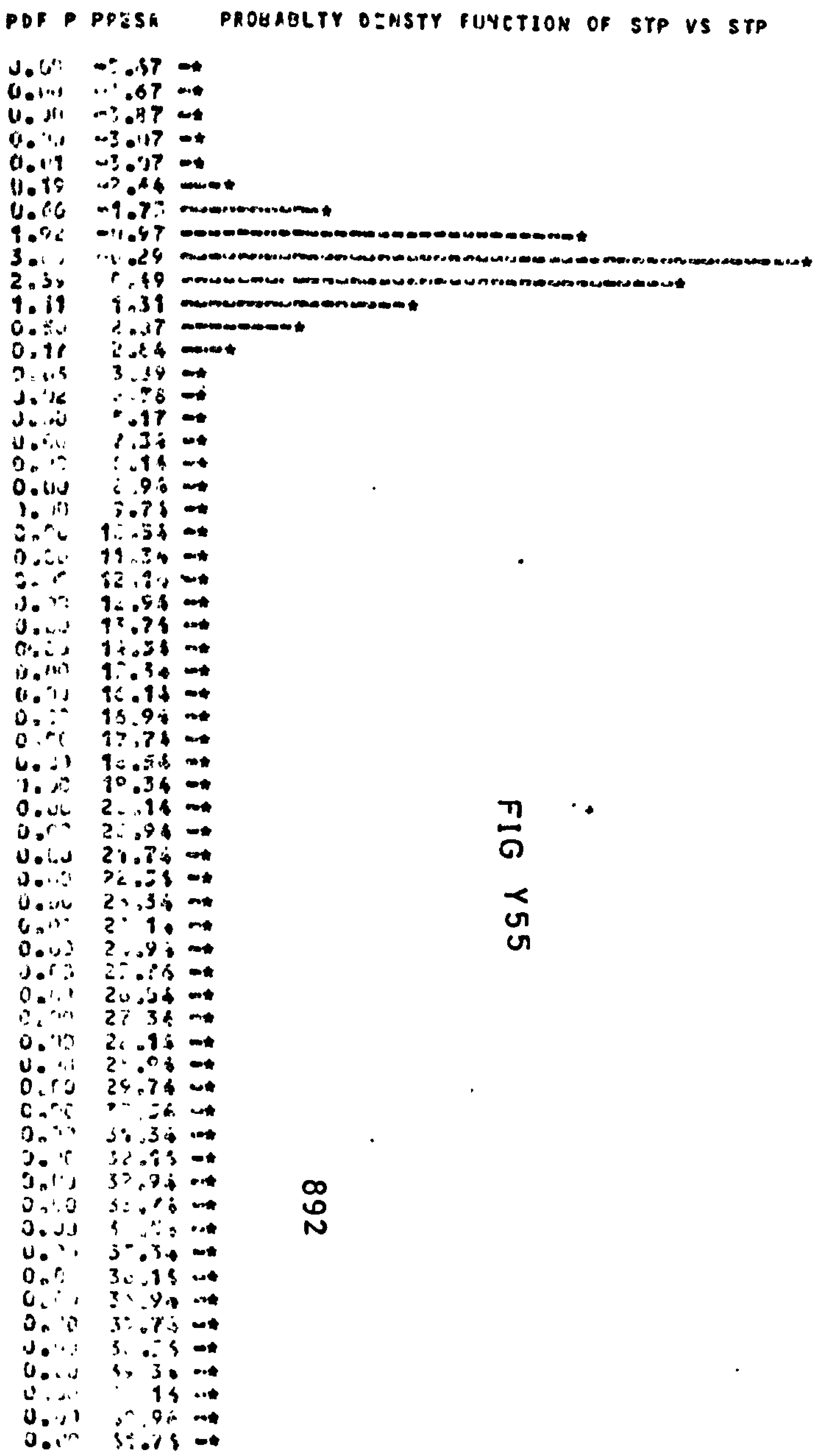

PDF V
MVRNC
PROBAPLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y 54

891


PDF P PPESA
PROBABLTY DENSTY FUNCTION OF STP VS STP

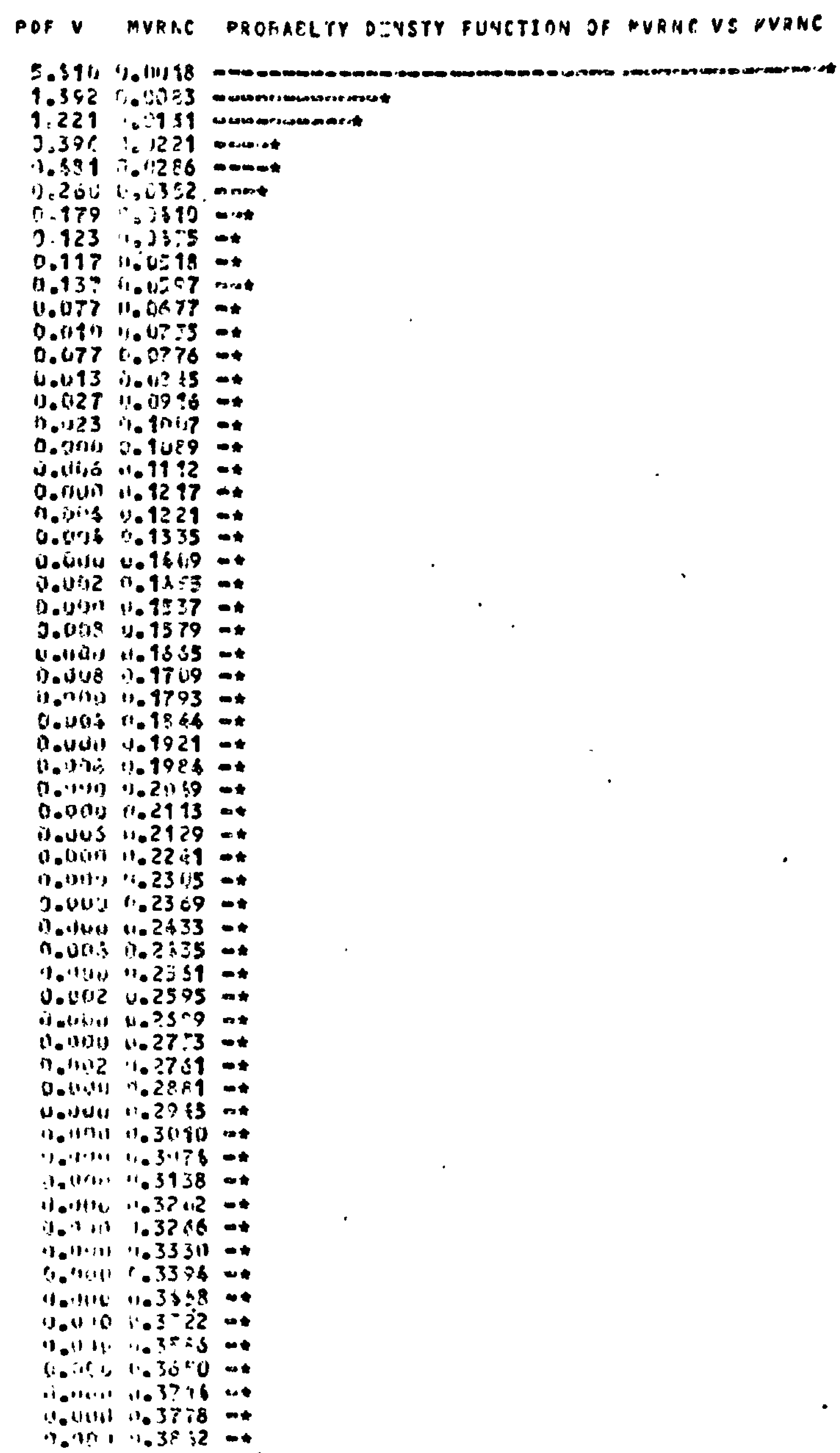
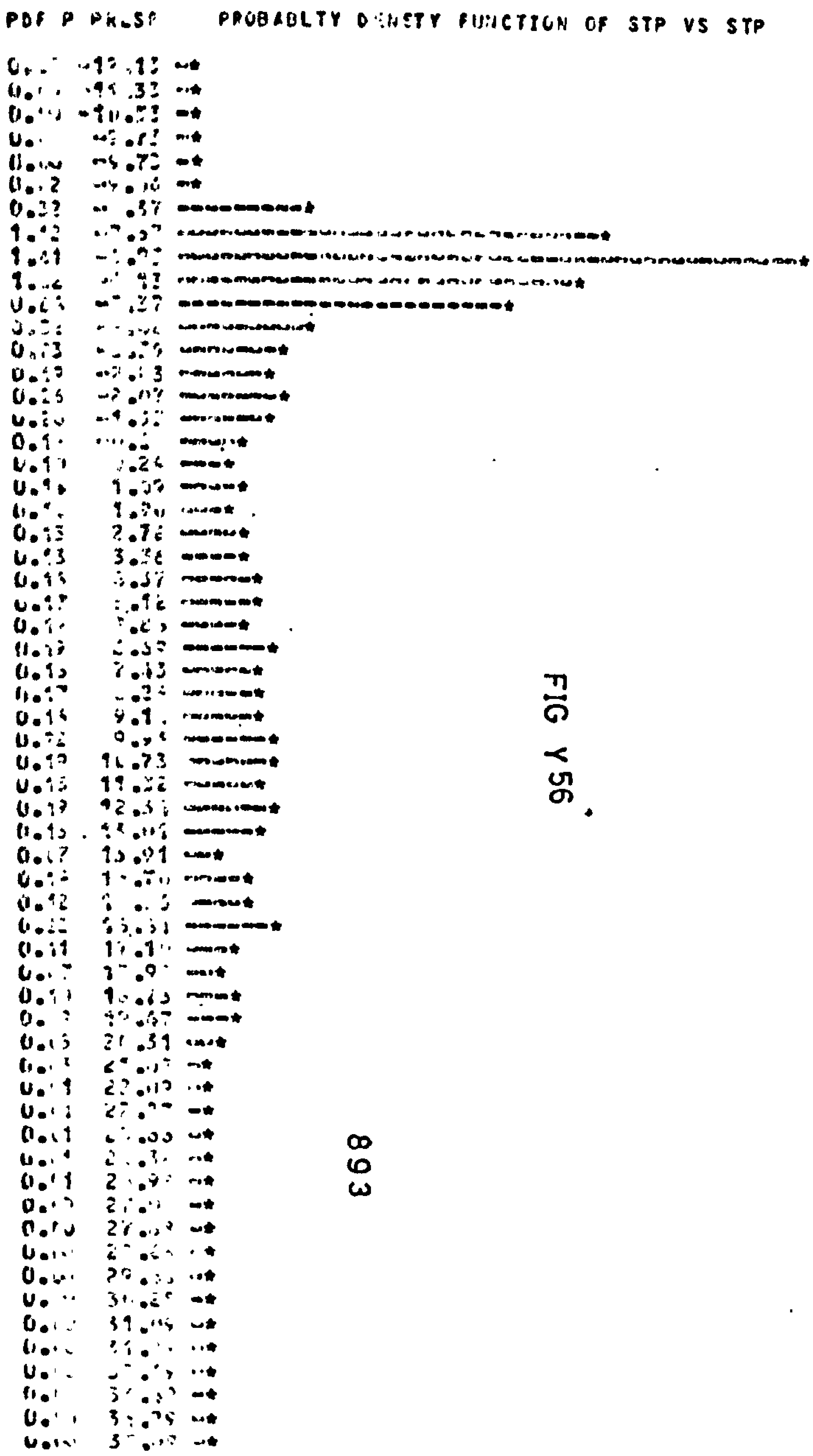

PDF V
MVRNC
PROBAELTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y55

892


PDF P PRESP PROBABLTY DENSTY FUNCTION OF STP VS STP

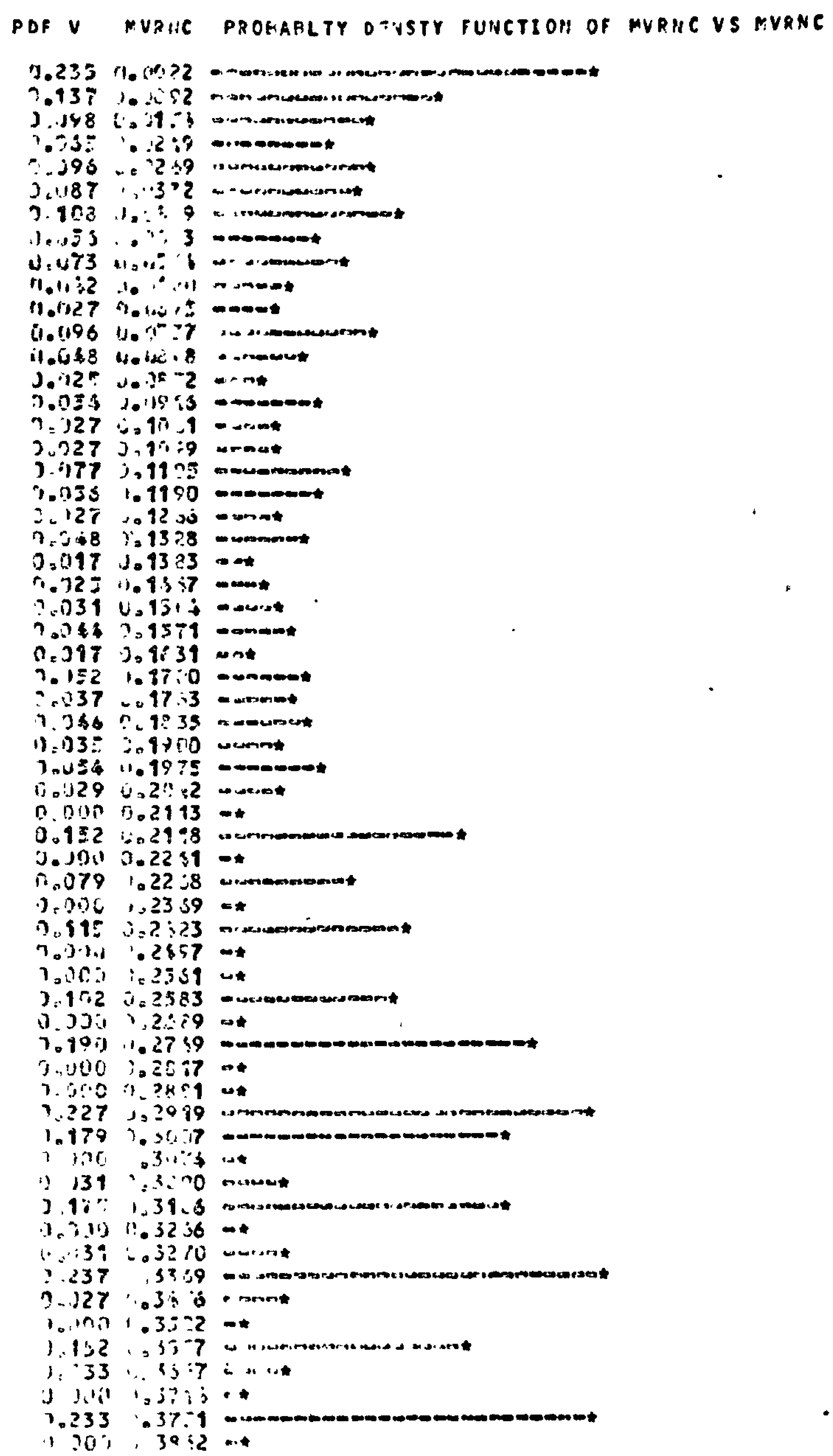
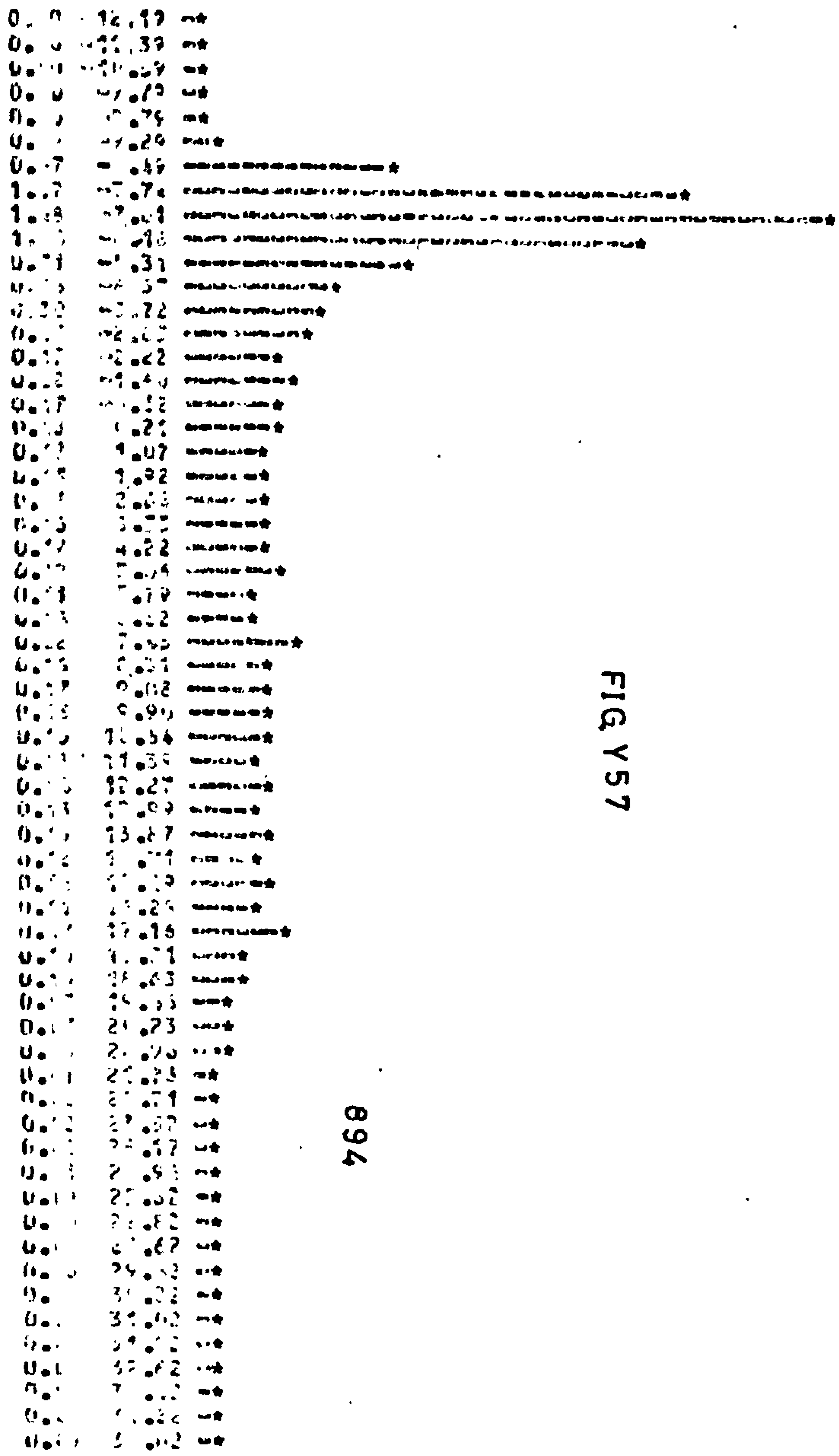

PDF V MVRNC PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

FIG Y56

PDF P P*ESR PROBABLTY DENSTY FUNCTION OF STP VS STP



PDF V MVRNC PROBABLTY DENSTY FUNCTION OF MVRNC VS MVRNC

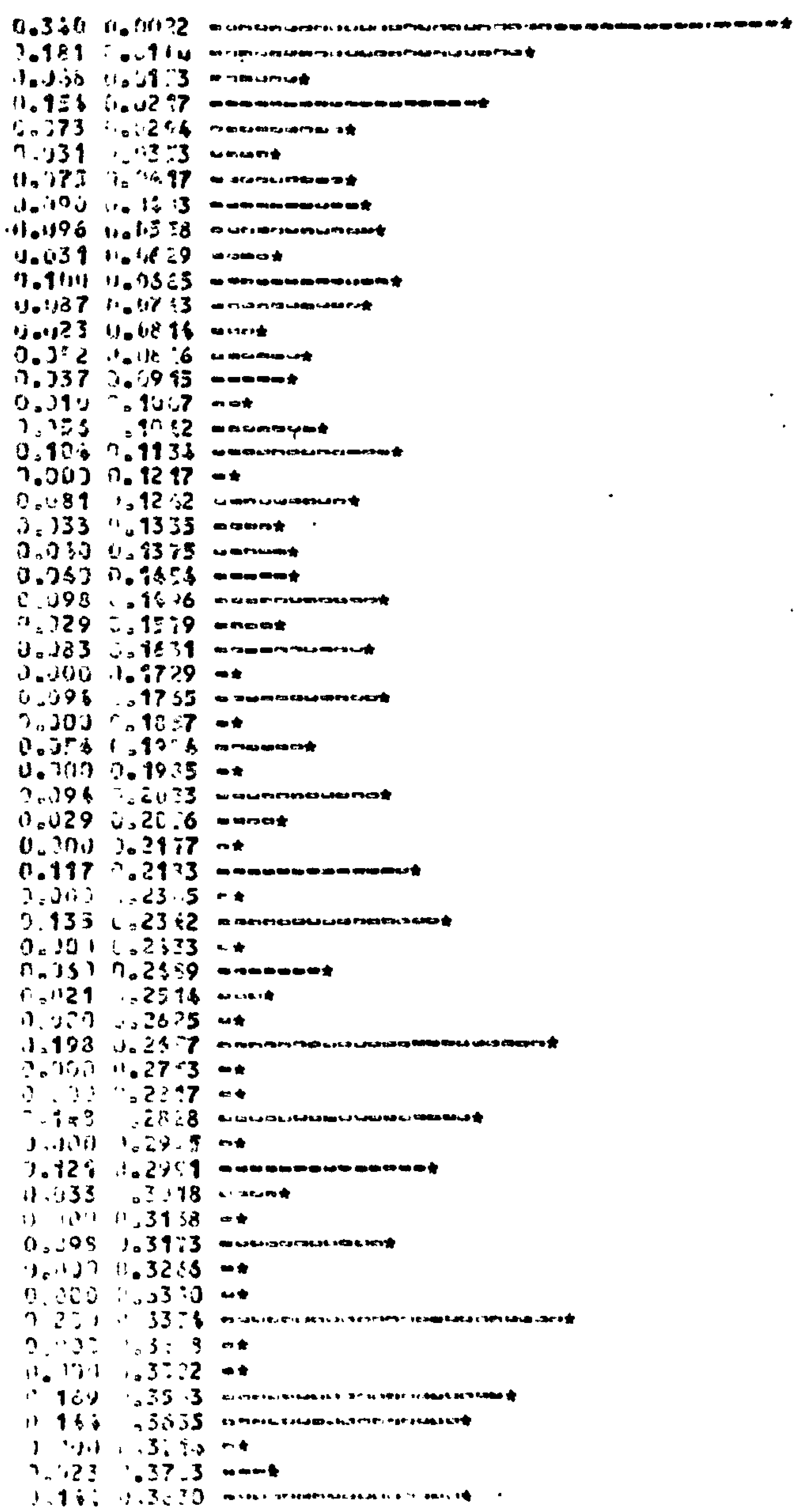


FIG Y57

894

PWR VD FRQCY   POWER DENSTY VS FRQNCY FOR VOID DATA

1.93	0.049
2.21	0.098
1.59	0.146
2.63	0.195
3.33	0.244
3.13	0.293
3.93	0.342
4.25	0.391
3.45	0.439
2.64	0.488
2.39	0.537
4.41	0.586
3.23	0.635
2.65	0.684
2.33	0.732
1.97	0.781
1.73	0.830
1.45	0.879
1.17	0.928
2.11	0.977
2.27	1.025
1.44	1.074
1.17	1.123
1.75	1.172
3.20	1.221
2.81	1.270
1.29	1.318
0.81	1.367
1.21	1.416
1.44	1.465
1.42	1.514
0.72	1.562
0.64	1.611
0.54	1.660
0.91	1.709
1.17	1.758
0.98	1.807
0.48	1.855
0.71	1.904
0.78	1.953
0.67	2.002
0.87	2.051
0.78	2.100
0.39	2.148
0.60	2.197
0.55	2.246
0.57	2.295
0.55	2.344
0.50	2.393
0.60	2.441
0.62	2.490
0.44	2.539
0.43	2.588
0.35	2.637
0.37	2.686
0.42	2.734
0.27	2.783
0.30	2.832
0.35	2.881
0.22	2.930
0.28	2.979
0.45	3.027
0.34	3.076
0.46	3.125

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.978
22.61	0.993
26.45	1.006
3.33	1.023
0.00	1.060
0.00	1.080

FIG Y 58

895

PWR VD FRQCY   POWER DENSTY VS FRQNCY FOR VOID DATA

6.54	0.049
3.85	0.098
3.15	0.146
1.73	0.195
1.86	0.244
2.83	0.293
3.32	0.342
3.02	0.391
2.39	0.439
1.62	0.488
2.15	0.537
1.65	0.586
0.73	0.635
1.17	0.684
2.36	0.732
2.33	0.781
2.03	0.830
2.33	0.879
1.65	0.928
1.52	0.977
3.02	1.025
3.31	1.074
1.83	1.123
1.23	1.172
1.11	1.221
1.15	1.270
1.13	1.318
1.29	1.367
1.07	1.416
1.05	1.465
0.96	1.514
0.66	1.562
0.63	1.611
0.90	1.660
0.89	1.709
0.54	1.758
0.53	1.807
0.60	1.855
0.80	1.904
0.71	1.953
0.45	2.002
0.63	2.051
0.83	2.100
0.81	2.148
1.11	2.197
0.97	2.246
0.39	2.295
0.46	2.344
0.51	2.393
0.55	2.441
0.61	2.490
0.43	2.539
0.32	2.588
0.34	2.637
0.28	2.686
0.47	2.734
0.43	2.783
0.35	2.832
0.51	2.881
0.54	2.930
[illegible]	[illegible]

PDF VD VDFRCTN *PROB.* DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.03	0.318
0.75	0.334
5.06	0.353
15.22	0.371
17.92	0.389
8.99	0.408
1.83	0.427
0.20	0.446
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000
[illegible]	[illegible]

FIG Y 59

896

PWR VD	FRQCY
17.30	0.049
6.48	0.098
3.15	0.146
2.49	0.195
2.79	0.244
3.93	0.293
4.18	0.342
3.65	0.391
1.51	0.439
1.29	0.488
1.85	0.537
1.57	0.586
1.07	0.635
1.34	0.684
1.74	0.732
1.41	0.781
1.15	0.830
1.35	0.879
1.32	0.928
1.06	0.977
0.83	1.025
0.87	1.074
0.85	1.123
0.73	1.172
0.59	1.221
0.60	1.270
0.77	1.318
0.81	1.367
0.92	1.416
0.99	1.465
0.77	1.514
0.82	1.562
0.79	1.611
0.69	1.660
0.89	1.709
0.80	1.758
1.07	1.807
0.94	1.855
0.37	1.904
0.36	1.953
0.59	2.002
0.49	2.051
0.37	2.100
0.55	2.148
0.45	2.197
0.46	2.246
0.55	2.295
0.45	2.344
0.41	2.393
0.30	2.441
0.17	2.490
0.53	2.539
0.65	2.588
0.34	2.637
0.49	2.686
0.48	2.734
0.37	2.783
0.32	2.832
0.42	2.881
0.48	2.930
[illegible]	[illegible]

POWER DENSTY VS FRQNCY FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.01	0.198
0.00	0.220
0.06	0.235
0.32	0.250
1.09	0.271
3.46	0.291
7.03	0.311
11.43	0.331
12.83	0.350
9.59	0.369
3.41	0.388
0.61	0.409
0.14	0.430
0.01	0.443
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000
[illegible]	[illegible]

PROB. DENSTY FUNCTION FOR VOID DATA

FIG Y 6D

PWR VD FRQCY — POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
4.15	0.049
5.11	0.098
4.99	0.146
6.14	0.195
5.04	0.244
2.25	0.293
3.88	0.342
4.42	0.391
2.73	0.439
2.24	0.488
3.64	0.537
4.41	0.586
3.49	0.635
2.47	0.684
1.06	0.732
2.71	0.781
3.39	0.830
1.89	0.879
1.72	0.928
1.49	0.977
1.69	1.025
2.08	1.074
1.62	1.123
1.22	1.172
1.24	1.221
1.16	1.270
1.32	1.318
1.21	1.367
0.79	1.416
0.98	1.465
1.08	1.514
0.93	1.562
1.02	1.611
0.96	1.660
0.71	1.709
0.51	1.758
0.46	1.807
0.36	1.855
0.37	1.904
0.48	1.953
0.46	2.002
0.45	2.051
0.58	2.100
0.53	2.148
0.37	2.197
0.41	2.246
0.42	2.295
0.23	2.344
0.18	2.393
0.49	2.441
0.52	2.490
0.33	2.539
0.30	2.588
0.29	2.637
0.25	2.686
0.19	2.734
0.21	2.783
0.13	2.832
0.15	2.881
0.33	2.930

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.02	0.618
0.47	0.634
2.12	0.652
5.14	0.671
10.80	0.691
14.42	0.710
11.08	0.730
4.83	0.749
1.04	0.766
0.07	0.785
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

FIG Y61

PWR VD	FRQCY
2.93	0.049
3.84	0.098
2.97	0.146
5.79	0.195
6.18	0.244
4.74	0.293
7.22	0.342
6.87	0.391
4.32	0.439
3.49	0.488
2.36	0.537
2.36	0.586
3.64	0.635
3.53	0.684
1.83	0.732
0.74	0.781
2.19	0.830
2.93	0.879
2.07	0.928
1.11	0.977
0.54	1.025
0.61	1.074
0.84	1.123
1.80	1.172
1.91	1.221
1.39	1.270
1.30	1.318
0.75	1.367
0.43	1.416
0.45	1.465
0.44	1.514
0.52	1.562
0.54	1.611
0.74	1.660
0.92	1.709
0.64	1.758
0.23	1.807
0.35	1.855
0.53	1.904
0.47	1.953
0.34	2.002
0.34	2.051
0.36	2.100
0.40	2.148
0.47	2.197
0.34	2.246
0.23	2.295
0.24	2.344
0.23	2.393
0.23	2.441
0.26	2.490
0.17	2.539
0.15	2.588
0.14	2.637
0.20	2.686
0.46	2.734
0.40	2.783
0.18	2.832
0.26	2.881
0.25	2.930

POWER DENSTY VS FRQNCY FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.03	0.679
0.34	0.694
3.02	0.713
9.47	0.733
18.17	0.751
15.22	0.769
3.31	0.787
0.24	0.804
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

PROB. DENSTY FUNCTION FOR VOID DATA

FIG Y 62

668

PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

0.89	0.049
1.90	0.098
2.74	0.146
5.43	0.195
6.65	0.244
4.02	0.293
4.11	0.342
3.29	0.391
2.86	0.439
4.88	0.438
4.52	0.337
3.59	0.586
3.37	0.635
3.71	0.684
3.27	0.732
1.76	0.781
1.61	0.830
3.02	0.879
2.40	0.928
1.51	0.977
1.45	1.025
1.57	1.074
1.87	1.123
1.50	1.172
1.74	1.221
2.13	1.270
1.89	1.318
1.05	1.367
0.92	1.416
0.59	1.463
0.46	1.514
0.73	1.562
0.63	1.611
0.74	1.660
0.95	1.709
0.92	1.758
0.77	1.807
0.83	1.855
0.98	1.904
0.66	1.953
0.43	2.002
0.24	2.051
0.28	2.100
0.43	2.148
0.42	2.197
0.39	2.246
0.28	2.295
0.38	2.344
0.30	2.393
0.31	2.441
0.27	2.490
0.41	2.539
0.45	2.588
0.27	2.637
0.15	2.686
0.20	2.734
0.23	2.783
0.15	2.832
0.16	2.881
0.23	2.930

900

FIG Y 63

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.18	0.737
1.89	0.753
9.48	0.772
18.24	0.790
16.36	0.809
3.65	0.826
0.21	0.843
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

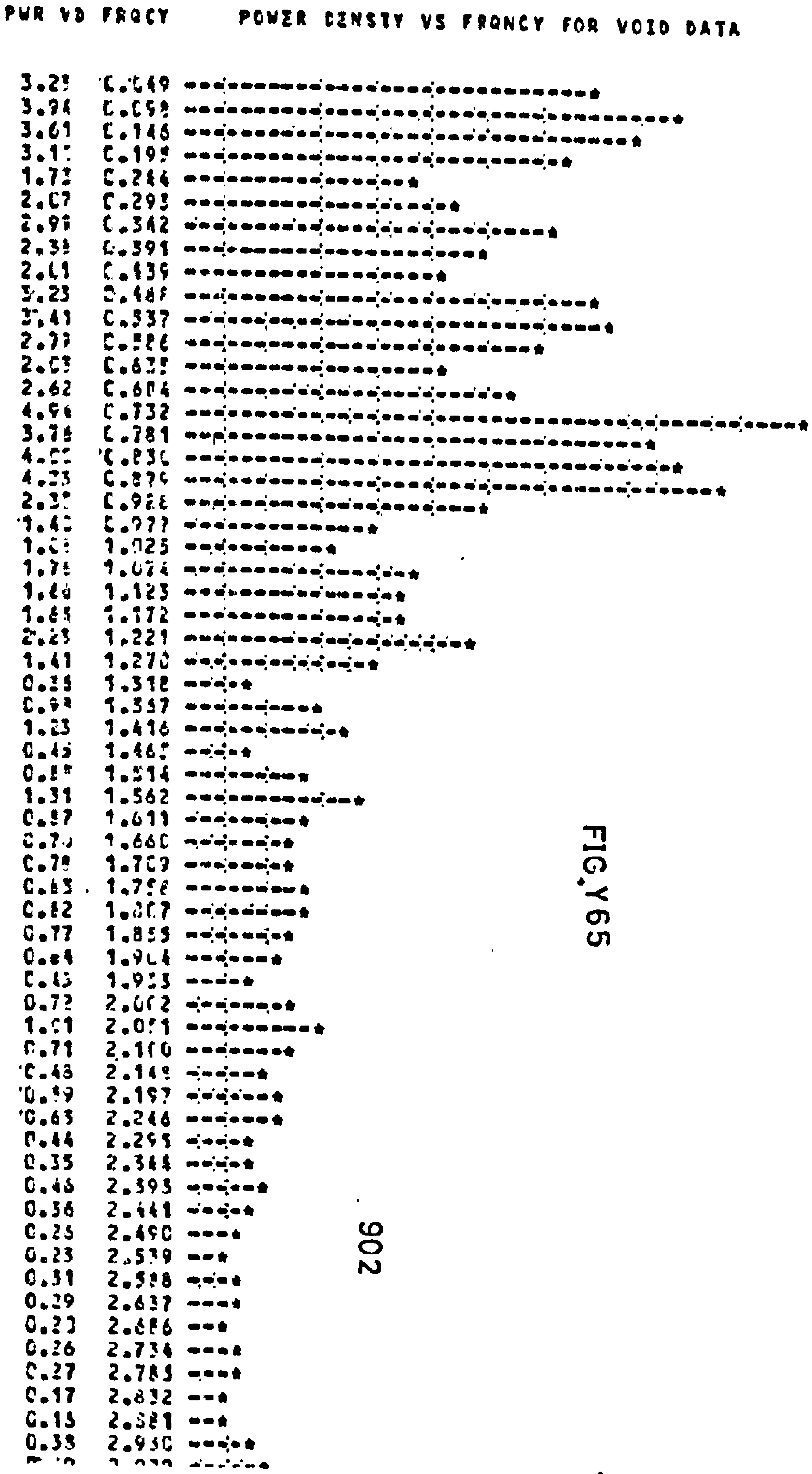
1.53	0.049
2.38	0.098
3.96	0.146
2.92	0.195
1.45	0.244
1.70	0.293
1.69	0.342
2.91	0.391
4.36	0.439
3.71	0.488
2.22	0.537
3.31	0.586
4.15	0.635
3.36	0.684
5.01	0.732
4.85	0.781
3.11	0.830
1.90	0.879
2.19	0.928
2.99	0.977
1.91	1.025
1.09	1.074
1.47	1.123
1.85	1.172
1.31	1.221
0.69	1.270
1.34	1.318
1.83	1.367
1.15	1.416
0.68	1.465
0.63	1.514
0.82	1.562
1.03	1.611
1.05	1.660
0.92	1.709
0.92	1.758
0.85	1.807
0.83	1.855
0.73	1.904
0.70	1.953
0.59	2.002
0.43	2.051
0.39	2.100
0.45	2.148
0.37	2.197
0.35	2.246
0.42	2.295
0.25	2.344
0.53	2.393
0.73	2.441
0.49	2.490
0.37	2.539
0.36	2.588
0.39	2.637
0.41	2.686
0.47	2.734
0.42	2.783
0.27	2.832
0.21	2.881
0.21	2.930

106

FIG Y 64

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.01	0.719
0.44	0.736
6.65	0.753
24.82	0.771
15.61	0.788
2.35	0.806
0.11	0.822
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000


PWR VD FRQCY
POWER DENSTY VS FRQNCY FOR VOID DATA
902

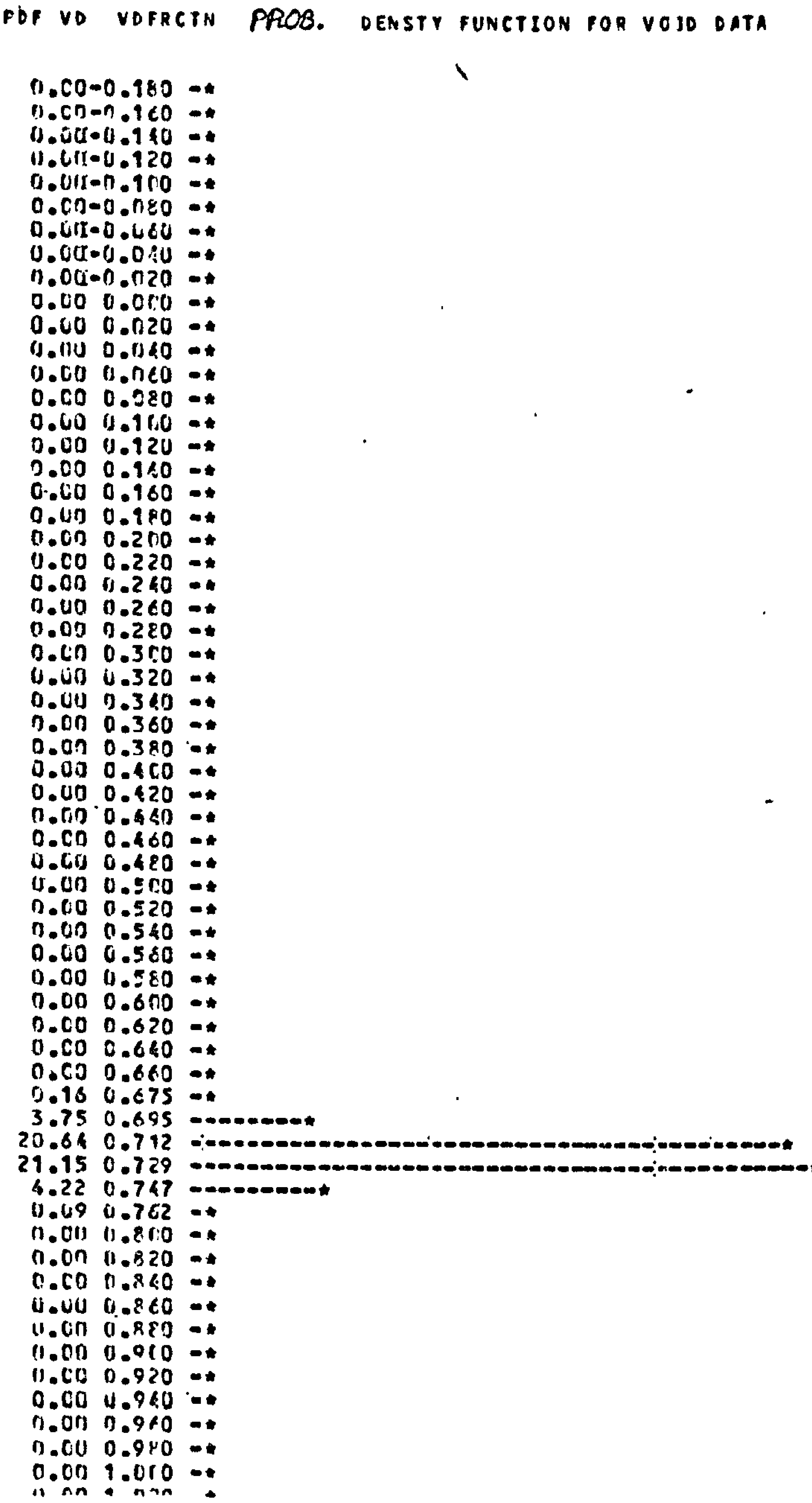

PDF VD VDFRCTN
PROB. DENSTY FUNCTION FOR VOID DATA

FIG.Y65

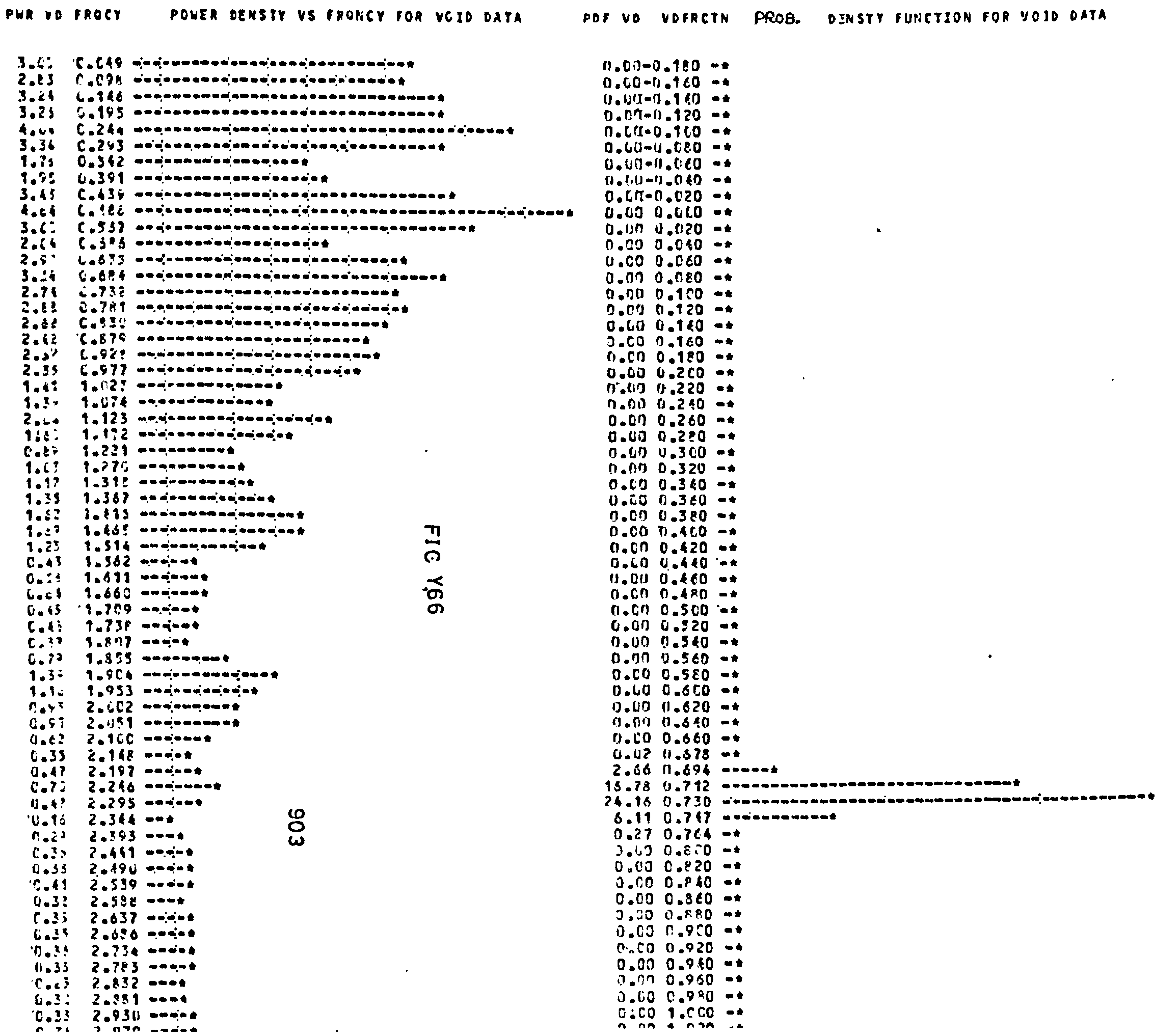

PWR VD FRQCY
POWER DENSITY VS FRQNCY FOR VOID DATA
PDF VD VDFRCTN
PROB. DENSITY FUNCTION FOR VOID DATA
903

FIG Y66

PWR VD FRQCY — POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
3.42	0.049
4.20	0.098
2.97	0.146
2.35	0.195
4.24	0.244
3.74	0.293
2.32	0.342
2.42	0.391
2.15	0.439
2.49	0.488
1.90	0.537
2.38	0.586
2.62	0.635
2.03	0.684
2.71	0.732
2.54	0.781
2.01	0.830
2.18	0.879
2.35	0.928
2.08	0.977
1.74	1.025
1.78	1.074
1.88	1.123
2.31	1.172
1.72	1.221
0.96	1.270
0.83	1.318
1.12	1.367
1.45	1.416
1.57	1.465
1.07	1.514
0.67	1.562
1.25	1.611
1.33	1.660
0.51	1.709
0.52	1.758
0.69	1.807
1.12	1.855
0.94	1.904
0.85	1.953
0.87	2.002
0.62	2.051
0.51	2.100
0.53	2.148
0.48	2.197
0.41	2.246
0.56	2.295
0.54	2.344
0.45	2.393
0.44	2.441
0.61	2.490
0.49	2.539
0.38	2.588
0.84	2.637
0.74	2.686
0.34	2.734
0.23	2.783
0.30	2.832
0.45	2.881
0.45	2.930

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.06	0.699
4.34	0.714
21.67	0.732
19.52	0.749
4.29	0.765
0.11	0.782
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

FIG Y67

904

FIG Y 68

905

PWR VD FRQCY   POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
2.84	0.049
3.15	0.098
1.64	0.146
1.11	0.195
1.51	0.244
4.44	0.293
4.41	0.342
2.89	0.391
2.69	0.439
3.08	0.488
4.06	0.537
2.92	0.586
2.71	0.635
3.37	0.684
3.69	0.732
2.77	0.781
1.21	0.830
1.77	0.879
2.56	0.928
2.55	0.977
2.58	1.025
2.17	1.074
1.20	1.123
1.43	1.172
1.83	1.221
1.39	1.270
1.73	1.318
1.53	1.367
0.98	1.416
1.53	1.465
1.62	1.514
1.28	1.562
1.30	1.611
1.07	1.660
0.93	1.709
0.83	1.758
0.63	1.807
0.87	1.855
1.01	1.904
0.38	1.953
0.35	2.002
0.41	2.051
0.27	2.100
0.26	2.148
0.74	2.197
0.77	2.246
0.47	2.295
0.51	2.344
0.29	2.393
0.22	2.441
0.37	2.490
0.33	2.539
0.21	2.588
0.25	2.637
0.25	2.686
0.31	2.734
0.49	2.783
0.41	2.832
0.28	2.881
0.41	2.930
[illegible]	[illegible]

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.19	0.535
1.96	0.553
10.11	0.572
21.27	0.590
13.35	0.608
2.83	0.627
0.27	0.647
0.01	0.661
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000
[illegible]	[illegible]

PWR VD	FRQCY
8.46	0.049
6.45	0.098
3.59	0.146
3.37	0.195
3.35	0.244
6.52	0.293
7.65	0.342
4.84	0.391
3.01	0.439
2.51	0.488
2.09	0.537
2.35	0.586
3.18	0.635
3.63	0.684
2.67	0.732
2.92	0.781
2.42	0.830
1.60	0.879
1.73	0.928
1.68	0.977
1.68	1.025
2.61	1.074
2.61	1.123
1.94	1.172
1.72	1.221
1.02	1.270
0.76	1.318
0.94	1.367
0.82	1.416
0.66	1.465
0.52	1.514
0.29	1.562
0.37	1.611
0.49	1.660
0.30	1.709
0.26	1.758
0.31	1.807
0.35	1.855
0.34	1.904
0.20	1.953
0.17	2.002
0.17	2.051
0.18	2.100
0.25	2.148
0.15	2.197
0.11	2.246
0.24	2.295
0.24	2.344
0.23	2.393
0.27	2.441
0.23	2.490
0.17	2.539
0.13	2.588
0.09	2.637
0.26	2.686
0.27	2.734
0.10	2.783
0.12	2.832
0.14	2.881
0.19	2.930

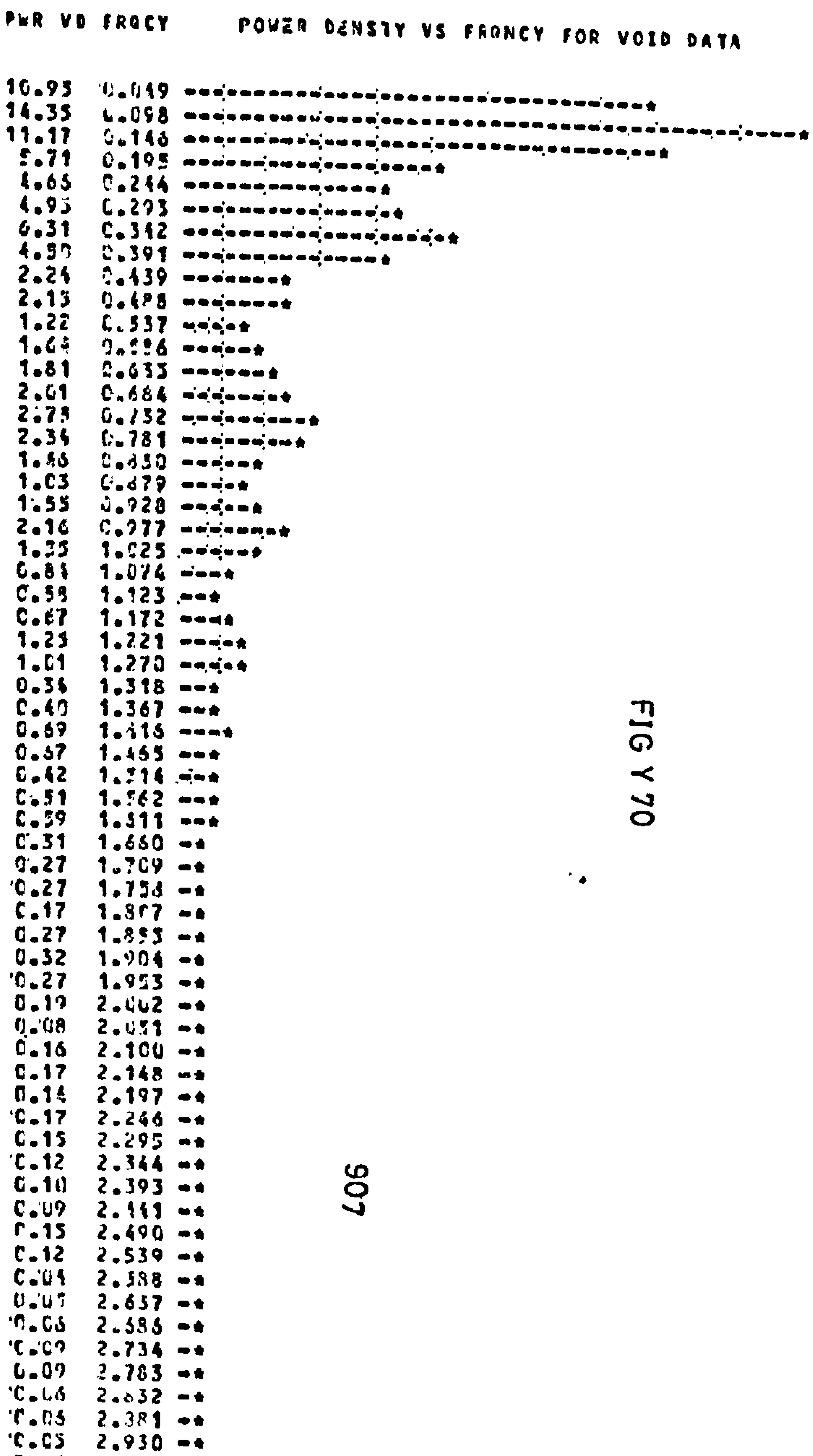
POWER DENSTY VS FRQNCY FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.04	0.393
0.18	0.415
0.73	0.432
2.22	0.452
4.18	0.471
8.11	0.490
10.52	0.510
11.15	0.529
7.11	0.549
3.56	0.569
1.33	0.589
0.59	0.608
0.22	0.627
0.03	0.642
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

PROBABILITY DENSTY FUNCTION FOR VOID DATA

FIGY 69

906


PWR VD FRQCY
POWER DENSTY VS FRQNCY FOR VOID DATA

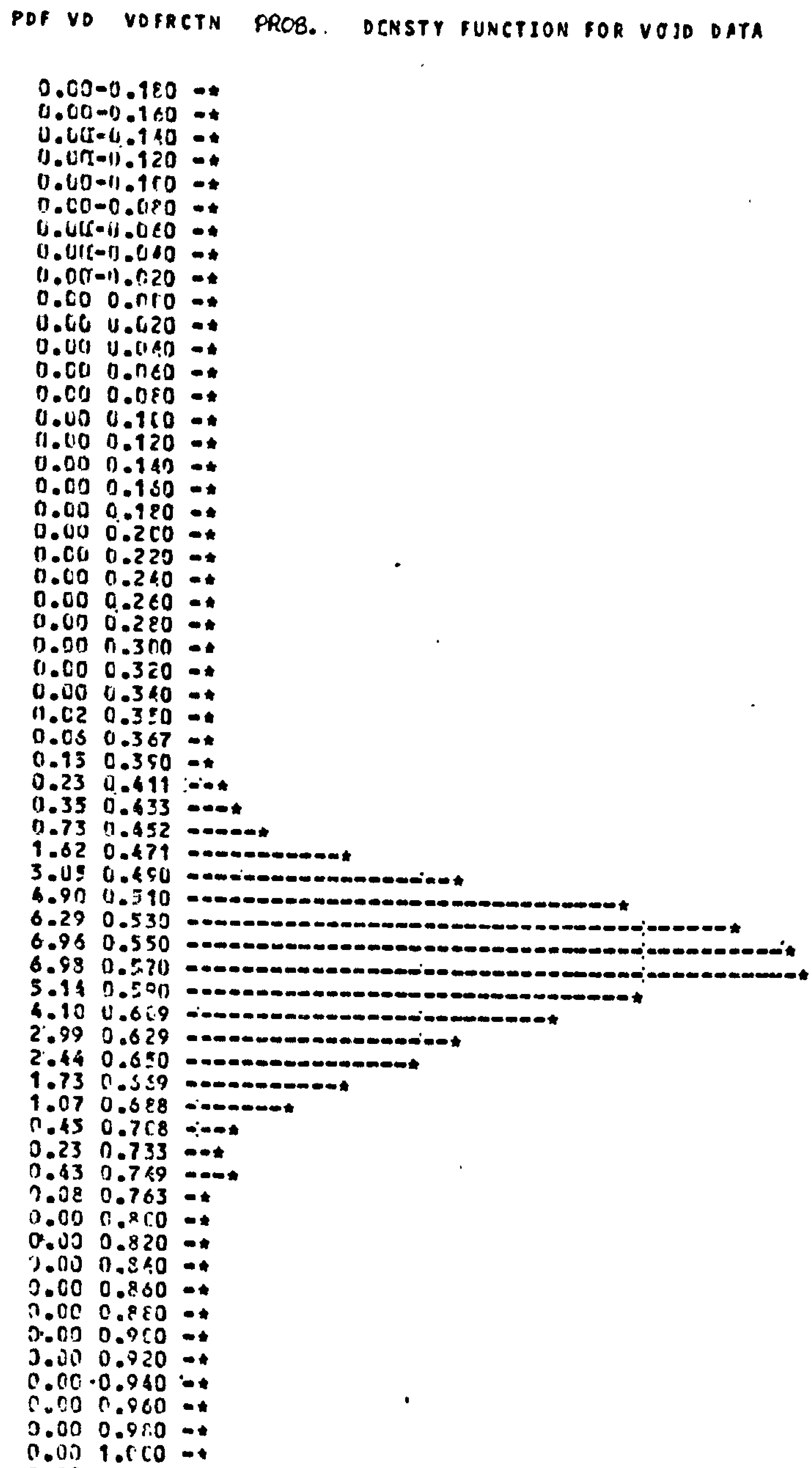

PDF VD VDFRCTN
PROB.
DENSTY FUNCTION FOR VOID DATA

FIG Y 70

907

PWR VD FRQCY — POWER DENSTY VS FRQNCY FOR VOID DATA

1.09	0.049
0.69	0.098
1.32	0.146
1.54	0.195
1.14	0.244
1.17	0.293
2.72	0.342
3.85	0.391
3.09	0.439
2.29	0.488
2.23	0.537
1.90	0.586
1.94	0.635
2.59	0.684
2.01	0.732
1.61	0.781
2.56	0.830
4.46	0.879
4.34	0.928
3.27	0.977
2.24	1.025
0.94	1.074
2.42	1.123
2.91	1.172
2.00	1.221
2.27	1.270
3.62	1.318
3.73	1.367
3.15	1.416
3.82	1.465
2.74	1.514
1.56	1.562
1.52	1.611
1.90	1.660
1.98	1.709
1.55	1.758
1.57	1.807
1.30	1.855
1.21	1.904
1.26	1.953
0.83	2.002
0.65	2.051
0.85	2.100
0.88	2.148
0.68	2.197
0.40	2.246
0.50	2.295
0.51	2.344
0.25	2.393
0.23	2.441
0.36	2.490
0.51	2.539
0.35	2.588
0.33	2.637
0.33	2.686
0.18	2.734
0.13	2.783
0.09	2.832
0.10	2.881
0.10	2.930

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.02	0.336
0.02	0.353
0.07	0.371
0.11	0.390
0.43	0.413
0.91	0.431
0.88	0.451
1.51	0.470
1.82	0.490
2.73	0.510
3.39	0.530
4.15	0.551
4.36	0.570
4.90	0.590
4.76	0.610
4.06	0.630
4.42	0.650
4.34	0.670
3.69	0.689
2.41	0.708
0.78	0.728
0.19	0.748
0.06	0.764
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

FIG Y71

908

PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

1.85	0.049
1.54	0.098
2.25	0.146
5.75	0.195
9.03	0.244
7.59	0.293
7.02	0.342
7.72	0.391
6.52	0.439
4.15	0.488
3.26	0.537
4.51	0.586
4.13	0.635
3.82	0.684
3.29	0.732
3.77	0.781
3.47	0.830
1.74	0.879
2.41	0.928
2.27	0.977
1.63	1.025
1.57	1.074
1.34	1.123
1.22	1.172
0.93	1.221
0.38	1.270
0.5[illegible]	1.318
0.55	1.367
0.71	1.416
0.65	1.465
0.39	1.514
0.35	1.562
0.35	1.611
0.26	1.660
0.27	1.709
0.19	1.758
0.15	1.807
0.15	1.855
0.16	1.904
0.17	1.953
0.12	2.002
0.12	2.051
0.14	2.100
0.09	2.148
0.05	2.197
0.08	2.246
0.07	2.295
0.05	2.344
0.06	2.393
0.03	2.441
0.02	2.490
0.03	2.539
0.05	2.588
0.05	2.637
0.04	2.686
0.02	2.734
0.03	2.783
0.03	2.832
0.02	2.881

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.01	0.207
0.00	0.240
0.04	0.254
0.02	0.273
0.07	0.293
0.09	0.310
0.11	0.335
0.23	0.351
0.39	0.369
0.40	0.390
0.63	0.410
1.10	0.431
1.53	0.450
2.06	0.470
2.61	0.490
2.74	0.509
2.60	0.530
2.36	0.550
2.78	0.571
2.97	0.590
3.72	0.610
4.60	0.630
3.99	0.650
3.51	0.670
4.11	0.690
3.28	0.709
2.35	0.730
1.39	0.748
0.28	0.764
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980

FIG Y 72

PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

5.62	0.049
22.06	0.098
23.66	0.146
12.36	0.195
8.48	0.244
4.51	0.293
3.00	0.342
3.18	0.391
2.96	0.439
2.34	0.488
1.84	0.537
1.24	0.586
1.30	0.635
1.01	0.684
0.86	0.732
0.49	0.781
0.71	0.830
0.66	0.879
0.43	0.928
0.47	0.977
0.25	1.025
0.17	1.074
0.20	1.123
0.21	1.172
0.19	1.221
0.16	1.270
0.11	1.318
0.06	1.367
0.10	1.416
0.12	1.465
0.10	1.514
0.06	1.562
0.05	1.611
0.04	1.660
0.04	1.709
0.05	1.758
0.04	1.807
0.03	1.855
0.03	1.904
0.04	1.953
0.04	2.002
0.02	2.051
0.02	2.100
0.02	2.148
0.02	2.197
0.02	2.246
0.01	2.295
0.02	2.344
0.02	2.393
0.02	2.441
0.02	2.490
0.02	2.539
0.02	2.588
0.02	2.637
0.02	2.686
0.02	2.734
0.02	2.783
0.01	2.832
0.01	2.881
[illegible]	[illegible]

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.03	0.152
0.18	0.176
0.22	0.188
0.51	0.207
0.58	0.230
0.50	0.253
0.47	0.272
0.44	0.291
0.58	0.310
0.57	0.331
0.74	0.352
1.03	0.368
1.10	0.389
1.24	0.411
1.11	0.430
1.32	0.450
1.70	0.470
2.42	0.490
2.54	0.510
3.32	0.530
4.32	0.550
4.04	0.570
4.49	0.590
4.03	0.610
3.95	0.629
4.60	0.650
2.82	0.669
1.12	0.686
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
[illegible]	[illegible]

FIG Y73

910

PWR VD FRQCY | POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
2.82	0.049
1.71	0.098
2.63	0.146
2.35	0.195
1.94	0.244
2.72	0.293
2.53	0.342
1.93	0.391
2.27	0.439
1.97	0.488
1.33	0.537
1.15	0.586
1.42	0.635
1.45	0.684
1.82	0.732
2.34	0.781
1.67	0.830
1.16	0.879
1.67	0.928
1.47	0.977
0.92	1.025
1.22	1.074
1.46	1.123
1.57	1.172
2.27	1.221
2.03	1.270
2.21	1.318
2.11	1.367
0.94	1.416
1.12	1.465
1.03	1.514
0.86	1.562
1.05	1.611
0.97	1.660
0.62	1.709
0.64	1.758
1.01	1.807
1.41	1.855
1.17	1.904
0.63	1.953
0.35	2.002
0.75	2.051
0.77	2.100
0.61	2.148
0.61	2.197
1.01	2.246
0.97	2.295
0.67	2.344
0.67	2.393
0.64	2.441
0.72	2.490
0.65	2.539
0.61	2.588
0.73	2.637
0.84	2.686
0.65	2.734
0.81	2.783
0.82	2.832
0.54	2.881
0.42	2.930
[illegible]	[illegible]

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.25	0.273
1.50	0.293
5.68	0.312
12.53	0.331
14.18	0.350
10.94	0.369
3.67	0.388
1.06	0.407
0.10	0.425
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000
[illegible]	1.020

FIG Y74

911

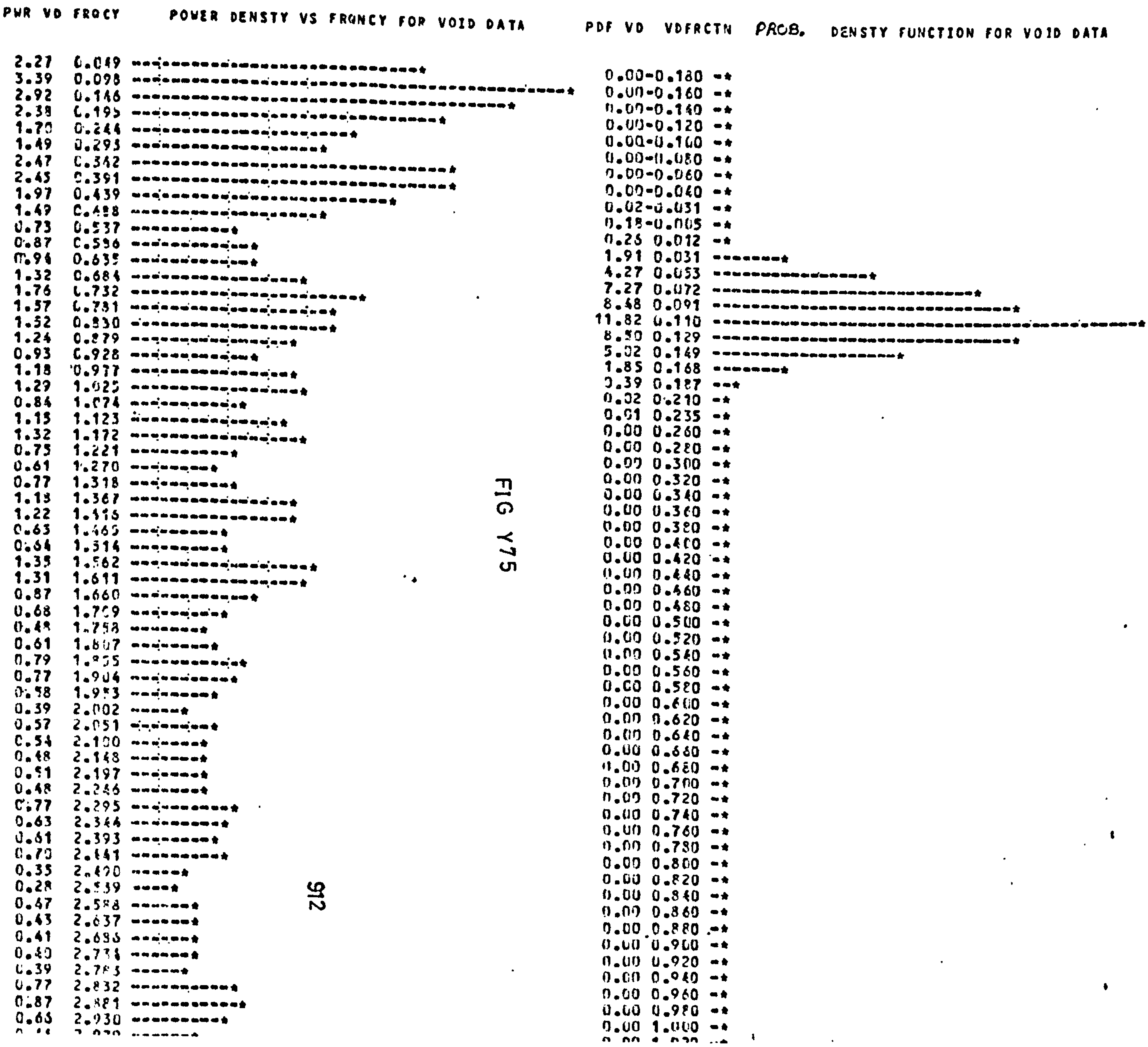

PWR VD FRQCY
POWER DENSTY VS FRQNCY FOR VOID DATA
2.27 0.049
3.39 0.098
2.92 0.146
2.38 0.195
1.70 0.244
1.49 0.293
2.47 0.342
2.45 0.391
1.97 0.439
1.49 0.488
0.73 0.537
0.87 0.586
0.94 0.635
1.32 0.684
1.76 0.732
1.57 0.781
1.52 0.830
1.24 0.879
0.93 0.928
1.18 0.977
1.29 1.025
0.84 1.074
1.15 1.123
1.32 1.172
0.75 1.221
0.61 1.270
0.77 1.318
1.18 1.367
1.22 1.416
0.63 1.465
0.64 1.514
1.35 1.562
1.31 1.611
0.87 1.660
0.68 1.709
0.48 1.758
0.61 1.807
0.79 1.855
0.77 1.904
0.58 1.953
0.39 2.002
0.57 2.051
0.54 2.100
0.48 2.148
0.51 2.197
0.48 2.246
0.77 2.295
0.63 2.344
0.61 2.393
0.70 2.441
0.35 2.490
0.28 2.539
0.47 2.588
0.43 2.637
0.41 2.686
0.40 2.734
0.39 2.783
0.77 2.832
0.87 2.881
0.65 2.930
912
PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA
0.00-0.180
0.00-0.160
0.00-0.140
0.00-0.120
0.00-0.100
0.00-0.080
0.00-0.060
0.00-0.040
0.02-0.031
0.18-0.005
0.26 0.012
1.91 0.031
4.27 0.053
7.27 0.072
8.48 0.091
11.82 0.110
8.50 0.129
5.02 0.149
1.85 0.168
0.39 0.187
0.02 0.210
0.01 0.235
0.00 0.260
0.00 0.280
0.00 0.300
0.00 0.320
0.00 0.340
0.00 0.360
0.00 0.380
0.00 0.400
0.00 0.420
0.00 0.440
0.00 0.460
0.00 0.480
0.00 0.500
0.00 0.520
0.00 0.540
0.00 0.560
0.00 0.580
0.00 0.600
0.00 0.620
0.00 0.640
0.00 0.660
0.00 0.680
0.00 0.700
0.00 0.720
0.00 0.740
0.00 0.760
0.00 0.780
0.00 0.800
0.00 0.820
0.00 0.840
0.00 0.860
0.00 0.880
0.00 0.900
0.00 0.920
0.00 0.940
0.00 0.960
0.00 0.980
0.00 1.000

FIG Y75

PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
1.03	0.049
1.13	0.098
1.61	0.146
2.44	0.193
2.45	0.244
1.83	0.293
2.02	0.342
2.87	0.391
2.97	0.439
2.79	0.488
1.94	0.537
0.71	0.586
0.79	0.635
1.83	0.684
2.33	0.732
1.67	0.781
1.06	0.830
2.14	0.879
3.03	0.928
1.73	0.977
0.79	1.025
0.50	1.074
0.63	1.123
0.60	1.172
0.66	1.221
0.63	1.270
0.49	1.318
0.61	1.367
1.01	1.416
0.87	1.465
0.68	1.514
0.61	1.562
1.21	1.611
1.64	1.660
0.78	1.709
0.33	1.758
0.49	1.807
0.69	1.855
0.69	1.904
0.49	1.953
0.44	2.002
0.37	2.051
0.53	2.100
0.74	2.148
0.41	2.197
0.49	2.246
0.76	2.295
0.54	2.344
0.28	2.393
0.28	2.441
0.59	2.490
0.68	2.539
0.37	2.588
0.36	2.637
0.73	2.686
0.78	2.734
0.63	2.783
0.67	2.832
0.52	2.881
0.41	2.930
[illegible]	[illegible]

PDF VD VDFRCTN PROB.- DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.05	-0.054
0.45	-0.031
1.59	-0.007
2.64	0.012
6.77	0.031
8.17	0.052
9.09	0.072
8.33	0.090
8.36	0.110
3.48	0.129
0.85	0.148
0.22	0.165
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000
[illegible]	[illegible]

FIG Y76

913

PWR VD	FRQCY
1.01	0.049
1.28	0.098
1.43	0.146
1.96	0.195
2.95	0.244
2.24	0.293
1.11	0.342
1.50	0.391
1.85	0.439
1.63	0.488
2.02	0.537
1.95	0.586
1.44	0.635
1.64	0.684
1.54	0.732
1.38	0.781
1.22	0.830
0.76	0.879
1.03	0.928
1.16	0.977
1.17	1.025
1.29	1.074
1.19	1.123
1.03	1.172
1.04	1.221
1.23	1.270
0.92	1.318
1.57	1.367
1.65	1.416
0.68	1.465
0.75	1.514
0.75	1.562
0.83	1.611
0.63	1.660
0.61	1.709
0.50	1.758
0.47	1.807
0.64	1.855
0.74	1.904
0.61	1.953
0.47	2.002
0.65	2.051
0.76	2.100
0.89	2.148
0.75	2.197
0.33	2.246
0.46	2.295
0.49	2.344
0.33	2.393
0.40	2.441
0.39	2.490
0.52	2.539
0.85	2.588
0.53	2.637
0.38	2.686
0.59	2.734
0.32	2.783
0.35	2.832
0.50	2.881
0.35	2.930
[illegible]	[illegible]

POWER DENSTY VS FRQNCY FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.051
0.60	-0.030
1.67	-0.006
2.45	0.011
8.15	0.031
9.33	0.051
8.87	0.071
8.32	0.090
7.07	0.109
2.81	0.128
0.58	0.147
0.07	0.166
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000
[illegible]	[illegible]

PROB. DENSTY FUNCTION FOR VOID DATA

914

FIG Y77

PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

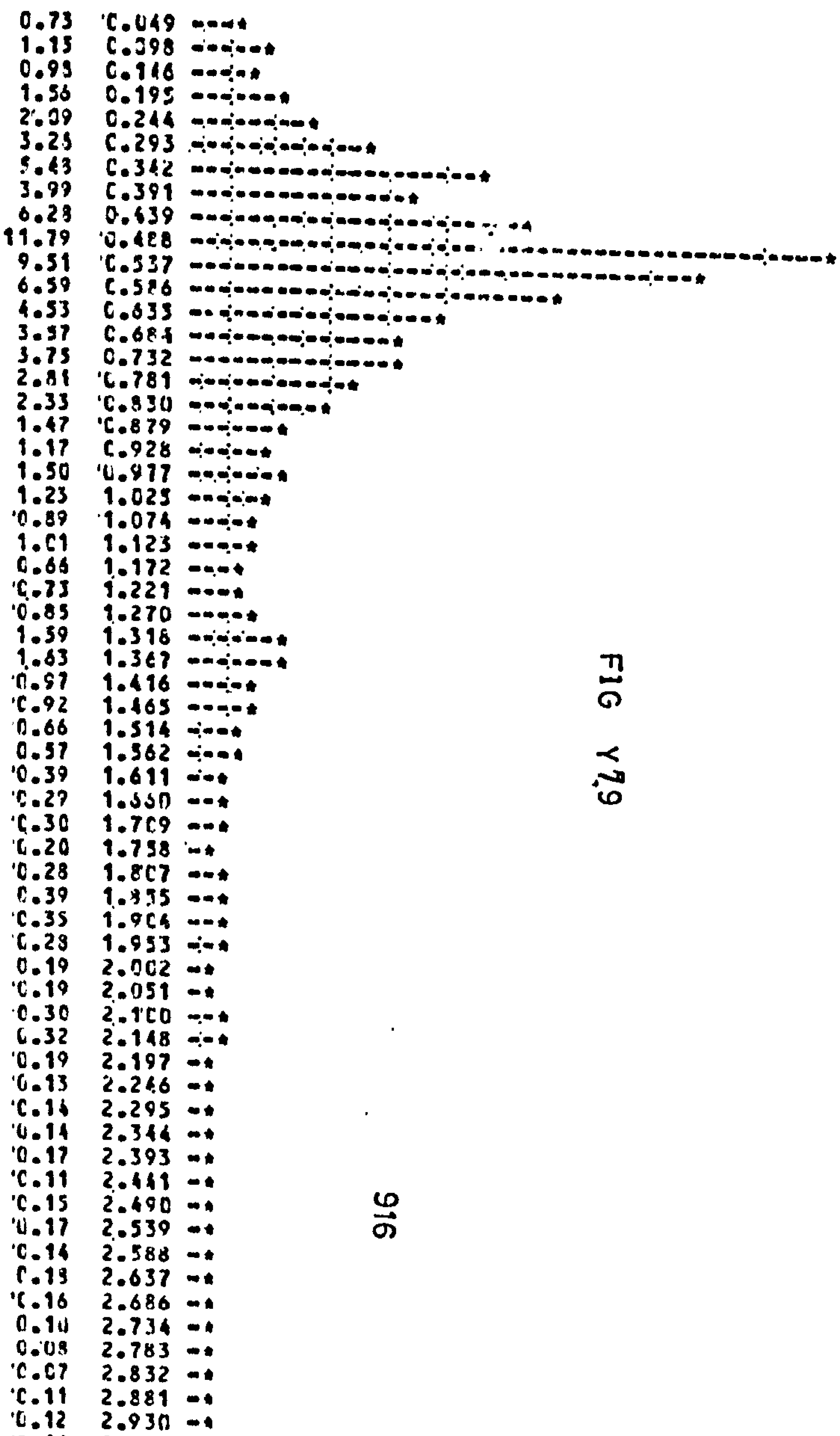
0.50	0.049
0.89	0.098
0.99	0.146
0.84	0.195
0.90	0.244
1.35	0.293
1.46	0.342
1.59	0.391
3.80	0.439
5.93	0.488
7.35	0.537
7.33	0.586
7.46	0.635
6.94	0.684
5.06	0.732
5.35	0.781
3.77	0.830
4.63	0.879
6.11	0.928
3.47	0.977
2.06	1.025
1.50	1.074
1.41	1.123
1.11	1.172
0.50	1.221
0.93	1.270
1.14	1.318
0.83	1.367
0.91	1.416
1.16	1.465
1.04	1.514
0.75	1.562
0.70	1.611
0.37	1.660
0.39	1.709
0.46	1.758
0.45	1.807
0.45	1.855
0.19	1.904
0.20	1.953
0.29	2.002
0.27	2.051
0.23	2.100
0.25	2.148
0.21	2.197
0.14	2.246
0.20	2.295
0.26	2.344
0.20	2.393
0.17	2.441
0.18	2.490
0.11	2.539
0.11	2.588
0.15	2.637
0.13	2.686
0.16	2.734
0.16	2.783
0.12	2.832
0.12	2.881
0.10	2.930

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.01	-0.102
0.05	-0.086
0.01	-0.068
0.22	-0.053
0.58	-0.030
0.94	-0.008
0.97	0.012
2.23	0.030
2.28	0.052
2.54	0.072
2.70	0.090
3.81	0.110
3.47	0.131
3.55	0.150
4.71	0.170
4.41	0.190
5.31	0.209
4.87	0.229
3.49	0.249
2.14	0.268
0.95	0.289
0.56	0.308
0.16	0.326
0.05	0.349
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.00	0.700
0.00	0.720
0.00	0.740
0.00	0.760
0.00	0.780
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

FIG Y78

PWR VD FRQCY   POWER DENSTY VS FRQNCY FOR VOID DATA



PDF VD VDFRCTN *PROB.* DENSTY FUNCTION FOR VOID DATA

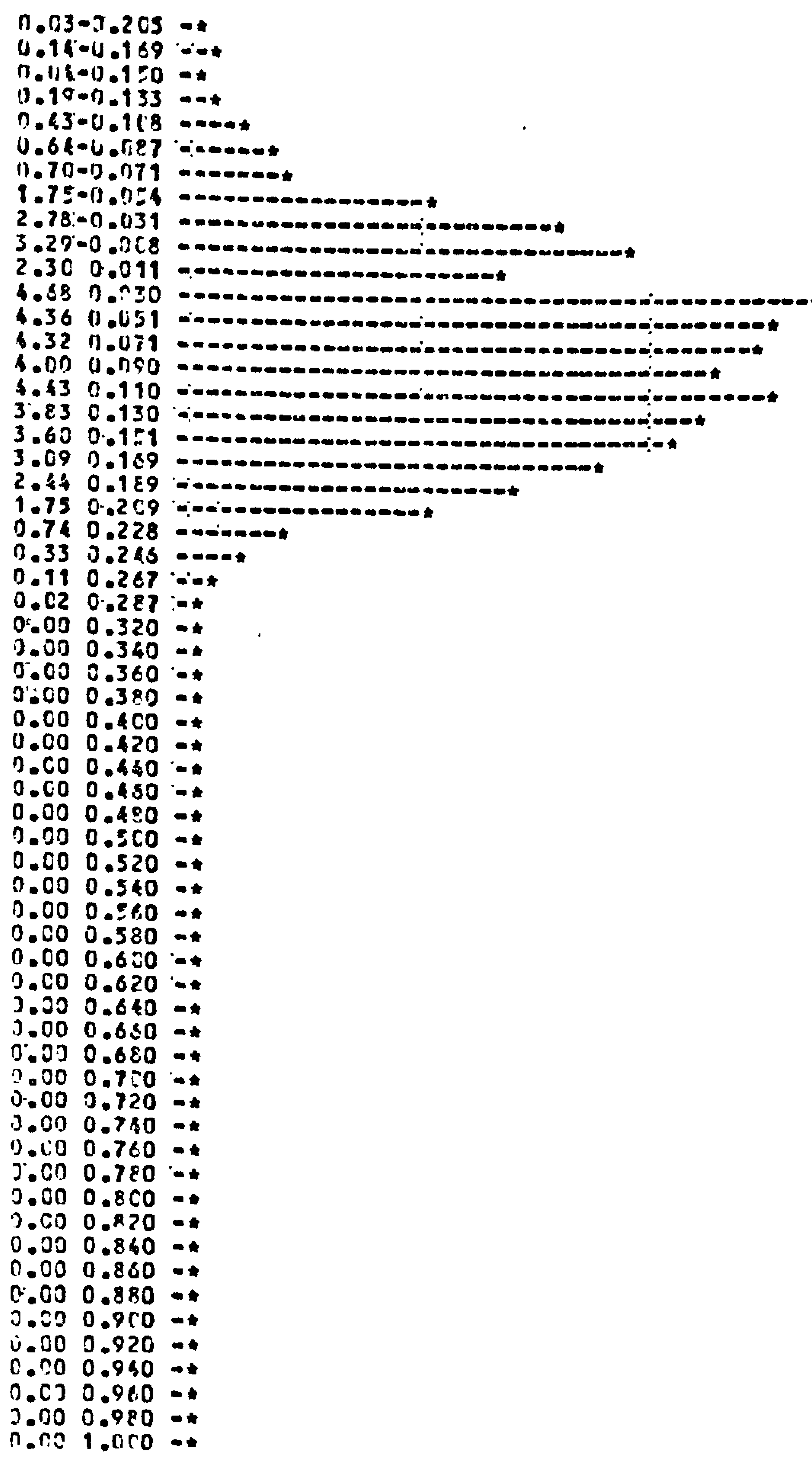


FIG Y7.9

916

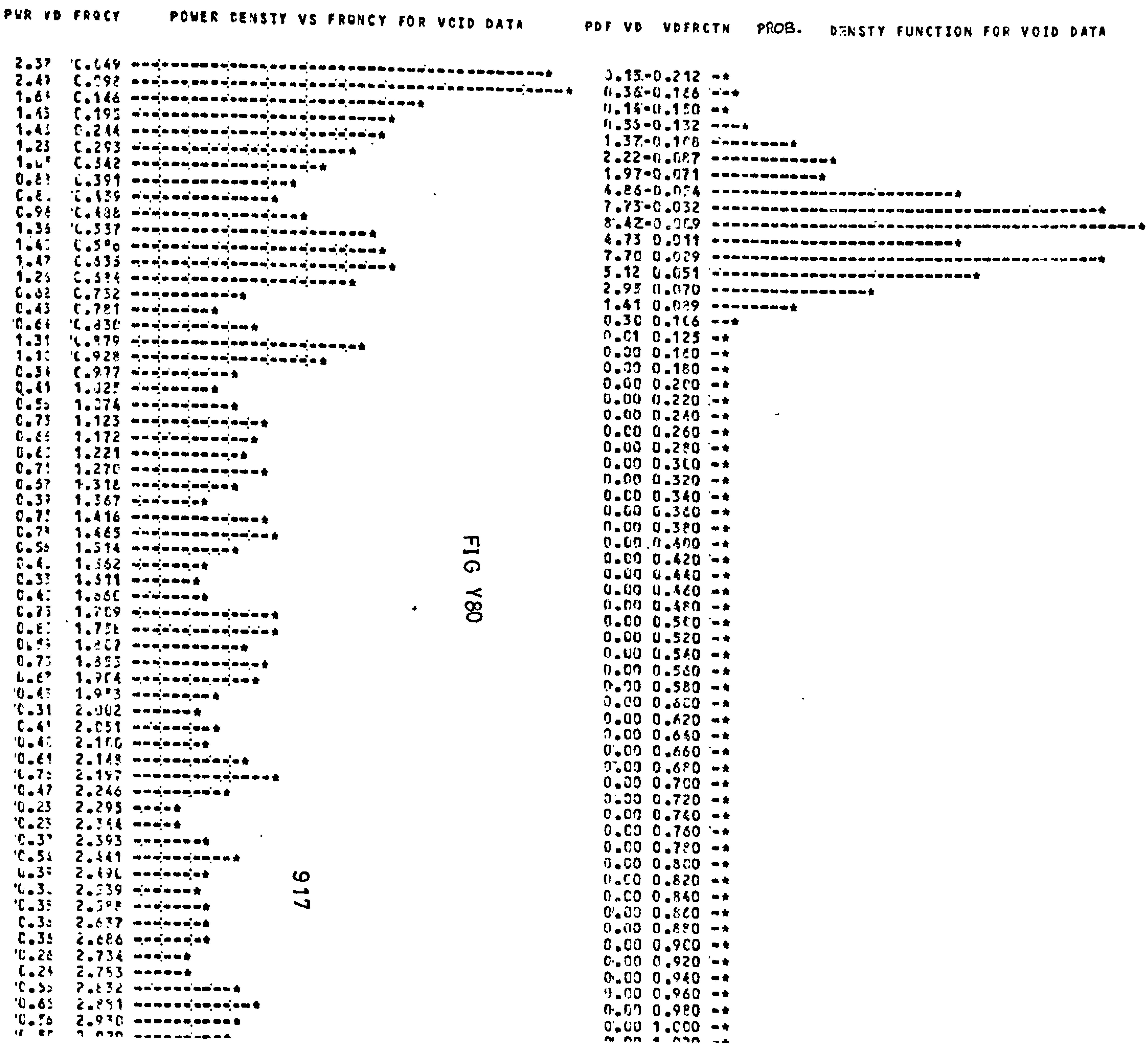

PWR VD FRQCY
POWER DENSTY VS FRQNCY FOR VOID DATA
PDF VD VDFRCTN PROB.
DENSTY FUNCTION FOR VOID DATA

FIG Y80

917

PWR VD FRQCY   POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
8.07	0.122
7.85	0.244
9.25	0.366
6.85	0.428
13.74	0.610
13.40	0.732
2.40	0.854
3.25	0.977
3.77	1.099
3.31	1.221
3.62	1.343
2.62	1.465
2.02	1.587
2.05	1.709
2.07	1.831
1.85	1.953
1.00	2.075
0.96	2.197
0.73	2.319
0.36	2.441
0.61	2.563
0.94	2.686
0.72	2.808
0.42	2.930
0.25	3.032
0.32	3.174
0.33	3.296
0.31	3.418
0.32	3.540
0.35	3.662
0.28	3.784
0.20	3.906
0.24	4.028
0.32	4.150
0.29	4.272
0.18	4.395
0.27	4.517
0.29	4.639
0.21	4.761
0.20	4.883
0.20	5.005
0.11	5.127
0.05	5.249
0.05	5.371
0.06	5.493
0.10	5.615
0.12	5.737
0.11	5.859
0.05	5.981
0.03	6.104
0.04	6.226
0.09	6.348
0.11	6.470
0.06	6.592
0.04	6.714
0.05	6.836
0.09	6.958
0.07	7.080
0.04	7.202
0.06	7.324

FIG Y81 .

918

PDF VD VDFRCTN *PROB.* DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.09	0.672
0.28	0.694
2.82	0.713
9.65	0.732
19.04	0.750
13.92	0.768
3.90	0.788
0.30	0.803
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.910
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

PWR VD FRQCY — POWER DENSTY VS FRQNCY FOR VOID DATA

PWR	VD FRQCY
6.27	0.122
4.93	0.244
5.23	0.366
7.11	0.488
6.65	0.610
5.06	0.732
3.91	0.854
6.01	0.977
5.85	1.099
4.19	1.221
5.12	1.343
6.25	1.465
4.42	1.587
2.53	1.709
3.49	1.831
2.69	1.953
1.79	2.075
1.62	2.197
1.19	2.319
1.26	2.441
1.49	2.563
0.92	2.686
0.65	2.808
0.58	2.930
0.64	3.052
0.50	3.174
0.27	3.296
0.54	3.418
0.59	3.540
0.47	3.662
0.25	3.784
0.23	3.906
0.39	4.028
0.52	4.150
0.51	4.272
0.35	4.395
0.21	4.517
0.16	4.639
0.22	4.761
0.19	4.883
0.12	5.005
0.12	5.127
0.15	5.249
0.13	5.371
0.16	5.493
0.14	5.615
0.11	5.737
0.14	5.859
0.09	5.981
0.06	6.104
0.10	6.226
0.08	6.348
0.09	6.470
0.11	6.592
0.07	6.714
0.10	6.836
0.11	6.958
0.09	7.080
0.11	7.202
0.09	7.324

PDF VD VDFRCTN — PROB. DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.00	0.680
0.83	0.695
7.44	0.714
24.31	0.731
14.21	0.748
3.19	0.766
0.02	0.782
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

FIG Y 82

919

PWR VD	FRQCY
5.05	0.122
5.38	0.244
11.22	0.366
11.24	0.488
4.73	0.610
9.45	0.732
9.97	0.854
4.02	0.977
4.89	1.099
3.73	1.221
2.13	1.343
1.70	1.465
2.08	1.587
1.72	1.709
1.48	1.831
1.99	1.953
1.78	2.075
1.51	2.197
0.99	2.319
0.88	2.441
1.03	2.563
0.69	2.686
0.66	2.808
0.85	2.930
0.63	3.052
0.50	3.174
0.45	3.296
0.38	3.418
0.41	3.540
0.44	3.662
0.25	3.784
0.22	3.906
0.21	4.028
0.24	4.150
0.30	4.272
0.26	4.395
0.13	4.517
0.19	4.639
0.32	4.761
0.26	4.883
0.11	5.005
0.10	5.127
0.15	5.249
0.14	5.371
0.12	5.493
0.12	5.615
0.11	5.737
0.09	5.859
0.05	5.981
0.07	6.104
0.09	6.226
0.12	6.348
0.17	6.470
0.13	6.592
0.08	6.714
0.07	6.836
0.07	6.958
0.06	7.080
0.06	7.202
0.06	7.324

POWER DENSTY VS FRQNCY FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.00	0.400
0.00	0.420
0.00	0.440
0.00	0.460
0.00	0.480
0.00	0.500
0.00	0.520
0.00	0.540
0.00	0.560
0.00	0.580
0.00	0.600
0.00	0.620
0.00	0.640
0.00	0.660
0.02	0.677
1.41	0.695
13.09	0.713
22.87	0.730
11.42	0.749
1.18	0.764
0.01	0.781
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

PROB. DENSTY FUNCTION FOR VOID DATA

FIG Y83

PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
26.60	0.122
17.05	0.244
13.20	0.366
8.33	0.488
8.00	0.610
6.36	0.732
3.70	0.854
3.69	0.977
2.81	1.099
1.35	1.221
1.03	1.343
1.12	1.465
1.08	1.587
0.94	1.709
0.62	1.831
0.59	1.953
0.52	2.075
0.38	2.197
0.36	2.319
0.18	2.441
0.20	2.563
0.17	2.686
0.09	2.808
0.12	2.930
0.11	3.052
0.09	3.174
0.07	3.296
0.02	3.418
0.02	3.540
0.03	3.662
0.06	3.784
0.09	3.906
0.08	4.028
0.05	4.150
0.02	4.272
0.02	4.395
0.03	4.517
0.05	4.639
0.05	4.761
0.03	4.883
0.03	5.005
0.01	5.127
0.02	5.249
0.02	5.371
0.01	5.493
0.02	5.615
0.03	5.737
0.01	5.859
0.01	5.981
0.01	6.104
0.01	6.226
0.01	6.348
0.02	6.470
0.02	6.592
0.01	6.714
0.01	6.836
0.01	6.958
0.01	7.080
0.01	7.202
0.01	7.324

PDF VD VDFRCTN PROB. DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.00	0.380
0.02	0.397
0.06	0.415
0.04	0.432
0.20	0.452
0.68	0.471
0.76	0.491
2.16	0.510
3.73	0.530
4.51	0.550
5.20	0.570
5.21	0.590
4.70	0.610
4.71	0.630
5.03	0.650
4.32	0.670
2.91	0.689
2.73	0.709
1.95	0.729
0.77	0.748
0.27	0.764
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

FIG Y 84

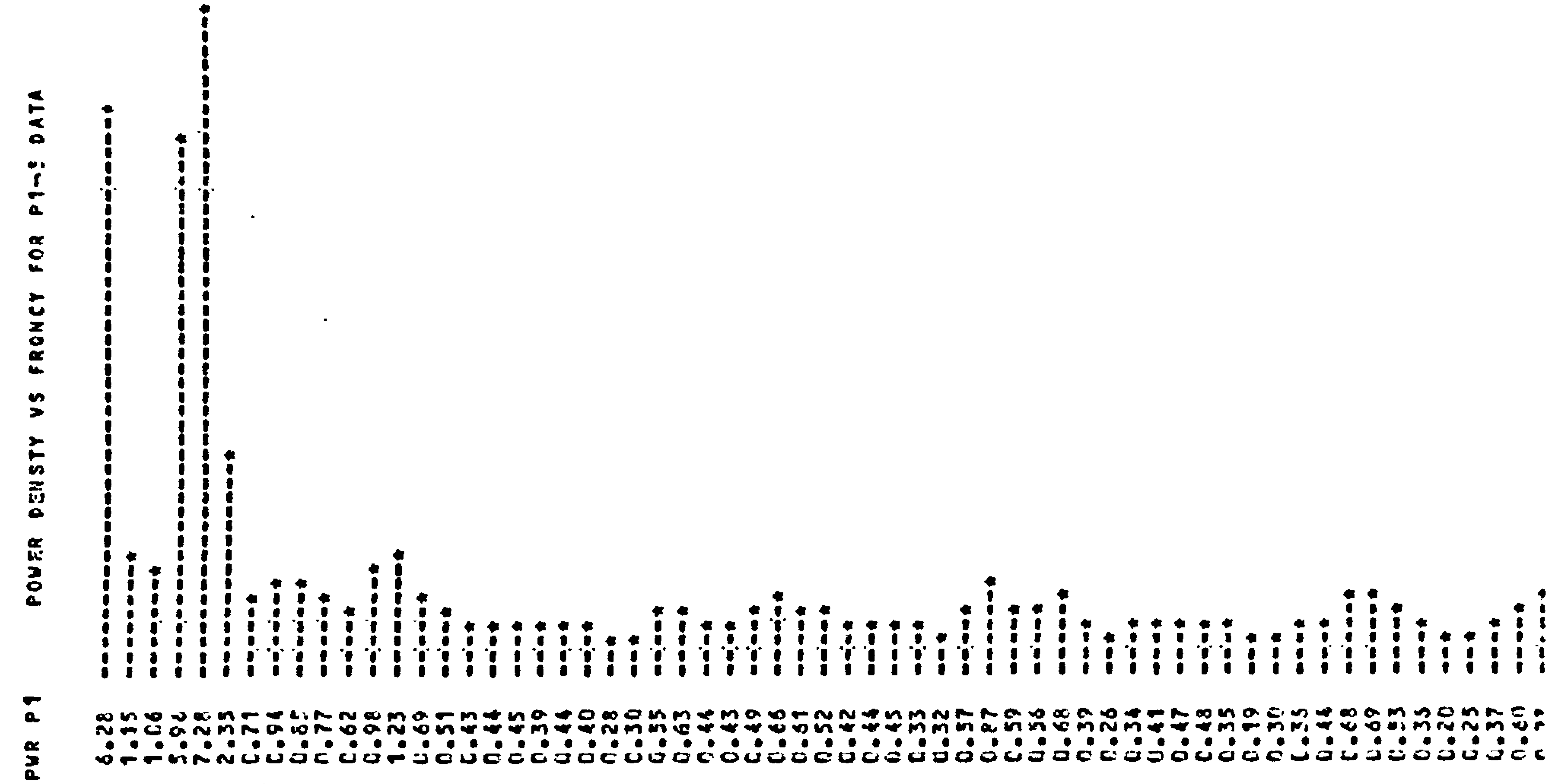
PWR VD FRQCY POWER DENSTY VS FRQNCY FOR VOID DATA

PWR VD	FRQCY
5.41	0.012
5.70	0.024
4.23	0.037
4.41	0.049
5.49	0.061
3.61	0.073
2.09	0.083
2.42	0.098
2.68	0.110
2.43	0.122
3.06	0.134
2.40	0.146
1.05	0.159
1.29	0.171
0.79	0.183
1.86	0.195
2.20	0.208
1.41	0.220
1.82	0.232
1.33	0.244
0.99	0.256
1.35	0.269
1.41	0.281
1.32	0.293
1.00	0.305
0.91	0.317
0.94	0.330
1.17	0.342
0.90	0.354
0.36	0.366
0.55	0.378
1.04	0.391
1.32	0.403
1.08	0.415
0.90	0.427
0.72	0.439
0.47	0.452
0.51	0.464
0.31	0.476
0.17	0.488
0.89	0.500
1.14	0.513
0.53	0.525
0.24	0.537
0.27	0.549
0.31	0.562
0.59	0.574
0.76	0.586
0.58	0.598
0.71	0.610
0.78	0.623
0.41	0.635
0.21	0.647
0.53	0.659
0.62	0.671
0.37	0.684
0.33	0.696
0.23	0.708
0.23	0.720
0.26	0.732

PDF VD VDFRCTN PROBABILITY DENSTY FUNCTION FOR VOID DATA

PDF VD	VDFRCTN
0.00	-0.180
0.00	-0.160
0.00	-0.140
0.00	-0.120
0.00	-0.100
0.00	-0.080
0.00	-0.060
0.00	-0.040
0.00	-0.020
0.00	0.000
0.00	0.020
0.00	0.040
0.00	0.060
0.00	0.080
0.00	0.100
0.00	0.120
0.00	0.140
0.00	0.160
0.00	0.180
0.00	0.200
0.00	0.220
0.00	0.240
0.00	0.260
0.00	0.280
0.00	0.300
0.00	0.320
0.00	0.340
0.00	0.360
0.01	0.369
0.03	0.396
0.07	0.414
0.06	0.431
0.26	0.453
0.67	0.472
1.51	0.490
2.47	0.511
4.01	0.531
5.48	0.550
6.35	0.570
5.58	0.590
4.96	0.609
4.24	0.630
3.98	0.649
2.78	0.670
2.11	0.689
1.70	0.710
1.11	0.730
0.99	0.751
0.92	0.764
0.00	0.800
0.00	0.820
0.00	0.840
0.00	0.860
0.00	0.880
0.00	0.900
0.00	0.920
0.00	0.940
0.00	0.960
0.00	0.980
0.00	1.000

FIG Y85


PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA

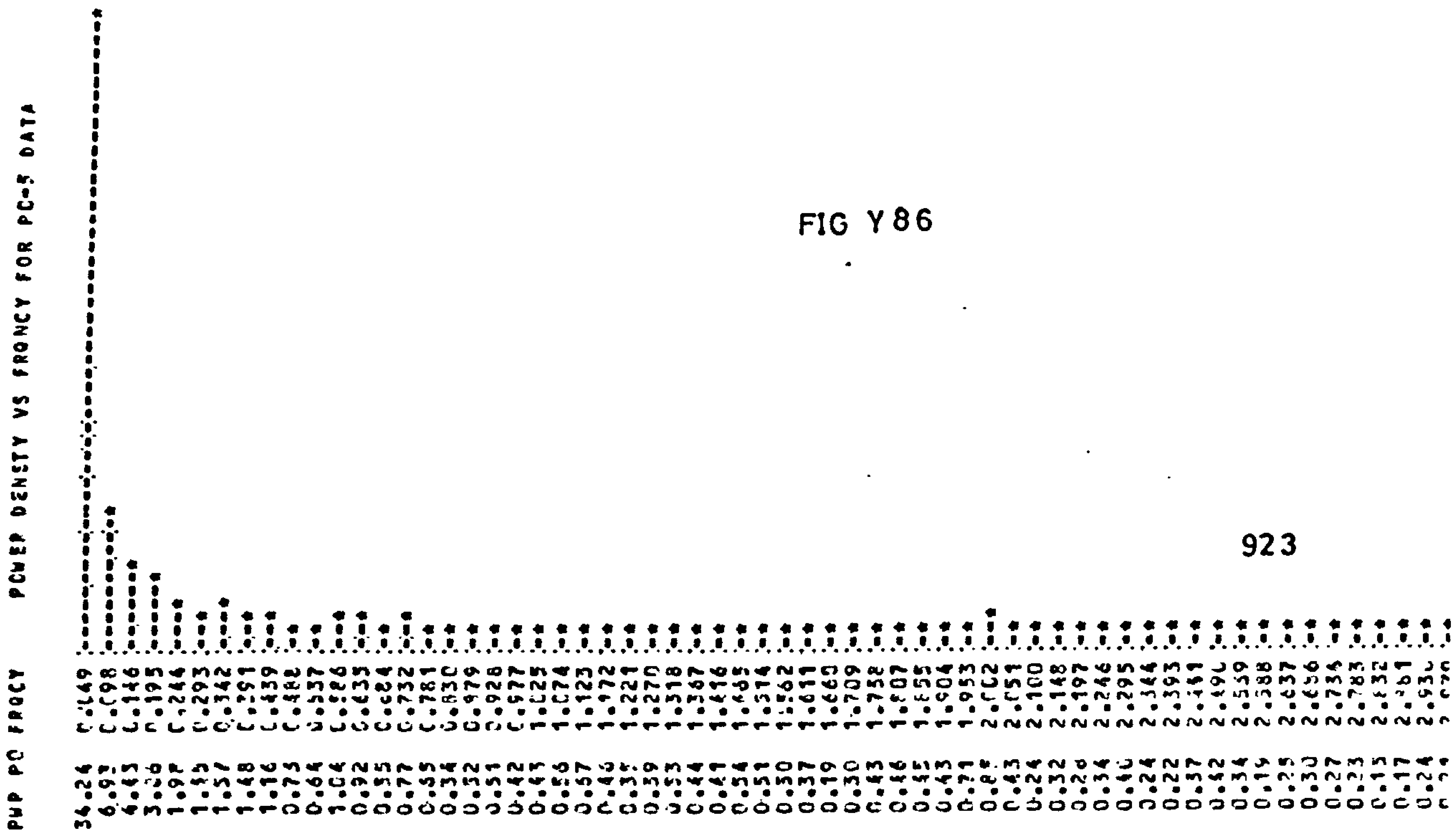
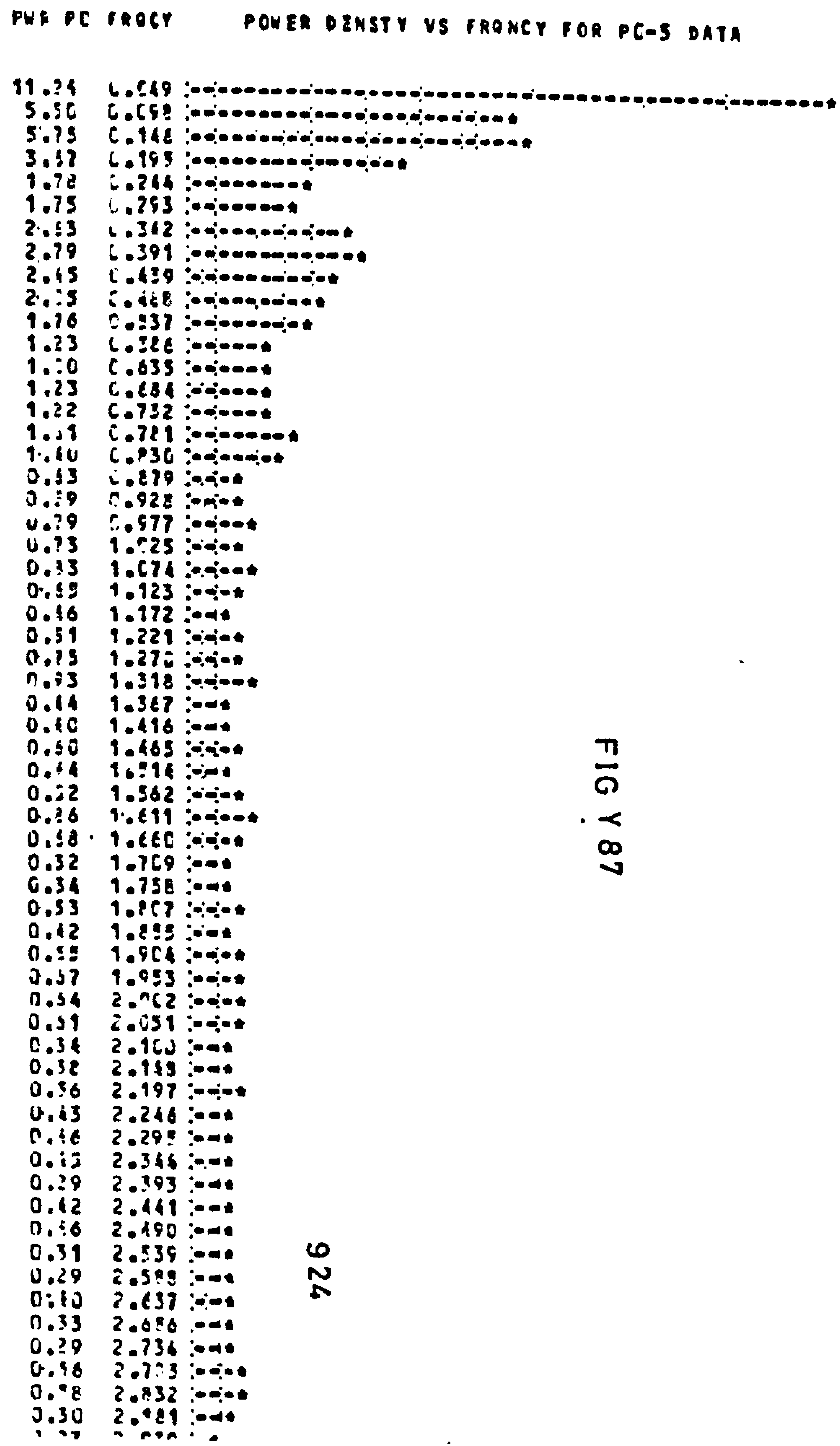

PWR PC FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA

FIG Y86

923


PWR PC FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA
11.24 0.049
5.50 0.098
5.75 0.146
3.47 0.195
1.78 0.244
1.75 0.293
2.53 0.342
2.79 0.391
2.45 0.439
2.35 0.488
1.76 0.537
1.23 0.586
1.10 0.635
1.23 0.684
1.22 0.732
1.31 0.781
1.40 0.830
0.53 0.879
0.39 0.928
0.79 0.977
0.73 1.025
0.33 1.074
0.55 1.123
0.46 1.172
0.51 1.221
0.75 1.270
0.93 1.318
0.44 1.367
0.40 1.416
0.60 1.465
0.44 1.514
0.32 1.562
0.26 1.611
0.58 1.660
0.32 1.709
0.34 1.758
0.53 1.807
0.42 1.855
0.55 1.904
0.57 1.953
0.54 2.002
0.51 2.051
0.34 2.100
0.32 2.149
0.36 2.197
0.43 2.246
0.46 2.295
0.13 2.344
0.29 2.393
0.42 2.441
0.56 2.490
0.31 2.539
0.29 2.588
0.10 2.637
0.33 2.686
0.29 2.734
0.56 2.783
0.78 2.832
0.30 2.881

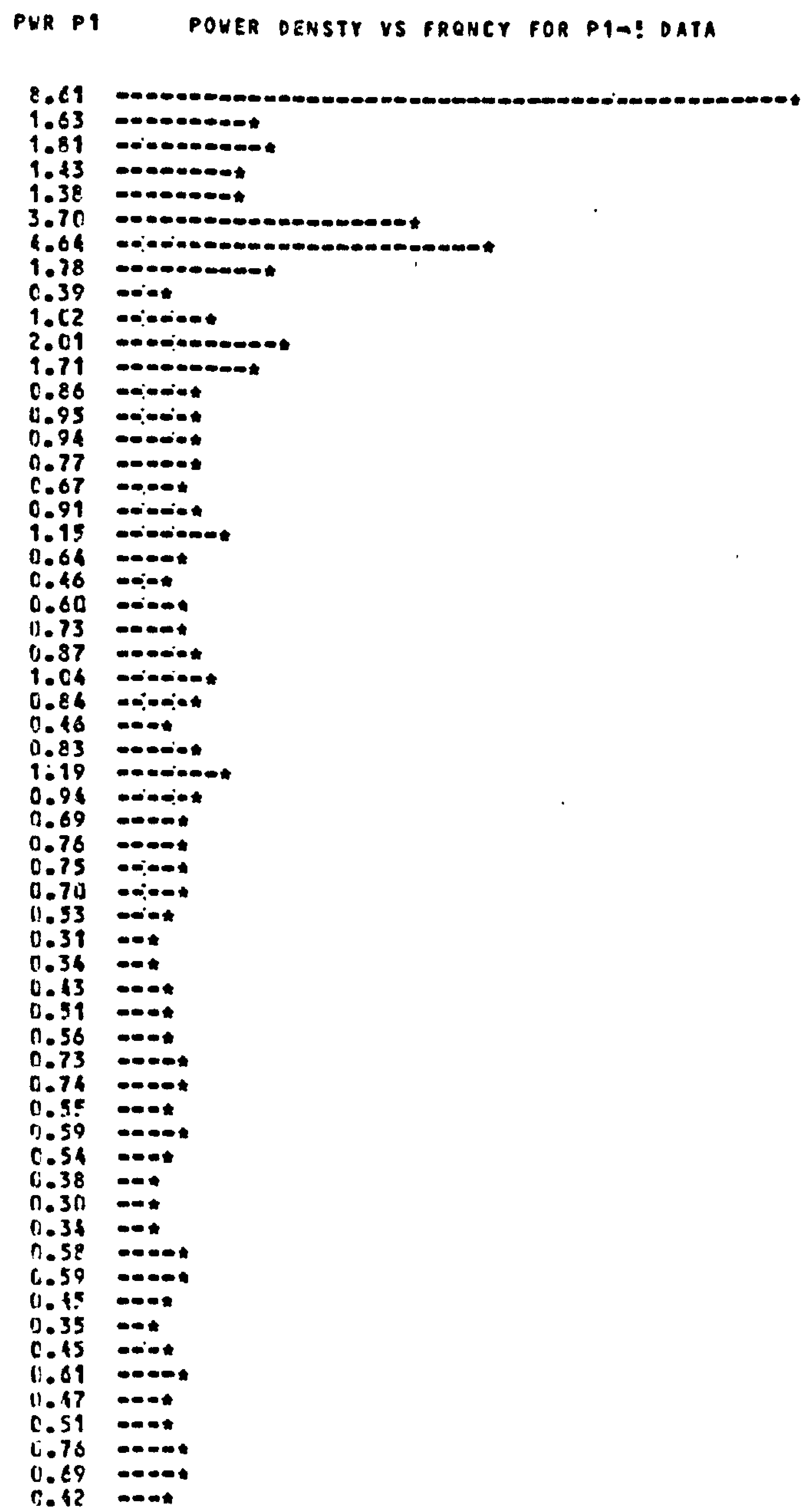

PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA
8.61
1.63
1.81
1.43
1.38
3.70
4.64
1.78
0.39
1.02
2.01
1.71
0.86
0.95
0.94
0.77
0.67
0.91
1.15
0.64
0.46
0.60
0.73
0.87
1.04
0.84
0.46
0.83
1.19
0.94
0.69
0.76
0.75
0.70
0.53
0.31
0.34
0.43
0.51
0.56
0.73
0.74
0.55
0.59
0.54
0.38
0.30
0.34
0.58
0.59
0.45
0.35
0.45
0.61
0.47
0.51
0.76
0.69
0.42

FIG Y 87

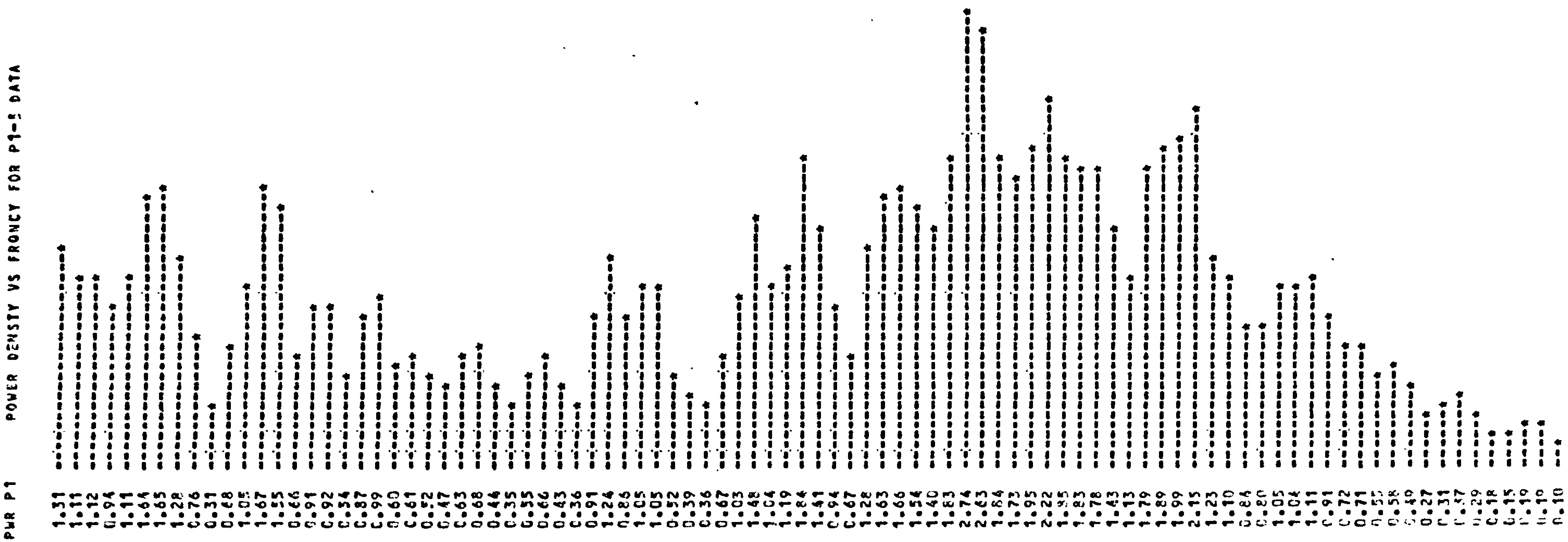
924

PWR P^	FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA	
9.56	0.098
7.36	0.195
3.08	0.293
1.43	0.391
1.52	0.488
1.34	0.586
1.03	0.684
0.92	0.781
1.07	0.879
0.71	0.977
0.59	1.074
0.65	1.172
0.99	1.270
1.45	1.367
1.07	1.465
0.59	1.562
0.57	1.660
0.51	1.758
0.51	1.855
0.48	1.953
0.58	2.051
0.66	2.148
0.67	2.246
1.01	2.344
0.98	2.441
0.64	2.539
0.62	2.637
0.65	2.734
0.73	2.832
0.78	2.930
1.32	3.027
1.31	3.125
0.69	3.223
0.38	3.320
1.06	3.418
1.02	3.516
1.06	3.613
0.76	3.711
0.40	3.809
0.48	3.906
0.52	4.004
0.44	4.102
0.54	4.199
0.43	4.297
0.35	4.395
0.40	4.492
0.62	4.590
0.53	4.687
0.42	4.785
0.39	4.883
0.39	4.980
0.33	5.078
0.19	5.176
0.36	5.273
0.44	5.371
0.32	5.469
0.26	5.566
0.18	5.664
0.17	5.762
0.24	5.859
0.30	[illegible]
0.38	8.789
0.49	8.887
0.33	8.984
0.26	9.082
0.40	9.180
0.37	9.277
0.29	9.375
0.26	9.473
0.13	9.570
0.21	9.668
0.24	9.766
0.80	9.863
3.70	9.961
3.22	10.059
1.19	10.156
1.16	10.254
0.32	10.352
0.32	10.449

925

FIG Y88

PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA
6.07
6.06
3.31
1.94
1.25
1.11
0.66
0.72
0.99
0.92
0.67
0.96
0.87
0.49
0.40
0.65
1.39
1.32
0.99
1.29
1.07
0.51
0.34
0.43
0.54
0.53
0.67
1.66
1.66
0.89
1.94
2.41
1.45
3.02
3.87
2.00
1.26
1.02
0.70
1.02
0.81
0.39
0.50
0.37
0.31
0.25
0.17
0.18
0.15
0.08
0.15
0.19
0.16
0.21
0.22
0.17
0.18
0.16
0.14
0.14
0.41
0.32
0.19
0.35
0.85
0.68
0.30
0.38
0.39
0.30
0.51
5.70
5.70
0.56
1.25
1.24
0.36
0.31


POWER DENSTY VS FRQNCY FOR P1-5 DATA
PWR P1

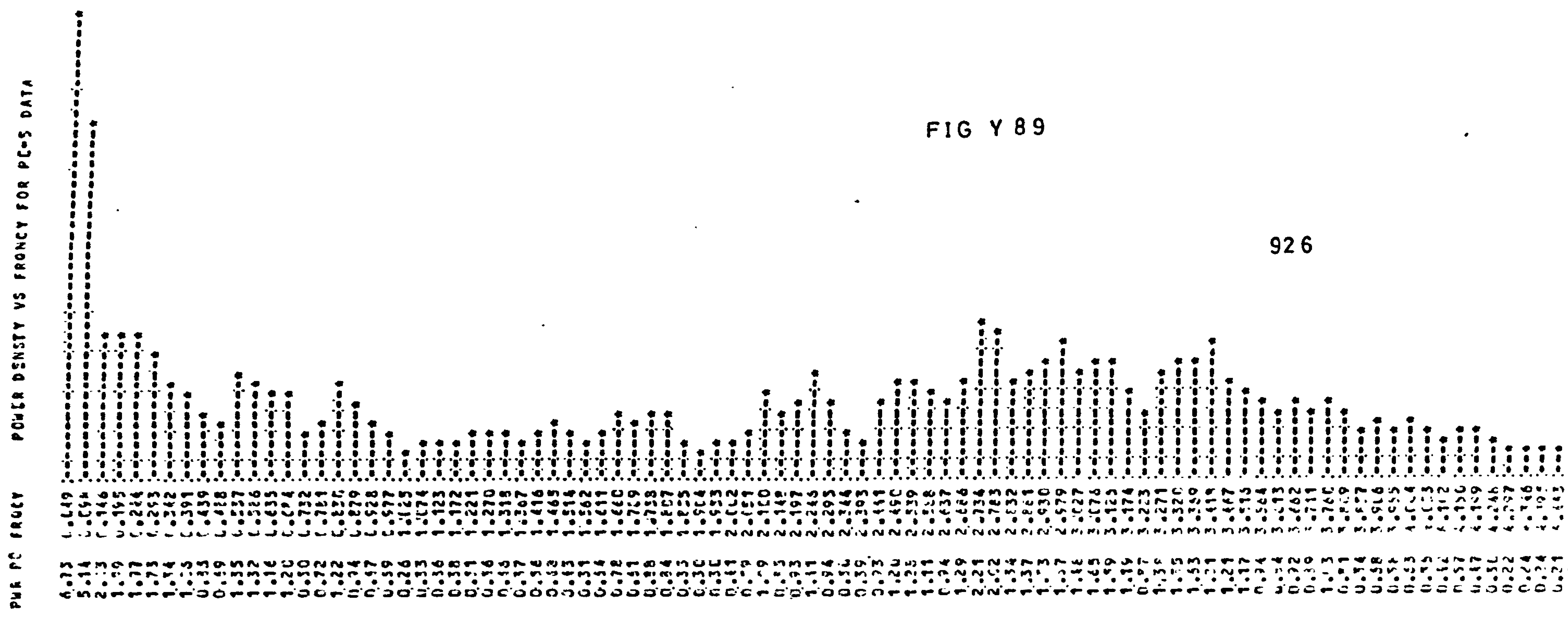

POWER DENSTY VS FRQNCY FOR PC-5 DATA
PWR PC FRQCY

FIG Y89

926

POWER DENSTY VS FRQNCY FOR P0-5 DATA

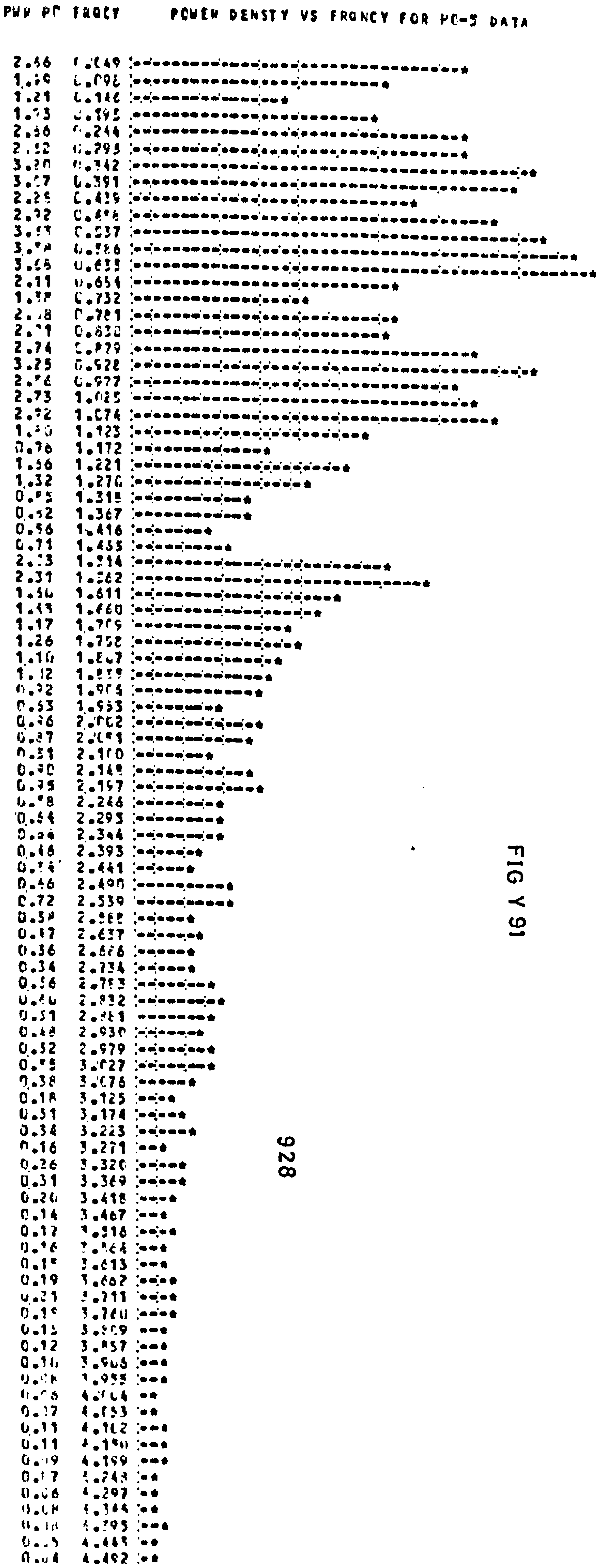
PWR P0	FRQCY
6.16	0.049
4.51	0.098
3.03	0.146
4.79	0.195
4.57	0.244
1.68	0.293
2.52	0.342
3.41	0.391
3.35	0.439
1.77	0.488
0.75	0.537
1.15	0.586
1.16	0.635
1.44	0.684
1.71	0.732
0.90	0.781
0.81	0.830
0.69	0.879
0.63	0.928
0.60	0.977
0.54	1.025
0.65	1.074
1.29	1.123
1.38	1.172
0.89	1.221
0.86	1.270
0.60	1.318
0.48	1.367
0.96	1.416
0.92	1.465
0.47	1.514
0.31	1.562
0.18	1.611
0.53	1.660
0.88	1.709
0.89	1.758
0.57	1.807
0.45	1.855
0.50	1.904
0.36	1.953
0.37	2.002
0.45	2.051
0.51	2.100
0.43	2.148
0.54	2.197
1.10	2.246
1.01	2.295
1.37	2.344
1.48	2.393
0.77	2.441
0.91	2.490
0.90	2.539
0.90	2.588
0.94	2.637
0.70	2.686
0.64	2.734
0.69	2.783
0.98	2.832
0.81	2.881
0.62	2.930
0.73	2.979
0.55	3.027
0.62	3.076
1.08	3.125
1.27	3.174
1.00	3.223
0.96	3.271
0.69	3.320
0.31	3.369
0.27	3.418
0.45	3.467
0.47	3.516
0.53	3.564
0.63	3.613
0.49	3.662
0.50	3.711
0.42	3.760
0.51	3.809
0.47	3.857
0.25	3.906
0.18	3.955
0.26	4.004
0.53	4.053
0.23	4.102
0.26	4.150
0.30	4.199
0.24	4.248
0.17	4.297
0.25	4.346
0.22	4.395
0.10	4.443
0.24	4.492
0.29	4.541

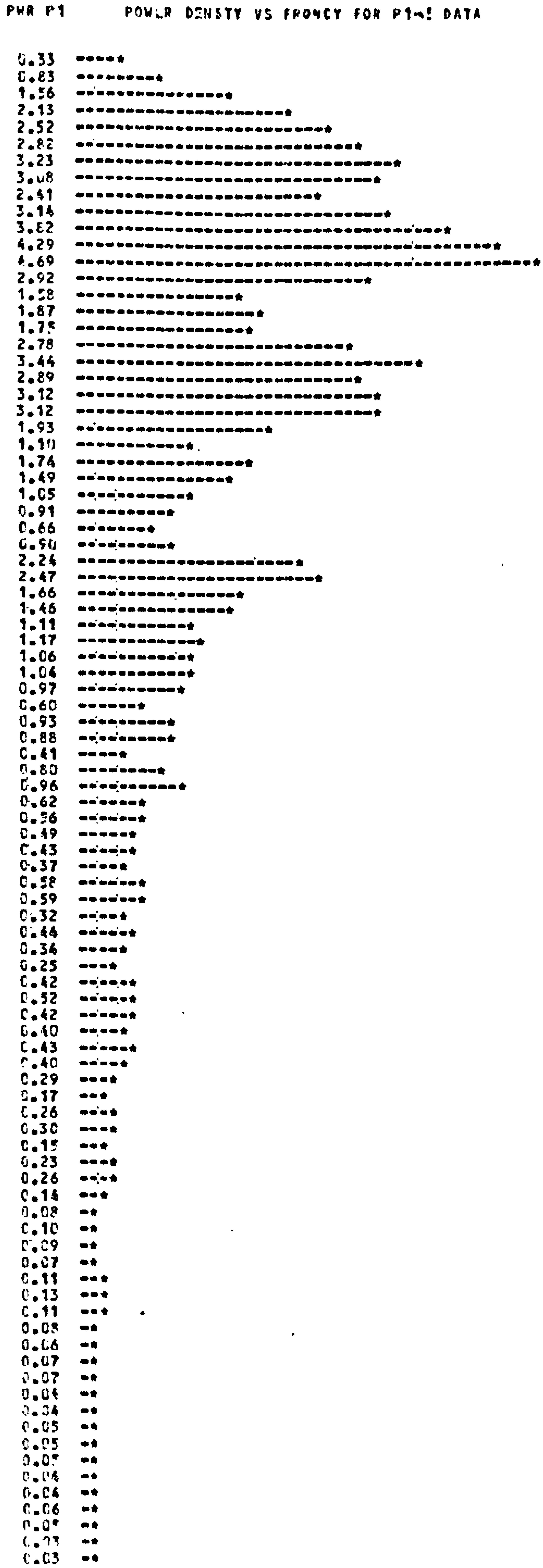
POWER DENSTY VS FRQNCY FOR P1-5 DATA

PWR P1
1.16
1.39
2.38
4.41
3.90
1.96
4.29
6.13
4.04
1.86
0.63
0.80
1.36
1.88
1.36
0.77
0.79
0.69
0.79
0.68
0.62
0.97
2.06
2.15
1.21
0.91
0.49
0.49
1.33
1.37
0.84
0.64
0.42
0.65
0.91
0.80
0.48
0.57
0.70
0.64
0.53
0.50
0.64
0.59
0.50
0.96
1.13
1.42
1.31
0.61
0.70
0.75
1.02
1.22
0.90
0.72
0.64
1.03
1.01
0.77
0.74
0.43
0.61
1.08
1.06
0.79
0.78
0.58
0.35
0.33
0.47
0.35
0.38
0.61
0.45
0.36
0.35
0.33
0.28
0.14
0.13
0.19
0.21
0.11
0.12
0.15
0.10
0.15
0.23
0.17
0.07
0.19
0.20

FIG Y 90

927

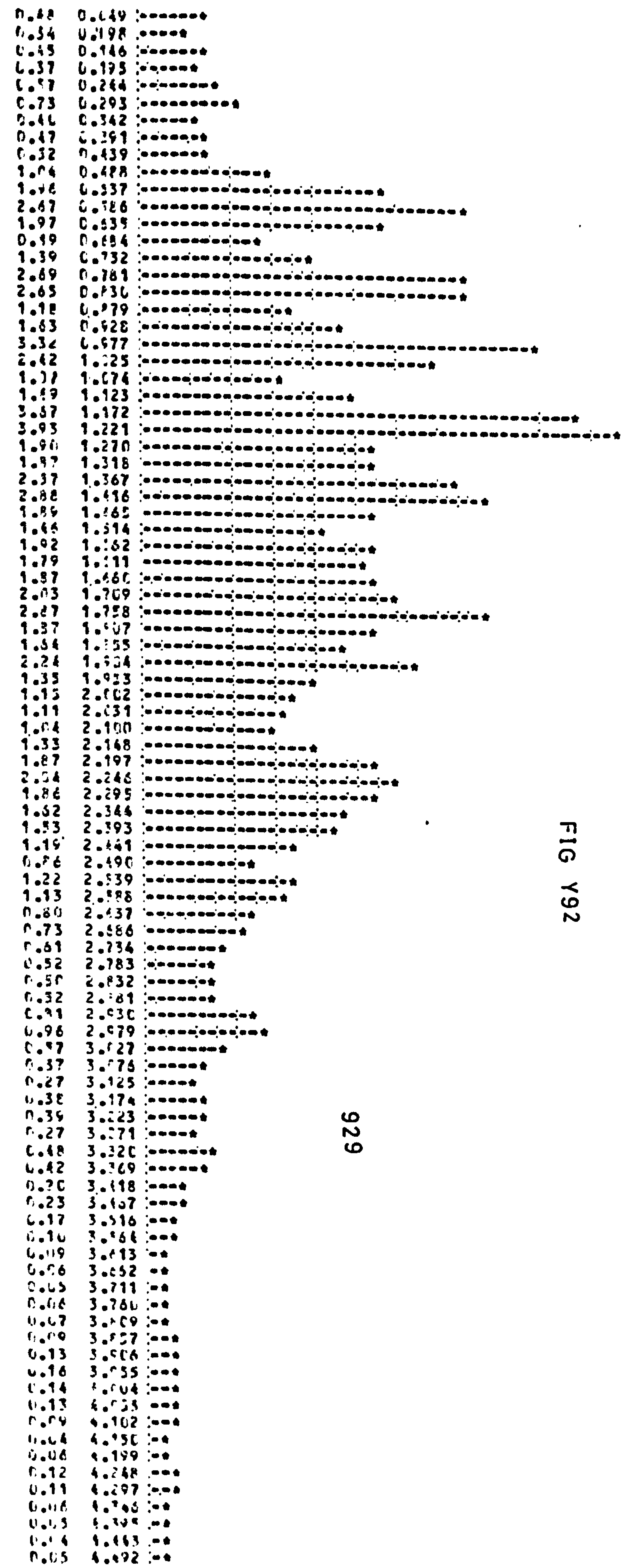

PWR PC FRQCY
POWER DENSTY VS FRQNCY FOR PC=5 DATA


PWR P1
POWER DENSTY VS FRQNCY FOR P1=5 DATA

928

FIG Y 91

PWR PC FRQCY POWER DENSTY VS FRQNCY FOR PC-5 DATA



PWR P1 POWER DENSTY VS FRQNCY FOP P1=5 DATA

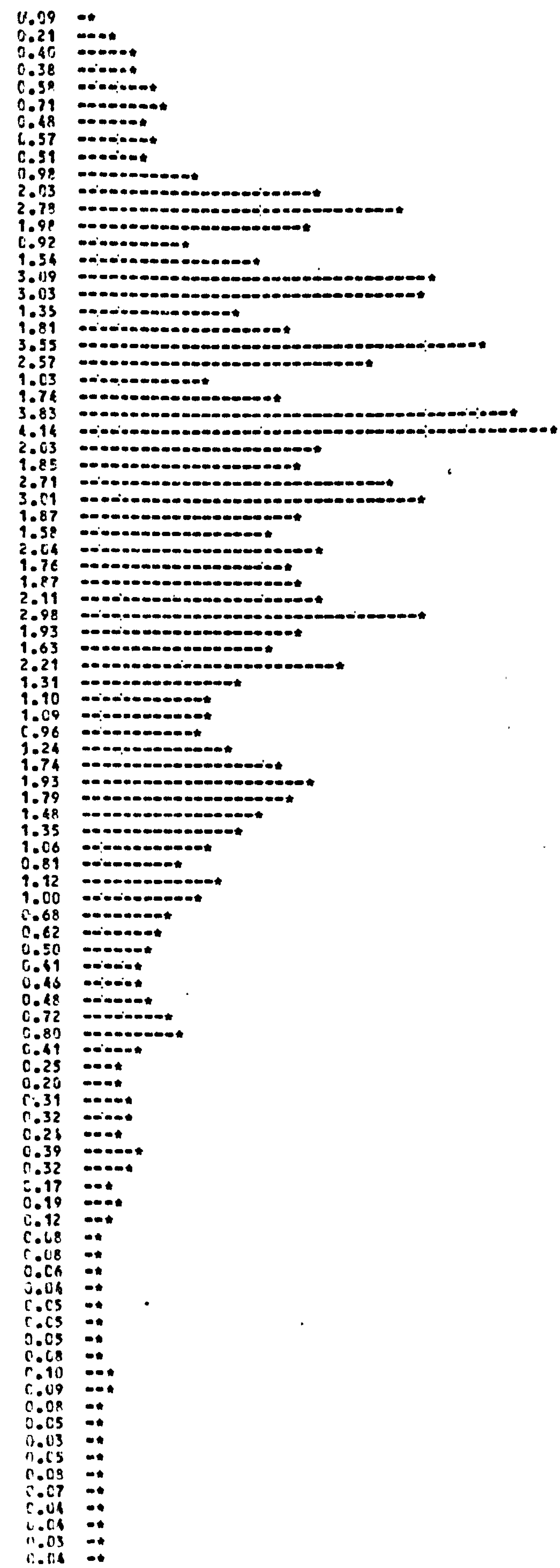
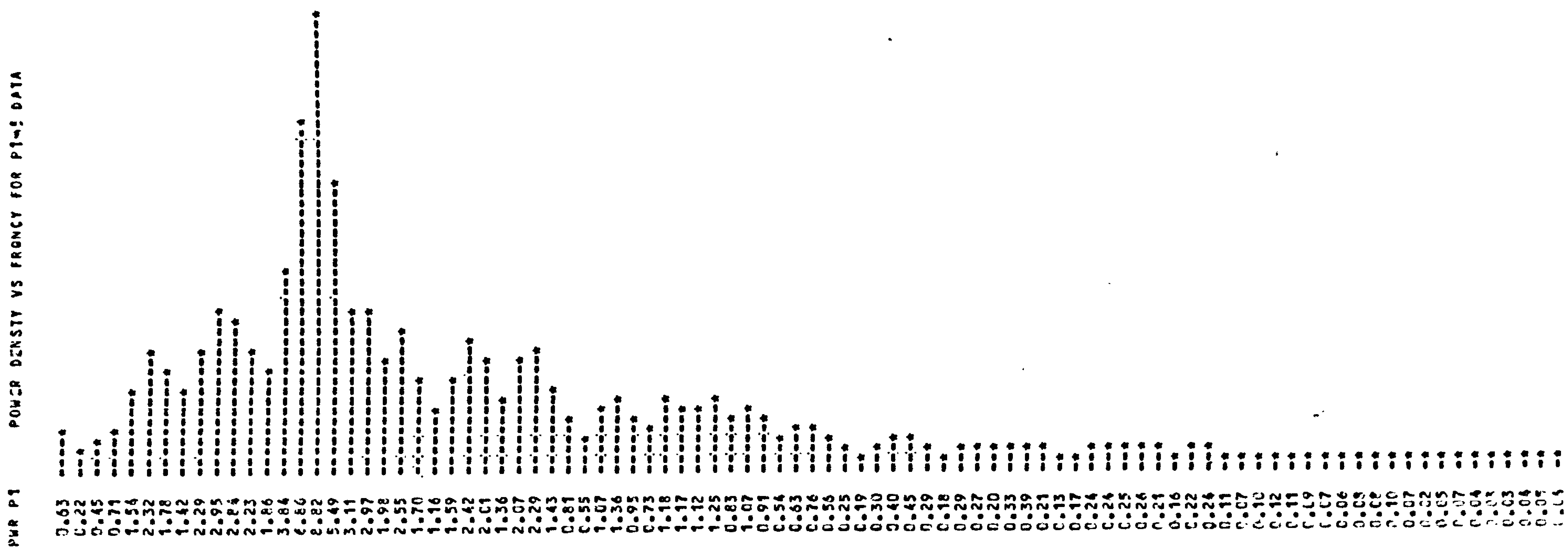


FIG Y92

929


POWER DENSTY VS FRQNCY FOR P1-5 DATA
PWR P1

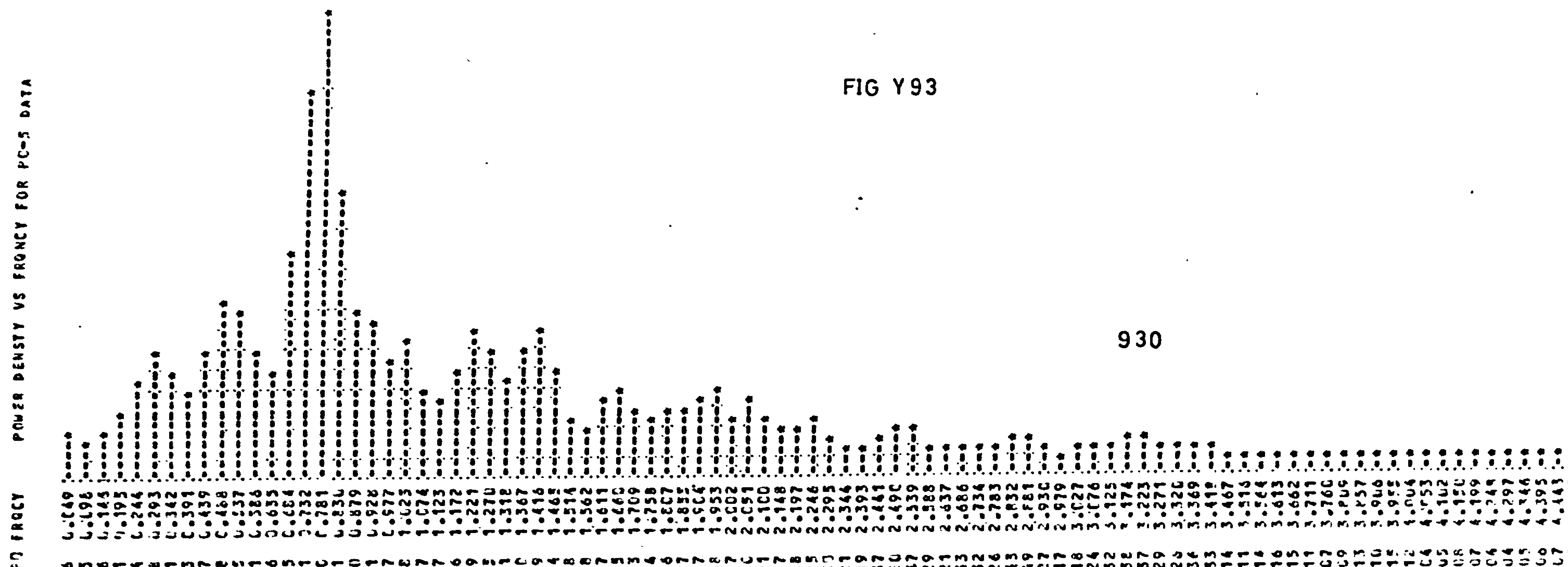
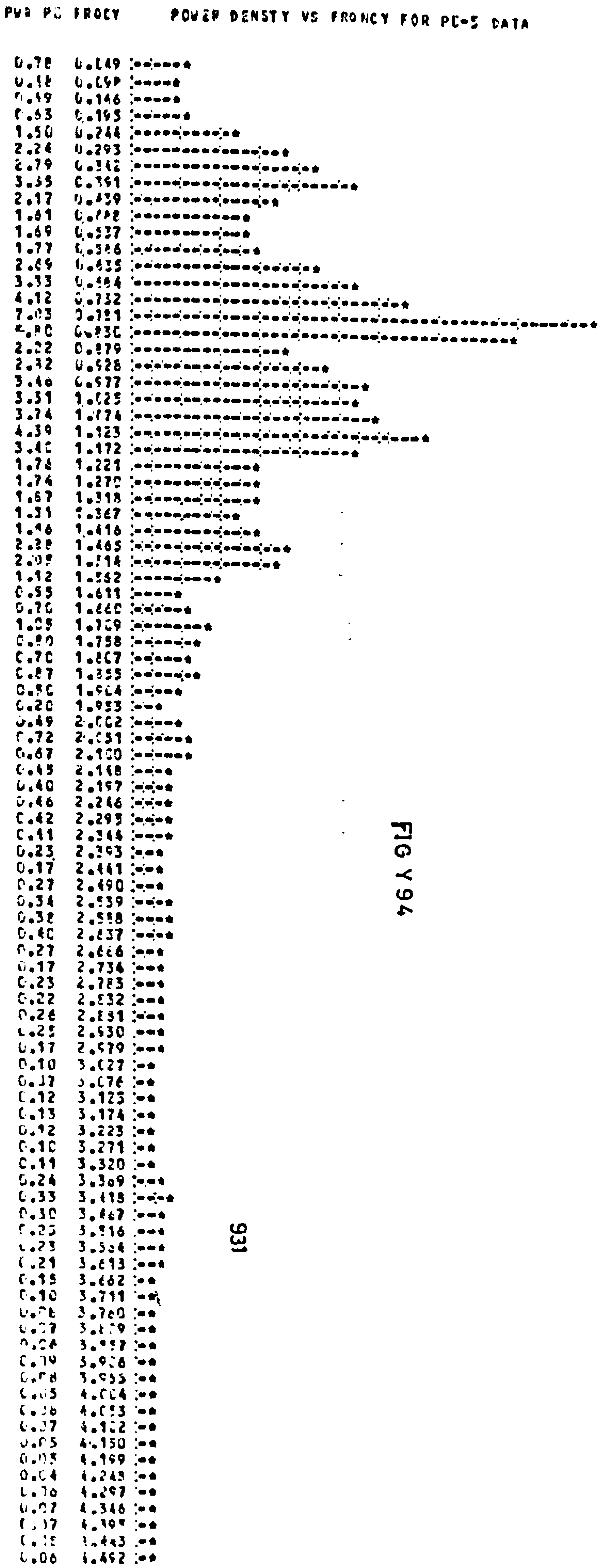

POWER DENSTY VS FRQNCY FOR PC-5 DATA
PWR FQ FRQCY

FIG Y93

930


PWR PC FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA

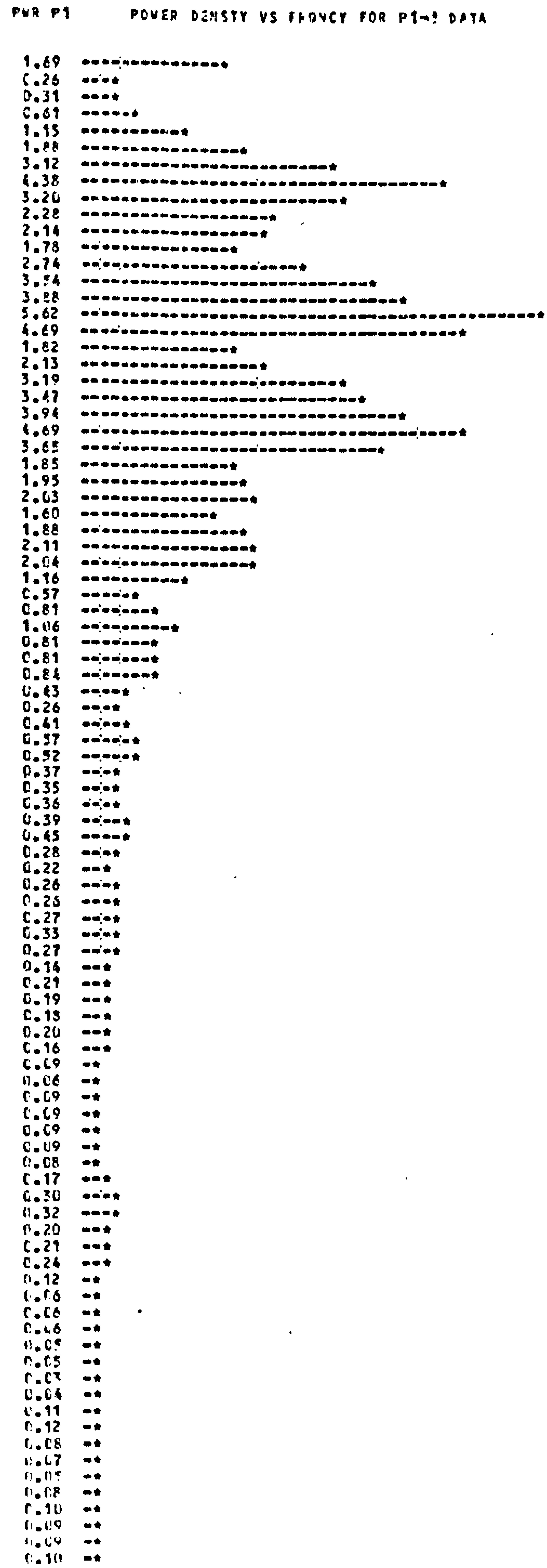
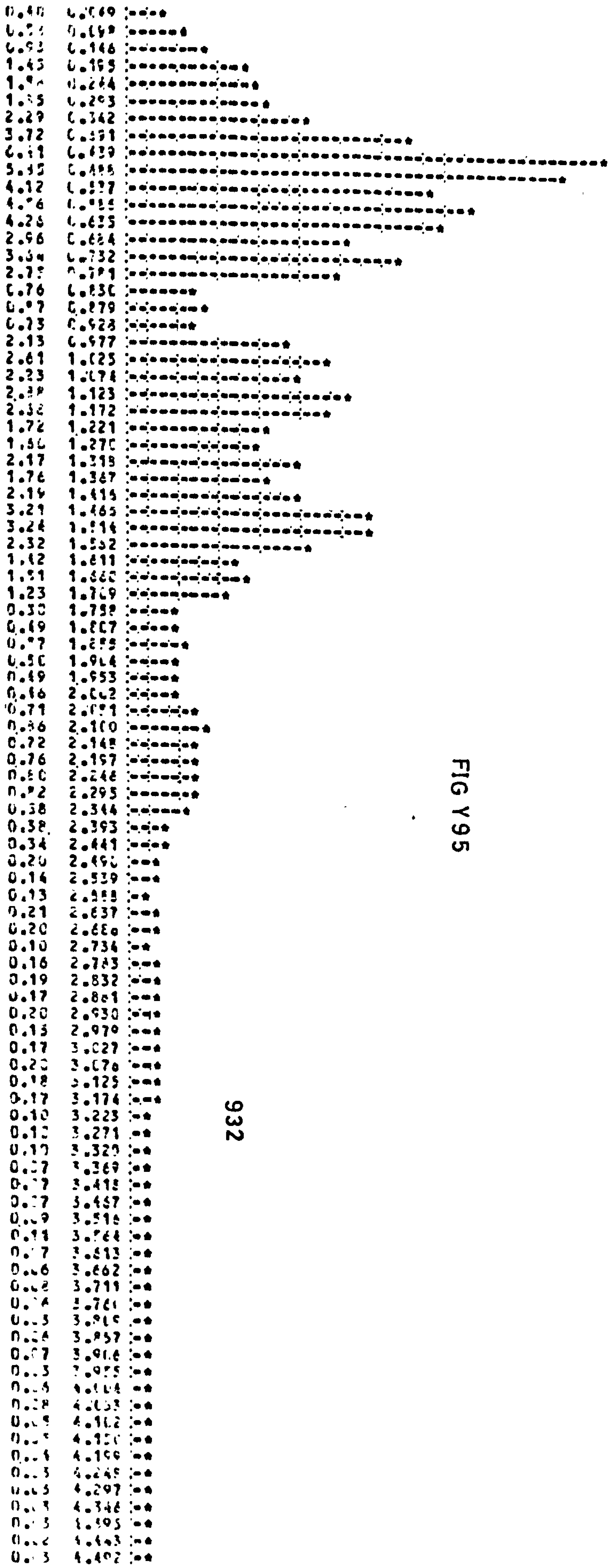

PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA

FIG Y 94

931

PWR PC FRQCY POWER DENSTY VS FRQNCY FOR PC-5 DATA



PWR P1 POWER DENSTY VS FRQNCY FOR P1-5 DATA

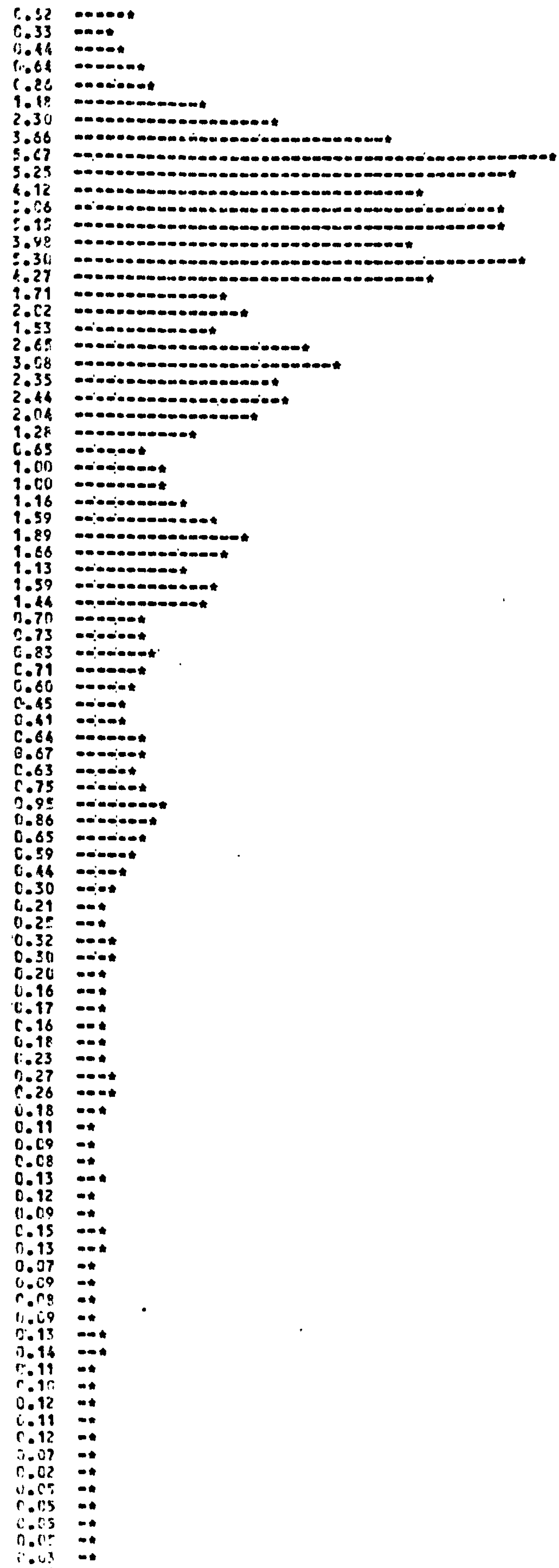


FIG Y95

932

PWR P0	FRQCY
0.61	0.049
0.24	0.098
0.35	0.146
0.49	0.195
1.07	0.244
4.16	0.293
5.34	0.342
2.90	0.391
2.31	0.439
1.47	0.488
1.58	0.537
3.32	0.586
4.97	0.635
10.69	0.684
11.31	0.732
4.82	0.781
1.63	0.830
2.10	0.879
3.60	0.928
4.21	0.977
4.76	1.025
3.36	1.074
1.17	1.123
0.85	1.172
1.13	1.221
2.09	1.270
2.20	1.318
1.56	1.367
0.93	1.416
0.94	1.465
0.88	1.514
0.52	1.562
0.59	1.611
0.98	1.660
0.85	1.709
0.27	1.758
0.43	1.807
0.52	1.855
0.45	1.904
0.32	1.953
0.40	2.002
0.53	2.051
0.26	2.100
0.16	2.148
0.24	2.197
0.18	2.246
0.15	2.295
0.26	2.344
0.21	2.393
0.11	2.441
0.30	2.490
0.31	2.539
0.14	2.588
0.11	2.637
0.11	2.686
0.16	2.734
0.17	2.783
0.16	2.832
0.10	2.881
[illegible]	[illegible]

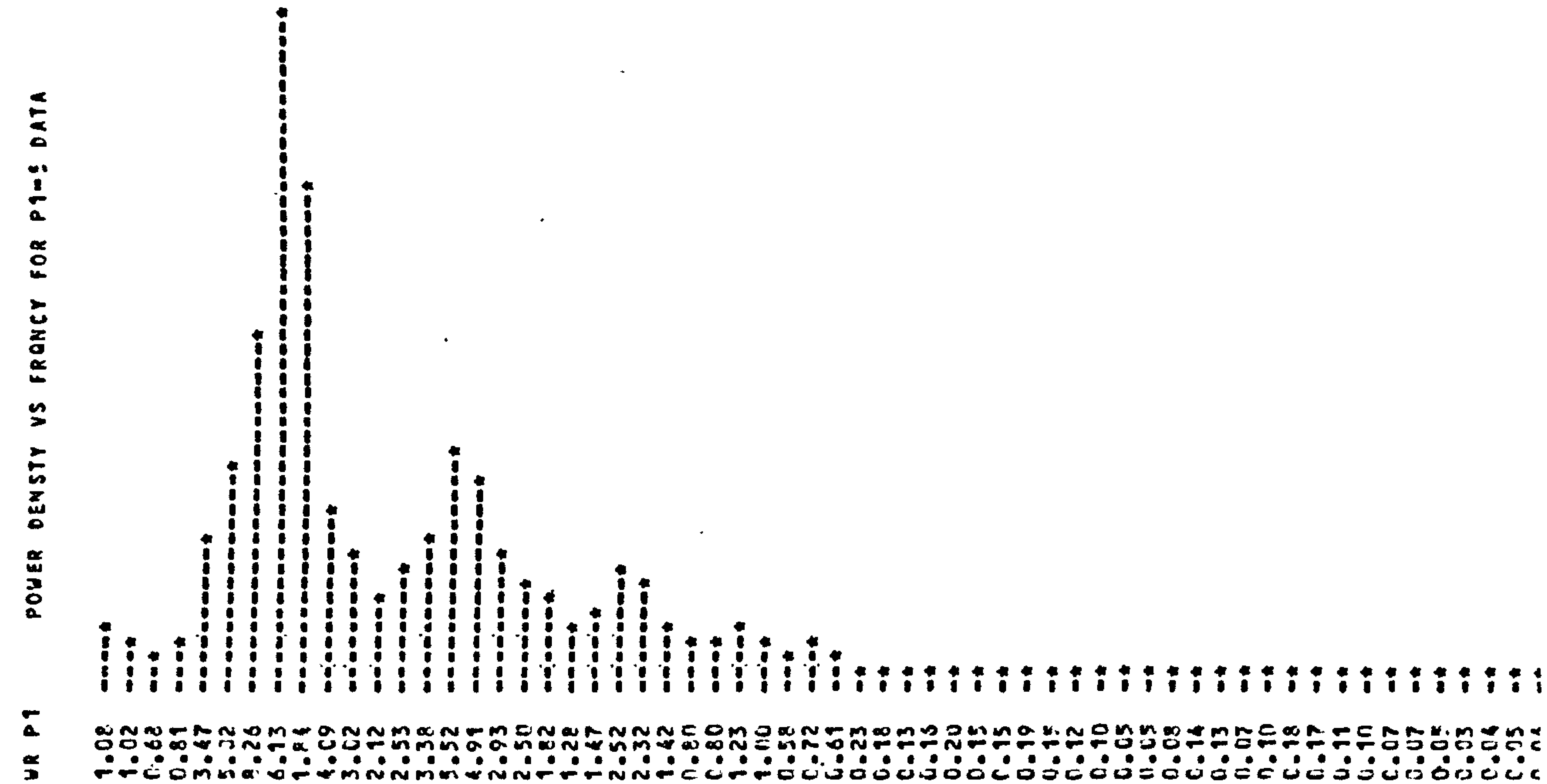
POWER DENSTY VS FRQNCY FOR PO-5 DATA

PWR P1
0.92
0.14
0.22
0.39
1.04
4.54
5.95
3.44
2.63
2.24
2.13
3.81
5.23
10.06
10.63
4.18
1.46
1.90
3.26
3.95
4.83
3.56
1.25
0.82
1.15
2.01
2.05
1.56
1.02
0.92
0.95
0.63
0.60
0.92
0.80
0.29
0.37
0.47
0.41
0.27
0.31
0.39
0.22
0.19
0.23
0.17
0.11
0.21
0.22
0.13
0.29
0.31
0.13
0.09
0.13
0.14
0.14
0.14
0.09
[illegible]

POWER DENSTY VS FRQNCY FOR P1-5 DATA

FIG Y96

933


PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA

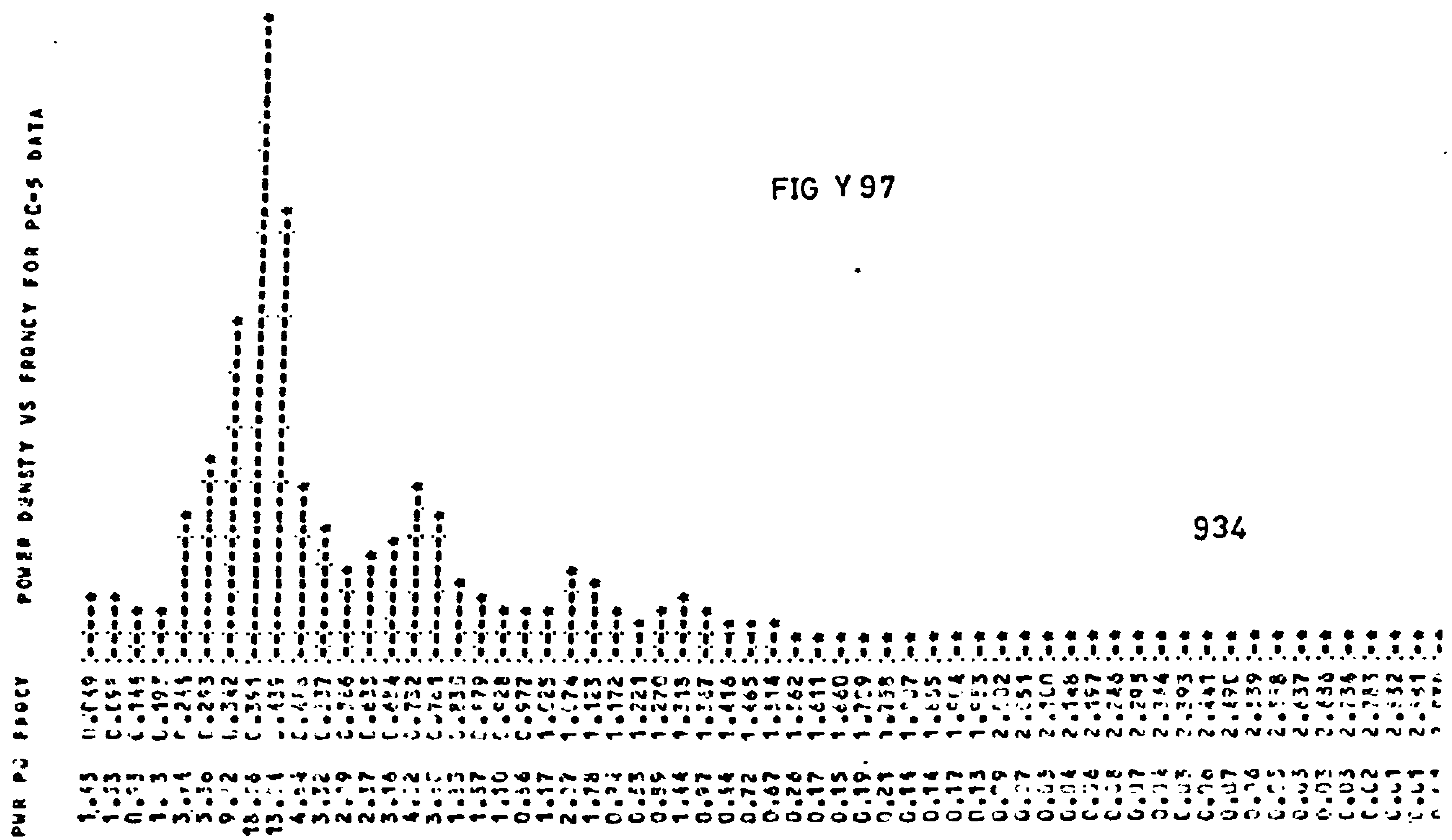
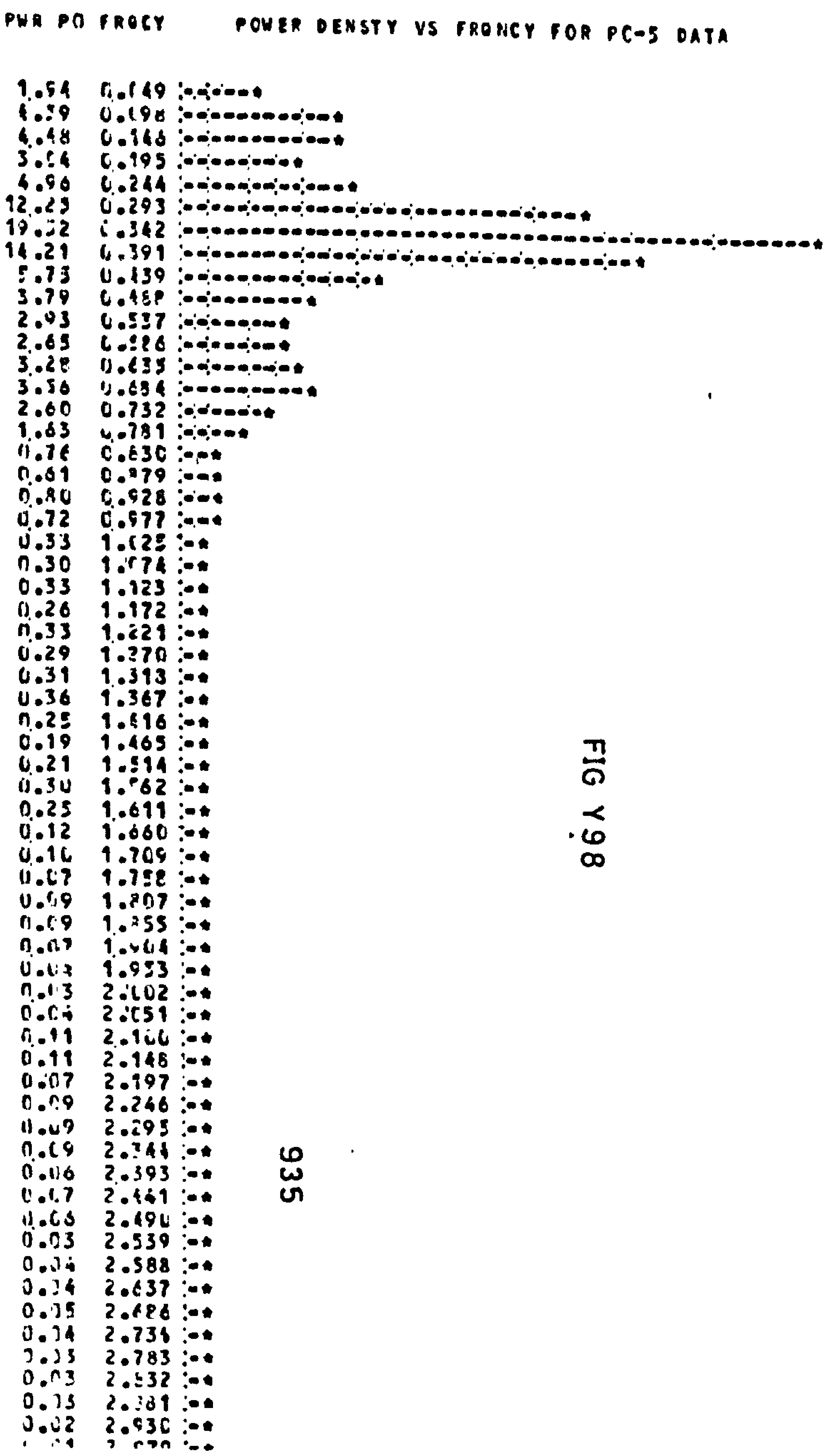

POWER DENSTY VS FRQNCY FOR PC-5 DATA

FIG Y 97

934


PWR PO FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA
1.54 0.049
4.79 0.098
4.48 0.146
3.04 0.195
4.96 0.244
12.23 0.293
19.22 0.342
14.21 0.391
5.73 0.439
3.79 0.488
2.93 0.537
2.65 0.586
3.28 0.635
3.56 0.684
2.60 0.732
1.63 0.781
0.76 0.830
0.61 0.879
0.80 0.928
0.72 0.977
0.33 1.025
0.30 1.074
0.33 1.123
0.26 1.172
0.33 1.221
0.29 1.270
0.31 1.313
0.36 1.367
0.25 1.416
0.19 1.465
0.21 1.514
0.30 1.562
0.25 1.611
0.12 1.660
0.10 1.709
0.07 1.758
0.09 1.807
0.09 1.855
0.07 1.904
0.03 1.953
0.03 2.002
0.04 2.051
0.11 2.100
0.11 2.148
0.07 2.197
0.09 2.246
0.09 2.295
0.09 2.344
0.06 2.393
0.07 2.441
0.06 2.490
0.03 2.539
0.04 2.588
0.04 2.637
0.05 2.686
0.04 2.734
0.03 2.783
0.03 2.832
0.15 2.881
0.02 2.930

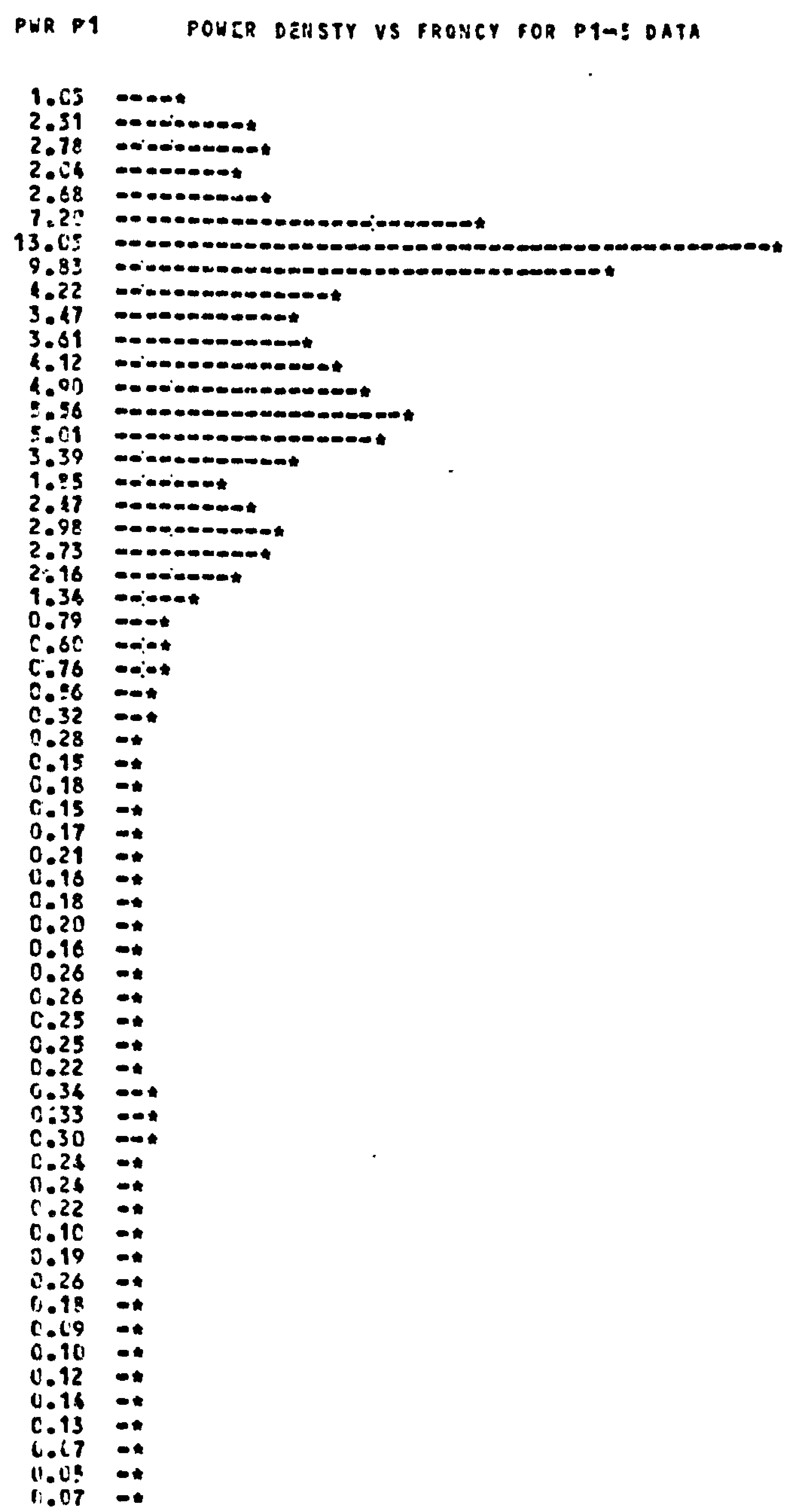
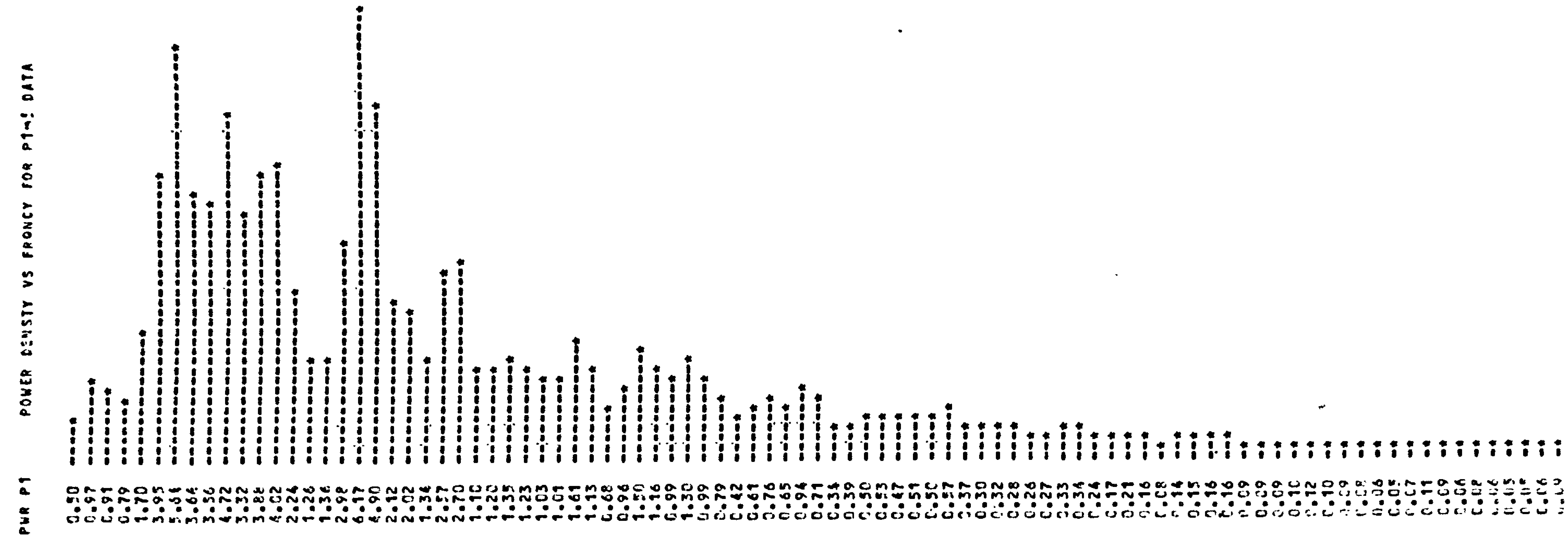

PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA
1.05
2.31
2.78
2.04
2.68
7.20
13.05
9.83
4.22
3.47
3.61
4.12
4.90
5.56
5.01
3.39
1.25
2.47
2.98
2.73
2.16
1.34
0.79
0.60
0.76
0.56
0.32
0.28
0.15
0.18
0.15
0.17
0.21
0.16
0.18
0.20
0.16
0.26
0.26
0.25
0.25
0.22
0.34
0.33
0.30
0.24
0.24
0.22
0.10
0.19
0.26
0.18
0.09
0.10
0.12
0.14
0.13
0.07
0.05
0.07

FIG Y98

935


POWER DENSTY VS FRQNCY FOR P1-1 DATA
PWR P1
0.50
0.97
0.91
0.79
1.70
3.95
5.84
3.64
3.56
4.72
3.32
3.88
4.02
2.24
1.26
1.36
2.98
6.17
4.90
2.12
2.02
1.34
2.57
2.70
1.10
1.20
1.35
1.23
1.03
1.01
1.61
1.13
0.68
0.96
1.50
1.16
0.99
1.30
0.79
0.42
0.61
0.76
0.65
0.94
0.71
0.34
0.39
0.50
0.53
0.47
0.51
0.50
0.57
0.37
0.30
0.32
0.28
0.26
0.27
0.33
0.34
0.24
0.17
0.21
0.16
0.08
0.14
0.15
0.16
0.16
0.09
0.09
0.09
0.10
0.12
0.10
0.09
0.08
0.06
0.05
0.07
0.11
0.09
0.06
0.08
0.06
0.05
0.08
0.06
0.09
0.07

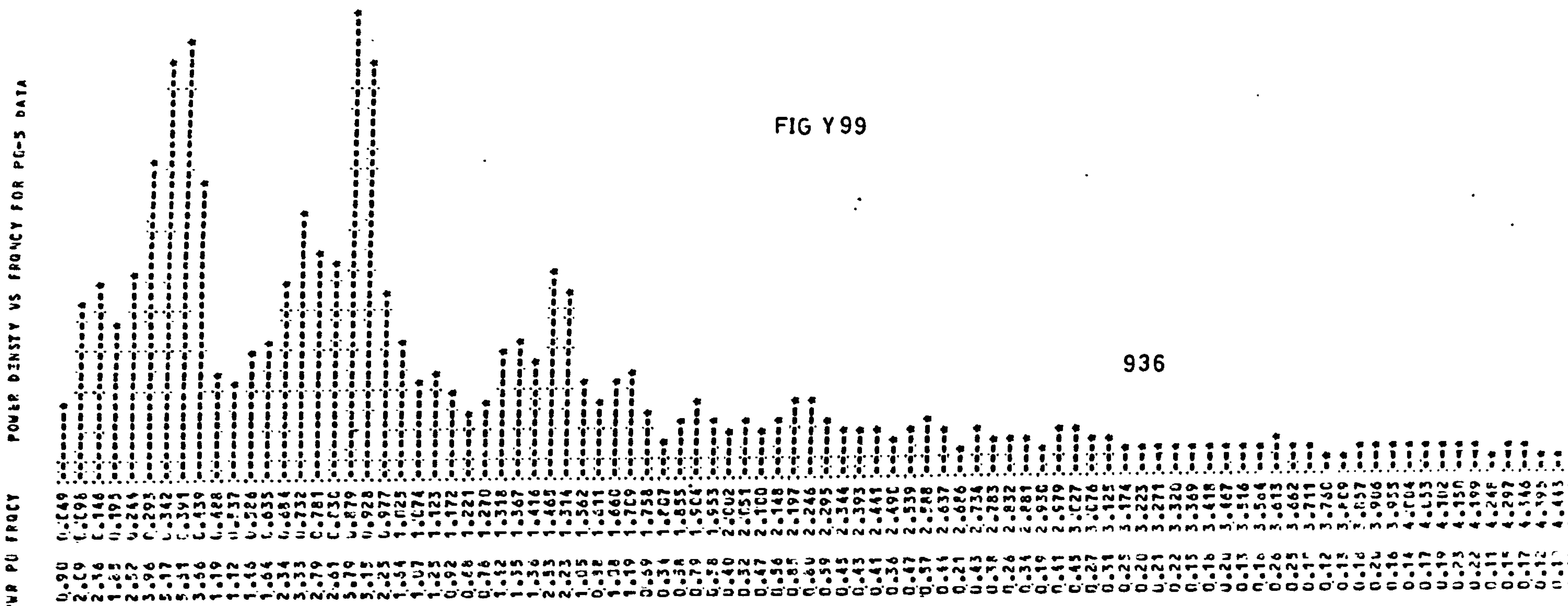

POWER DENSTY VS FRQNCY FOR PG-5 DATA
PWR PO FRQCY
0.90 0.049
2.09 0.098
2.36 0.146
1.85 0.195
2.52 0.244
3.96 0.293
5.17 0.342
5.51 0.391
3.56 0.439
1.19 0.488
1.12 0.537
1.46 0.586
1.64 0.635
2.34 0.684
3.33 0.732
2.79 0.781
2.61 0.830
5.79 0.879
5.15 0.928
2.25 0.977
1.54 1.025
1.07 1.074
1.25 1.123
0.92 1.172
0.68 1.221
0.76 1.270
1.12 1.318
1.35 1.367
1.36 1.416
2.55 1.465
2.23 1.514
1.05 1.562
0.38 1.611
1.08 1.660
1.19 1.709
0.69 1.758
0.34 1.807
0.38 1.855
0.79 1.904
0.58 1.953
0.40 2.002
0.32 2.051
0.47 2.100
0.56 2.148
0.85 2.197
0.60 2.246
0.59 2.295
0.45 2.344
0.43 2.393
0.41 2.441
0.36 2.490
0.47 2.539
0.57 2.588
0.44 2.637
0.21 2.686
0.43 2.734
0.38 2.783
0.26 2.832
0.34 2.881
0.19 2.930
0.41 2.979
0.45 3.027
0.27 3.076
0.31 3.125
0.25 3.174
0.20 3.223
0.21 3.271
0.22 3.320
0.15 3.369
0.18 3.418
0.20 3.467
0.15 3.516
0.16 3.564
0.26 3.613
0.25 3.662
0.17 3.711
0.12 3.760
0.13 3.809
0.18 3.857
0.20 3.906
0.16 3.955
0.14 4.004
0.17 4.053
0.19 4.102
0.25 4.150
0.22 4.199
0.11 4.248
0.14 4.297
0.17 4.346
0.12 4.395
0.13 4.443
0.10 4.492

FIG Y99

936

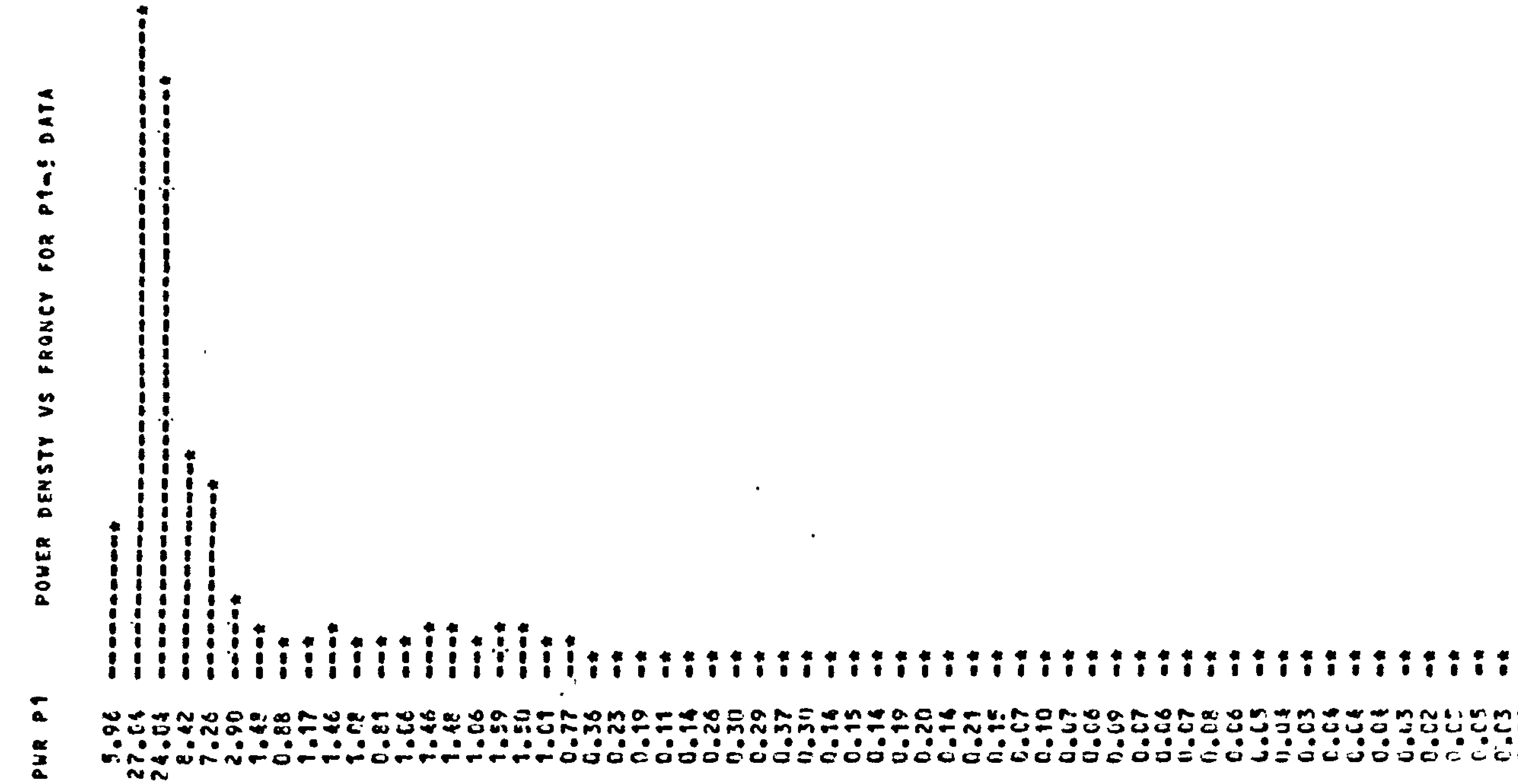
PWR P0 FRQCY POWER DENSTY VS FRQNCY FOR P0-5 DATA

PWR P0	FRQCY
2.02	0.049
3.05	0.098
6.22	0.146
6.27	0.195
3.60	0.244
5.27	0.293
2.32	0.342
2.20	0.391
2.33	0.439
2.95	0.488
2.63	0.537
2.93	0.586
4.08	0.635
3.95	0.684
2.27	0.732
2.07	0.781
1.32	0.830
1.46	0.879
1.87	0.928
1.20	0.977
1.19	1.025
1.98	1.074
3.32	1.123
3.33	1.172
2.14	1.221
2.25	1.270
1.83	1.318
0.70	1.367
1.24	1.416
1.25	1.465
0.76	1.514
0.75	1.562
0.59	1.611
0.49	1.660
0.72	1.709
0.93	1.758
0.61	1.807
0.40	1.855
0.46	1.904
0.56	1.953
0.54	2.002
0.27	2.051
0.22	2.100
0.44	2.148
0.57	2.197
0.50	2.246
0.23	2.295
0.30	2.344
0.45	2.393
0.45	2.441
0.27	2.490
0.27	2.539
0.33	2.588
0.22	2.637
0.29	2.686
0.31	2.734
0.20	2.783
0.29	2.832
0.29	2.881
0.11	2.930
[illegible]	[illegible]

PWR P1 POWER DENSTY VS FRQNCY FOR P1-5 DATA

PWR P1
1.33
2.75
7.46
8.74
10.33
10.54
7.24
6.11
3.13
1.69
2.06
1.99
1.31
1.79
1.82
1.36
1.22
1.06
0.72
0.64
1.12
2.58
3.07
1.99
1.52
1.95
1.76
0.90
1.26
1.21
0.72
0.56
0.44
0.51
0.59
0.41
0.23
0.22
0.20
0.23
0.20
0.21
0.26
0.24
0.29
0.27
0.13
0.16
0.24
0.17
0.13
0.15
0.14
0.13
0.08
0.09
0.10
0.09
0.10
0.08
[illegible]

FIG Y 100


PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA

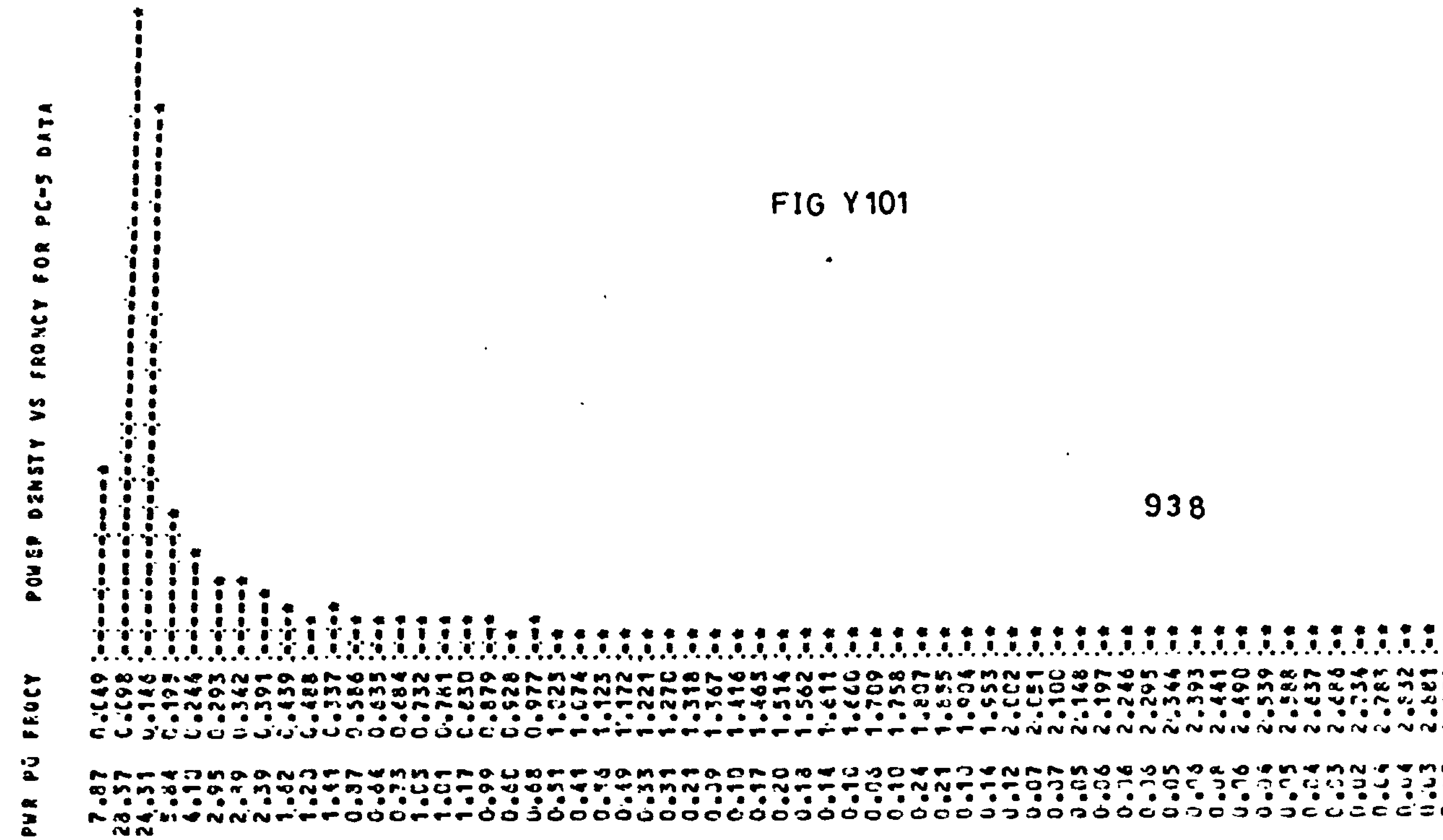

PWR PO FRQCY
POWEP DENSTY VS FRQNCY FOR PC-5 DATA

FIG Y101

938

PWR PQ	FRQCY	POWER DENSTY VS FRQNCY FOR PQ-5 DATA
12.51	0.049	
5.70	0.098	
3.32	0.146	
3.56	0.195	
4.52	0.244	
3.25	0.293	
1.53	0.342	
1.34	0.391	
2.11	0.439	
2.16	0.488	
1.27	0.537	
0.71	0.586	
0.74	0.635	
0.93	0.684	
1.04	0.732	
0.90	0.781	
0.57	0.830	
0.62	0.879	
1.35	0.928	
1.13	0.977	
0.72	1.025	
1.61	1.074	
1.82	1.123	
1.27	1.172	
0.77	1.221	
0.34	1.270	
0.85	1.318	
1.35	1.367	
0.73	1.416	
0.44	1.465	
0.49	1.514	
0.57	1.562	
0.67	1.611	
0.50	1.660	
0.53	1.709	
0.75	1.758	
1.01	1.807	
0.81	1.855	
0.77	1.904	
0.70	1.953	
0.76	2.002	
1.53	2.051	
1.24	2.100	
0.54	2.148	
0.99	2.197	
1.35	2.246	
0.88	2.295	
0.57	2.344	
0.55	2.393	
0.33	2.441	
0.31	2.490	
0.29	2.539	
0.29	2.588	
0.25	2.637	
0.42	2.686	
0.52	2.734	
0.36	2.783	
0.50	2.832	
0.68	2.881	
0.30	2.930	
0.34	2.979	
0.40	3.027	
0.36	3.076	
0.28	3.125	
0.25	3.174	
0.27	3.223	
0.35	3.271	
0.23	3.320	
0.49	3.369	
0.19	3.418	
0.25	3.467	
0.26	3.516	
0.32	3.564	
0.35	3.613	
0.41	3.662	
0.42	3.711	
0.49	3.760	
0.51	3.809	
0.36	3.857	
0.23	3.906	
0.28	3.955	
0.25	4.004	
0.23	4.053	
0.24	4.102	
0.18	4.150	
0.33	4.199	
0.43	4.248	
0.33	4.297	
0.24	4.346	
0.23	4.395	
0.23	4.443	
0.26	4.492	

PWR P1	POWER DENSTY VS FRQNCY FOR P1-? DATA
8.27	
1.91	
0.44	
0.49	
0.47	
0.30	
0.32	
0.79	
1.02	
0.89	
1.13	
0.92	
0.95	
1.42	
1.30	
1.60	
1.80	
1.02	
0.78	
0.94	
0.86	
1.40	
1.56	
0.82	
0.53	
0.50	
0.53	
0.66	
0.68	
0.49	
0.45	
0.65	
0.71	
1.28	
1.12	
0.77	
1.65	
1.83	
2.20	
2.06	
1.70	
2.28	
2.27	
2.44	
2.21	
2.73	
2.33	
1.08	
1.48	
1.63	
0.97	
0.68	
0.51	
0.35	
0.36	
0.33	
0.31	
0.08	
0.13	
0.23	
0.32	
0.31	
0.29	
0.36	
0.35	
0.91	
1.43	
0.93	
0.59	
0.78	
1.19	
1.43	
1.28	
1.25	
0.86	
0.52	
0.71	
0.71	
0.59	
0.55	
0.60	
0.45	
0.53	
0.65	
0.37	
0.25	
0.32	
0.35	
0.25	
0.22	
0.20	
0.11	

FIG Y102

PWR PU	FRQCY
4.30	0.049
4.65	0.098
4.33	0.146
3.67	0.195
3.61	0.244
4.78	0.293
3.53	0.342
3.96	0.391
3.75	0.439
1.97	0.488
2.86	0.537
3.54	0.586
3.10	0.635
1.96	0.684
1.40	0.732
1.52	0.781
1.54	0.830
0.87	0.879
0.29	0.928
0.43	0.977
0.49	1.025
0.50	1.074
0.83	1.123
1.46	1.172
1.11	1.221
0.60	1.270
0.83	1.318
0.81	1.367
1.19	1.416
1.30	1.465
1.03	1.514
0.69	1.562
0.58	1.611
0.55	1.660
0.71	1.709
0.66	1.758
0.45	1.807
0.51	1.855
0.52	1.904
0.49	1.953
0.56	2.002
0.55	2.051
0.44	2.100
0.31	2.148
0.55	2.197
0.66	2.246
0.83	2.295
0.73	2.344
0.41	2.393
0.37	2.441
0.32	2.490
0.28	2.539
0.17	2.588
0.31	2.637
0.52	2.686
0.45	2.734
0.48	2.783
0.46	2.832
0.38	2.881
0.44	2.930
0.35	2.979
0.28	3.027
0.36	3.076
0.36	3.125
0.22	3.174
0.19	3.223
0.41	3.271
0.49	3.320
0.42	3.369
0.35	3.418
0.31	3.467
0.49	3.516
0.50	3.564
0.60	3.613
0.77	3.662
0.53	3.711
0.42	3.760
0.53	3.809
0.41	3.857
0.36	3.906
0.47	3.955
0.40	4.004
0.25	4.053
0.20	4.102
0.30	4.150
0.39	4.199
0.33	4.248
0.30	4.297
0.23	4.346
0.17	4.395
0.24	4.443
0.26	4.492

POWER DENSTY VS FRQNCY FOR PC-5 DATA

940

PWR P1
1.32
2.24
2.37
1.74
1.75
2.43
1.83
2.15
1.88
0.88
1.04
1.21
1.14
0.83
0.98
1.68
2.00
1.22
0.49
0.71
1.11
1.13
2.03
3.35
2.52
1.28
1.38
1.44
1.76
1.94
1.40
0.71
0.39
0.70
1.02
0.78
0.49
0.55
0.57
0.47
0.39
0.41
0.45
0.33
0.36
0.38
0.68
0.63
0.32
0.42
0.38
0.28
0.30
0.54
0.59
0.49
0.68
0.87
1.07
1.22
1.14
0.84
0.92
1.08
0.57
0.39
0.59
0.68
0.67
0.50
0.56
1.14
1.12
1.22
1.45
1.03
0.79
0.84
0.72
0.61
0.79
0.77
0.61
0.42
0.56
0.76
0.65
0.57
0.39
0.35
0.52
0.45

POWER DENSITY VS FRQNCY FOR P1-5 DATA

FIG 103

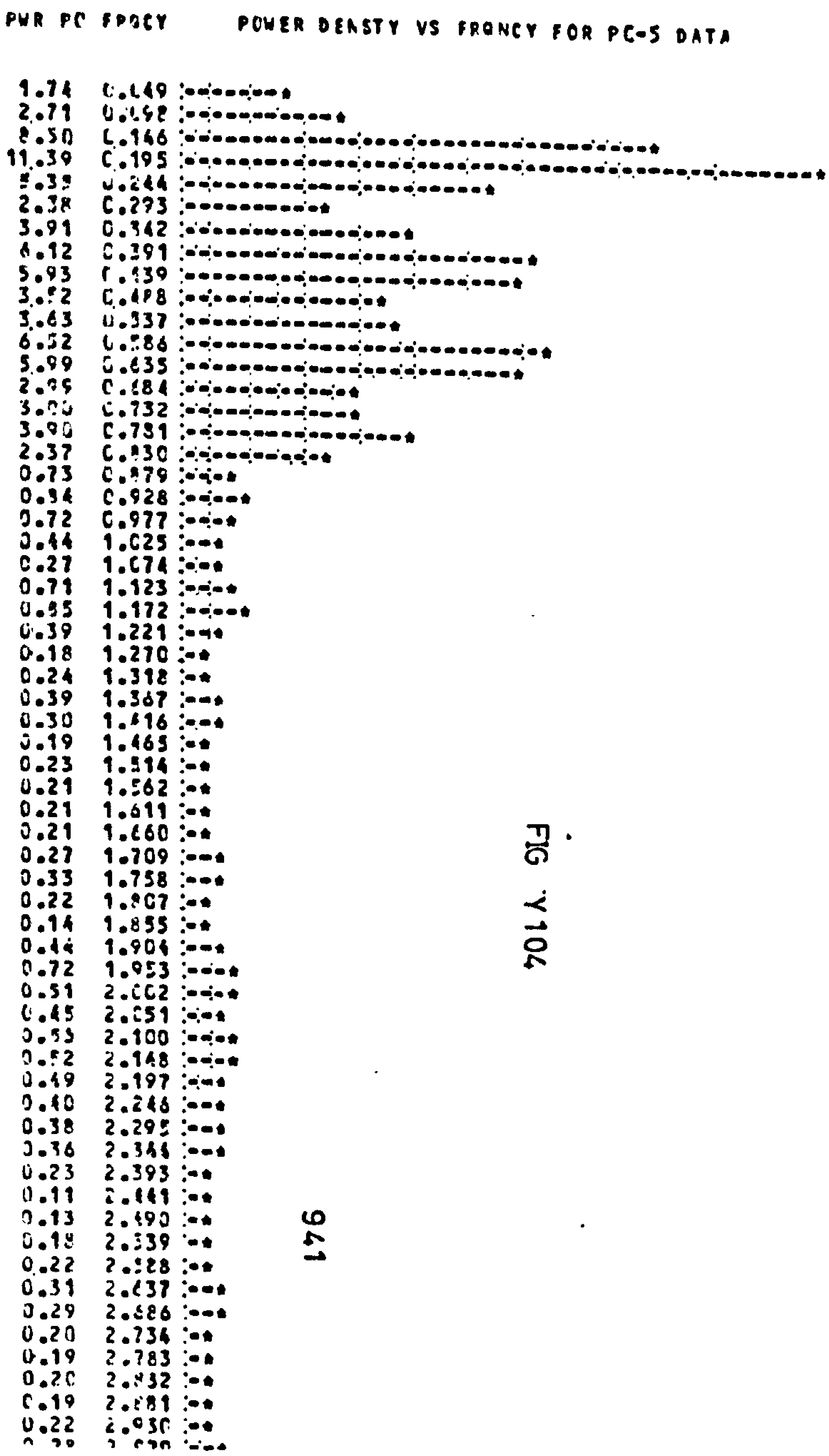
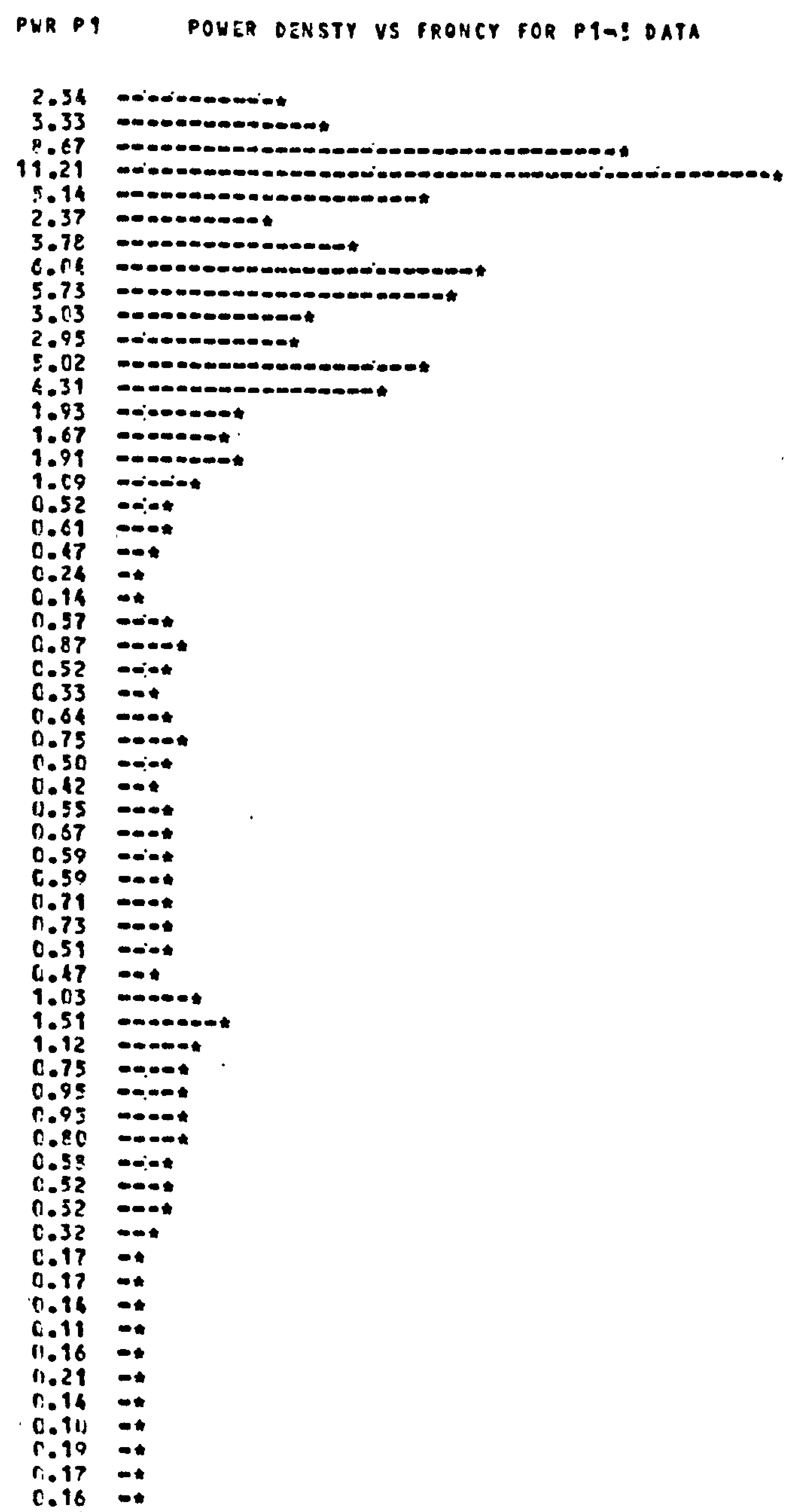

PWR PC FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA
1.74 0.049
2.71 0.098
8.50 0.146
11.39 0.195
8.39 0.244
2.38 0.293
3.91 0.342
6.12 0.391
5.93 0.439
3.52 0.488
3.63 0.537
6.52 0.586
5.99 0.635
2.95 0.684
3.00 0.732
3.90 0.781
2.37 0.830
0.73 0.879
0.54 0.928
0.72 0.977
0.44 1.025
0.27 1.074
0.71 1.123
0.65 1.172
0.39 1.221
0.18 1.270
0.24 1.318
0.39 1.367
0.30 1.416
0.19 1.465
0.23 1.514
0.21 1.562
0.21 1.611
0.21 1.660
0.27 1.709
0.33 1.758
0.22 1.807
0.14 1.855
0.44 1.904
0.72 1.953
0.51 2.002
0.45 2.051
0.55 2.100
0.52 2.148
0.49 2.197
0.40 2.246
0.38 2.295
0.36 2.344
0.23 2.393
0.11 2.441
0.13 2.490
0.18 2.539
0.22 2.588
0.31 2.637
0.29 2.686
0.20 2.734
0.19 2.783
0.20 2.832
0.19 2.881
0.22 2.930

FIG Y104

941


PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA
2.34
3.33
8.67
11.21
5.14
2.37
3.78
6.06
5.73
3.03
2.95
5.02
4.31
1.93
1.67
1.91
1.09
0.52
0.61
0.47
0.24
0.14
0.57
0.87
0.52
0.33
0.64
0.75
0.50
0.42
0.55
0.67
0.59
0.59
0.71
0.73
0.51
0.47
1.03
1.51
1.12
0.75
0.95
0.93
0.80
0.58
0.52
0.52
0.32
0.17
0.17
0.14
0.11
0.16
0.21
0.14
0.10
0.19
0.17
0.16

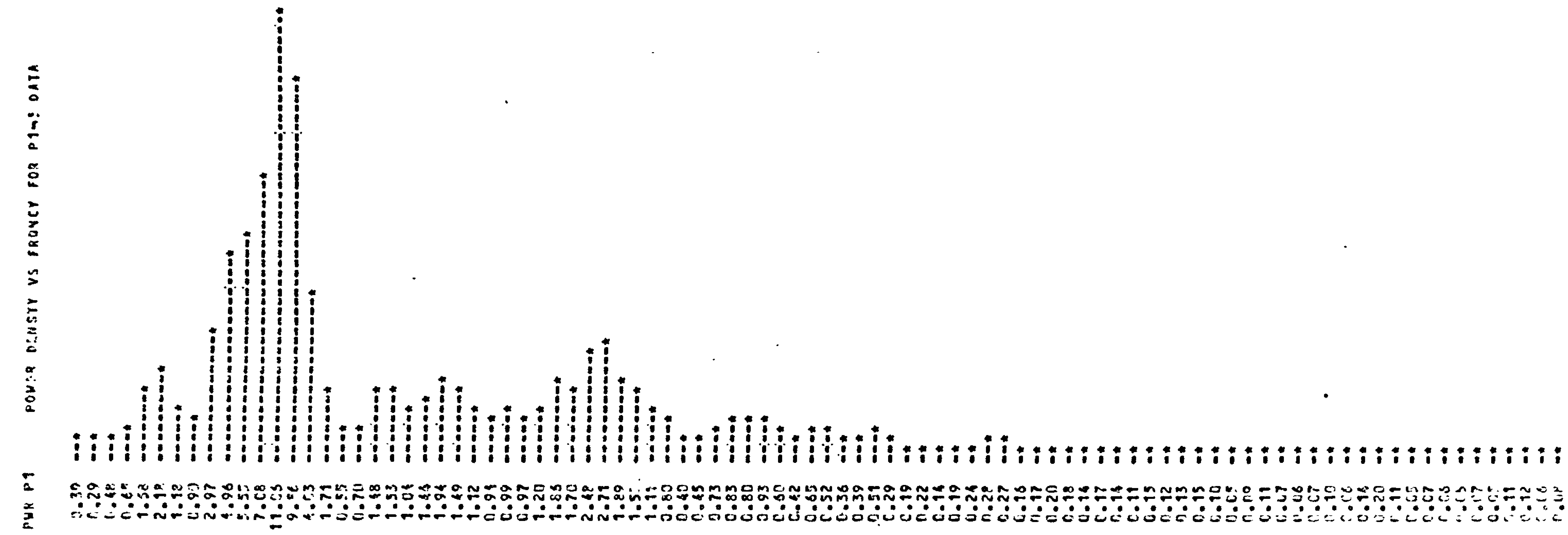
PWR PC FRQCY POWER DENSTY VS FRQNCY FOR PC-5 DATA

PWR PC	FRQCY
3.14	0.049
2.88	0.098
3.23	0.146
4.51	0.195
6.30	0.244
6.76	0.293
4.42	0.342
1.89	0.391
3.67	0.439
6.72	0.488
5.12	0.537
4.35	0.586
5.23	0.635
6.97	0.684
6.69	0.732
6.20	0.781
5.39	0.830
1.90	0.879
1.12	0.928
0.83	0.977
0.47	1.025
0.62	1.074
0.47	1.123
0.33	1.172
0.31	1.221
0.39	1.270
0.37	1.318
0.16	1.367
0.13	1.416
0.15	1.465
0.12	1.514
0.16	1.562
0.31	1.611
0.25	1.660
0.16	1.709
0.17	1.758
0.15	1.807
0.22	1.855
0.21	1.904
0.13	1.953
0.17	2.002
0.16	2.051
0.16	2.100
0.19	2.148
0.20	2.197
0.20	2.246
0.21	2.295
0.25	2.344
0.22	2.393
0.17	2.441
0.15	2.490
0.11	2.539
0.06	2.588
0.16	2.637
0.21	2.686
0.15	2.734
0.17	2.783
0.13	2.832
0.10	2.881
0.11	2.930
0.07	2.979
0.05	3.027
0.08	3.076
0.09	3.125
0.10	3.174
0.12	3.223
0.13	3.271
0.16	3.320
0.14	3.369
0.07	3.418
0.10	3.467
0.09	3.516
0.10	3.564
0.09	3.613
0.06	3.662
0.07	3.711
0.07	3.760
0.05	3.809
0.04	3.857
0.03	3.906
0.04	3.955
0.02	4.004
0.03	4.053
0.03	4.102
0.03	4.150
0.04	4.199
0.04	4.248
0.03	4.297
0.02	4.346
0.03	4.395
0.03	4.443

PWR P1 POWER DENSTY VS FRQNCY FOR P1-5 DATA

PWR P1
2.57
3.30
3.90
5.45
7.84
7.97
4.85
2.07
3.37
6.24
4.72
3.68
4.18
5.57
5.31
4.29
3.49
1.03
0.59
0.51
0.28
0.27
0.18
0.25
0.34
0.46
0.50
0.26
0.29
0.38
0.29
0.45
0.85
0.69
0.44
0.40
0.39
0.48
0.43
0.49
0.49
0.35
0.42
0.47
0.46
0.52
0.49
0.46
0.39
0.33
0.20
0.08
0.09
0.10
0.11
0.07
0.10
0.11
0.08
0.07
0.03
0.04
0.05
0.04
0.06
0.10
0.08
0.09
0.07
0.08
0.15
0.21
0.26
0.18
0.13
0.17
0.16
0.14
0.10
0.08
0.09
0.08
0.11
0.10
0.07
0.08
0.07
0.06
0.05
0.05
0.04

FIG Y105


POWER DENSTY VS FRQNCY FOR P1-3 DATA
PWR P1

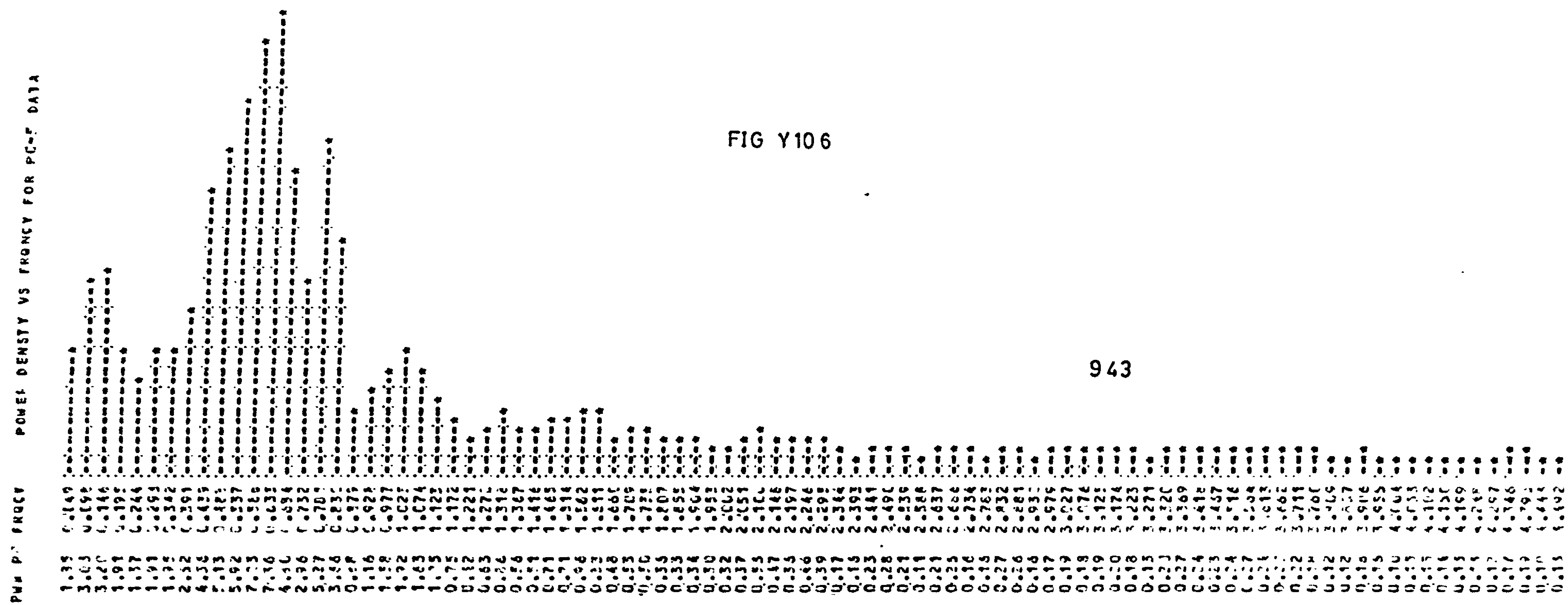
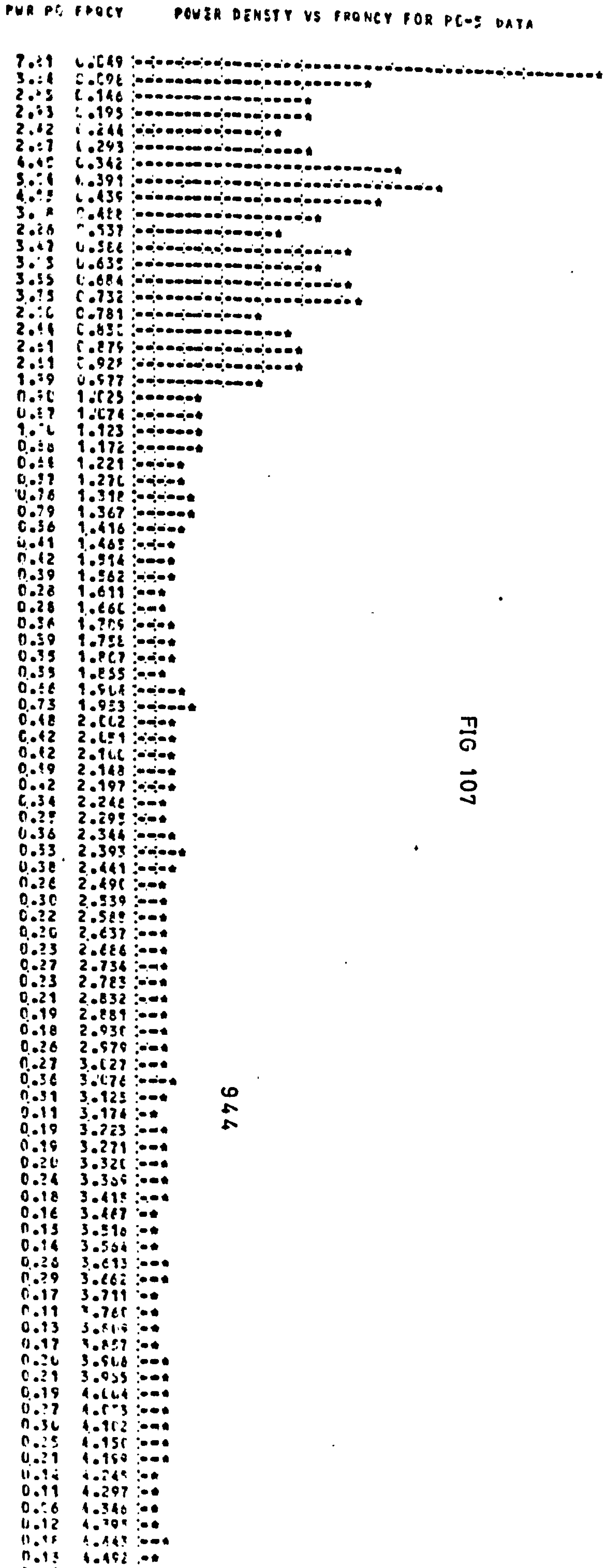

POWER DENSTY VS FRQNCY FOR PC-F DATA
PWR P1 FRQCY

FIG Y106


PWR PC FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA

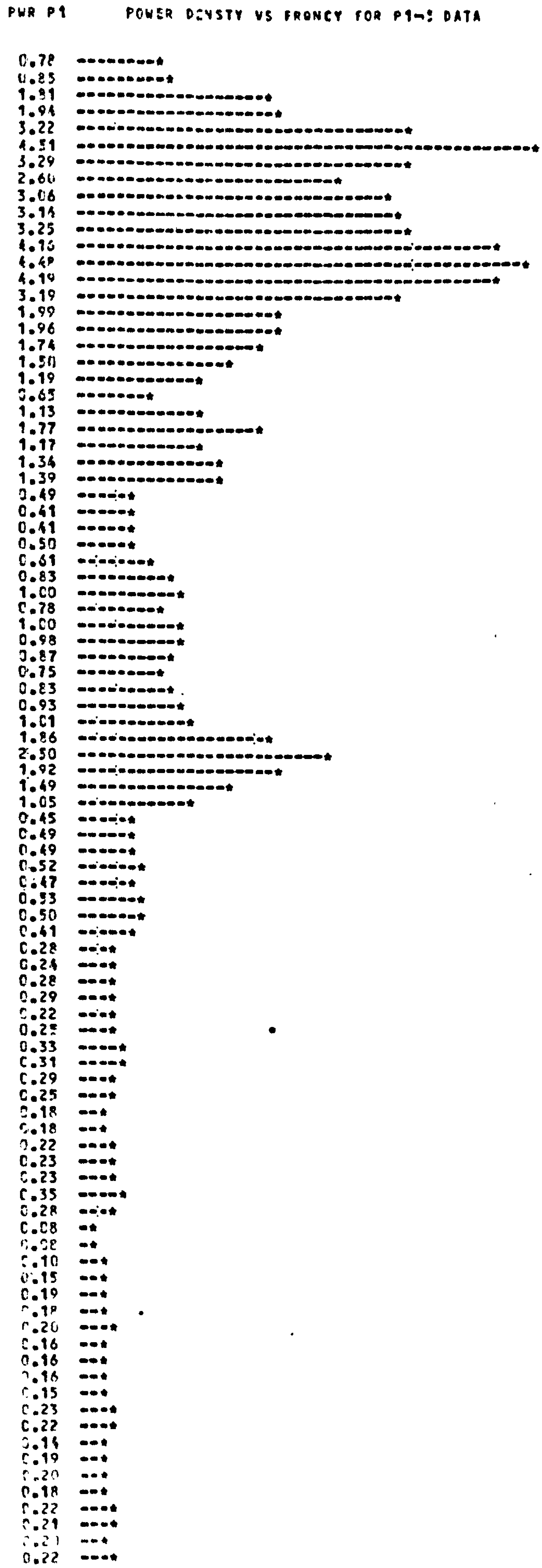

PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA

FIG 107

944

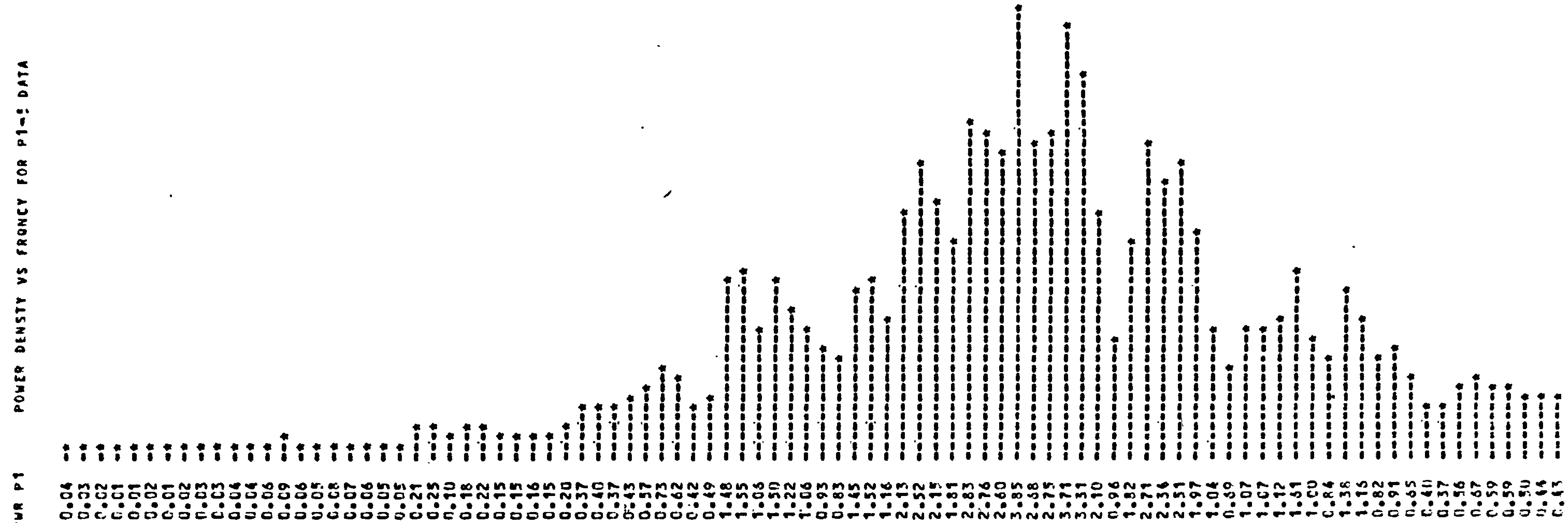
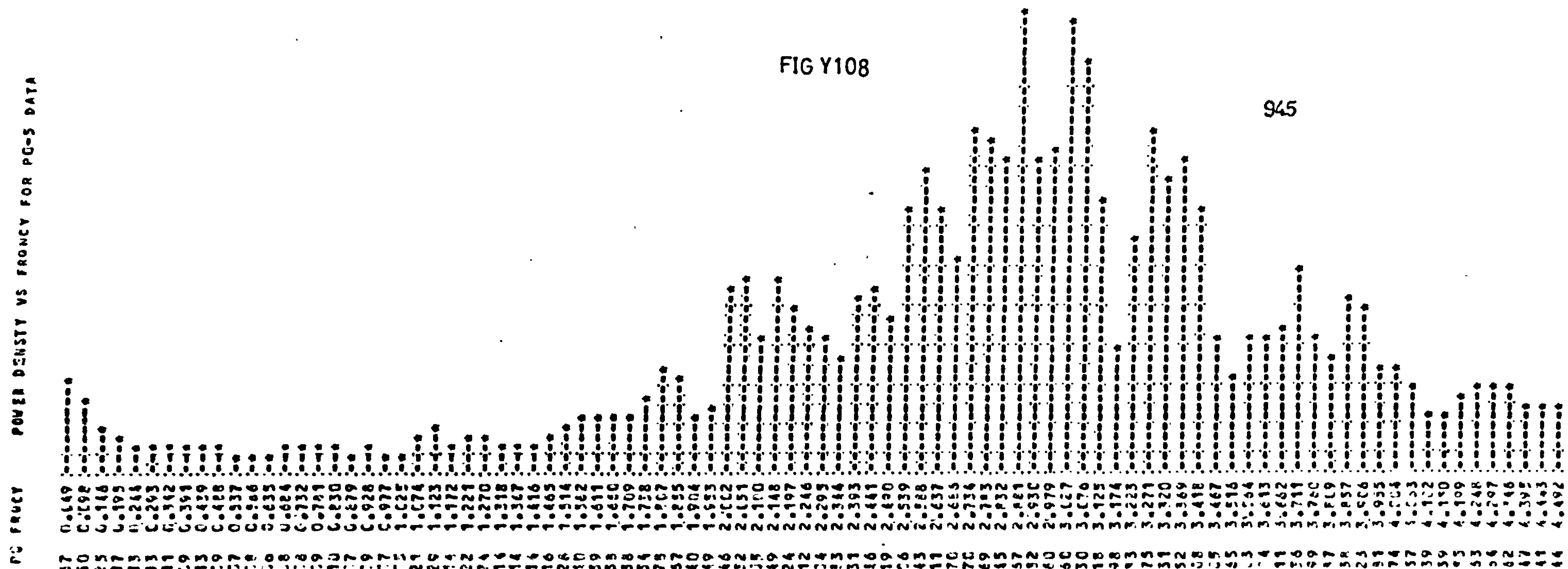
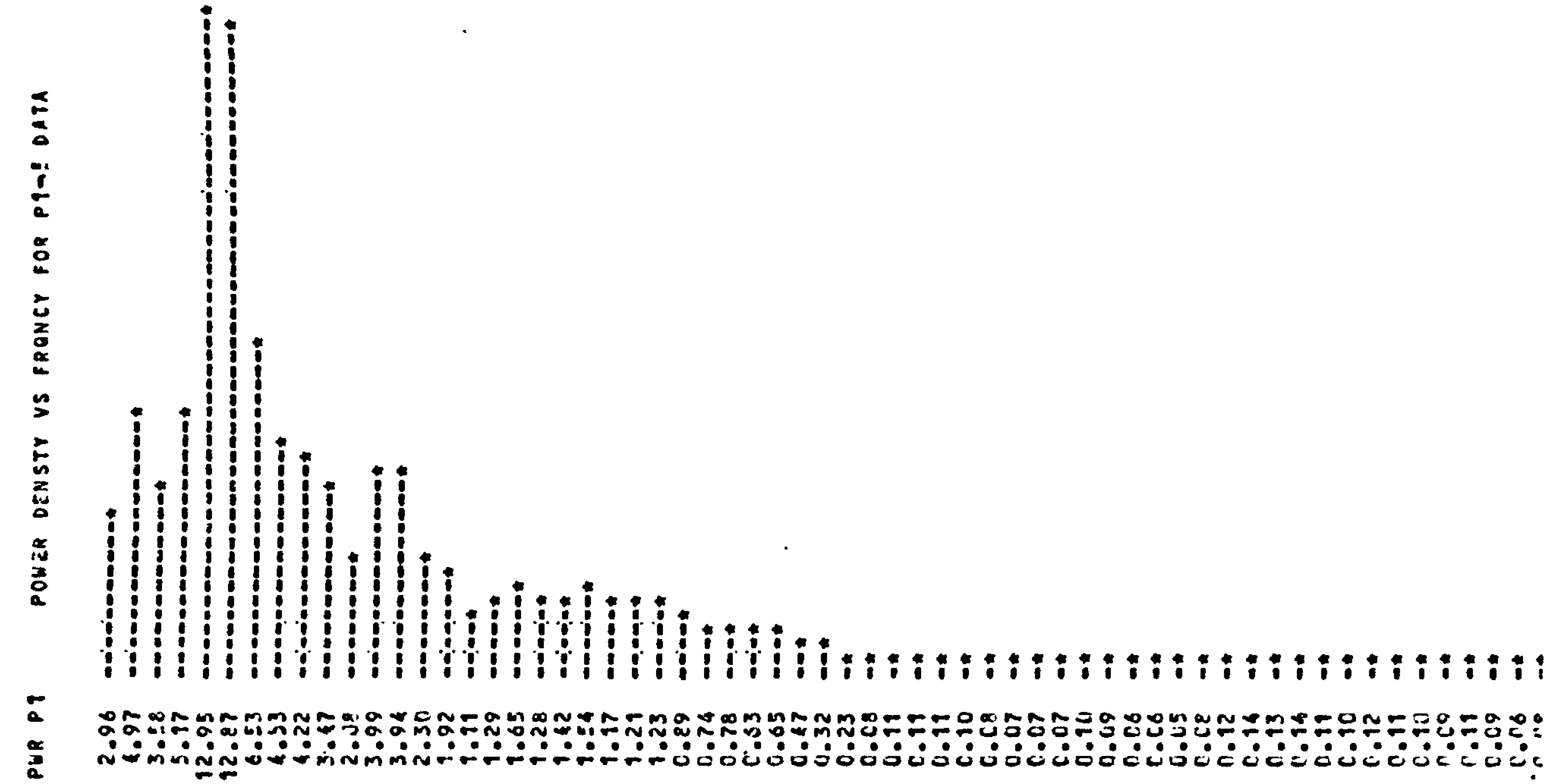

POWER DENSTY VS FRQNCY FOR P1-5 DATA
PWR P1

FIG Y108

945


POWER DENSTY VS FRQNCY FOR PG-5 DATA
PWR PG FRQCY


POWER DENSTY VS FRQNCY FOR P1-5 DATA
PWR P1

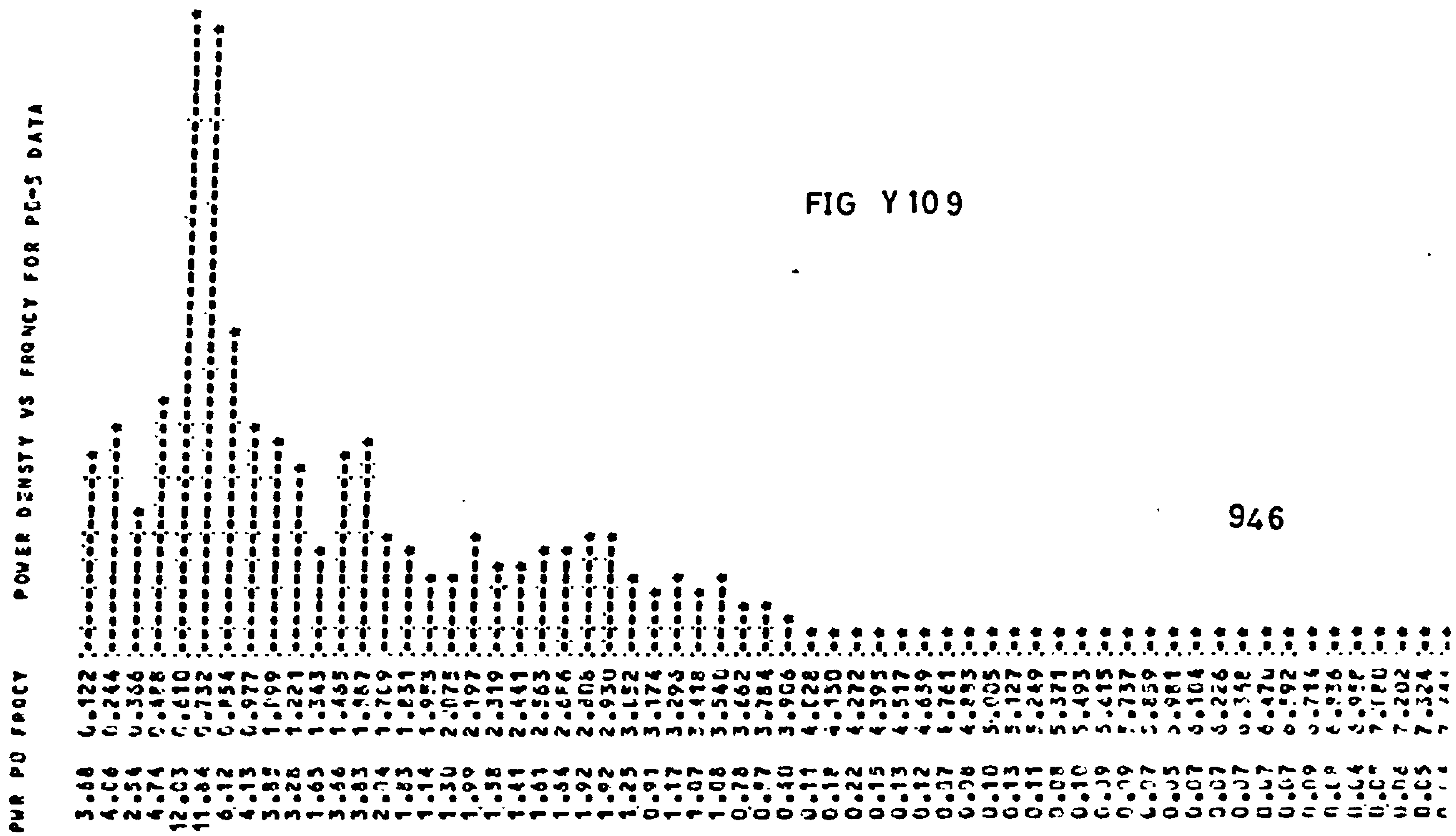
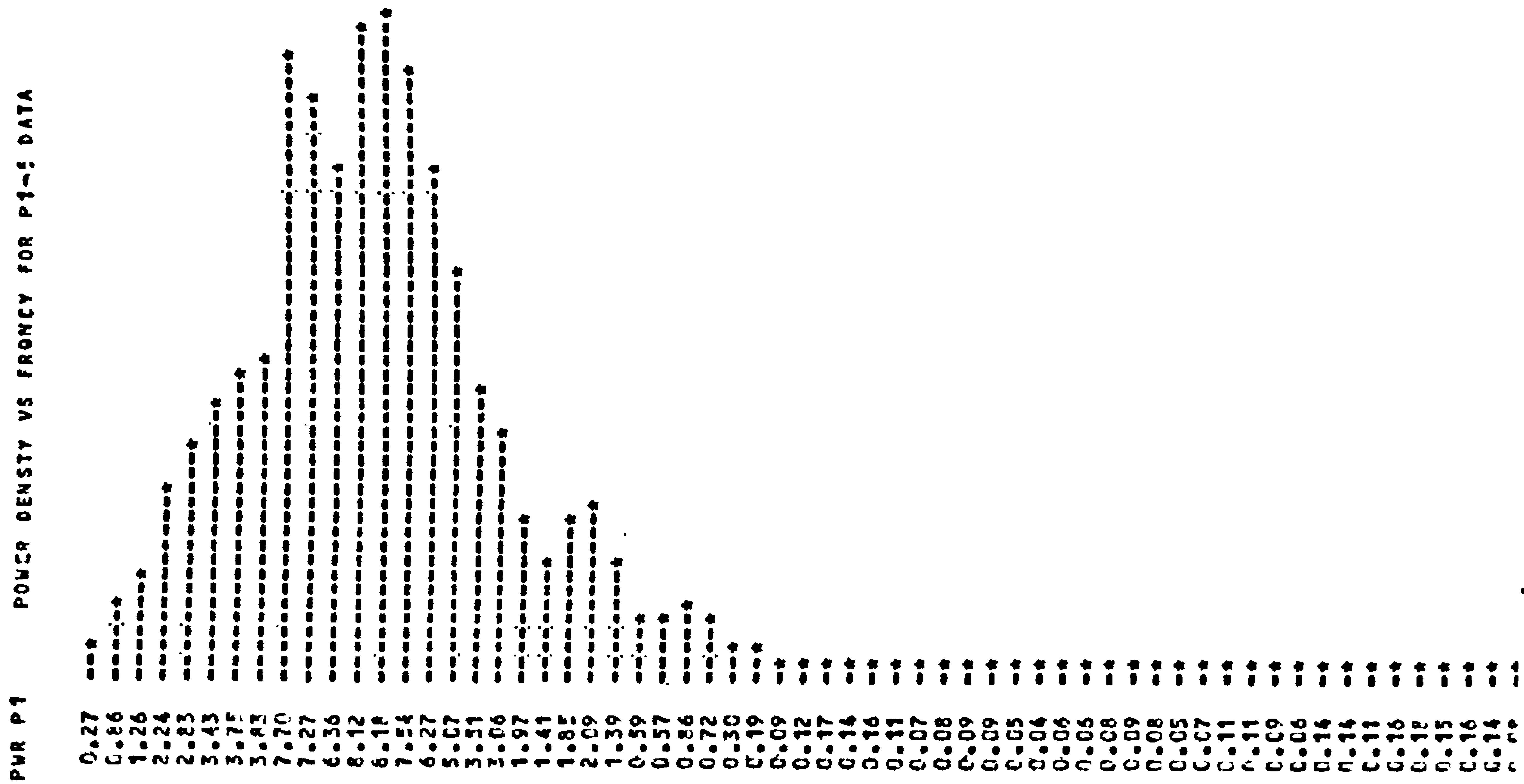

POWER DENSTY VS FRQNCY FOR PO-5 DATA
PWR PO FRQCY

FIG Y109


PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA

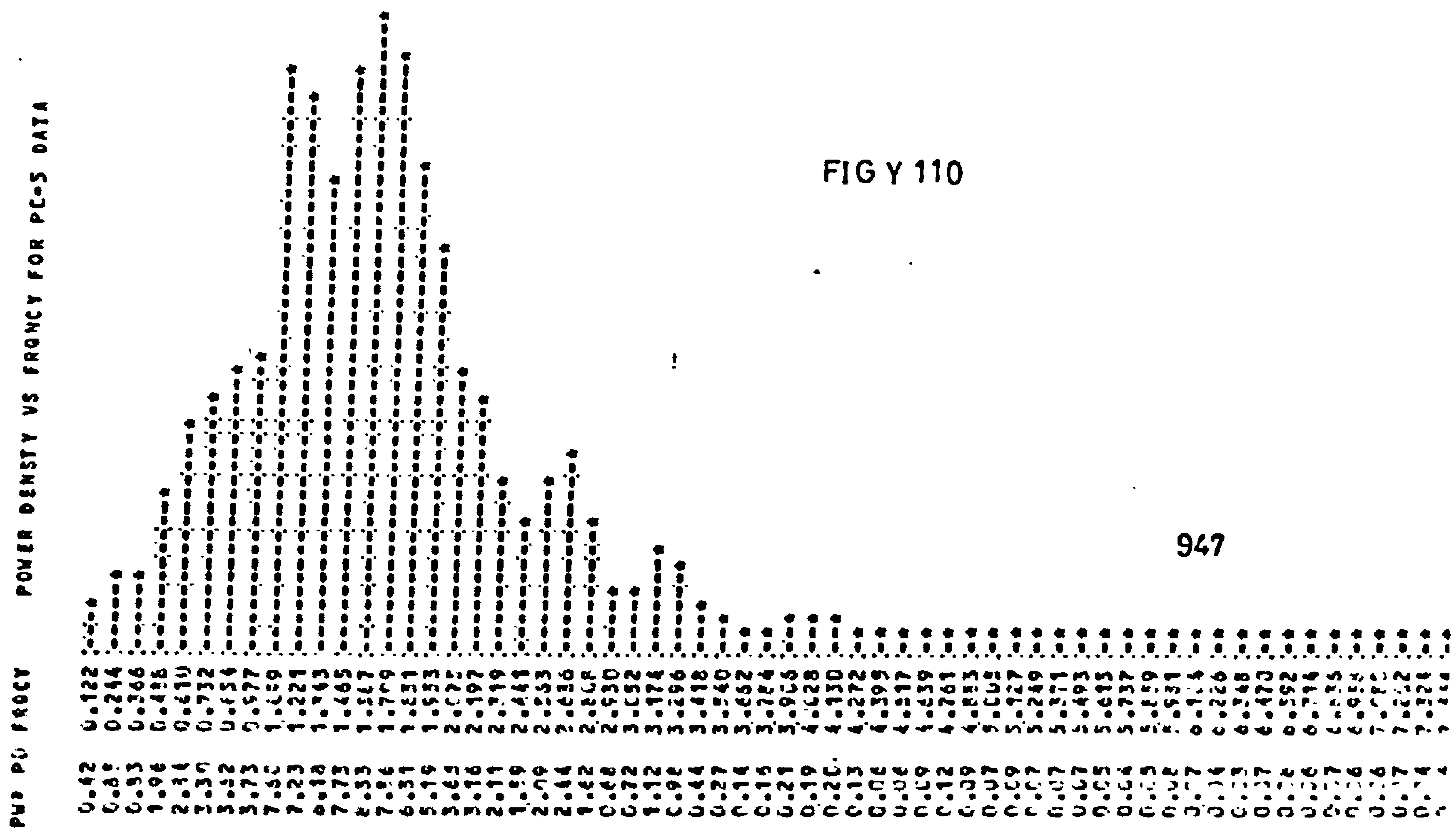

PWR PO FRQCY
POWER DENSTY VS FRQNCY FOR PO-5 DATA

FIG Y 110

947

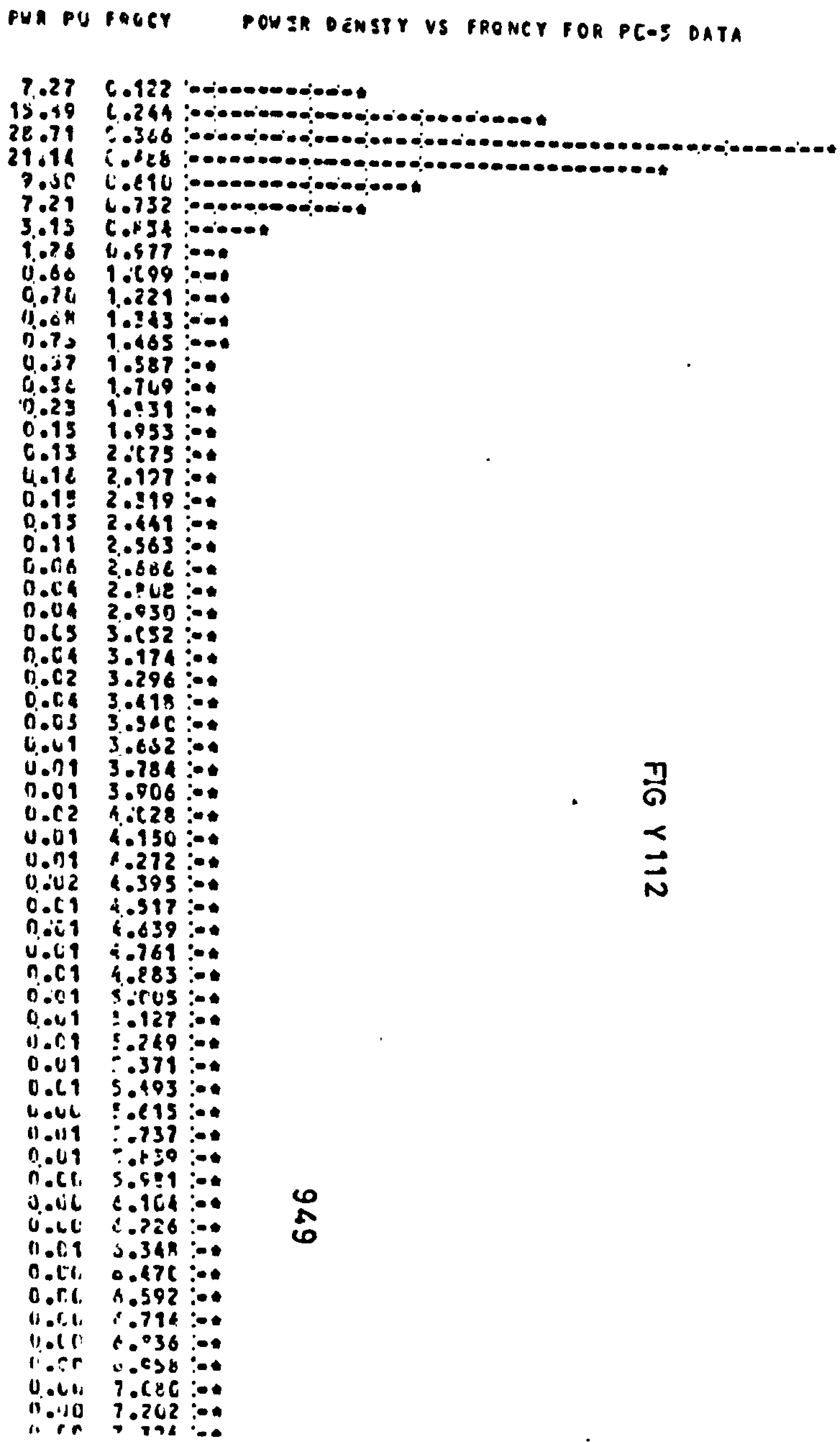
PWR PC FRQCY POWER DENSTY VS FRQNCY FOR PC=5 DATA

PWR PC	FRQCY
1.18	0.122
6.35	0.244
9.23	0.366
3.46	0.488
5.39	0.610
9.15	0.732
10.71	0.854
10.83	0.977
7.77	1.099
4.97	1.221
4.25	1.343
4.19	1.465
3.04	1.587
1.62	1.709
1.04	1.831
0.69	1.953
1.19	2.075
1.14	2.197
0.75	2.319
0.39	2.441
0.31	2.563
0.32	2.686
0.32	2.808
0.33	2.930
0.26	3.052
0.29	3.174
0.44	3.296
0.37	3.418
0.47	3.540
0.58	3.662
0.38	3.784
0.24	3.906
0.26	4.028
0.26	4.150
0.15	4.272
0.16	4.395
0.14	4.517
0.07	4.639
0.06	4.761
0.05	4.883
0.03	5.005
0.06	5.127
0.09	5.249
0.09	5.371
0.06	5.493
0.09	5.615
0.14	5.737
0.08	5.859
0.08	5.981
0.08	6.104
0.04	6.226
0.05	6.348
0.07	6.470
0.07	6.592
0.06	6.714
0.05	6.835
0.03	6.958
0.03	7.080
0.07	7.202

PWR P1 POWER DENSTY VS FRQNCY FOR P1=5 DATA

PWR P1
0.64
6.99
10.27
4.72
5.66
9.07
9.42
10.05
7.27
5.11
4.26
4.07
3.21
1.57
1.13
0.77
0.91
0.93
0.60
0.47
0.42
0.33
0.25
0.17
0.21
0.30
0.43
0.44
0.39
0.38
0.33
0.22
0.19
0.22
0.17
0.18
0.12
0.07
0.08
0.08
0.09
0.10
0.11
0.11
0.10
0.10
0.12
0.09
0.10
0.10
0.05
0.06
0.10
0.10
0.06
0.05
0.05
0.04
0.13

FIG Y 111


PWR PU FRQCY
POWER DENSTY VS FRQNCY FOR PC-5 DATA
7.27 0.122
15.49 0.244
28.71 0.366
21.14 0.488
9.30 0.610
7.21 0.732
3.15 0.854
1.76 0.977
0.66 1.099
0.76 1.221
0.68 1.343
0.75 1.465
0.37 1.587
0.34 1.709
0.23 1.831
0.15 1.953
0.13 2.075
0.16 2.197
0.15 2.319
0.13 2.441
0.11 2.563
0.06 2.686
0.04 2.808
0.04 2.930
0.05 3.052
0.04 3.174
0.02 3.296
0.04 3.418
0.03 3.540
0.01 3.662
0.01 3.784
0.01 3.906
0.02 4.028
0.01 4.150
0.01 4.272
0.02 4.395
0.01 4.517
0.01 4.639
0.01 4.761
0.01 4.883
0.01 5.005
0.01 5.127
0.01 5.249
0.01 5.371
0.01 5.493
0.00 5.615
0.01 5.737
0.01 5.859
0.00 5.981
0.00 6.104
0.00 6.226
0.01 6.348
0.00 6.470
0.00 6.592
0.00 6.714
0.00 6.836
0.00 6.958
0.00 7.080
0.00 7.202

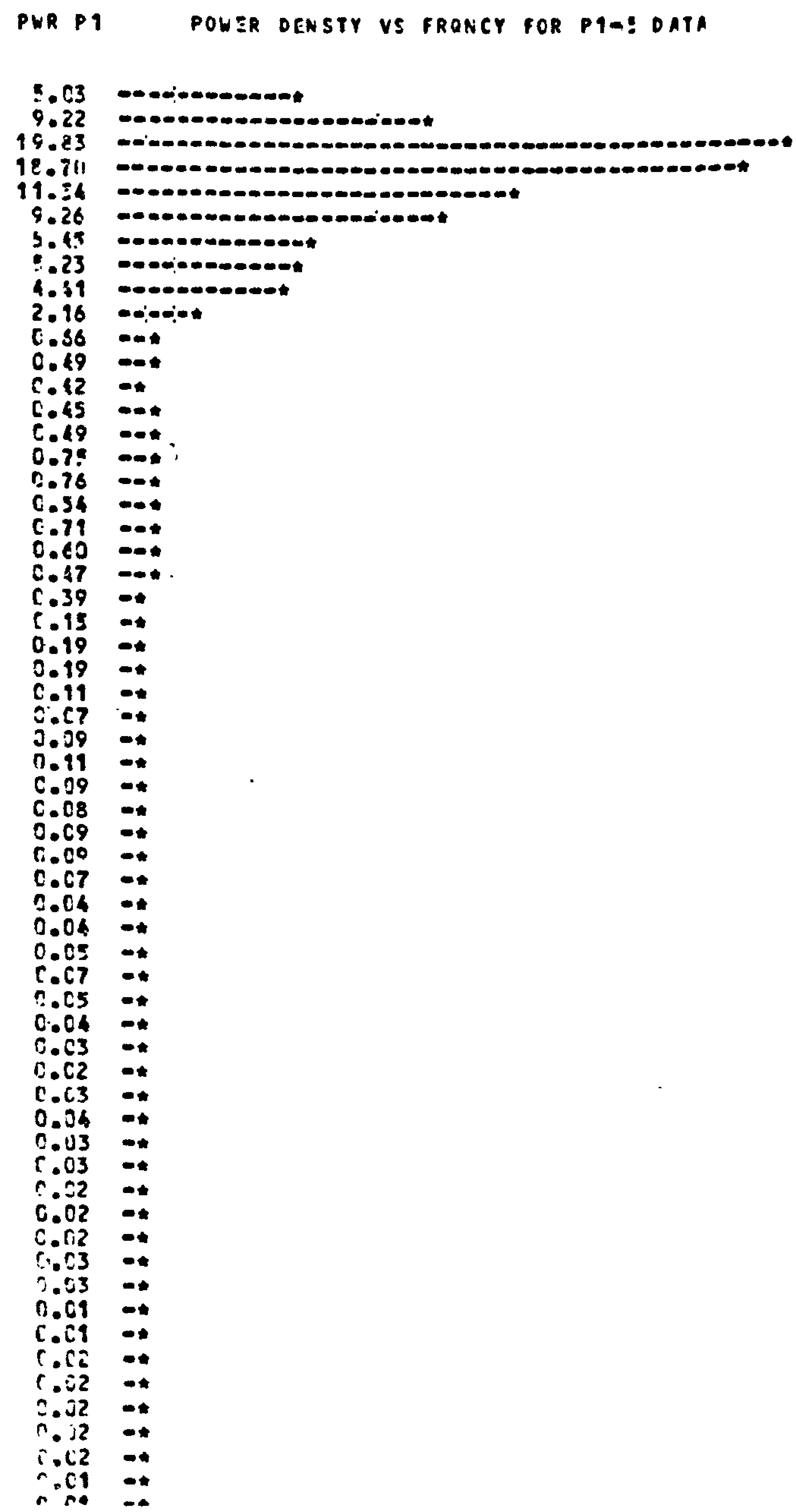

PWR P1
POWER DENSTY VS FRQNCY FOR P1-5 DATA
5.03
9.22
19.83
18.70
11.34
9.26
5.45
5.23
4.51
2.16
0.56
0.49
0.42
0.45
0.49
0.75
0.76
0.54
0.71
0.60
0.47
0.39
0.15
0.19
0.19
0.11
0.07
0.09
0.11
0.09
0.08
0.09
0.09
0.07
0.04
0.04
0.05
0.07
0.05
0.04
0.03
0.02
0.03
0.04
0.03
0.03
0.02
0.02
0.02
0.03
0.03
0.01
0.01
0.02
0.02
0.02
0.02
0.02
0.01

FIG Y112

949

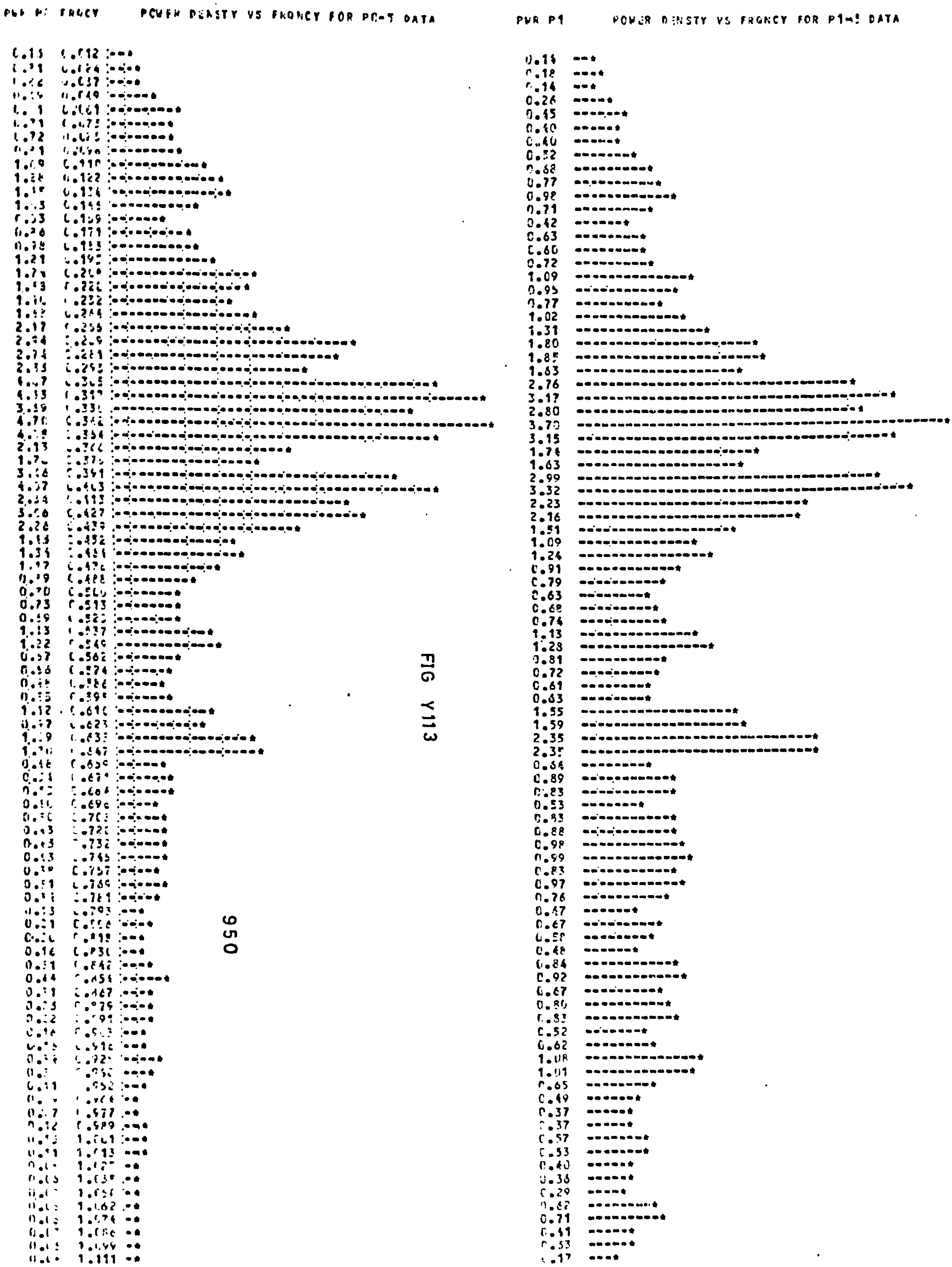

PWR P1 FRNCY
POWER DENSITY VS FRNCY FOR PD-T DATA
PWR P1
POWER DENSITY VS FRNCY FOR P1-T DATA

FIG Y113

950

CS PWR	FRQCY	CROSS SPECTRA VS FRQNCY OF PC AND P1	PHS ANGL	PHASE ANGL VS FRQNCY
89.31	0.049		10.72	
1.59	0.098		-17.91	
0.89	0.146		-39.54	
1.62	0.195		14.05	
1.81	0.244		77.72	
0.54	0.293		36.73	
0.13	0.342		-35.43	
0.27	0.391		-32.62	
0.21	0.439		-53.34	
0.05	0.488		-31.96	
0.05	0.537		4.27	
0.13	0.586		7.34	
0.13	0.635		32.11	
0.05	0.684		37.12	
0.04	0.732		38.72	
0.04	0.781		-38.34	
0.02	0.830		-20.09	
0.03	0.879		11.88	
0.03	0.928		-21.35	
0.03	0.977		2.26	
0.03	1.025		1.59	
0.02	1.074		29.46	
0.02	1.123		-2.91	
0.03	1.172		-11.65	
0.03	1.221		40.09	
0.02	1.270		56.75	
0.03	1.318		45.45	
0.03	1.367		27.35	
0.04	1.416		23.31	
0.04	1.465		21.82	
0.03	1.514		12.07	
0.02	1.562		0.31	
0.01	1.611		-10.39	
0.01	1.660		-1.08	
0.01	1.709		11.60	
0.01	1.758		-36.66	
0.05	1.807		-44.81	
0.13	1.855		42.01	
0.07	1.904		9.93	
0.07	1.953		-46.04	
0.03	2.002		-33.11	
0.03	2.051		-11.94	
0.01	2.100		15.13	
0.01	2.148		10.57	
0.02	2.197		17.77	
0.02	2.246		29.12	
0.02	2.295		47.90	
0.01	2.344		16.61	
0.01	2.393		11.25	
0.02	2.441		7.57	
0.02	2.490		-15.58	
0.02	2.539		-48.01	
0.02	2.588		-65.29	
0.03	2.637		-11.94	
0.03	2.686		15.87	
0.01	2.734		7.21	
0.01	2.783		43.89	
0.01	2.832		20.89	
0.01	2.881		-16.69	

FIG Y 114

CS PWR FRQCY CROSS SRECTRA VS FRQNCY OF PC AND P1 PHS ANGL PHASE ANGL VS FRQNCY

CS PWR	FRQCY	PHS ANGL
67.10	0.049	20.23
3.41	0.098	-6.45
4.33	0.146	-15.69
2.[illegible]3	0.195	-3.06
0.93	0.244	26.96
1.47	0.293	72.74
4.32	0.342	76.45
2.74	0.391	35.97
0.33	0.439	-19.49
0.65	0.488	39.61
1.14	0.537	77.85
0.42	0.586	48.22
0.32	0.635	37.85
0.33	0.684	14.32
0.15	0.732	-10.07
0.34	0.781	-37.68
0.54	0.830	-36.67
0.09	0.879	-12.47
0.19	0.928	-1.05
0.22	0.977	-21.76
0.09	1.025	-3.16
0.15	1.074	28.63
0.13	1.123	20.09
0.18	1.172	-56.78
0.14	1.221	-51.66
0.10	1.270	39.91
0.14	1.318	46.64
0.12	1.367	19.11
0.19	1.416	-14.15
0.19	1.465	-13.92
0.0[illegible]	1.514	47.97
0.07	1.562	26.68
0.12	1.611	-58.59
0.13	1.660	-68.75
0.09	1.709	3.82
0.04	1.758	45.40
0.05	1.807	34.82
0.06	1.855	-26.76
0.10	1.904	-44.40
0.15	1.953	32.61
0.19	2.002	36.67
0.15	2.051	-30.12
0.05	2.100	-88.12
0.11	2.148	-47.98
0.13	2.197	-32.33
0.0[illegible]	2.246	-54.92
0.03	2.295	-43.04
0.0[illegible]	2.344	6.39
0.05	2.393	-21.07
0.06	2.441	-34.75
0.06	2.490	-0.69
0.04	2.539	-34.04
0.09	2.588	-12.98
0.15	2.637	-7.64
0.07	2.686	-34.69
0.34	2.734	11.67
0.13	2.783	45.40
0.13	2.832	-20.06
0.04	2.881	-10.92
0.03	2.930	46.99
[illegible]	2.9[illegible]	[illegible]

FIG Y 115

952

CS PWR	FRQCY	PHS ANGL
20.94	0.098	-7.81
19.32	0.195	-35.27
6.11	0.293	-26.07
1.46	0.391	11.48
0.63	0.488	0.86
0.53	0.586	-87.15
0.33	0.684	-62.72
0.26	0.781	20.27
0.33	0.879	-2.85
0.18	0.977	-32.89
0.09	1.074	-55.38
0.37	1.172	-37.30
0.51	1.270	-39.62
0.41	1.367	-45.00
0.23	1.465	-5.59
0.15	1.562	-35.45
0.30	1.660	-24.06
0.25	1.758	11.46
0.22	1.855	23.60
0.32	1.953	32.55
0.28	2.051	7.55
0.13	2.148	13.06
0.09	2.246	26.14
0.23	2.344	18.33
0.25	2.441	-24.78
0.13	2.539	-42.76
0.17	2.637	-8.90
0.90	2.734	10.35
0.91	2.832	-22.65
0.27	2.930	-19.55
1.39	3.027	3.04
1.55	3.125	10.25
0.47	3.223	4.29
2.15	3.320	-13.28
2.49	3.418	-14.24
1.02	3.516	-2.79
0.74	3.613	-13.09
0.28	3.711	-33.85
0.12	3.809	-40.15
0.26	3.906	-19.30
0.21	4.004	32.95
0.08	4.102	33.30
0.15	4.199	-11.30
0.13	4.297	-50.56
0.05	4.395	-27.60
0.06	4.492	-2.68
0.05	4.590	-16.11
0.03	4.687	-3.01
0.02	4.785	54.29
0.01	4.883	87.67
0.04	4.980	56.86
0.04	5.078	27.95
0.01	5.176	28.72
0.04	5.273	-41.86
0.04	5.371	-80.98
0.02	5.469	-49.24
0.01	5.566	-28.91
0.01	5.664	-12.39
0.04	5.742	-9.50
0.20	9.277	16.16
0.04	9.375	20.63
0.04	9.473	27.24
0.02	9.570	10.53
0.03	9.668	10.30
0.05	9.766	25.88
11.52	9.863	-3.03
12.39	9.961	-26.51
0.55	10.059	-62.41
2.61	10.156	-18.86
2.53	10.254	29.83
0.28	10.352	39.16
0.27	10.449	32.40
0.02	10.547	-8.32
0.02	10.645	-21.85
0.03	10.742	-34.57

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

FIG Y116

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CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

CS PWR	FRQCY	PHS ANGL
7.01	0.049	-18.68
2.40	0.098	-28.81
1.36	0.146	-24.94
1.23	0.195	-31.54
1.15	0.244	-23.64
1.50	0.293	-0.45
1.80	0.342	30.40
1.41	0.391	14.62
0.37	0.439	32.63
0.14	0.488	20.47
0.76	0.537	-13.52
0.91	0.586	23.32
2.31	0.635	20.52
2.30	0.684	-6.10
0.23	0.732	-27.37
0.45	0.781	-12.58
0.64	0.830	2.41
0.35	0.879	21.20
0.49	0.928	24.80
0.43	0.977	-12.53
0.09	1.025	-36.90
0.12	1.074	4.70
0.11	1.123	8.05
0.10	1.172	-14.35
0.20	1.221	-4.33
0.25	1.270	1.13
0.16	1.318	41.05
0.10	1.367	35.77
0.26	1.416	1.80
0.31	1.465	-8.44
0.13	1.514	-13.71
0.09	1.563	-2.95
0.39	1.611	-2.46
0.65	1.660	12.81
0.44	1.709	19.01
1.44	1.758	-1.48
1.41	1.807	7.65
0.12	1.855	-18.39
0.09	1.904	-23.67
0.06	1.953	4.53
0.19	2.002	-13.40
0.41	2.051	-25.55
1.04	2.100	-17.19
0.80	2.148	-16.87
1.57	2.197	-33.85
2.49	2.246	-29.16
1.19	2.295	-15.89
0.34	2.344	-11.40
0.18	2.393	-26.01
1.90	2.441	-34.31
2.32	2.490	-8.46
1.37	2.539	-26.08
1.22	2.588	-30.13
0.87	2.637	-9.87
1.31	2.686	-6.68
4.64	2.734	-9.02
4.43	2.783	-21.01
1.87	2.832	-25.22
1.79	2.881	-30.14
2.18	2.930	-32.36
3.76	2.979	-40.75
2.79	3.027	-44.64
3.47	3.076	-26.10
3.26	3.125	-12.41
1.39	3.174	-10.13
0.95	3.223	-16.31
1.83	3.271	-27.21
2.02	3.320	-36.12
2.56	3.369	-31.96
2.99	3.418	-14.66
1.44	3.467	-23.50
1.06	3.516	-34.27
0.49	3.564	-33.39
0.33	3.613	-50.20
0.71	3.662	-50.68
0.79	3.711	-60.23
0.94	3.760	-66.28
0.59	3.809	-44.50
0.37	3.857	-22.42
0.36	3.906	-21.01
0.25	3.955	-34.28
0.33	4.004	-9.07
0.31	4.053	-29.03
0.12	4.102	-71.53
0.15	4.150	-51.98
0.10	4.199	-47.82
0.06	4.248	-24.54
0.03	4.297	17.14
0.02	4.346	-36.10
0.04	4.395	-59.04
0.04	4.443	-23.94
0.01	4.492	-50.17

FIG Y117

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CS PWR	FRQCY	PHS ANGL
3.30	0.049	0.85
3.71	0.098	46.84
3.56	0.146	31.50
13.12	0.195	-23.59
11.83	0.244	-10.25
1.57	0.293	1.48
7.09	0.342	-34.18
11.23	0.391	-21.65
7.09	0.439	-11.84
2.59	0.488	-13.77
0.58	0.537	-32.08
0.49	0.586	-29.86
0.63	0.635	1.97
2.24	0.684	10.47
2.25	0.732	9.52
0.47	0.781	16.65
0.46	0.830	11.03
0.25	0.879	32.41
0.23	0.928	35.64
0.17	0.977	2.98
0.18	1.025	3.87
0.33	1.074	22.52
2.27	1.123	10.06
2.33	1.172	-25.41
0.33	1.221	7.52
0.43	1.270	38.64
0.20	1.318	21.04
0.15	1.367	-14.94
1.22	1.416	-29.08
1.21	1.465	-9.66
0.26	1.514	-13.35
0.19	1.562	-10.21
0.03	1.611	-17.46
0.22	1.660	-40.43
0.59	1.709	-22.92
0.53	1.758	-4.64
0.19	1.807	-23.11
0.26	1.855	-25.24
0.27	1.904	-3.48
0.14	1.953	22.19
0.11	2.002	33.10
0.11	2.051	36.96
0.18	2.100	31.19
0.17	2.148	15.25
0.16	2.197	-27.44
0.73	2.246	-27.13
0.74	2.295	7.76
1.50	2.344	2.40
1.51	2.393	-7.22
0.25	2.441	-19.13
0.42	2.490	-28.57
0.43	2.539	-23.77
0.45	2.588	-2.00
0.63	2.637	-16.81
0.42	2.686	-38.00
0.21	2.734	-32.20
0.19	2.783	-31.42
0.74	2.832	-14.53
0.73	2.881	15.82
0.32	2.930	11.51
0.35	2.979	-1.99
0.16	3.027	-32.74
0.21	3.076	-36.27
0.66	3.125	-28.27
0.83	3.174	-54.62
0.58	3.223	-41.02
0.44	3.271	-38.91
0.19	3.320	-60.10
0.08	3.369	-58.07
0.06	3.418	-50.46
0.21	3.467	-59.40
0.19	3.516	-46.48
0.13	3.564	-24.30
0.22	3.613	-12.53
0.15	3.662	-16.53
0.10	3.711	-37.47
0.09	3.760	-51.36
0.10	3.809	-53.04
0.08	3.857	-47.73
0.02	3.906	-40.42
0.01	3.955	-20.45
0.03	4.004	-12.39
0.05	4.053	-21.88
0.02	4.102	1.79
0.07	4.150	-0.77
0.02	4.199	-47.05
0.01	4.248	-57.61
0.01	4.297	-54.55
0.08	4.346	-55.71
0.03	4.395	-67.33
0.00	4.443	-9.63
0.04	4.492	27.08

CROSS SPECTRA VS FRQNCY OF PC AND PT

PHASE ANGL VS FRQNCY

FIG Y118

CS PWR FRQCY   CROSS SPECTRA VS FRQNCY OF PC AND P1

CS PWR	FRQCY
0.41	0.049
0.70	0.098
0.71	0.146
2.13	0.195
3.27	0.244
3.04	0.293
3.52	0.342
3.23	0.391
2.10	0.439
3.45	0.488
4.23	0.537
8.09	0.586
9.11	0.635
4.97	0.684
0.77	0.732
1.93	0.781
1.95	0.830
4.81	0.879
7.09	0.928
3.15	0.977
2.72	1.025
3.71	1.074
2.45	1.123
0.45	1.172
1.22	1.221
0.95	1.270
0.43	1.318
0.40	1.367
0.19	1.416
0.33	1.465
2.92	1.514
3.37	1.562
1.31	1.611
0.97	1.660
0.58	1.709
0.52	1.758
0.43	1.807
0.57	1.855
0.54	1.904
0.13	1.953
0.35	2.002
0.33	2.051
0.08	2.100
0.29	2.148
0.43	2.197
0.27	2.246
0.16	2.295
0.16	2.344
0.12	2.393
0.11	2.441
0.22	2.490
0.23	2.539
0.07	2.588
0.09	2.637
0.05	2.686
0.34	2.734
0.11	2.783
0.16	2.832
0.11	2.881
0.12	2.930
0.14	2.979

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FIG Y 119

PHS ANGL   PHASE ANGL VS FRQNCY

PHS ANGL
-13.92
21.36
-2.21
-24.47
12.92
24.40
7.17
-12.01
-12.89
-10.88
-26.36
-21.14
1.15
8.47
-3.42
-7.41
8.90
-0.86
2.46
13.80
0.60
-10.30
-13.82
-7.91
-4.06
-8.85
-26.40
-47.47
-38.48
-26.70
-18.78
-10.45
-12.25
-10.37
-14.94
-17.56
-20.55
-19.68
-10.55
-15.42
-18.18
-10.08
-6.67
-19.72
-32.64
-23.86
-20.10
-27.76
-29.34
-28.65
-23.34
4.20
19.14
-3.65
-25.01
-22.40
-30.47
-34.12
-14.59
-33.73
-33.54

CROSS SPECTRA VS FRQNCY OF F0 AND P1

PHASE ANGL VS FRQNCY

CS PWR	FRQCY	PHS ANGL
0.21	0.049	-9.68
0.24	0.098	33.31
0.28	0.146	36.28
0.16	0.195	4.98
0.34	0.244	-14.53
0.41	0.293	-19.77
0.39	0.342	3.20
0.14	0.391	20.34
0.15	0.439	14.35
0.55	0.488	-4.03
2.32	0.537	-11.64
3.96	0.586	-4.48
2.13	0.635	-0.26
0.31	0.684	3.10
0.93	0.732	-3.12
3.14	0.781	-8.18
3.14	0.830	-4.64
0.81	0.879	6.36
[illegible]	0.928	3.23
5.13	0.977	-8.81
3.41	1.025	-6.18
0.43	1.074	-11.20
1.35	1.123	-10.64
9.25	1.172	-7.17
9.71	1.221	-8.47
1.77	1.270	-5.16
1.92	1.318	-6.70
3.13	1.367	-9.43
3.45	1.416	-6.71
2.10	1.465	-9.39
1.29	1.514	-14.58
1.39	1.562	-12.99
2.24	1.611	-11.69
2.29	1.660	-23.33
1.92	1.709	-28.19
4.24	1.758	-18.87
2.93	1.807	-8.68
2.27	1.855	-4.88
2.77	1.904	-13.24
0.87	1.953	-13.36
0.69	2.002	-18.75
0.58	2.051	-19.39
0.69	2.100	-17.23
1.09	2.148	-18.69
1.43	2.197	-17.01
[illegible]	2.246	-20.64
1.56	2.295	-22.62
1.32	2.344	-25.24
0.92	2.393	-28.38
0.52	2.441	-31.74
0.35	2.490	-26.32
0.77	2.539	-18.89
0.55	2.588	-21.25
0.29	2.637	-30.67
0.28	2.686	-30.92
0.17	2.734	-22.23
0.11	2.783	-27.53
0.12	2.832	-29.77
0.14	2.881	-29.09
0.31	2.930	-36.95
0.34	2.979	-32.26
[illegible]	3.027	-31.38
[illegible]	3.076	-38.96
[illegible]	3.125	-29.27
[illegible]	3.174	-10.21
[illegible]	3.223	-5.31
[illegible]	3.271	-24.49
0.10	3.320	-48.15
[illegible]	3.369	-56.62
[illegible]	3.418	-51.86
[illegible]	3.467	-51.81
[illegible]	3.516	-43.59
[illegible]	3.564	-41.14
[illegible]	3.613	-35.19
[illegible]	3.662	-30.13
[illegible]	3.711	-56.82
[illegible]	3.760	-37.31
[illegible]	3.809	-27.47
[illegible]	3.857	-64.84
[illegible]	3.906	-77.29
[illegible]	3.955	-75.27
[illegible]	4.004	-55.63
[illegible]	4.053	-26.30
[illegible]	4.102	-31.94
[illegible]	4.150	-40.09
[illegible]	4.199	-35.79
[illegible]	4.248	-53.99
[illegible]	4.297	-73.96
[illegible]	4.346	-58.24
[illegible]	4.395	-54.40
[illegible]	4.443	-58.25
[illegible]	4.492	-51.98

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FIG Y120

CS PWR	FRQCY	PHS ANGL
0.16	0.049	11.46
0.02	0.098	-12.49
0.09	0.146	6.18
0.15	0.195	5.67
0.63	0.244	3.28
1.39	0.293	-5.88
1.05	0.342	8.81
0.33	0.391	9.46
1.19	0.439	-12.56
2.01	0.488	-8.65
1.83	0.537	-2.58
1.12	0.586	8.39
1.17	0.635	22.34
4.86	0.684	2.60
18.00	0.732	-11.56
27.12	0.781	-1.79
15.63	0.830	-2.84
2.70	0.879	-5.35
2.61	0.928	-7.50
1.83	0.977	-9.38
2.03	1.025	-10.01
0.72	1.074	-3.96
0.43	1.123	-7.72
1.01	1.172	-20.51
2.23	1.221	-18.12
1.63	1.270	3.92
0.47	1.318	-2.43
1.19	1.367	-21.51
1.61	1.416	-9.89
0.83	1.465	-14.98
0.17	1.514	-25.63
0.09	1.562	-15.02
0.55	1.611	-1.47
0.66	1.660	-6.52
0.26	1.709	-17.38
0.15	1.758	-26.07
0.41	1.807	-17.50
0.40	1.855	-12.20
0.45	1.904	-26.74
0.43	1.953	-31.38
0.14	2.002	-27.73
0.33	2.051	-27.77
0.35	2.100	-24.81
0.09	2.148	-19.89
0.13	2.197	-30.38
0.20	2.246	-37.77
0.12	2.295	-37.24
0.02	2.344	-19.87
0.01	2.393	-22.68
0.03	2.441	-39.66
0.07	2.490	-37.38
0.07	2.539	-44.43
0.03	2.588	-16.11
0.01	2.637	-15.33
0.03	2.686	-56.74
0.03	2.734	-55.38
0.02	2.783	-37.07
0.03	2.832	-30.44
0.04	2.881	-27.57
0.02	2.930	-30.40
[illegible]	[illegible]	[illegible]

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

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FIG Y 121

CS PWR	FRQCY	PHS ANGL
0.87	0.049	-35.44
0.03	0.098	-15.90
0.36	0.146	14.29
0.17	0.195	26.78
0.39	0.244	34.74
1.06	0.293	39.53
2.78	0.342	24.71
4.68	0.391	3.68
2.75	0.439	-2.54
1.32	0.488	7.32
1.33	0.537	-14.37
0.83	0.586	-30.43
2.09	0.635	-23.76
4.63	0.684	-20.72
6.19	0.732	-16.04
14.65	0.781	-9.00
12.47	0.830	-10.85
1.29	0.879	-18.03
2.98	0.928	-11.85
5.93	0.977	-7.25
5.19	1.025	-9.56
5.82	1.074	-7.85
6.47	1.123	-7.85
3.46	1.172	-17.16
1.39	1.221	-29.13
1.19	1.270	-25.91
1.31	1.318	-21.42
0.73	1.367	-15.35
0.97	1.416	-23.26
1.87	1.465	-9.49
1.90	1.514	17.64
0.64	1.562	-18.77
0.10	1.611	-41.32
0.16	1.660	-34.83
0.29	1.709	-26.29
0.17	1.758	-30.55
0.19	1.807	-14.28
0.23	1.855	-3.80
0.09	1.904	-23.82
0.02	1.953	-13.00
0.05	2.002	-14.41
0.13	2.051	-4.73
0.13	2.100	-5.94
0.45	2.148	-15.07
0.65	2.197	-11.46
0.05	2.246	-27.74
0.09	2.295	-35.81
0.05	2.344	-26.35
0.03	2.393	-14.20
0.01	2.441	-9.66
0.02	2.490	-23.55
0.03	2.539	-41.03
0.03	2.588	-45.92
0.04	2.637	-54.89
0.03	2.686	-64.41
0.01	2.734	-57.14
0.02	2.783	-40.41
0.01	2.832	-18.97
0.02	2.881	-5.55
[illegible]	[illegible]	[illegible]

CROSS SRECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

FIG Y122

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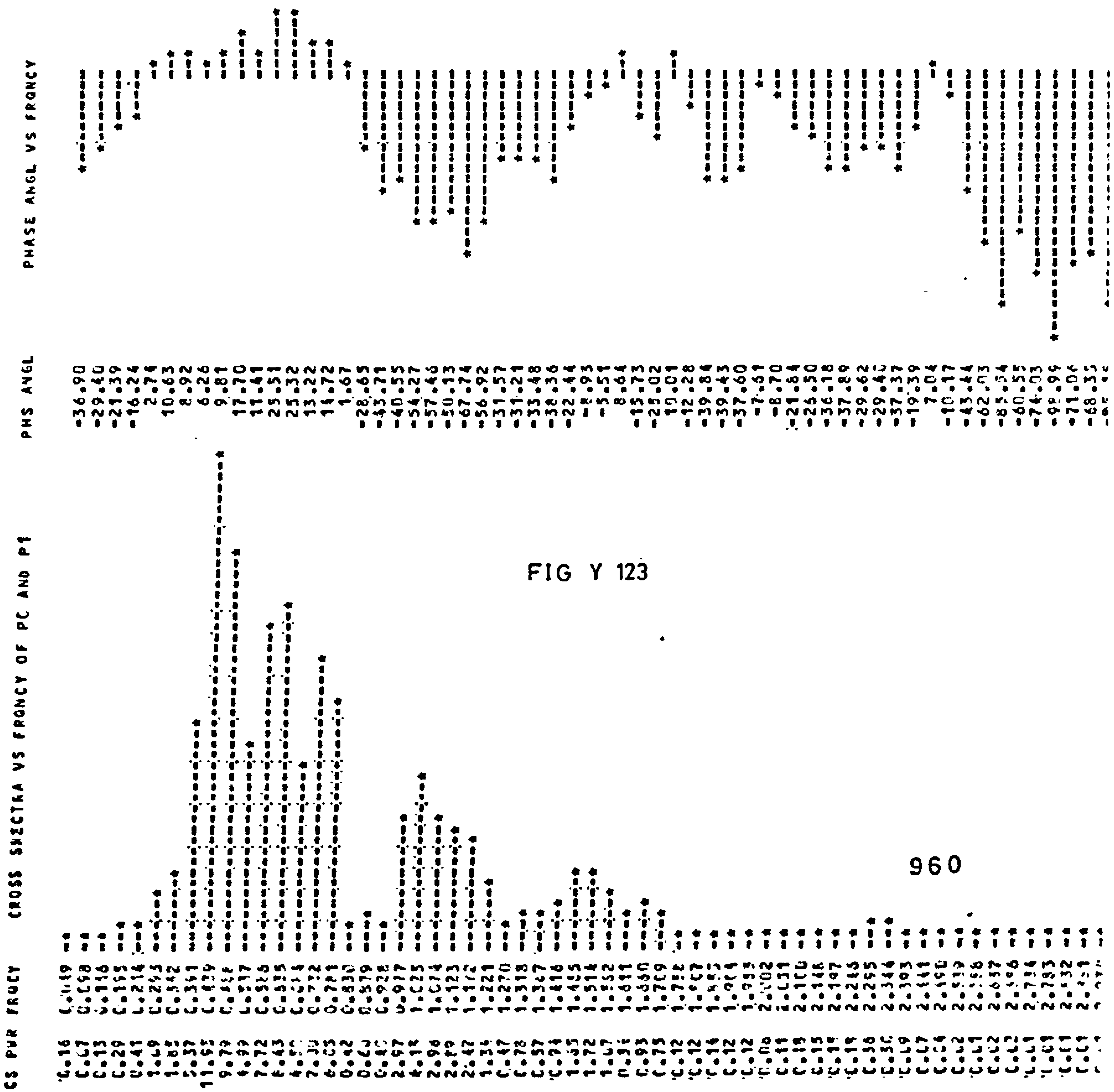
CS PWR FRQCY
CROSS SPECTRA VS FRQNCY OF PC AND P1
PHS ANGL
PHASE ANGL VS FRQNCY

FIG Y 123

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FIG Y124

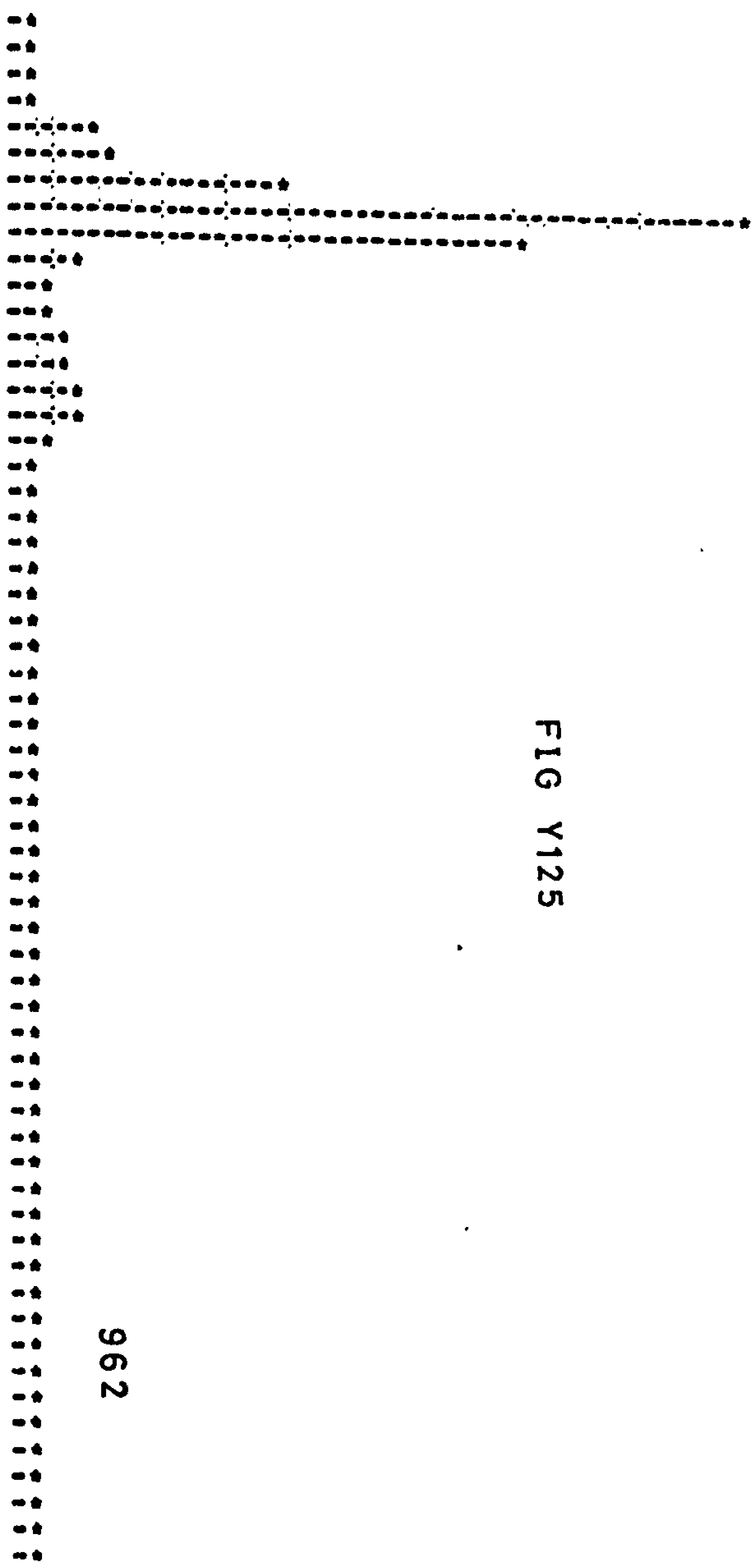
CS PWR	FRQCY	PHS ANGL
0.24	0.049	22.24
0.00	0.098	39.57
0.01	0.146	42.16
0.03	0.195	19.11
0.38	0.244	0.45
6.54	0.293	10.89
7.71	0.342	8.32
1.63	0.391	-3.84
1.63	0.439	-8.46
0.94	0.488	-1.20
0.77	0.537	-10.32
1.19	0.586	-22.38
4.66	0.635	-18.80
23.35	0.684	-15.18
24.39	0.732	-15.26
3.75	0.781	-13.62
0.42	0.830	-7.33
0.91	0.879	-4.80
2.72	0.928	-8.02
3.15	0.977	-6.93
4.32	1.025	-7.88
3.35	1.074	-4.13
0.34	1.123	-0.64
0.13	1.172	-10.60
0.29	1.221	-19.99
0.61	1.270	-20.81
0.65	1.318	-15.24
0.39	1.367	-10.81
0.15	1.416	-14.00
0.11	1.465	-19.05
0.15	1.514	-25.74
0.07	1.562	-30.54
0.06	1.611	-22.45
0.26	1.660	-17.96
0.23	1.709	-9.66
0.02	1.758	-17.94
0.03	1.807	-30.59
0.01	1.855	-25.26
0.03	1.904	-17.18
0.02	1.953	-24.30
0.03	2.002	-34.27
0.04	2.051	-27.87
0.01	2.100	-37.65
0.01	2.148	-42.55
0.01	2.197	-31.36
0.01	2.246	-9.99
0.00	2.295	-14.76
0.01	2.344	-25.03
0.01	2.393	-8.25
0.00	2.441	-8.75
0.02	2.490	-34.79
0.02	2.539	-41.89
0.03	2.588	-35.41
0.00	2.637	-29.15
0.00	2.686	-51.57
0.00	2.734	-66.99
0.01	2.783	-72.00
0.01	2.832	-70.33
0.00	2.881	-45.19
0.00	2.930	-43.37

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

CS PWR	FRQCY	PHS ANGL
0.45	0.049	-19.32
0.43	0.098	-14.93
0.13	0.146	4.03
0.17	0.195	1.60
3.62	0.244	1.53
4.43	0.293	0.20
12.94	0.342	4.40
34.66	0.391	14.68
24.06	0.439	25.81
2.59	0.488	28.77
1.54	0.537	27.43
0.79	0.586	4.49
1.67	0.635	-22.34
1.96	0.684	-14.02
3.03	0.732	0.75
2.46	0.781	3.41
0.93	0.830	-6.79
0.73	0.879	9.50
0.35	0.928	-7.48
0.23	0.977	-22.08
0.36	1.025	-2.98
0.71	1.074	-8.73
0.61	1.123	-19.81
0.28	1.172	-10.93
0.10	1.221	8.28
0.19	1.270	-10.64
0.21	1.318	-33.75
0.13	1.367	-24.95
0.04	1.416	-24.80
0.09	1.465	-32.59
0.06	1.514	-36.71
0.01	1.562	-39.28
0.00	1.611	-40.81
0.00	1.660	-13.03
0.00	1.709	21.80
0.01	1.758	12.75
0.00	1.807	-2.27
0.00	1.855	-2.81
0.00	1.904	-11.93
0.00	1.953	2.10
0.00	2.002	16.12
0.00	2.051	46.30
0.00	2.100	40.52
0.00	2.148	-3.87
0.00	2.197	4.74
0.00	2.246	6.67
0.00	2.295	12.40
0.00	2.344	27.26
0.00	2.393	-2.38
0.00	2.441	-24.77
0.00	2.490	-27.44
0.00	2.539	-32.16
0.00	2.588	-32.13
0.00	2.637	-53.26
0.00	2.686	-32.32
0.00	2.734	-11.20
0.00	2.783	-43.47
0.00	2.832	-21.67
0.00	2.881	7.02
0.00	2.930	-11.62
0.00	2.979	-20.48

CROSS SPECTRA VS FRQNCY OF P0 AND P1



PHASE ANGL VS FRQNCY

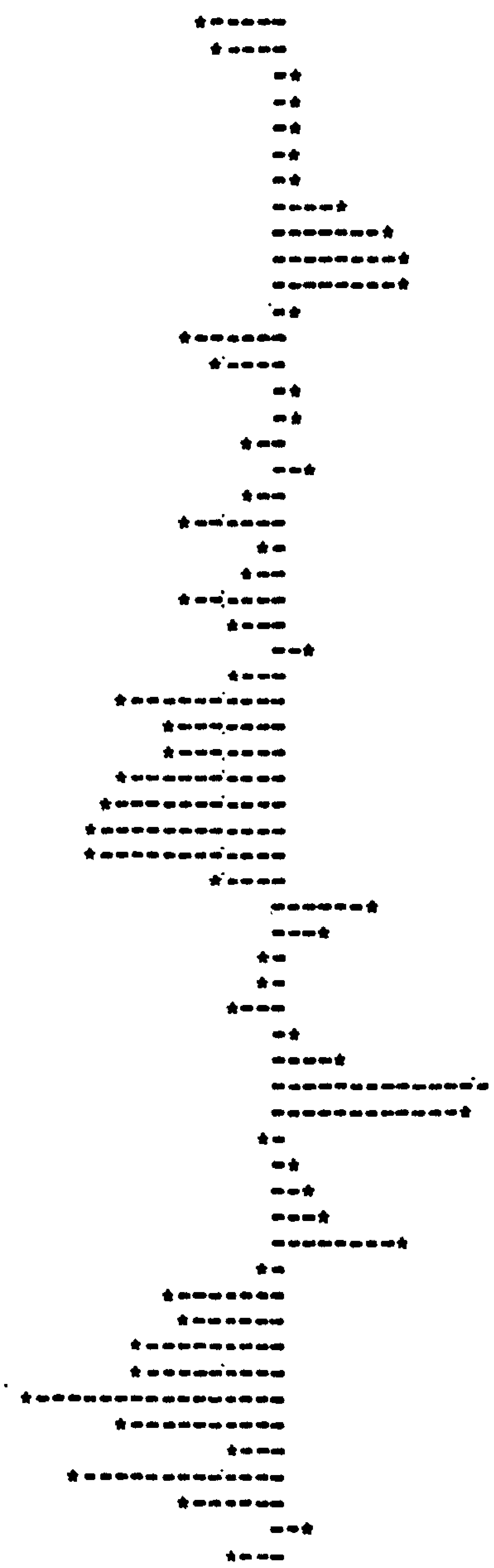


FIG Y125

962

CS PWR	FRQCY	PHS ANGL
0.46	0.049	17.65
1.94	0.098	-12.27
2.12	0.146	3.26
0.95	0.195	15.08
2.27	0.244	9.93
15.35	0.293	12.89
35.96	0.342	33.71
24.03	0.391	45.15
3.02	0.439	56.17
1.45	0.488	46.98
1.09	0.537	43.54
1.46	0.586	19.13
2.90	0.635	26.45
3.02	0.684	61.44
1.59	0.732	67.59
0.72	0.781	64.11
0.19	0.830	43.90
0.20	0.879	36.97
0.23	0.928	42.82
0.22	0.977	7.55
0.11	1.025	-24.77
0.03	1.074	-14.51
0.03	1.123	-26.66
0.01	1.172	-36.91
0.02	1.221	-2.06
0.01	1.270	33.48
0.01	1.318	56.64
0.01	1.367	53.01
0.00	1.416	-24.78
0.00	1.465	-72.60
0.00	1.514	-52.16
0.00	1.562	-77.12
0.00	1.611	-36.75
0.00	1.660	-37.03
0.00	1.709	-39.02
0.00	1.758	23.71
0.00	1.807	38.45
0.00	1.855	1.49
0.00	1.904	22.93
0.00	1.953	-0.30
0.00	2.002	-50.82
0.00	2.051	-3.96
0.00	2.100	40.95
0.00	2.149	17.41
0.00	2.197	-15.99
0.00	2.246	-10.06
0.00	2.295	-23.23
0.00	2.344	4.28
0.00	2.393	21.30
0.00	2.441	-30.27
0.00	2.490	-49.67
0.00	2.539	-36.95
0.00	2.588	-22.37
0.00	2.637	-36.12
0.00	2.686	-45.39
0.00	2.734	-27.79
0.00	2.783	-39.53
0.00	2.832	16.67
0.00	2.881	20.72
0.00	2.930	-35.00

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

FIG Y 126

963

FIG Y 127

964

CS PWR	FRQCY	PHS ANGL
0.20	0.049	35.44
0.69	0.098	-11.85
0.71	0.146	-29.97
0.60	0.195	19.74
1.71	0.244	32.85
7.16	0.293	51.06
9.69	0.342	63.53
5.33	0.391	52.59
2.43	0.439	5.29
1.24	0.488	-43.93
0.65	0.537	-20.54
1.31	0.586	40.02
1.82	0.635	21.73
1.56	0.684	-46.09
1.56	0.732	-69.65
1.29	0.781	4.07
4.02	0.830	-1.97
20.60	0.879	-15.14
18.23	0.928	50.30
1.66	0.977	11.30
0.98	1.025	45.35
0.46	1.074	29.46
1.55	1.123	-69.90
1.49	1.172	-40.27
0.29	1.221	0.44
0.51	1.270	13.63
0.78	1.318	-13.42
0.87	1.367	-14.82
0.59	1.416	-18.11
1.75	1.465	-32.34
2.16	1.514	-18.70
0.64	1.562	9.59
0.24	1.611	23.09
0.39	1.660	-21.71
0.29	1.709	25.49
0.55	1.758	32.49
0.15	1.807	2.88
0.30	1.855	45.31
0.34	1.904	-1.04
0.20	1.953	-69.41
0.08	2.002	-47.36
0.09	2.051	-5.30
0.09	2.100	0.57
0.13	2.148	-3.48
0.31	2.197	-45.07
0.24	2.246	-31.50
0.09	2.295	12.78
0.04	2.344	-21.56
0.03	2.393	-43.54
0.09	2.441	-37.03
0.07	2.490	7.70
0.12	2.539	15.31
0.12	2.588	7.31
0.08	2.637	20.78
0.03	2.686	-16.71
0.05	2.734	-38.80
0.05	2.783	13.54
0.03	2.832	37.45
0.03	2.881	17.51
0.01	2.930	-18.71
[illegible]	[illegible]	[illegible]

CS PWR FRQCY — CROSS SPECTRA VS FRQNCY OF PC AND P1 — PHS ANGL — PHASE ANGL VS FRQNCY

FIG Y 128

965

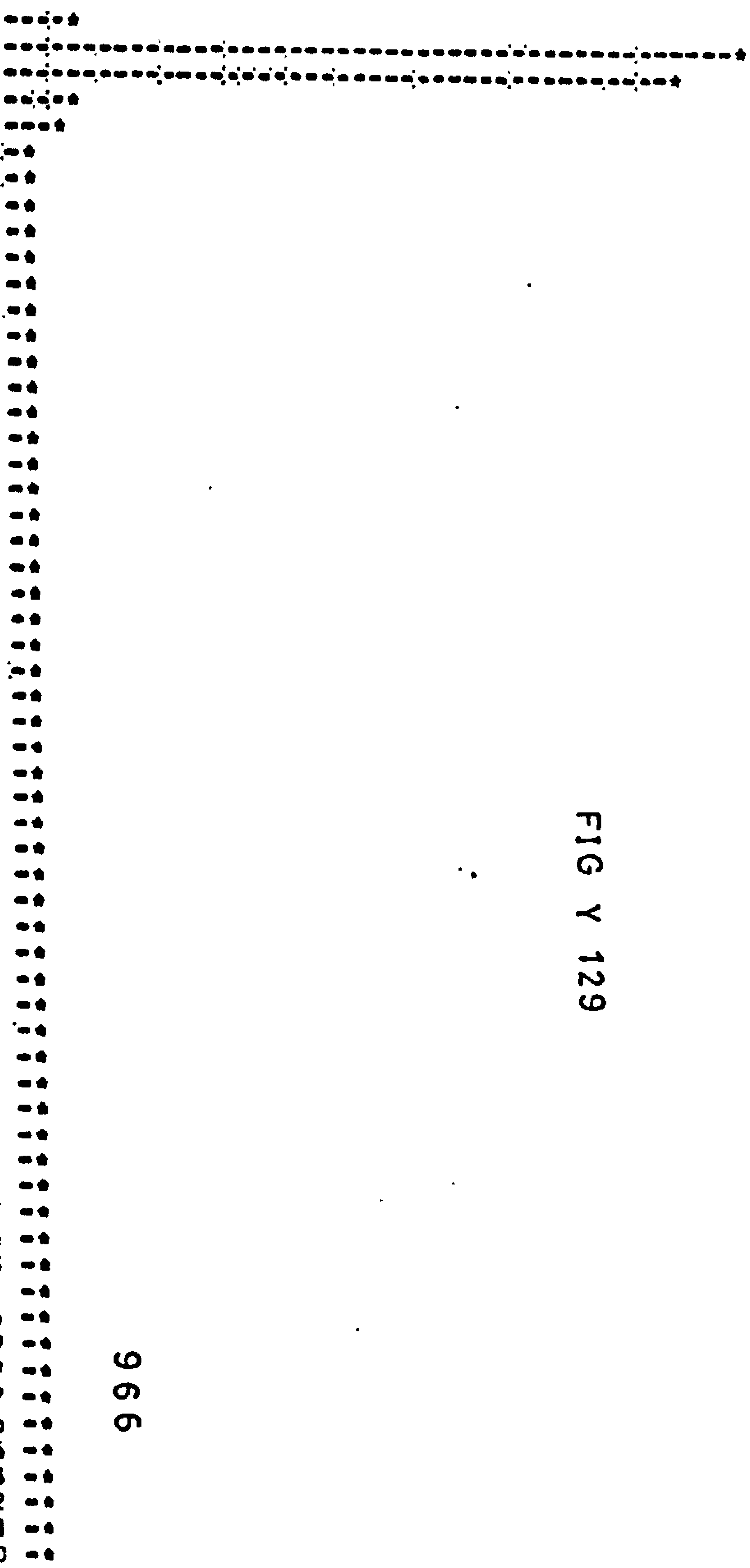
CS PWR	FRQCY	PHS ANGL
0.41	0.049	6.43
1.28	0.098	32.13
20.72	0.146	17.74
22.[illegible]	0.195	43.35
17.55	0.244	90.25
16.25	0.293	70.95
2.09	0.342	-1.19
1.92	0.391	-30.02
1.05	0.439	4.46
0.79	0.488	-15.69
0.63	0.537	-45.66
0.33	0.586	-5.58
0.29	0.635	-6.14
1.26	0.684	10.12
0.85	0.732	16.90
0.43	0.781	-2.56
0.36	0.830	-22.52
0.27	0.879	-13.99
0.28	0.928	30.49
0.07	0.977	11.03
0.22	1.025	-30.41
1.53	1.074	-29.35
2.72	1.123	-31.27
1.73	1.172	-25.82
0.65	1.221	-13.87
0.86	1.270	-15.97
0.77	1.318	-2.10
0.16	1.367	1.79
0.31	1.416	33.68
0.33	1.465	37.01
0.11	1.514	17.58
0.69	1.563	53.99
0.03	1.611	69.24
0.05	1.660	18.47
0.11	1.709	-15.45
0.09	1.758	0.10
0.02	1.807	1.88
0.02	1.855	29.13
0.02	1.904	41.16
0.03	1.953	-3.76
0.02	2.002	-66.35
0.01	2.051	-29.65
0.01	2.100	-18.45
0.01	2.148	-50.47
0.03	2.197	-11.43
0.03	2.246	27.48
0.01	2.295	22.43
0.01	2.344	-26.55
0.02	2.393	-15.48
0.02	2.441	-16.97
0.01	2.490	-18.80
0.01	2.539	6.91
0.01	2.588	-14.95
0.00	2.637	-19.18
0.00	2.686	32.68
0.01	2.734	35.39
0.00	2.783	10.62
0.00	2.832	10.26
0.00	2.881	43.51

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

CS PWR	FRQCY	PHS ANGL
3.77	0.049	3.77
45.67	0.098	56.94
42.60	0.146	73.89
3.43	0.195	75.49
2.97	0.244	12.64
0.41	0.293	-47.76
0.24	0.342	-49.12
0.49	0.391	-24.77
0.05	0.439	48.01
0.09	0.488	18.02
0.09	0.537	-62.06
0.02	0.586	-5.93
0.13	0.635	23.90
0.10	0.684	-6.86
0.11	0.732	-14.88
0.05	0.781	-20.40
0.11	0.830	-31.52
0.09	0.879	-15.37
0.03	0.928	12.95
0.02	0.977	43.44
0.01	1.025	48.41
0.00	1.074	8.16
0.01	1.123	19.02
0.00	1.172	71.63
0.00	1.221	78.30
0.00	1.270	71.31
0.00	1.318	45.07
0.00	1.367	7.24
0.00	1.416	-21.03
0.00	1.465	-28.45
0.00	1.514	-15.41
0.00	1.562	2.00
0.00	1.611	5.31
0.00	1.660	-6.31
0.00	1.709	-1.59
0.00	1.758	3.32
0.00	1.807	2.84
0.00	1.855	-0.81
0.00	1.904	-1.93
0.00	1.953	-4.01
0.00	2.002	15.71
0.00	2.051	20.19
0.00	2.100	25.68
0.00	2.148	64.68
0.00	2.197	34.47
0.00	2.246	-9.46
0.00	2.295	10.21
0.00	2.344	-5.11
0.00	2.393	-4.77
0.00	2.441	41.61
0.00	2.490	-3.82
0.00	2.539	-14.34
0.00	2.588	-10.71
0.00	2.637	-45.19
0.00	2.686	-18.20
0.00	2.734	60.07
0.00	2.783	58.26
0.00	2.832	-13.89
0.00	2.881	-2.10
0.00	2.930	1.92

CROSS SPECTRA VS FRQNCY OF PC AND P1



PHASE ANGL VS FRQNCY

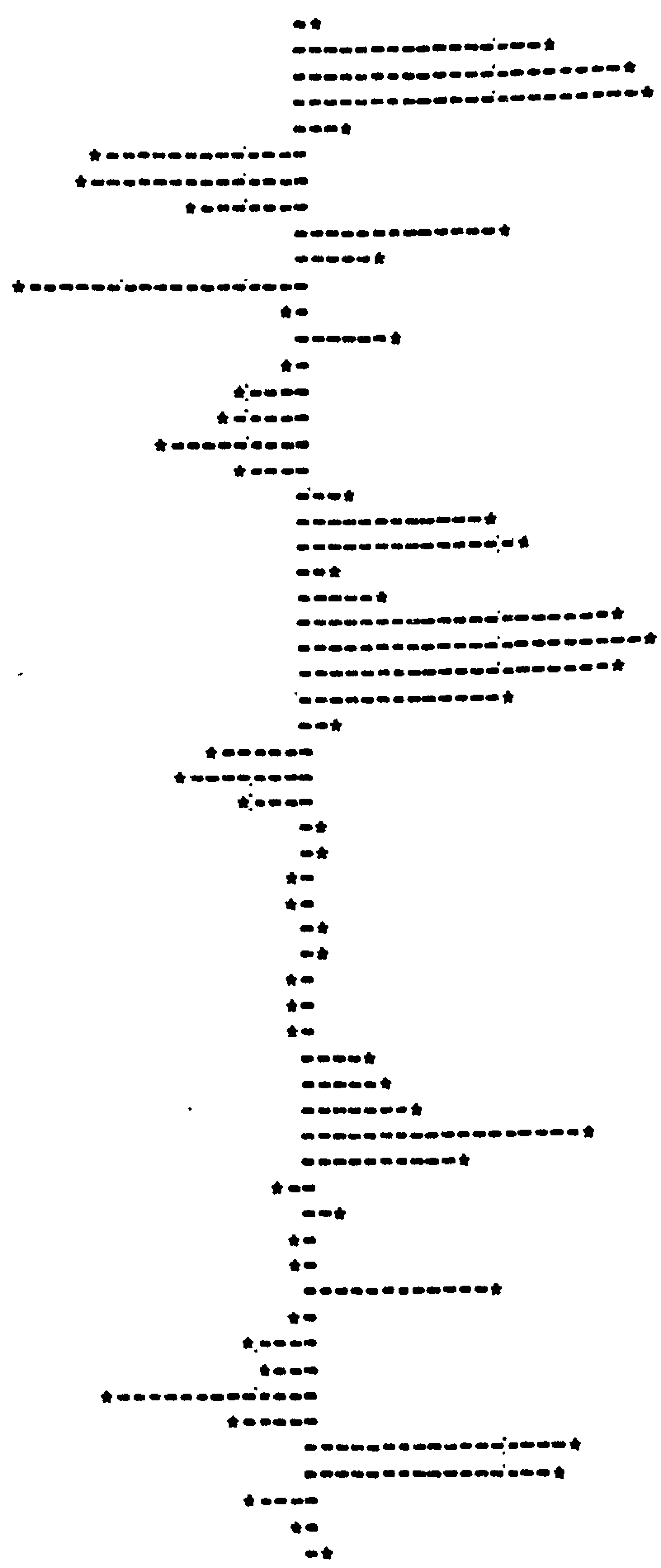


FIG Y 129

966

CS PWR	FRQCY	PHS ANGL
61.25	0.049	24.41
5.35	0.098	-17.89
0.87	0.146	-40.47
0.90	0.195	-1.01
0.93	0.244	37.90
0.35	0.293	13.35
0.25	0.342	-28.78
0.71	0.391	-18.48
1.19	0.439	12.22
0.28	0.488	12.00
0.45	0.537	-5.19
0.27	0.586	21.53
0.38	0.635	32.18
0.65	0.684	26.93
0.87	0.732	54.50
0.73	0.781	32.24
0.51	0.830	34.42
0.29	0.879	15.72
0.39	0.928	-18.24
0.57	0.977	6.88
0.26	1.025	-13.94
1.34	1.074	-37.12
1.31	1.123	-4.99
0.27	1.172	3.70
0.14	1.221	-5.83
0.10	1.270	-6.13
0.19	1.318	-49.35
0.29	1.367	-58.58
0.14	1.416	14.36
0.05	1.465	13.75
0.09	1.514	-38.88
0.18	1.562	25.99
0.17	1.611	73.51
0.20	1.660	39.14
0.18	1.709	-29.30
0.27	1.758	-13.98
0.67	1.807	7.28
0.37	1.855	-1.95
0.75	1.904	-9.84
0.78	1.953	-2.25
0.93	2.002	-22.88
1.90	2.051	-52.77
1.32	2.100	-4.63
0.82	2.148	-41.26
0.92	2.197	-30.30
1.87	2.246	-36.50
1.45	2.295	-35.95
0.31	2.344	-31.72
0.35	2.393	-50.36
0.16	2.441	-5.36
0.09	2.490	10.55
0.09	2.539	7.03
0.05	2.588	-19.51
0.03	2.637	20.93
0.03	2.686	18.55
0.05	2.734	-4.38
0.04	2.783	-19.57
0.01	2.832	-57.34
0.03	2.881	-46.75
[illegible]	[illegible]	[illegible]

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

FIG Y 130

967

CS PWR FRQCY   CROSS SPECTRA VS FRQCY OF PC AND P1   PHS ANGL   PHASE ANGL VS FRQCY

CS PWR	FRQCY	PHS ANGL
3.05	0.049	-7.03
5.51	0.098	-9.75
6.94	0.146	-2.26
5.63	0.195	-4.34
4.95	0.244	-8.96
7.17	0.293	-10.75
4.35	0.342	-19.11
9.59	0.391	-30.28
9.00	0.439	-43.11
0.95	0.488	-48.97
1.70	0.537	-61.96
2.73	0.586	-73.45
2.34	0.635	-98.27
1.01	0.684	-83.09
0.97	0.732	-63.29
2.47	0.781	-72.00
3.29	0.830	-19.55
1.43	0.879	42.84
0.07	0.928	19.31
0.20	0.977	-39.07
0.27	1.025	-40.65
0.29	1.074	-60.15
1.53	1.123	-38.54
3.24	1.172	-34.27
1.96	1.221	-85.16
0.49	1.270	-90.96
0.69	1.318	-87.12
0.69	1.367	-65.59
1.13	1.416	-61.83
1.55	1.465	-51.98
0.91	1.514	-41.96
0.22	1.562	-45.89
0.13	1.611	-40.02
0.30	1.660	-44.41
0.45	1.709	-63.17
0.29	1.758	-77.45
0.14	1.807	-67.57
0.20	1.855	-48.94
0.20	1.904	-53.86
0.09	1.953	-63.57
0.09	2.002	-80.07
0.13	2.051	-45.21
0.13	2.100	25.35
0.07	2.148	24.06
0.15	2.197	6.42
0.19	2.246	21.59
0.33	2.295	15.74
0.29	2.344	14.98
0.06	2.393	20.61
0.07	2.441	33.28
0.10	2.490	6.13
0.08	2.539	-15.05
0.03	2.588	23.04
0.15	2.637	77.90
0.29	2.686	93.74
0.23	2.734	12.69
0.27	2.783	25.09
0.25	2.832	77.71
0.33	2.881	79.11
0.42	2.930	95.68
0.25	2.979	126.80
0.13	3.027	79.05
0.13	3.076	71.61
0.22	3.125	107.10
0.19	3.174	47.41
0.04	3.223	52.31
0.29	3.271	95.02
0.34	3.320	55.34
0.21	3.369	29.40
0.12	3.418	57.37
0.09	3.467	38.84
0.37	3.516	51.63
0.39	3.564	90.93
0.66	3.613	100.85
0.65	3.662	114.02
0.37	3.711	105.06
0.25	3.760	63.46
0.32	3.809	50.35
0.23	3.857	64.76
0.19	3.906	52.48
0.32	3.955	62.73
0.27	4.004	67.07
0.12	4.053	62.43
0.07	4.102	80.57
0.14	4.150	91.59
0.27	4.199	80.69
0.14	4.248	68.79
0.12	4.297	71.03
0.09	4.346	60.63
0.07	4.395	32.80
0.11	4.443	39.00
0.08	4.492	60.47

FIG Y 131

968

CS PWR	FRQCY	PHS ANGL
0.68	0.049	
1.31	0.098	15.33
20.60	0.146	4.44
27.40	0.195	-5.69
7.93	0.244	-3.41
1.35	0.293	1.61
2.96	0.342	-0.62
5.87	0.391	-9.41
5.43	0.439	-16.23
2.49	0.488	-20.07
2.38	0.537	-25.80
7.95	0.586	-27.18
7.64	0.635	-29.04
1.32	0.684	-39.72
0.93	0.732	-52.63
1.13	0.781	-53.36
0.33	0.830	-45.14
0.08	0.879	-61.03
0.10	0.928	-72.06
0.06	0.977	-50.94
0.02	1.025	-48.74
0.00	1.074	-36.12
0.10	1.123	-28.96
0.13	1.172	-26.08
0.08	1.221	-27.59
0.01	1.270	-65.92
0.02	1.318	-37.82
0.04	1.367	-52.46
0.03	1.416	-102.67
0.01	1.465	-54.75
0.02	1.514	-50.29
0.02	1.562	-61.65
0.02	1.611	-46.89
0.03	1.660	-48.64
0.05	1.709	-50.61
0.04	1.758	-16.38
0.01	1.807	-5.51
0.01	1.855	-56.60
0.14	1.904	-38.30
0.28	1.953	-16.71
0.16	2.002	-31.94
0.07	2.051	-33.16
0.16	2.100	-45.55
0.14	2.148	-42.18
0.07	2.197	-34.04
0.05	2.246	-43.66
0.06	2.295	-56.58
0.06	2.344	-61.72
0.02	2.393	-78.18
0.00	2.441	-66.05
0.00	2.490	-71.31
0.00	2.539	-79.67
0.01	2.588	-67.35
0.01	2.637	-99.62
0.01	2.686	-80.30
0.00	2.734	-60.88
0.00	2.783	-60.22
0.01	2.832	-22.22
0.01	2.881	14.91
[illegible]	[illegible]	-1.08
		[illegible]

CROSS SPECTRA VS FRQNCY OF P0 AND P1

PHASE ANGL VS FRQNCY

FIG Y 132

969

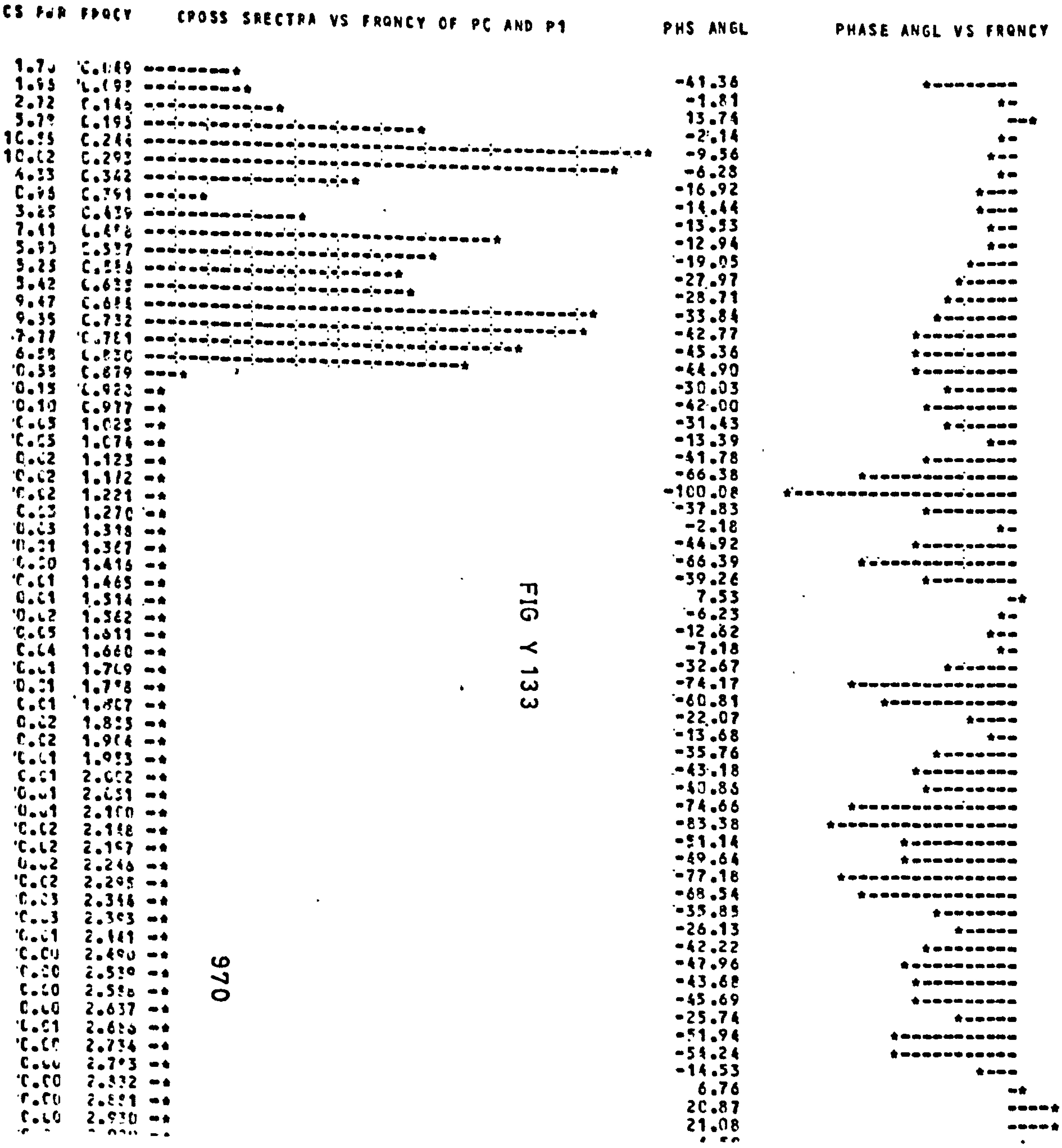

CS PWR FRQCY
CROSS SPECTRA VS FRQNCY OF PC AND P1
PHS ANGL
PHASE ANGL VS FRQNCY

FIG Y 133

970

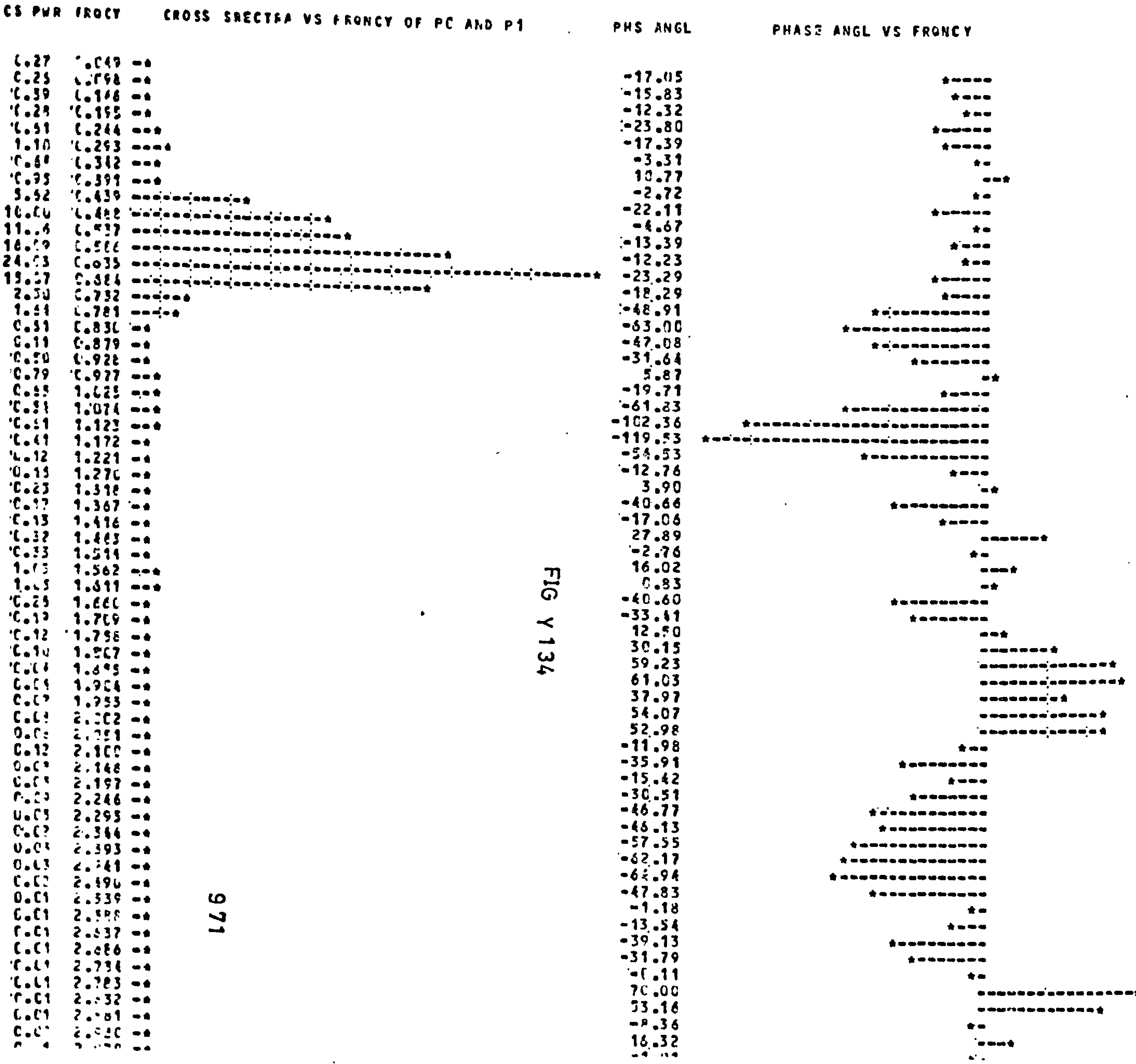

CS PWR FRQCY
CROSS SPECTRA VS FRQNCY OF PC AND P1
PHS ANGL
PHASE ANGL VS FRQNCY

FIG Y 134

971

CS PWR	FRQCY	PHS ANGL
3.83	0.049	-12.80
0.87	0.098	-0.76
3.12	0.146	29.44
3.06	0.195	55.94
4.23	0.244	22.02
6.52	0.293	-7.50
6.23	0.342	-21.74
6.49	0.391	-34.71
6.32	0.439	13.99
5.13	0.488	39.46
3.36	0.537	18.41
8.38	0.586	-19.83
8.31	0.635	-14.38
7.36	0.684	13.84
6.19	0.732	-0.67
1.78	0.781	0.26
3.24	0.830	21.93
2.99	0.879	-15.85
1.78	0.928	-35.78
1.31	0.977	0.61
0.29	1.025	-2.00
0.39	1.074	-44.63
0.85	1.123	-92.06
0.49	1.172	-79.25
0.32	1.221	-57.35
0.28	1.270	-59.51
0.15	1.318	-22.21
0.13	1.367	16.87
0.07	1.416	31.34
0.05	1.465	27.94
0.09	1.514	-13.70
0.09	1.562	-24.08
0.13	1.611	-24.91
0.12	1.660	-43.86
0.21	1.709	-2.56
0.21	1.758	16.68
0.15	1.807	3.85
0.14	1.855	-42.53
0.34	1.904	-71.38
0.35	1.953	-22.62
0.18	2.002	-19.49
0.24	2.051	-33.66
0.66	2.100	-57.59
0.64	2.148	-34.16
0.23	2.197	-6.69
0.21	2.246	6.85
0.04	2.295	21.90
0.06	2.344	-8.26
0.10	2.393	-8.75
0.05	2.441	-27.99
0.04	2.490	-26.64
0.05	2.539	-8.98
0.03	2.588	-23.90
0.02	2.637	2.11
0.03	2.686	22.23
0.03	2.734	-34.44
0.02	2.783	-45.35
0.02	2.832	-16.96
0.02	2.881	-55.85
0.01	2.930	-60.57
[illegible]	[illegible]	[illegible]

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

FIG Y13 5

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CS PWR FRQCY — CROSS SPECTRA VS FRQNCY OF PC AND P1 — PHS ANGL — PHASE ANGL VS FRQNCY

CS PWR	FRQCY	PHS ANGL
0.01	0.049	
0.01	0.098	52.37
0.00	0.146	72.73
0.00	0.195	24.77
0.00	0.244	31.34
0.00	0.293	23.39
0.00	0.342	-5.66
0.00	0.391	41.35
0.00	0.439	15.32
0.00	0.488	-16.58
0.00	0.537	21.10
0.00	0.586	-4.79
0.00	0.635	-47.01
0.00	0.684	-30.68
0.00	0.732	-26.30
0.00	0.781	-19.82
0.00	0.830	-18.84
0.00	0.879	-12.29
0.00	0.928	-0.35
0.00	0.977	-0.89
0.00	1.025	-32.72
0.04	1.074	-18.06
0.05	1.123	14.92
0.01	1.172	18.08
0.03	1.221	-5.16
0.03	1.270	-30.06
0.01	1.318	1.96
0.01	1.367	23.03
0.01	1.416	6.06
0.01	1.465	0.64
0.04	1.514	26.42
0.11	1.562	-4.44
0.12	1.611	-18.85
0.09	1.660	0.46
0.09	1.709	-3.62
0.16	1.758	0.35
0.31	1.807	-7.80
0.27	1.855	-7.56
0.10	1.904	7.91
0.13	1.953	9.89
1.91	2.002	-1.97
1.91	2.051	5.04
0.85	2.100	7.91
1.41	2.148	5.54
0.84	2.197	7.98
0.93	2.246	9.27
0.93	2.295	8.78
0.48	2.344	8.55
0.91	2.393	3.44
1.10	2.441	0.97
0.79	2.490	20.80
2.35	2.539	19.59
3.24	2.588	2.66
2.40	2.637	-4.45
1.79	2.686	-3.20
5.21	2.734	5.09
4.37	2.783	6.80
4.19	2.832	3.95
6.24	2.881	0.42
3.33	2.930	-1.05
4.11	2.979	3.83
7.77	3.027	3.76
7.30	3.076	4.32
3.58	3.125	6.81
0.32	3.174	5.76
3.30	3.223	3.97
5.70	3.271	0.55
3.46	3.320	2.92
3.16	3.369	-3.21
2.11	3.418	-6.44
0.66	3.467	-0.67
0.29	3.516	3.66
0.56	3.564	4.83
0.57	3.613	-0.80
0.95	3.662	-0.85
1.37	3.711	5.00
0.55	3.760	4.18
0.37	3.809	11.69
0.98	3.857	9.44
0.90	3.906	-0.70
0.43	3.955	-4.81
0.32	4.004	-12.61
0.19	4.053	-2.96
0.08	4.102	13.39
0.06	4.150	8.31
0.24	4.199	3.63
0.30	4.248	-1.04
0.19	4.297	-4.92
0.18	4.346	7.40
0.14	4.395	-5.63
0.08	4.443	-9.86
0.18	4.492	7.29

FIG Y 13 6

973

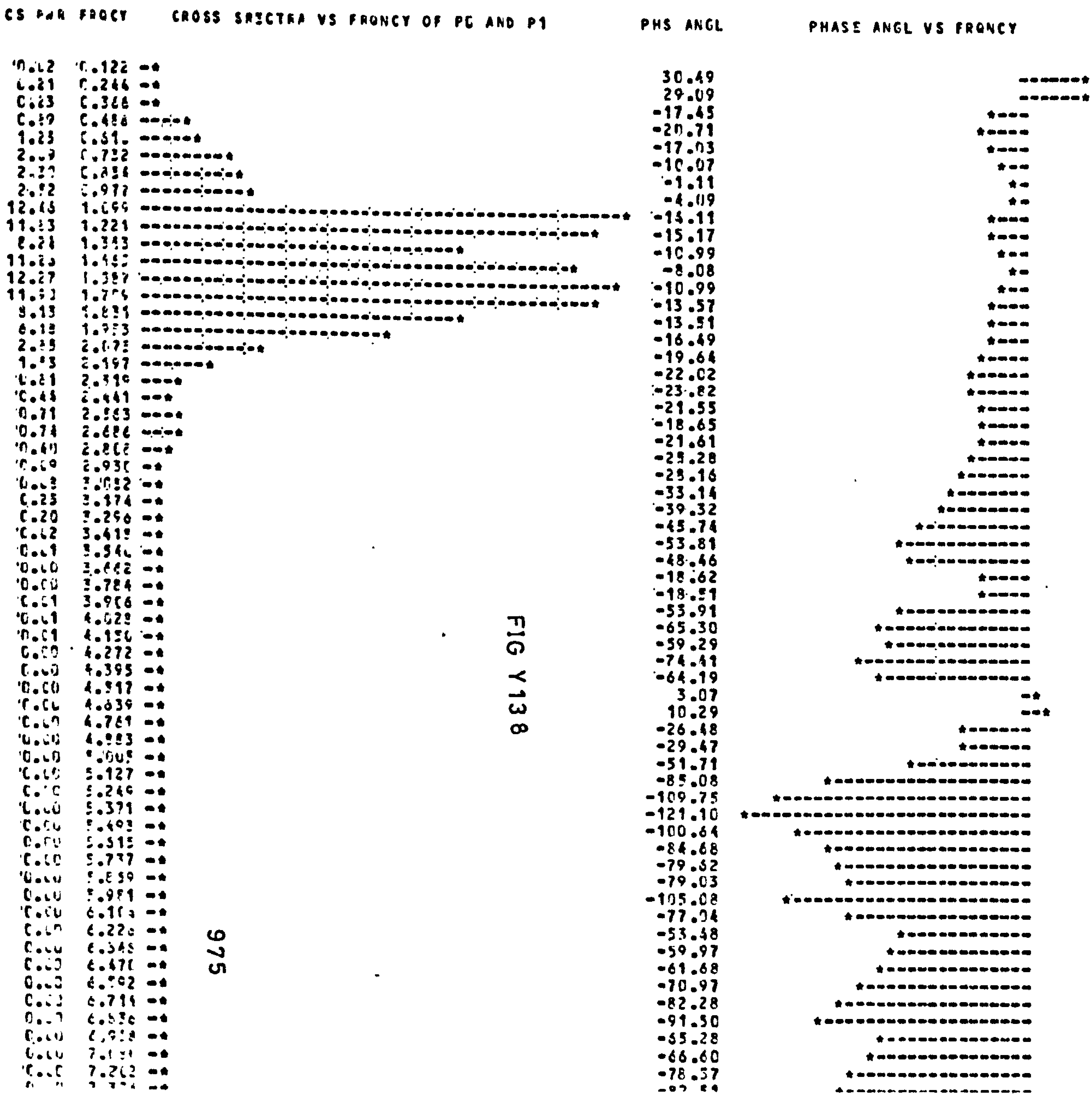
CS PWR	FRQCY	PHS ANGL
1.32	0.122	-22.40
1.96	0.244	-40.25
1.13	0.366	2.40
6.64	0.488	7.57
32.65	0.610	-8.69
30.68	0.732	-4.26
6.65	0.854	-4.60
2.70	0.977	-6.61
2.49	1.099	-6.13
2.29	1.221	-0.42
0.50	1.343	2.65
2.79	1.465	-12.44
2.94	1.587	-16.32
0.78	1.709	-13.26
0.66	1.831	-1.47
0.17	1.953	10.88
0.31	2.075	-3.97
0.53	2.197	-11.69
0.37	2.319	-12.96
0.40	2.441	-18.05
0.40	2.563	-21.75
0.27	2.686	-40.19
0.29	2.808	-39.25
0.25	2.930	-20.56
0.15	3.052	-39.07
0.09	3.174	-39.40
0.11	3.296	-32.58
0.08	3.418	-38.38
0.10	3.540	-44.36
0.06	3.662	-70.35
0.03	3.784	-73.79
0.02	3.906	-34.68
0.00	4.028	11.89
0.00	4.150	4.91
0.00	4.272	-31.19
0.00	4.395	-1.92
0.00	4.517	-18.41
0.00	4.639	-39.76
0.00	4.761	-38.82
0.00	4.883	-88.32
0.00	5.005	-114.27
0.00	5.127	-79.70
0.00	5.249	-20.32
0.00	5.371	-2.05
0.00	5.493	-4.05
0.00	5.615	-25.31
0.00	5.737	-39.41
0.00	5.859	-67.87
0.00	5.981	-102.43
0.00	6.104	-82.80
0.00	6.226	-59.01
0.00	6.348	-24.61
0.00	6.470	-30.76
0.00	6.592	-75.41
0.00	6.714	-44.96
0.00	6.836	-54.55
0.00	6.958	-76.05
0.00	7.080	-66.96
0.00	7.202	-38.71
[illegible]	7.324	[illegible]

CROSS SPECTRA VS FRQNCY OF PC AND P1

PHASE ANGL VS FRQNCY

FIG Y 137

974



CS PWR FRQCY
CROSS SPECTRA VS FRQNCY OF PC AND P1
PHS ANGL
PHASE ANGL VS FRQNCY

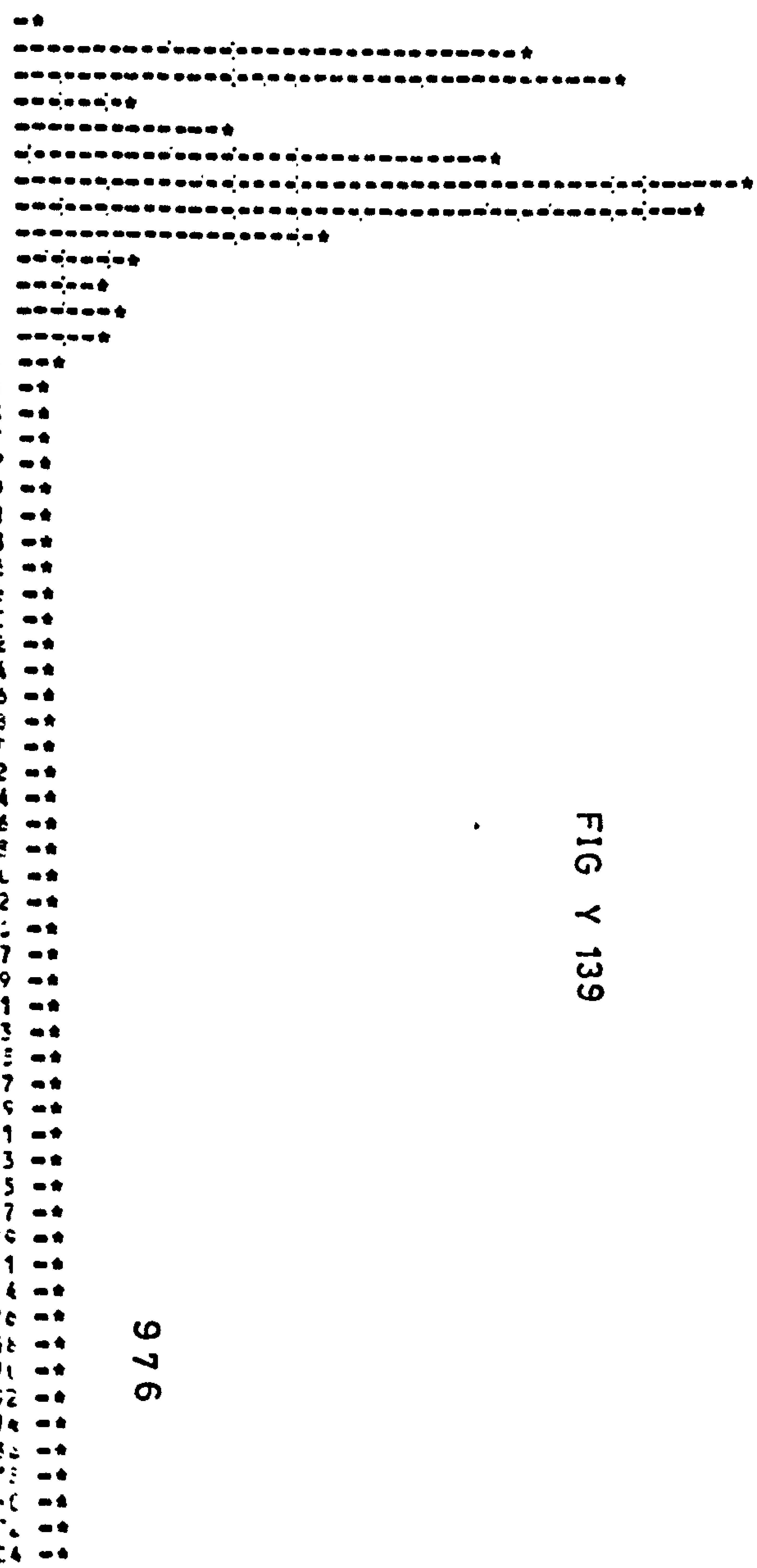
FIG Y13 8

975

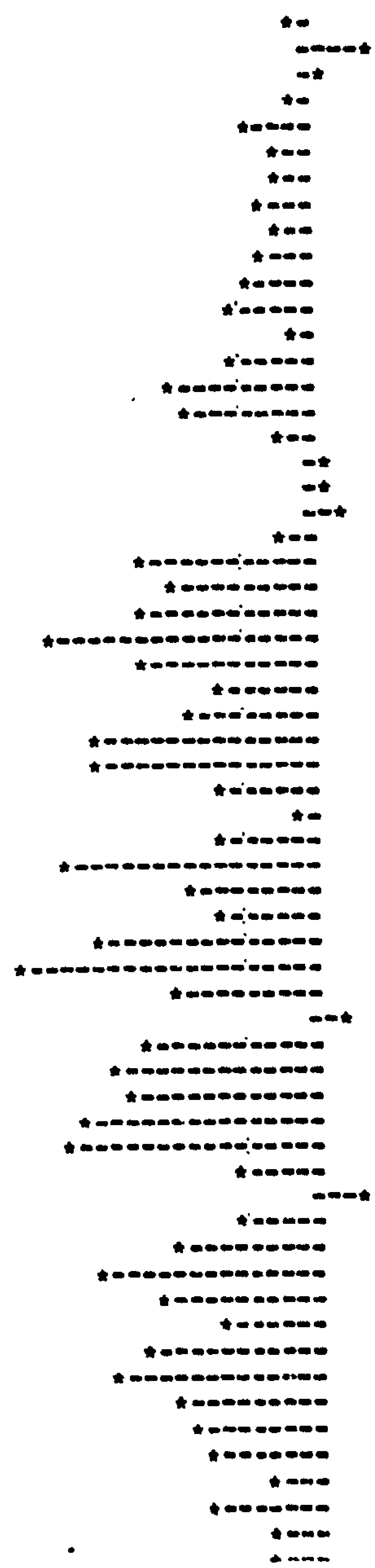
FIG Y 139

CS PWR	FRQCY	PHS ANGL
0.08	0.122	-3.47
12.31	0.244	17.16
15.31	0.366	2.70
2.55	0.488	-7.18
5.7	0.610	-17.18
11.77	0.732	-12.37
18.21	0.854	-9.99
17.17	0.977	-12.74
7.51	1.099	-10.40
2.64	1.221	-12.81
1.37	1.343	-20.85
2.23	1.465	-22.97
1.74	1.587	-8.11
0.46	1.709	-24.68
0.13	1.831	-41.62
0.13	1.953	-34.02
0.14	2.075	-10.19
0.14	2.197	3.08
0.05	2.319	0.04
0.04	2.441	8.47
0.02	2.563	-10.45
0.01	2.686	-45.94
0.01	2.808	-41.53
0.01	2.930	-49.22
0.01	3.052	-72.62
0.01	3.174	-47.75
0.03	3.296	-23.48
0.03	3.418	-33.20
0.02	3.540	-58.80
0.02	3.662	-59.67
0.02	3.784	-25.89
0.01	3.906	-7.34
0.01	4.028	-25.90
0.01	4.150	-68.46
0.00	4.272	-37.32
0.00	4.394	-27.53
0.00	4.517	-62.01
0.00	4.639	-81.30
0.00	4.761	-37.80
0.00	4.883	11.04
0.00	5.005	-49.40
0.00	5.127	-58.44
0.00	5.249	-52.99
0.00	5.371	-64.18
0.00	5.493	-67.75
0.00	5.615	-23.53
0.00	5.737	15.78
0.00	5.859	-21.16
0.00	5.981	-38.90
0.00	6.104	-59.85
0.00	6.226	-45.95
0.00	6.348	-26.91
0.00	6.470	-48.58
0.00	6.592	-77.26
0.00	6.714	-39.82
0.00	6.836	-37.54
0.00	6.958	-30.77
0.00	7.080	-11.08
0.00	7.202	-32.57
0.00	7.324	-16.33
[illegible]	7.446	-42.50

CROSS SPECTRA VS FRQNCY OF PC AND P1



PHASE ANGL VS FRQNCY



976

CS PWR	FRQCY	CROSS SPECTRA VS FRQNCY OF PC AND P1	PHS ANGL	PHASE ANGL VS FRQNCY
4.20	0.122		-23.01	
12.39	0.244		23.65	
38.44	0.366		39.25	
30.95	0.488		52.65	
7.24	0.610		54.17	
4.90	0.732		35.29	
1.10	0.854		36.41	
0.35	0.977		33.69	
0.13	1.099		8.92	
0.08	1.221		4.13	
0.04	1.343		-0.53	
0.03	1.465		4.71	
0.02	1.587		-51.99	
0.02	1.709		-14.86	
0.01	1.831		42.28	
0.01	1.953		-23.91	
0.01	2.075		-22.50	
0.00	2.197		11.52	
0.01	2.319		7.21	
0.00	2.441		-17.27	
0.00	2.563		-59.43	
0.00	2.686		-64.89	
0.00	2.808		-9.47	
0.00	2.930		40.31	
0.00	3.052		5.85	
0.00	3.174		-36.08	
0.00	3.296		-1.65	
0.00	3.418		6.37	
0.00	3.540		24.82	
0.00	3.662		48.53	
0.00	3.784		17.95	
0.00	3.906		-9.13	
0.00	4.028		-13.53	
0.00	4.150		2.60	
0.00	4.272		16.73	
0.00	4.395		-13.29	
0.00	4.517		-8.45	
0.00	4.639		52.91	
0.00	4.761		24.74	
0.00	4.883		14.63	
0.00	5.005		14.71	
0.00	5.127		-32.36	
0.00	5.249		-23.30	
0.00	5.371		-18.66	
0.00	5.493		-26.76	
0.00	5.615		-33.27	
0.00	5.737		-86.31	
0.00	5.859		-53.54	
0.00	5.981		24.88	
0.00	6.104		-50.99	
0.00	6.226		-52.89	
0.00	6.348		30.23	
0.00	6.470		19.07	
0.00	6.592		-17.92	
0.00	6.714		11.79	
0.00	6.836		3.08	
0.00	6.958		-28.04	
0.00	7.080		-16.37	
0.00	7.202		17.84	
0.00	7.324		33.43	
[illegible]	[illegible]		[illegible]	

FIG Y140

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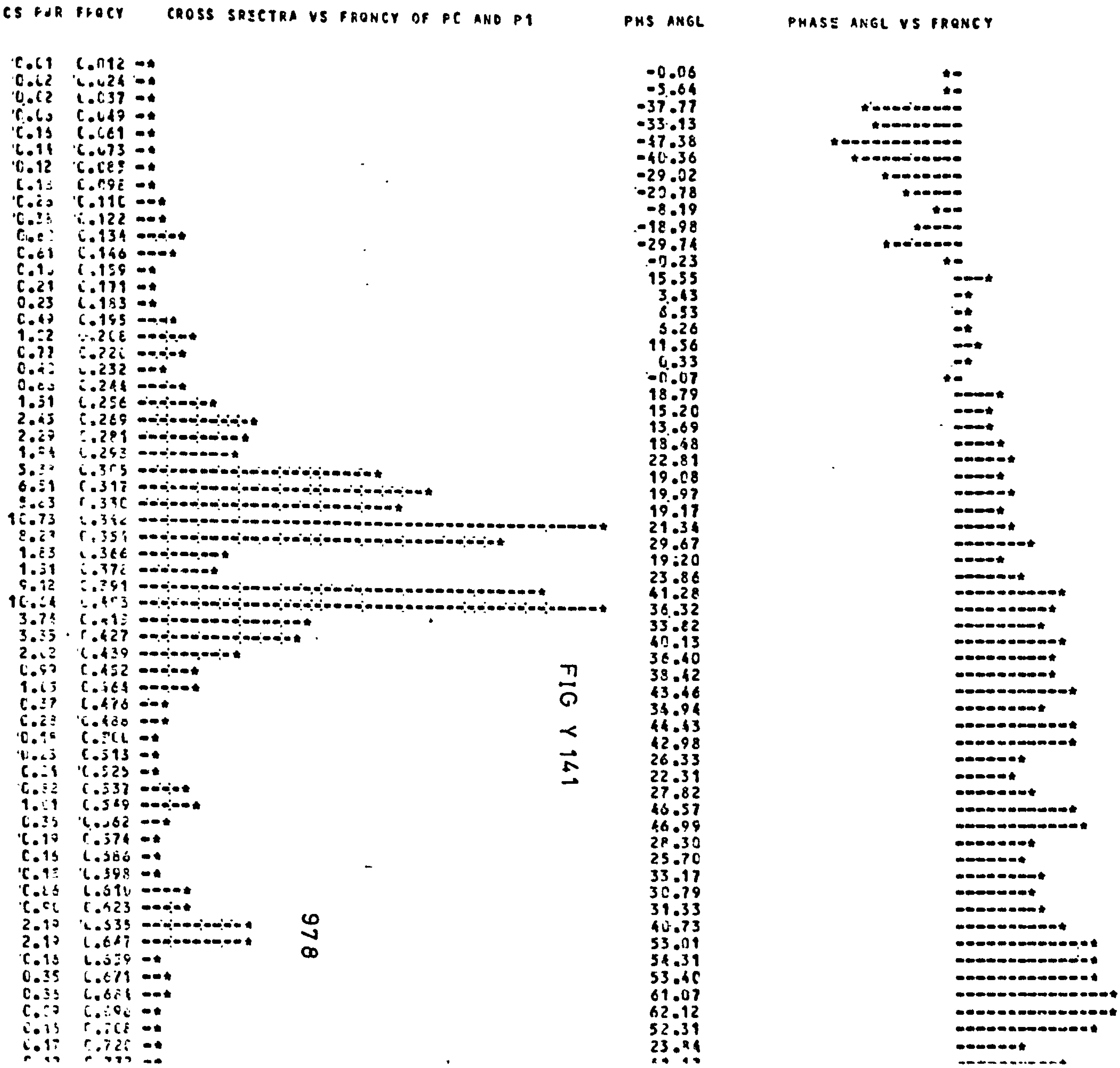
CS PWR FRQCY
CROSS SPECTRA VS FRQNCY OF PC AND P1
PHS ANGL
PHASE ANGL VS FRQNCY

FIG Y 141

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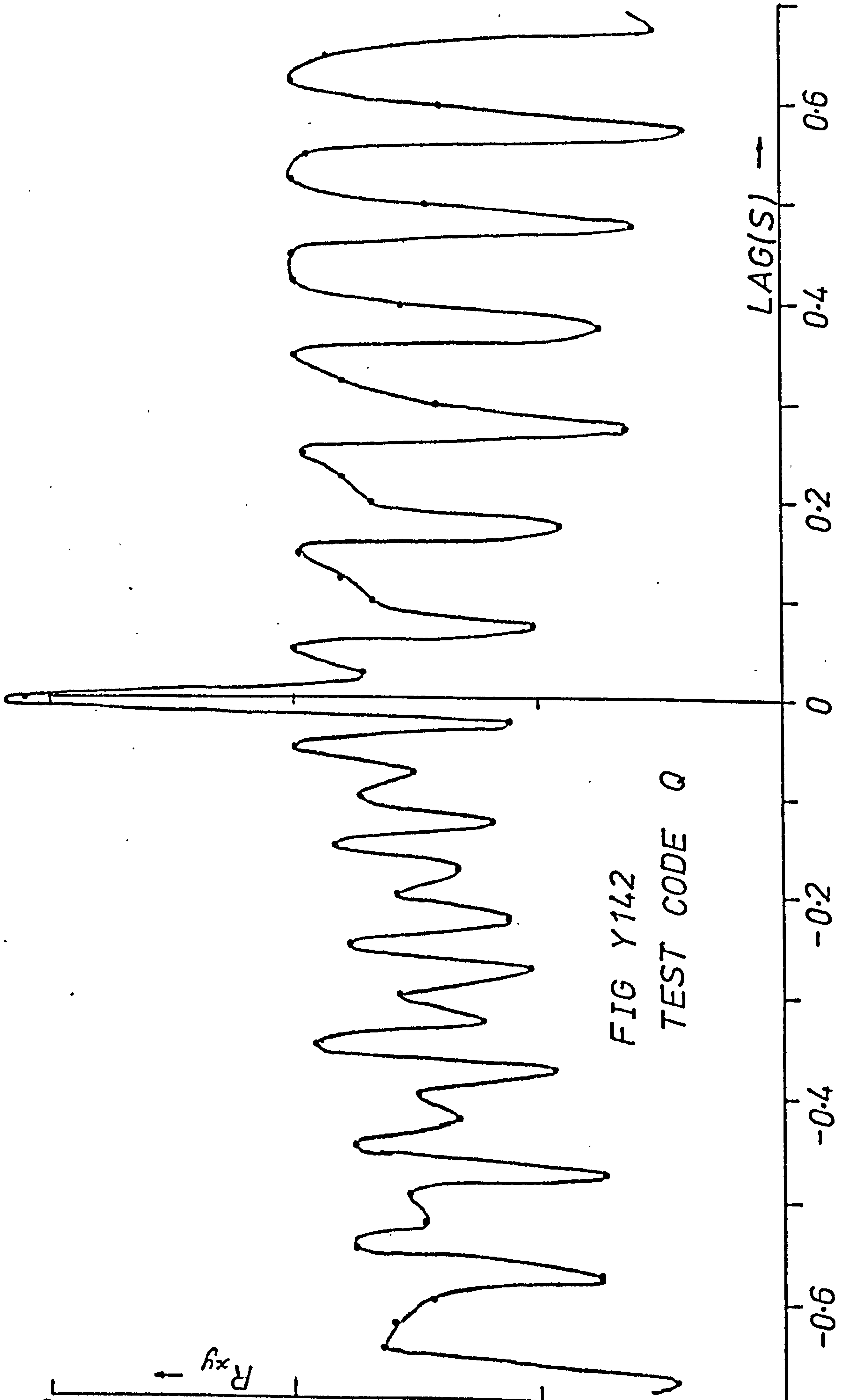


FIG Y142
TEST CODE Q

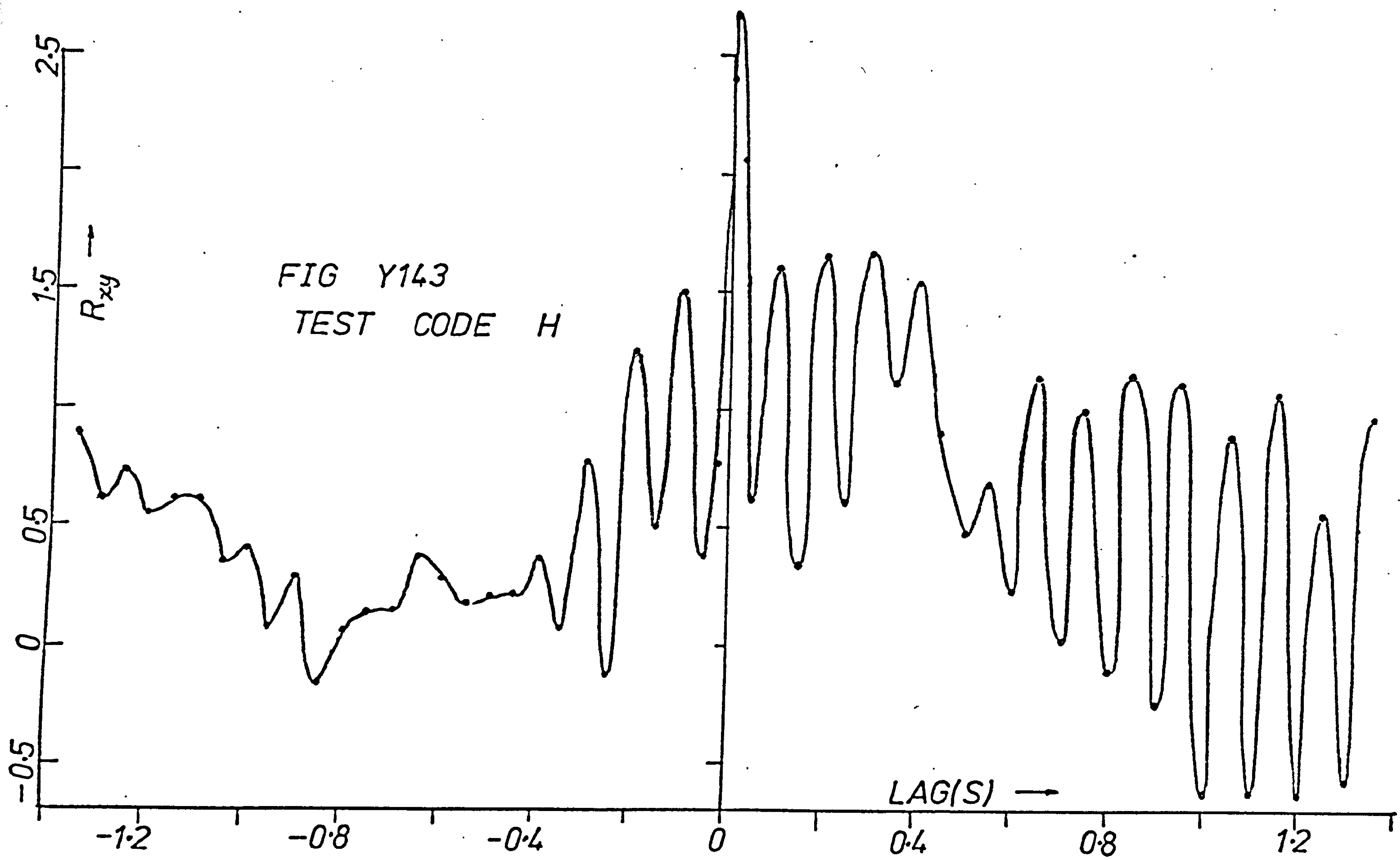


FIG Y143
TEST CODE H

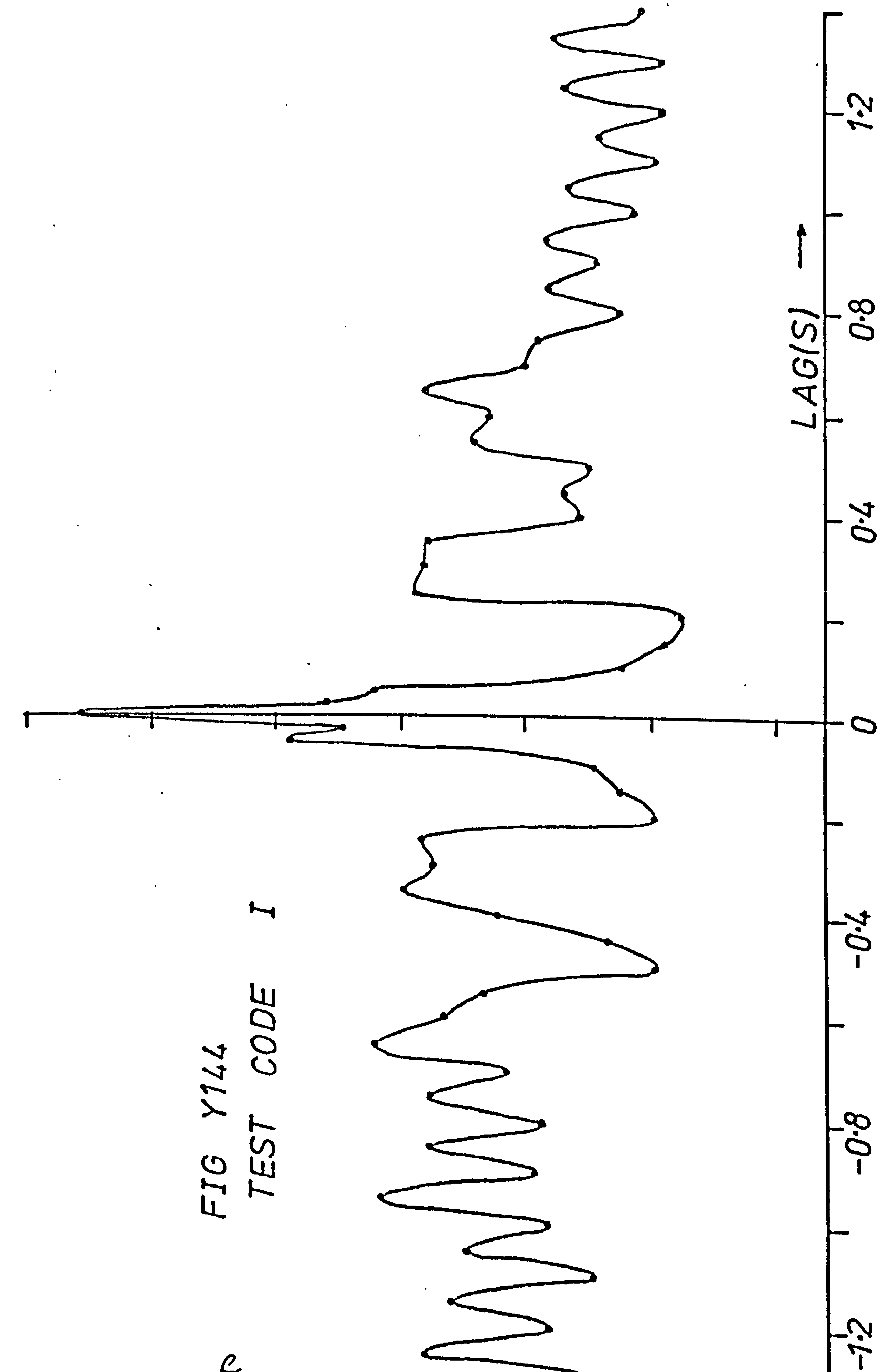


FIG Y144
TEST CODE I

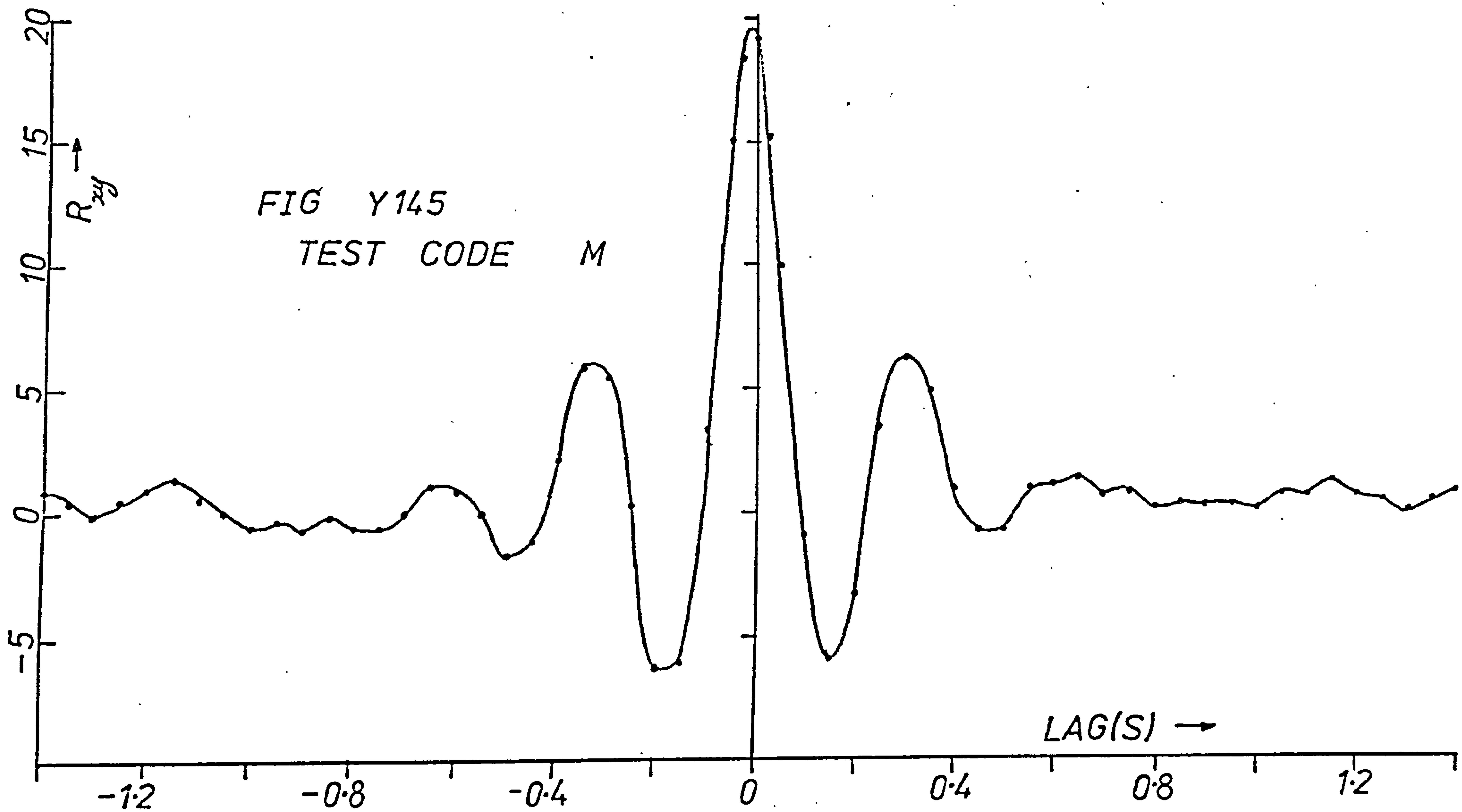


FIG Y145
TEST CODE M

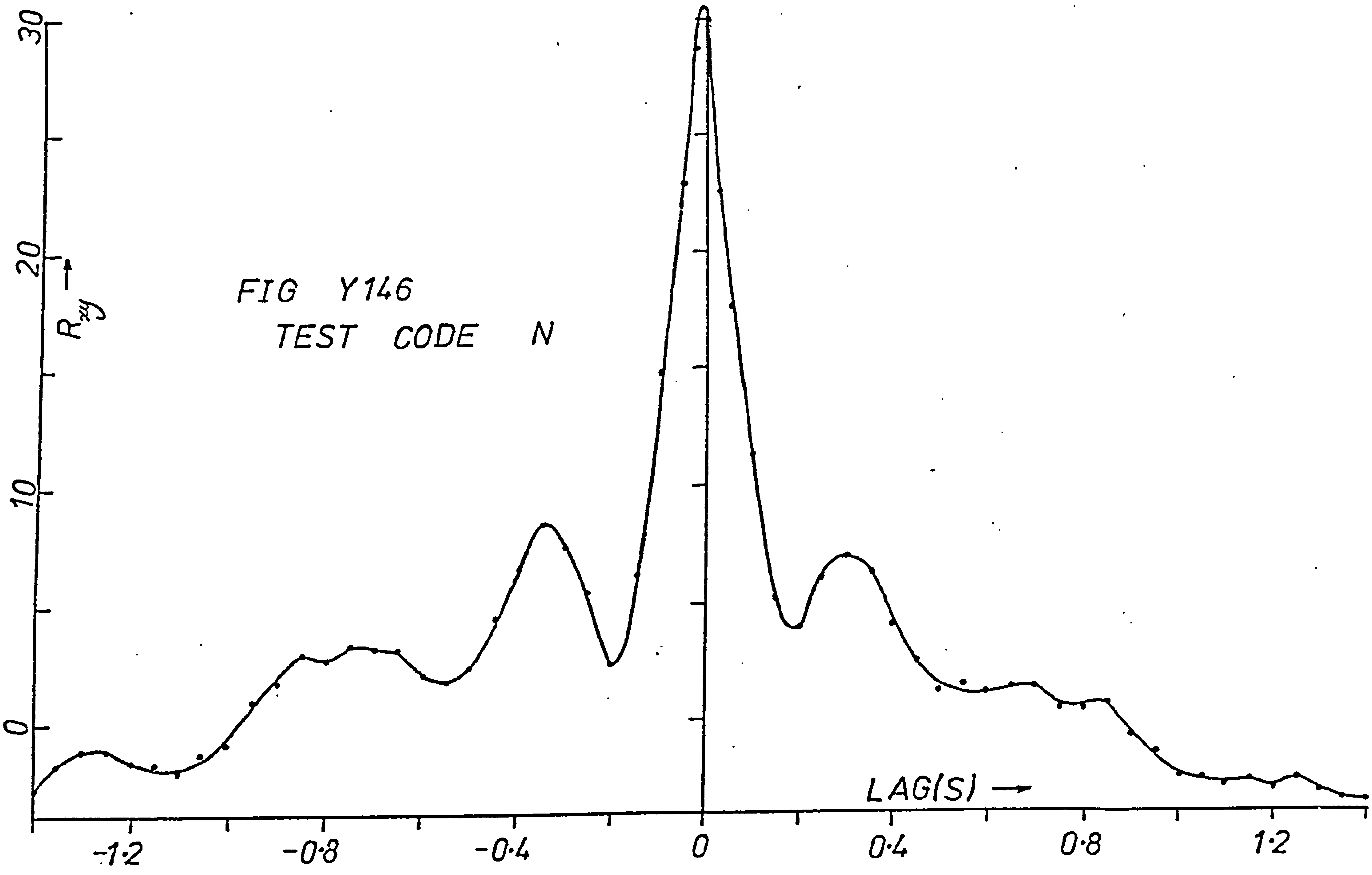


FIG Y146
TEST CODE N
R_{xy}
30
20
10
0
-1·2
-0·8
-0·4
0
0·4
0·8
1·2
LAG(S)

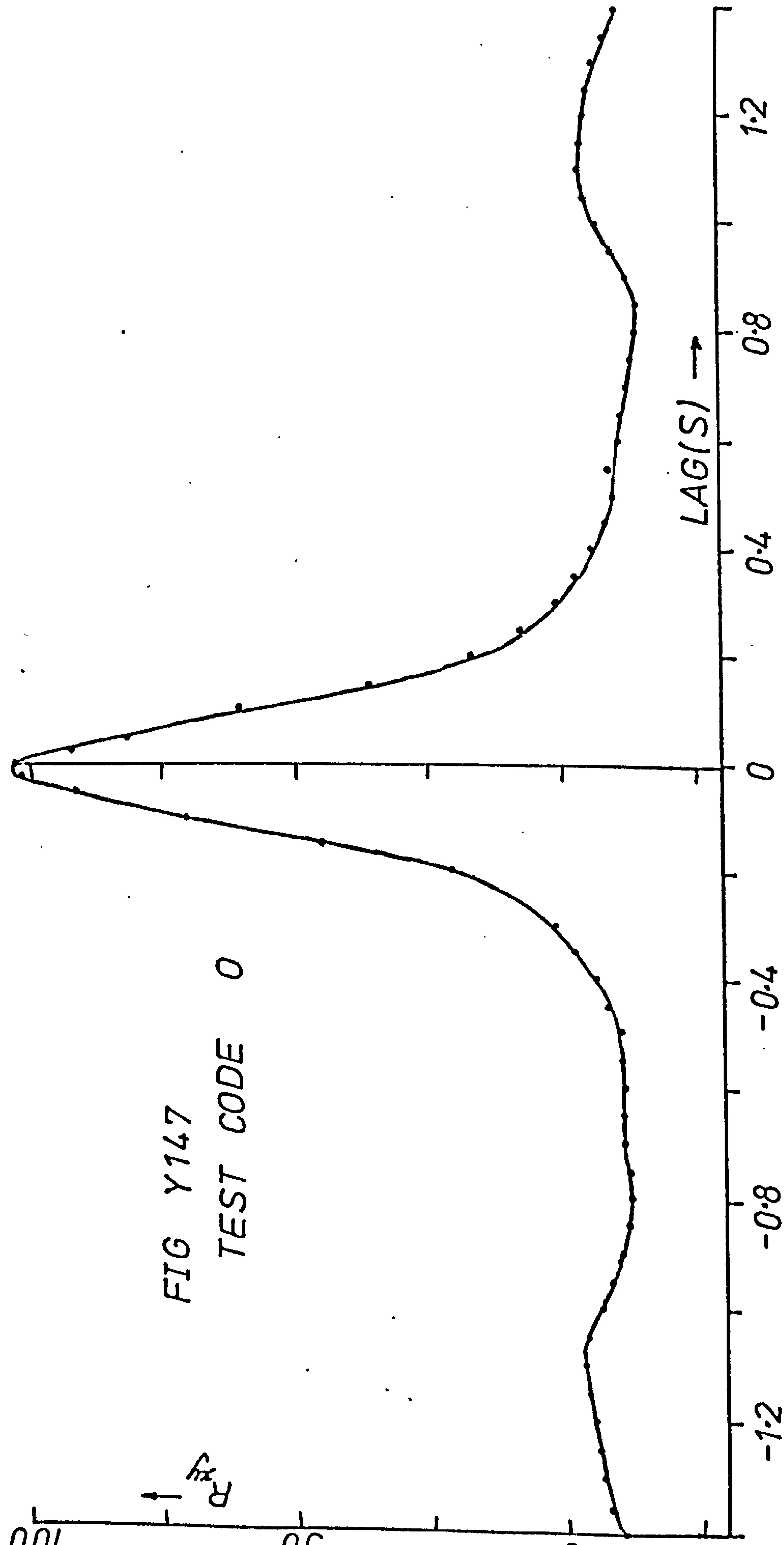


FIG Y147
TEST CODE 0

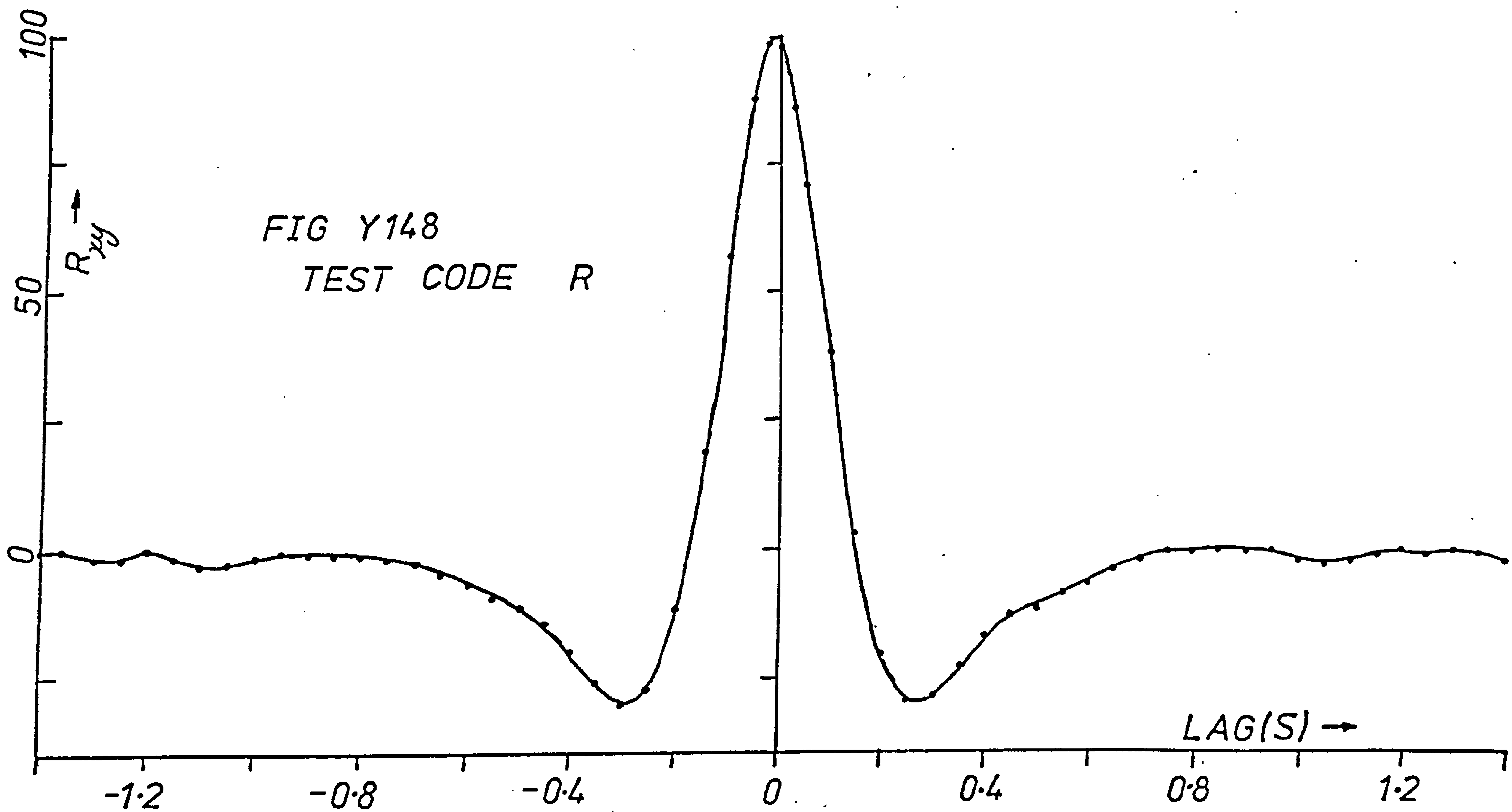


FIG Y148
TEST CODE R

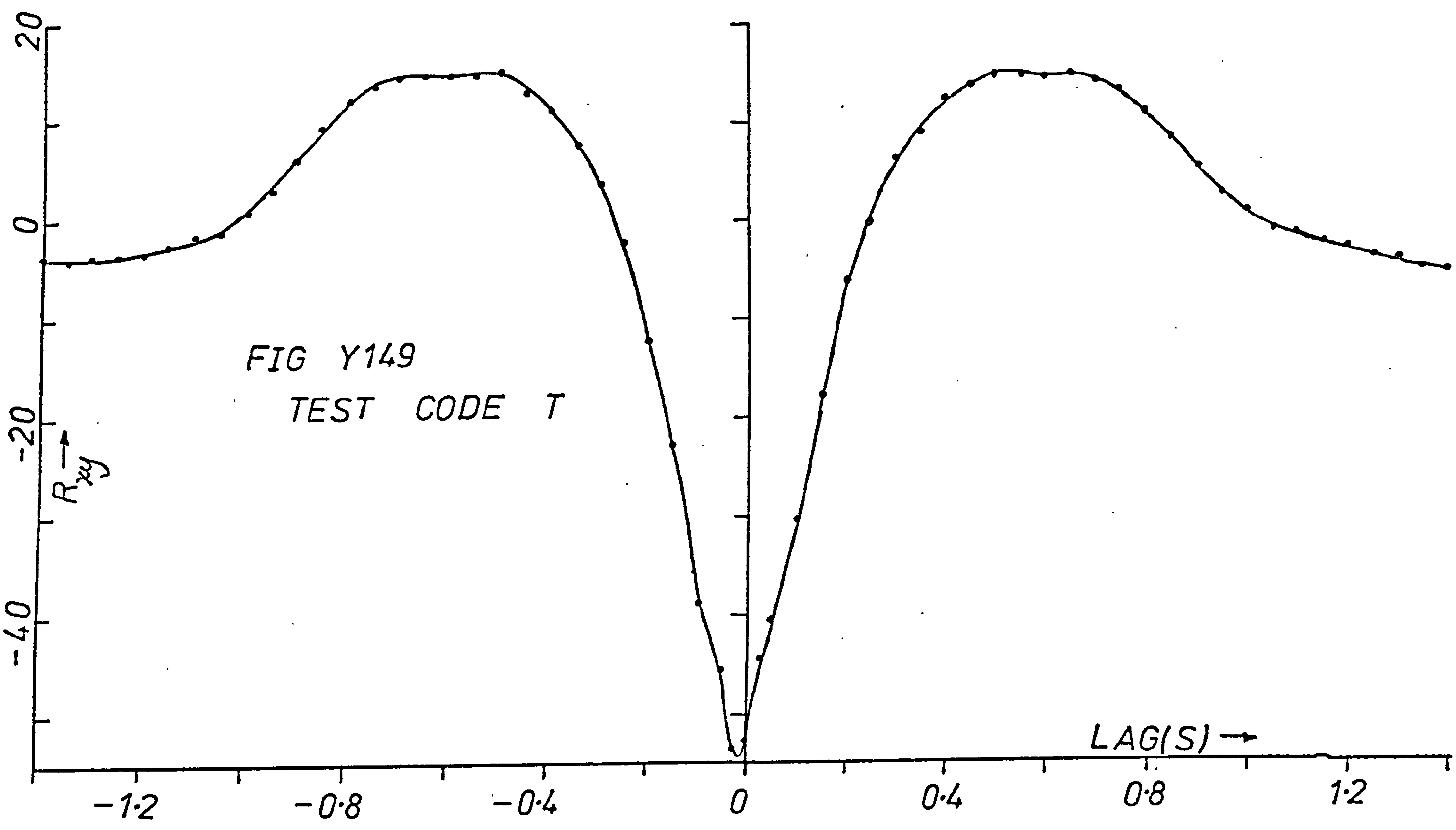


FIG Y149
TEST CODE T
R_{xy} →
20
0
-20
-40
LAG(S) →
-1·2
-0·8
-0·4
0
0·4
0·8
1·2

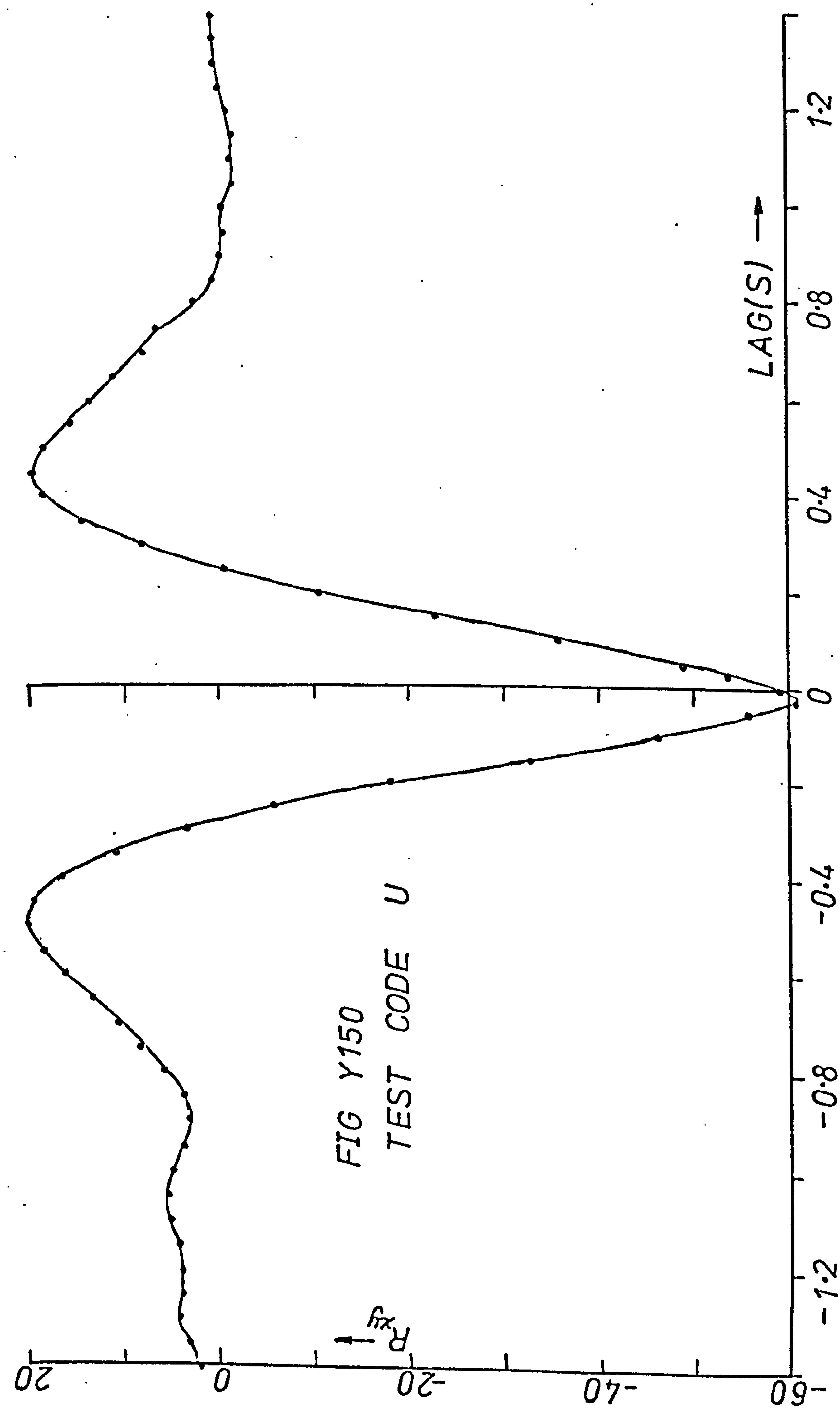


FIG Y150
TEST CODE U
LAG(S) →
R_xy
-1·2
-0·8
-0·4
0
0·4
0·8
1·2
20
0
-20
-40
-60

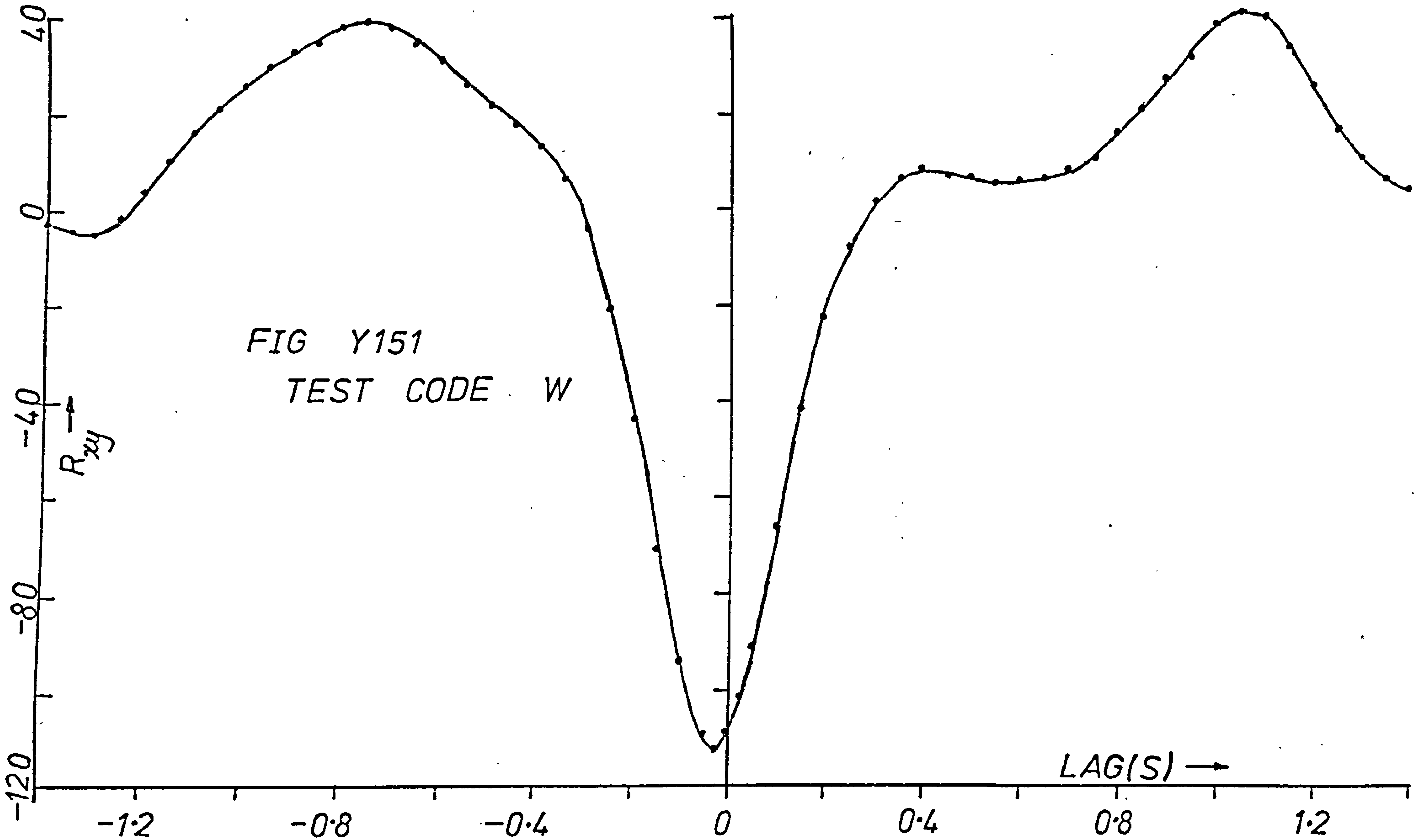


FIG Y151
TEST CODE W

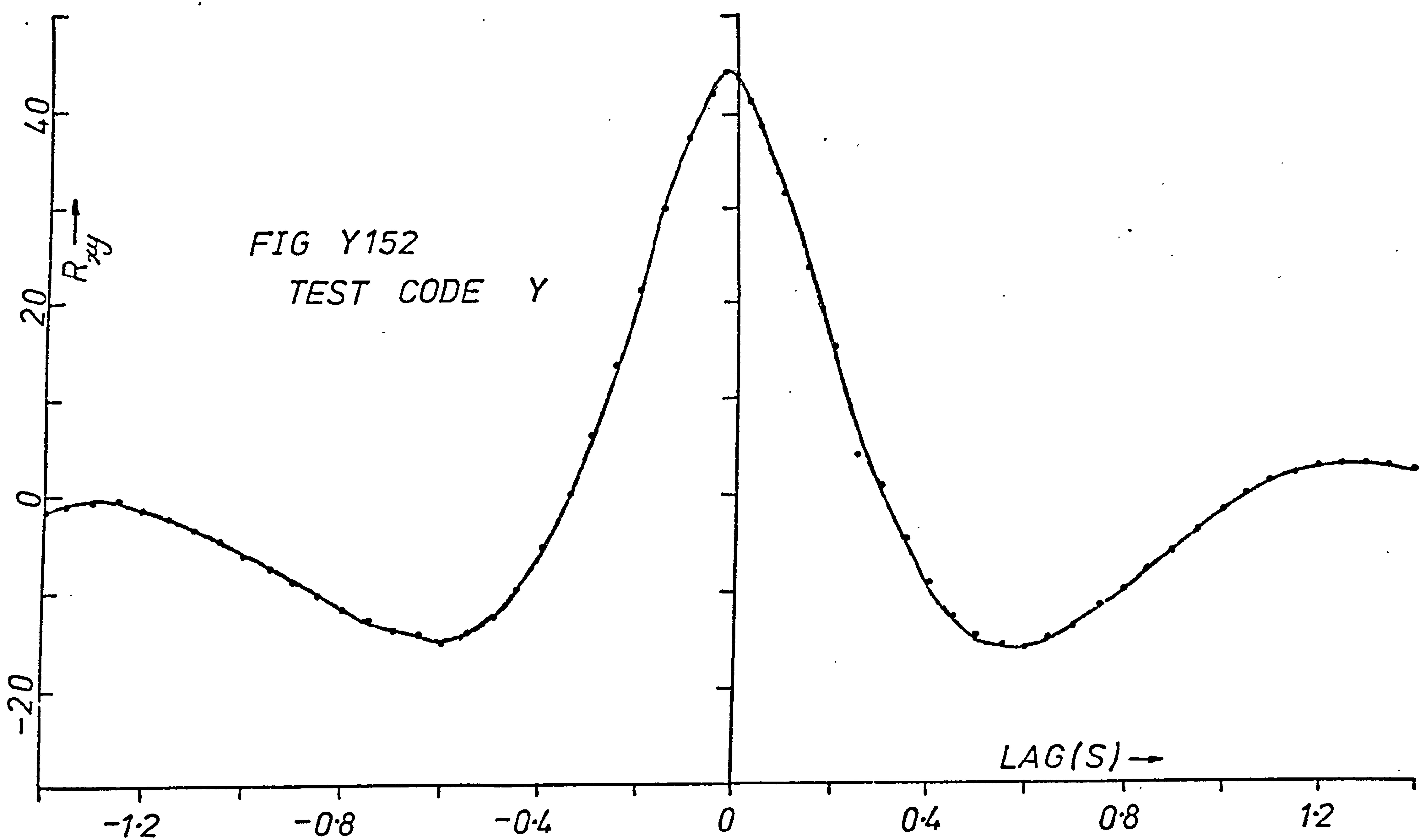


FIG Y152
TEST CODE Y

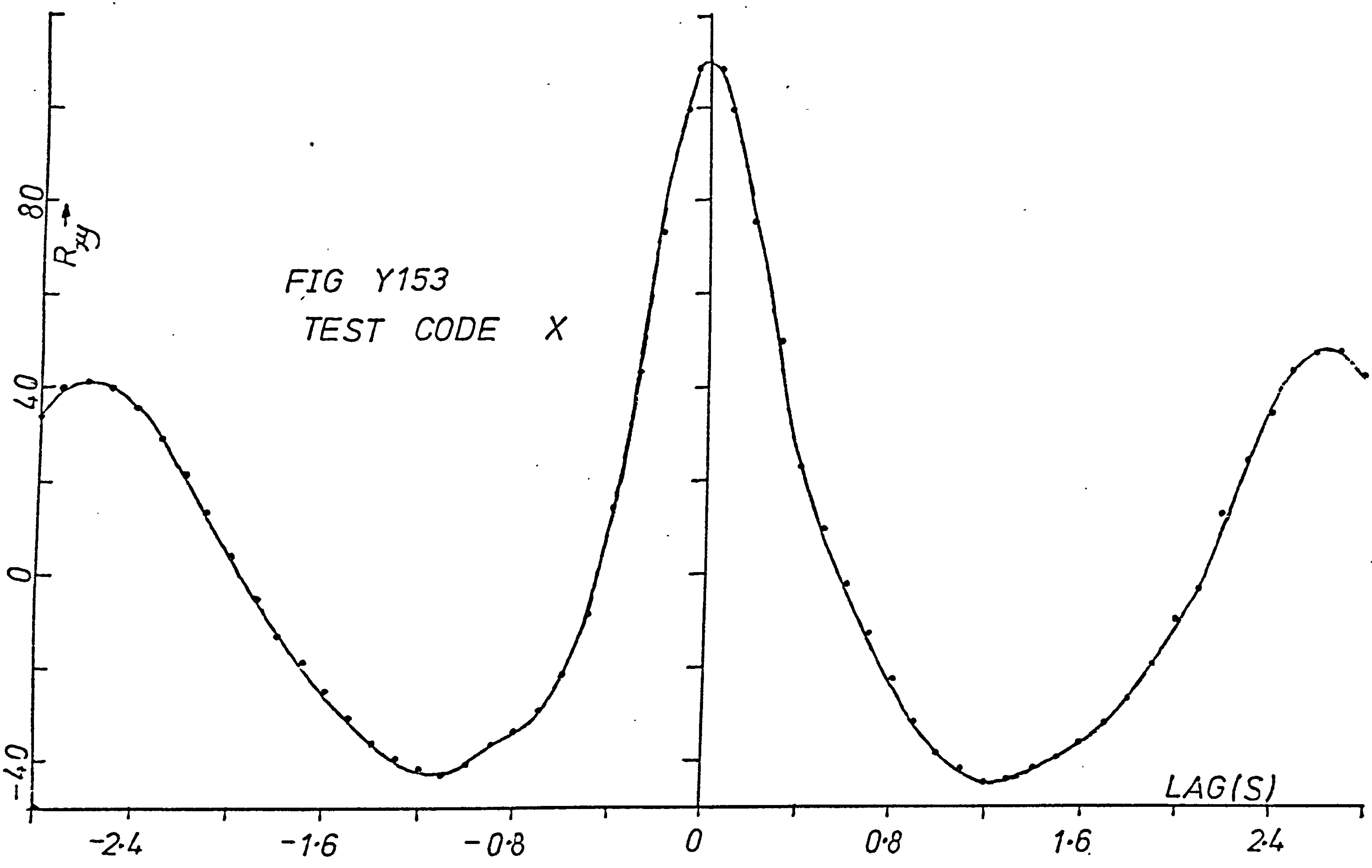


FIG Y153
TEST CODE X

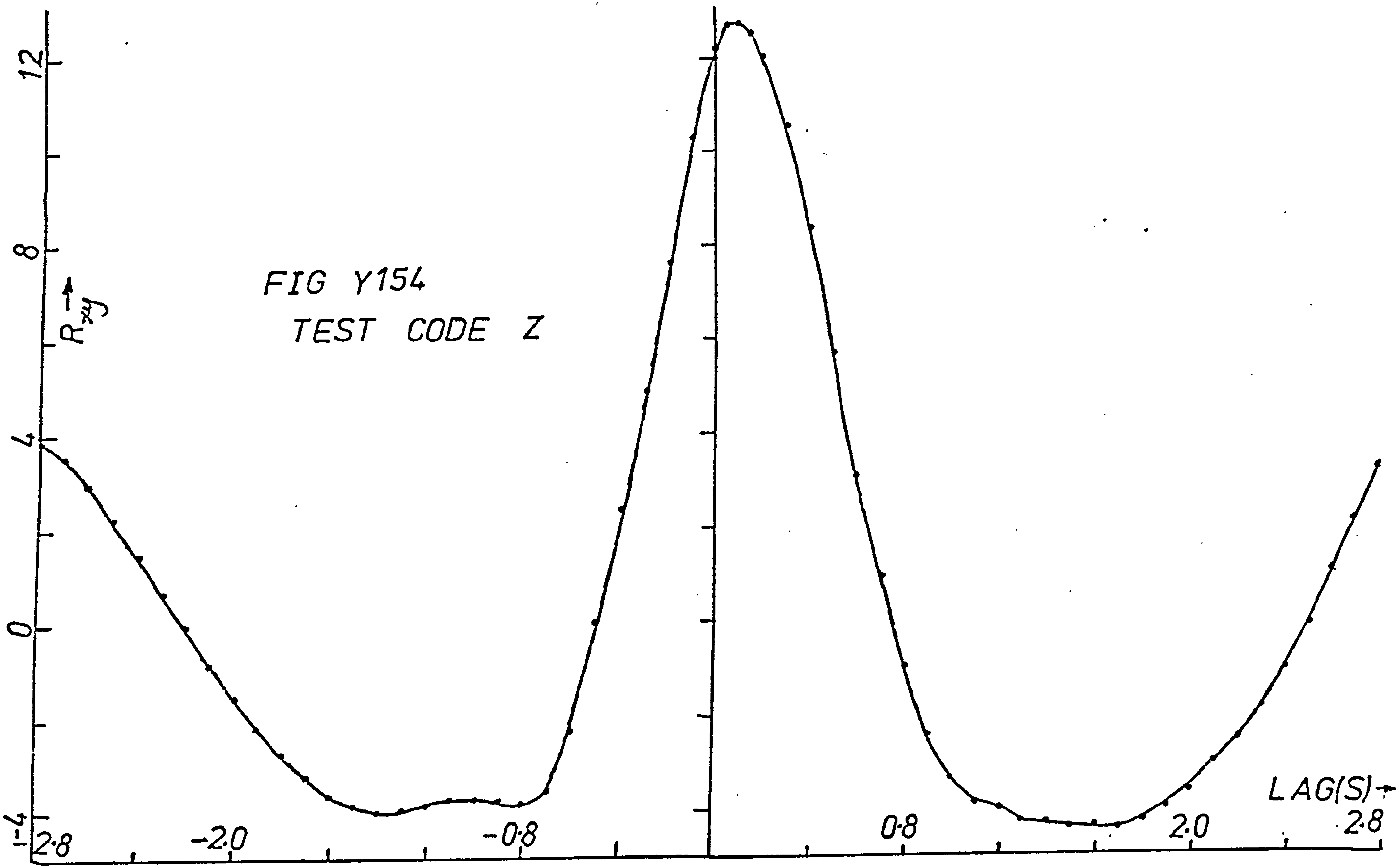


FIG Y154
TEST CODE Z

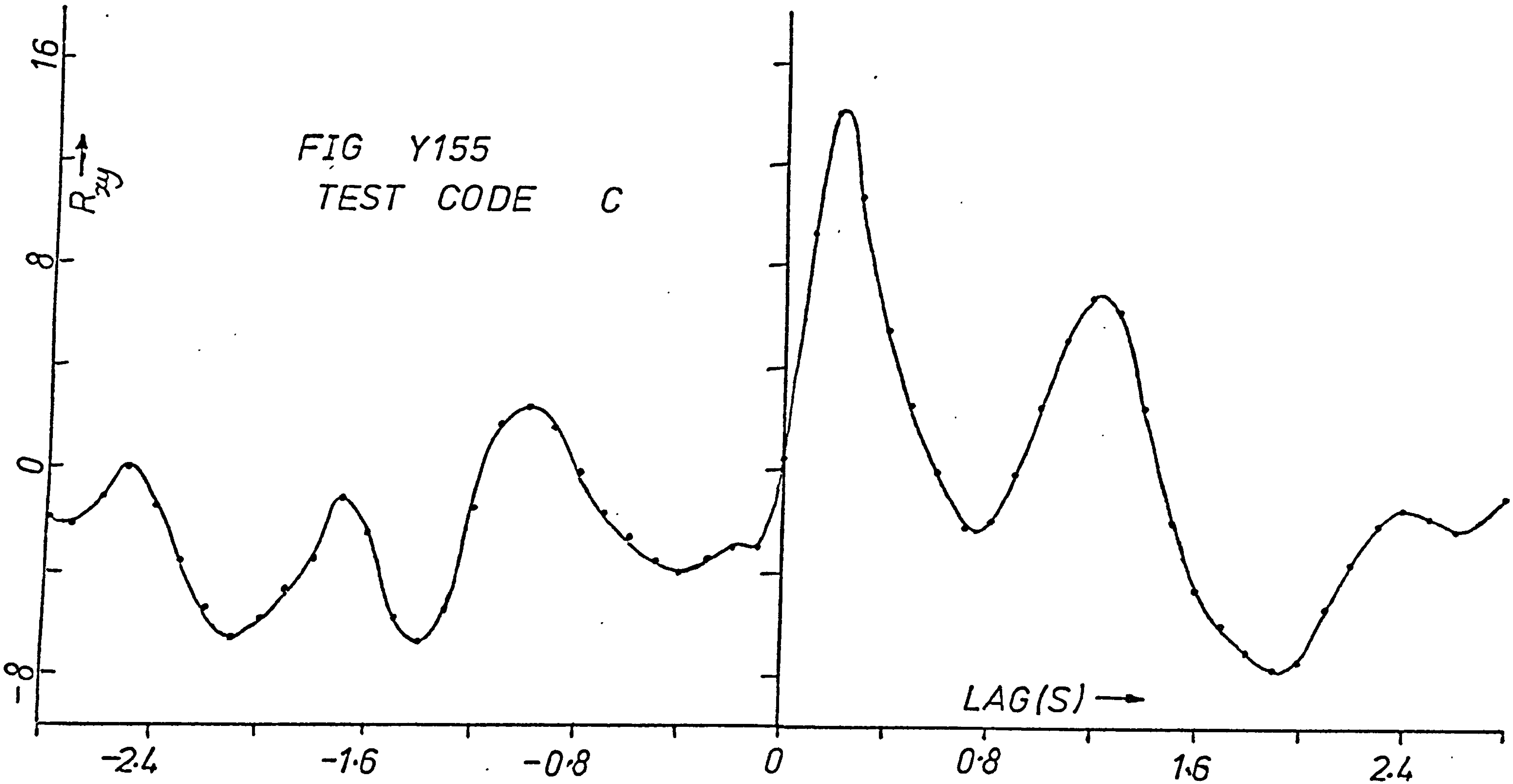


FIG Y155
TEST CODE C

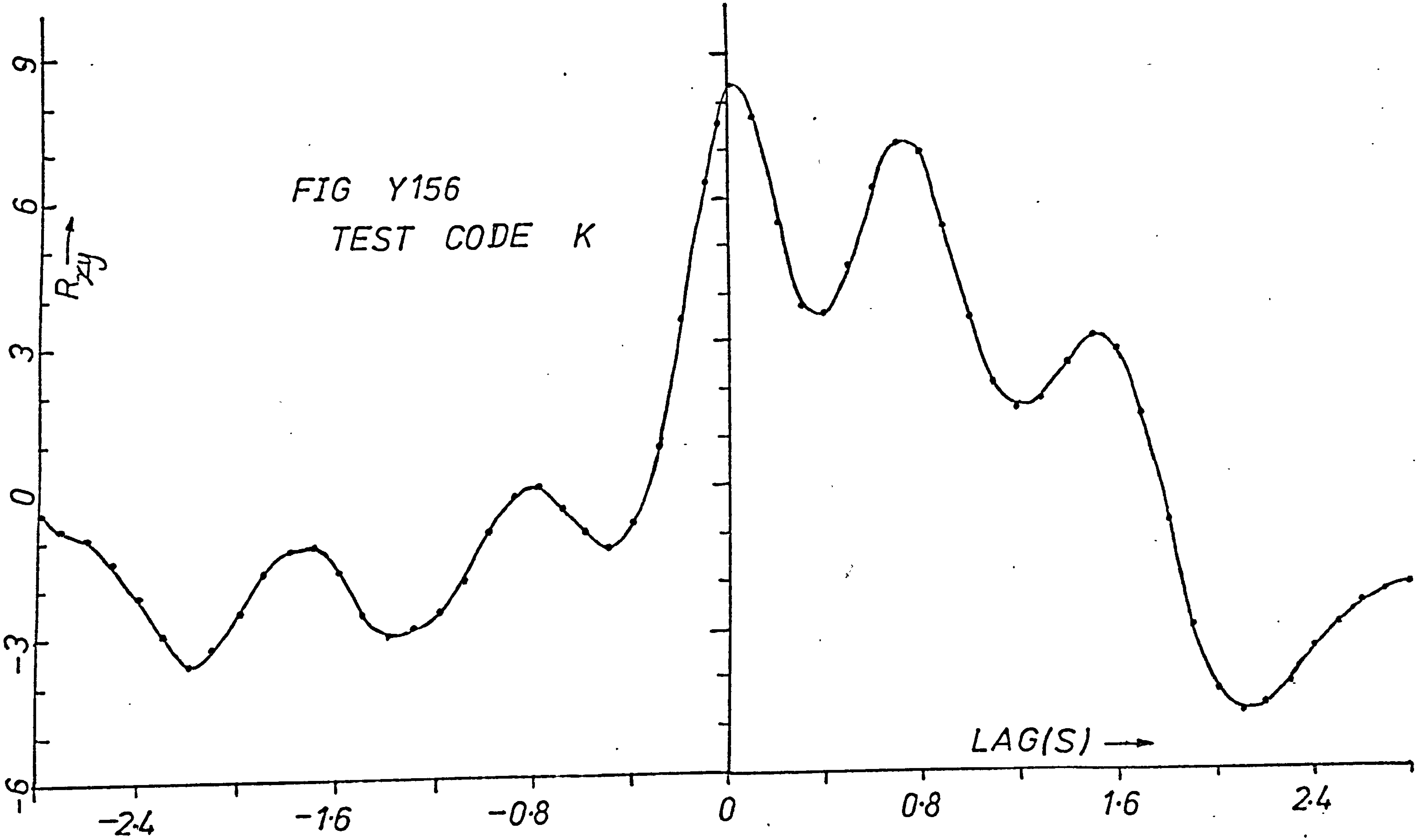


FIG Y156
TEST CODE K

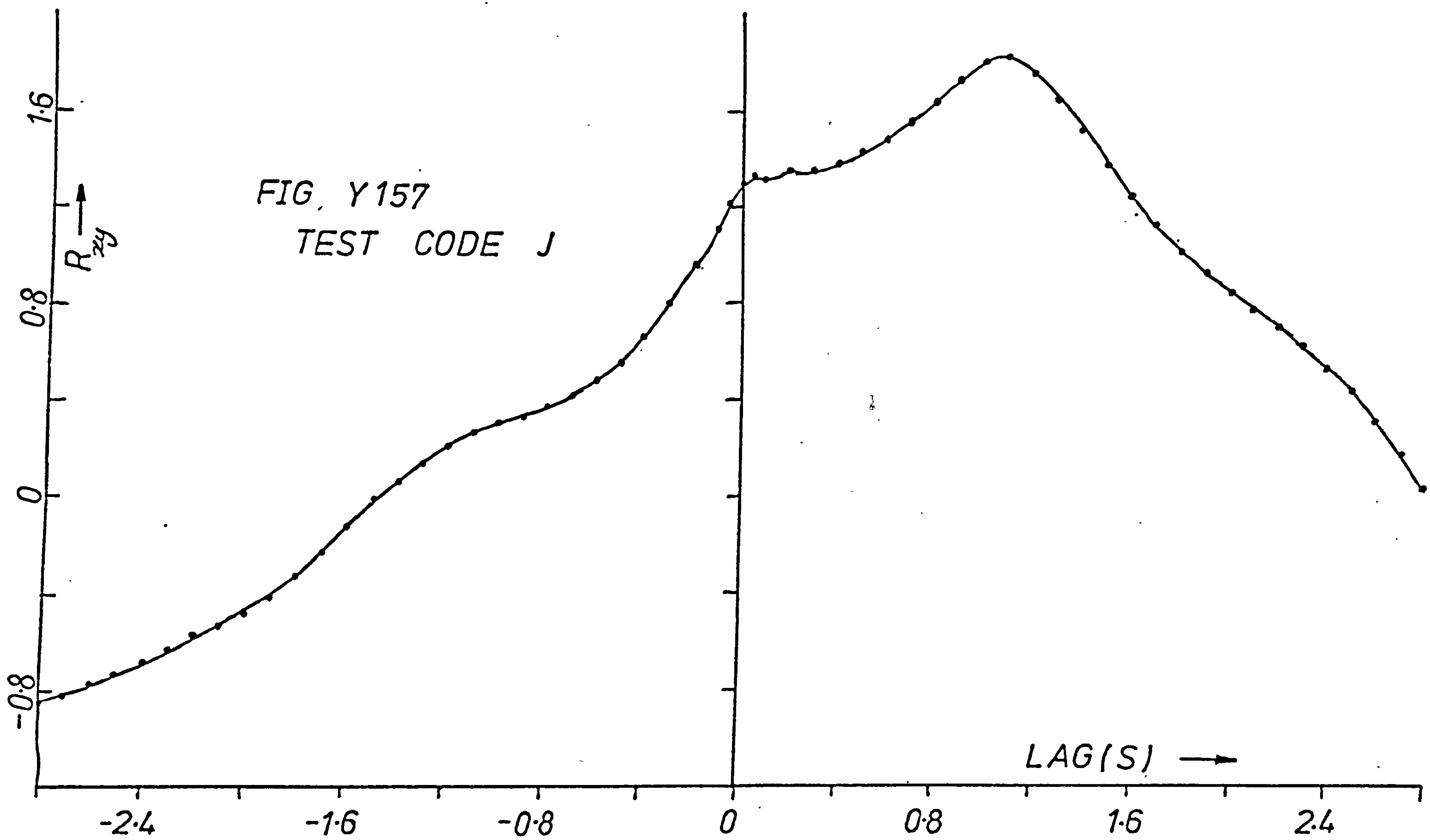


FIG. Y157
TEST CODE J

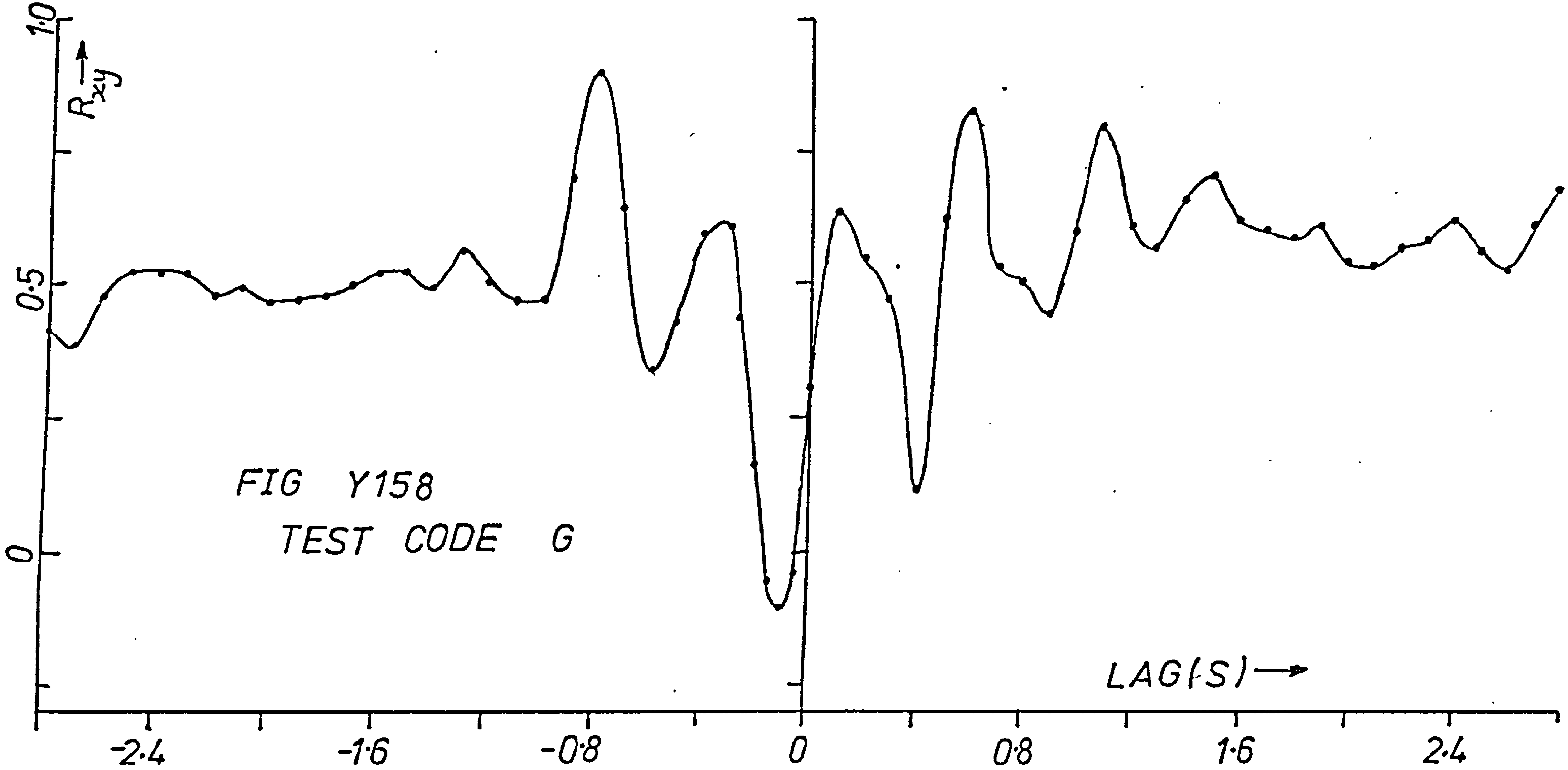


FIG Y158
TEST CODE G

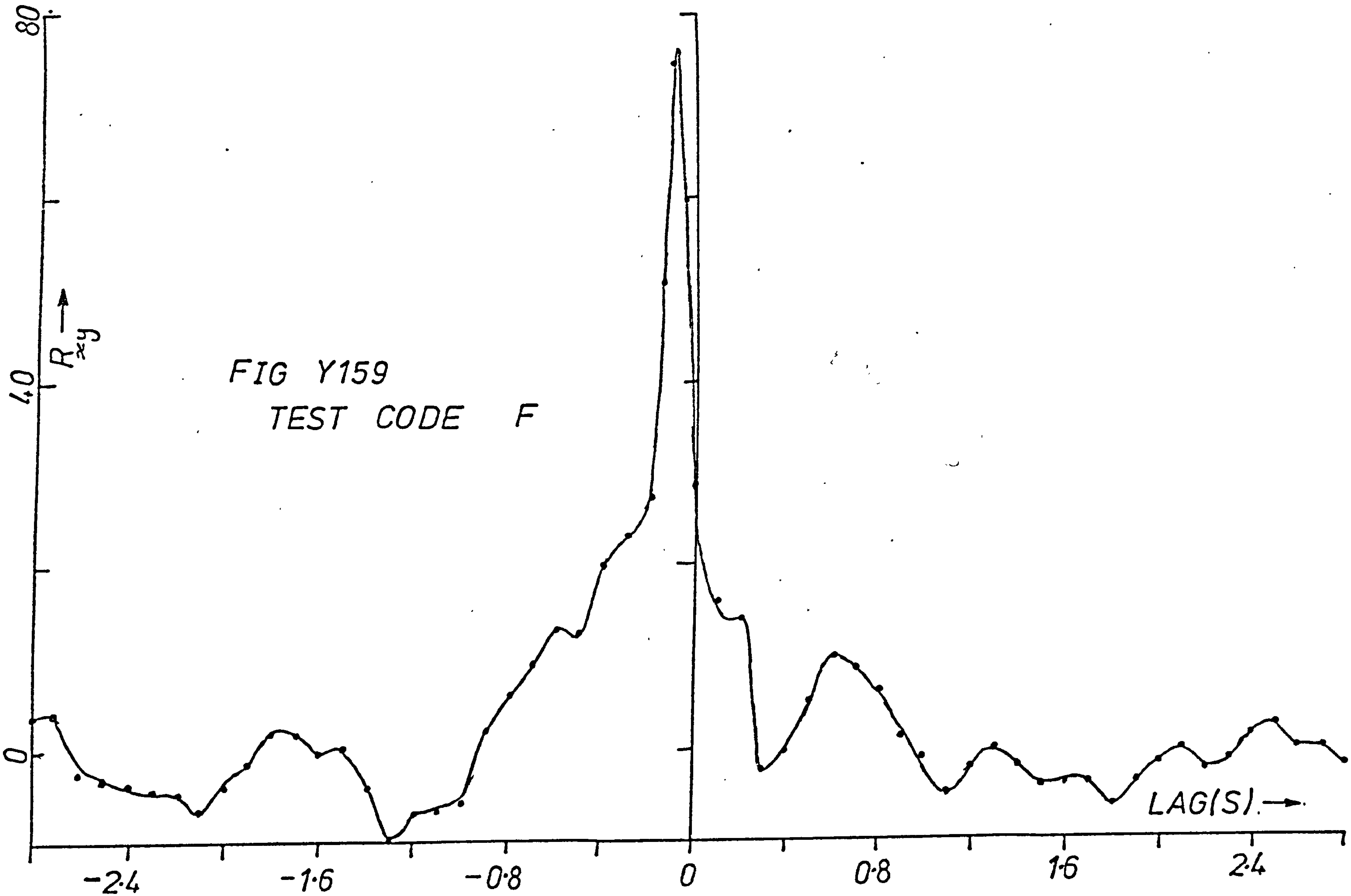


FIG Y159
TEST CODE F

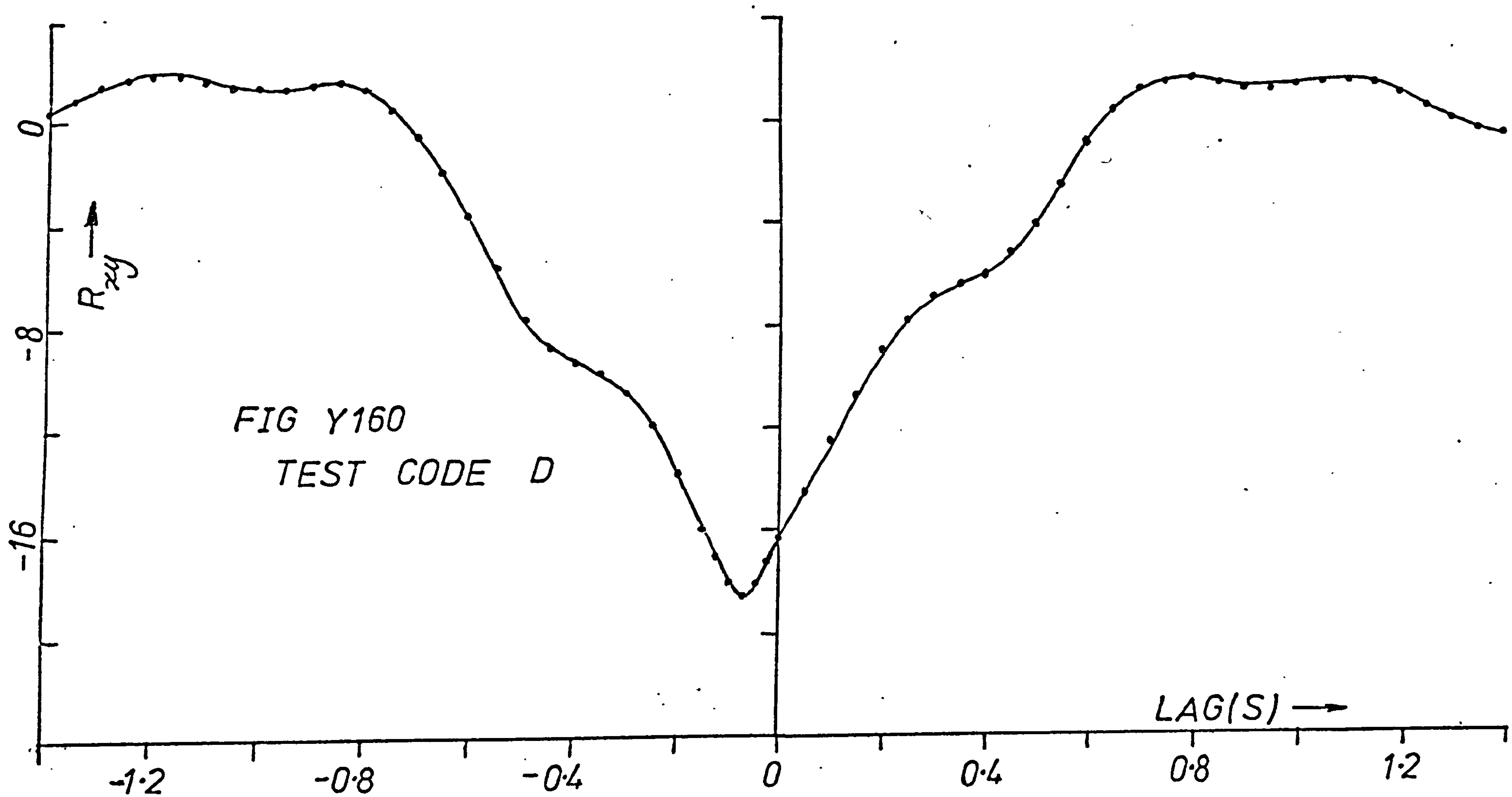
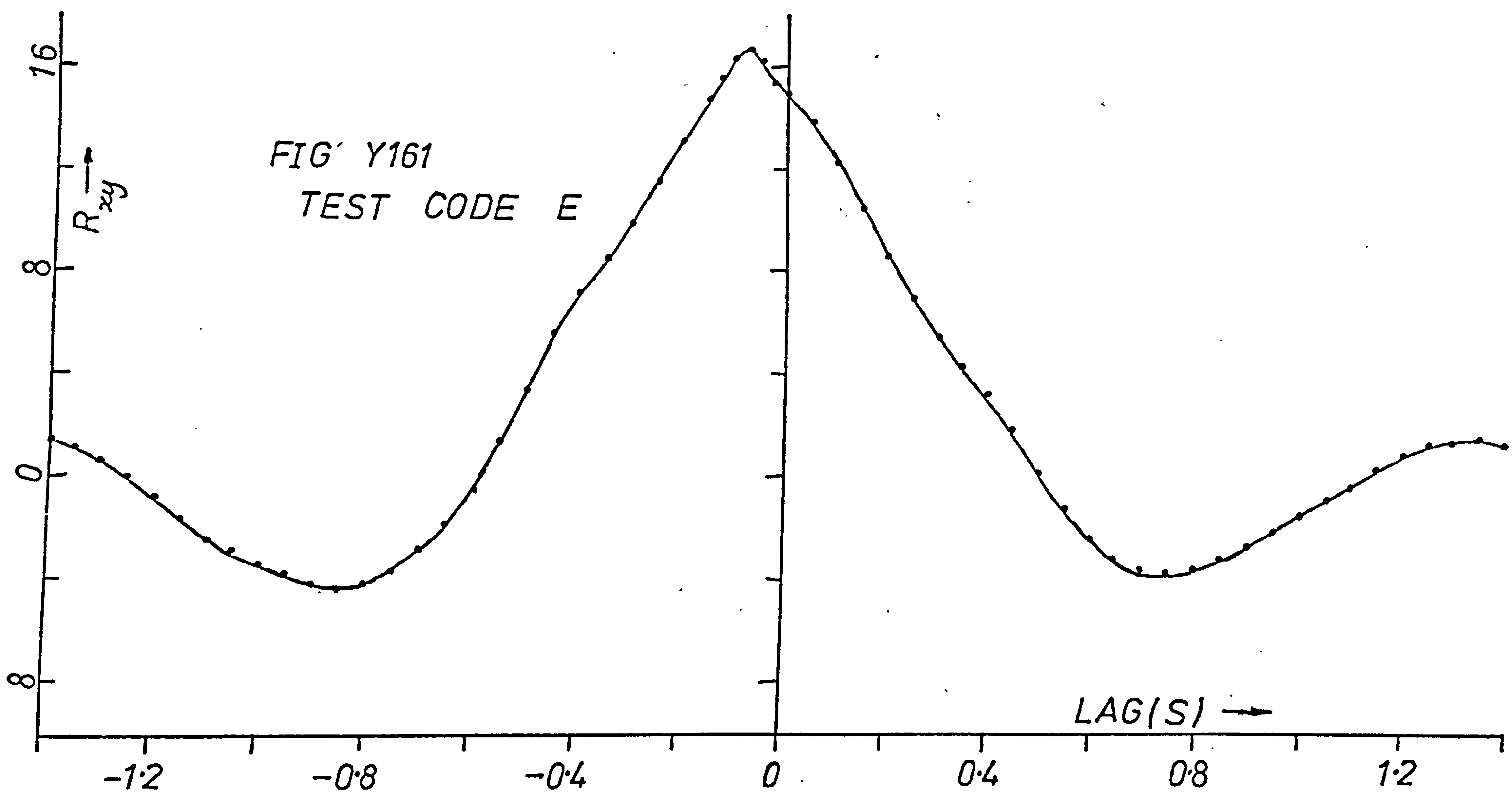


FIG Y160
TEST CODE D
R_{xy}
LAG(S)
0
-8
-16
-1·2
-0·8
-0·4
0
0·4
0·8
1·2



FIG' Y161
TEST CODE E

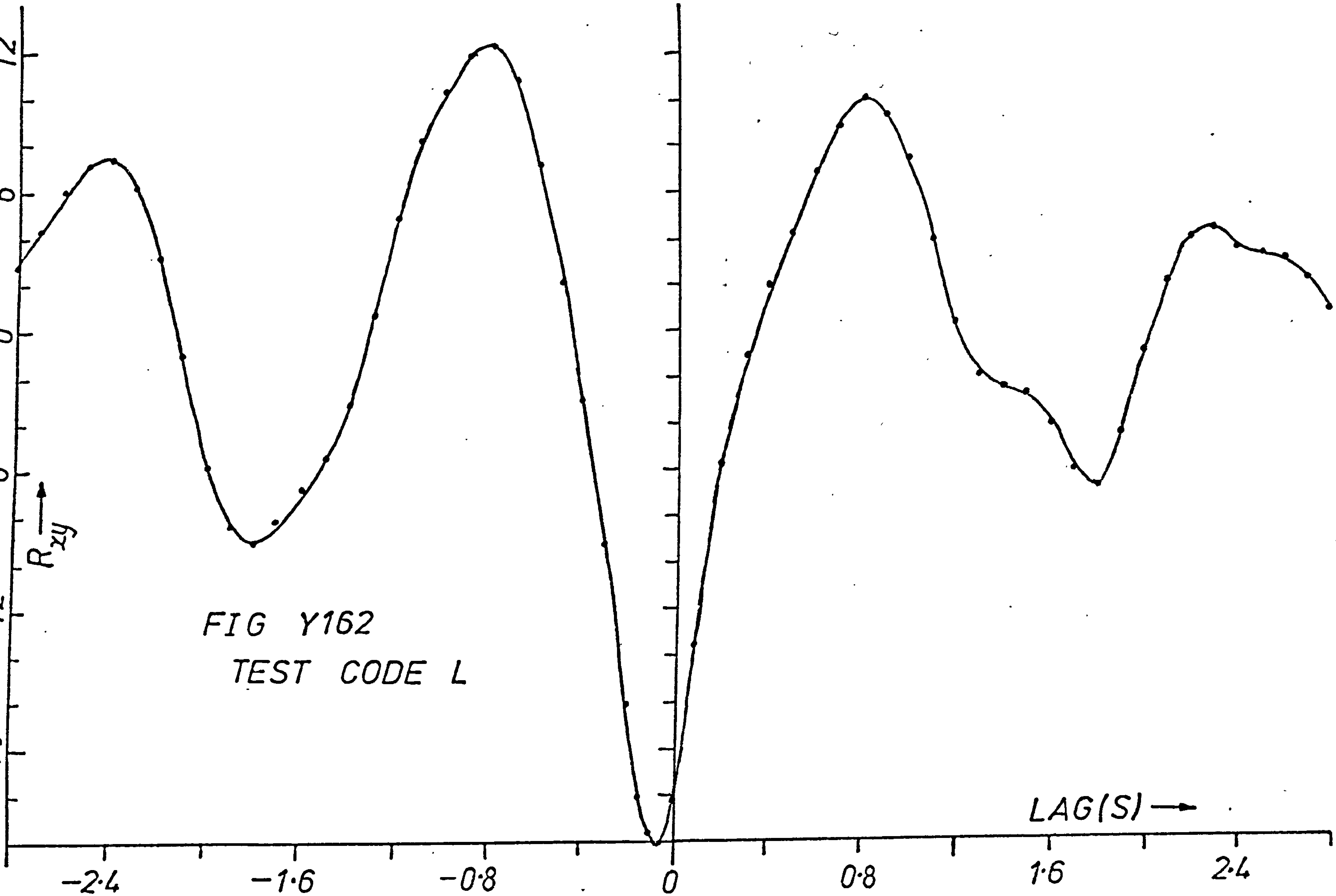


FIG Y162
TEST CODE L

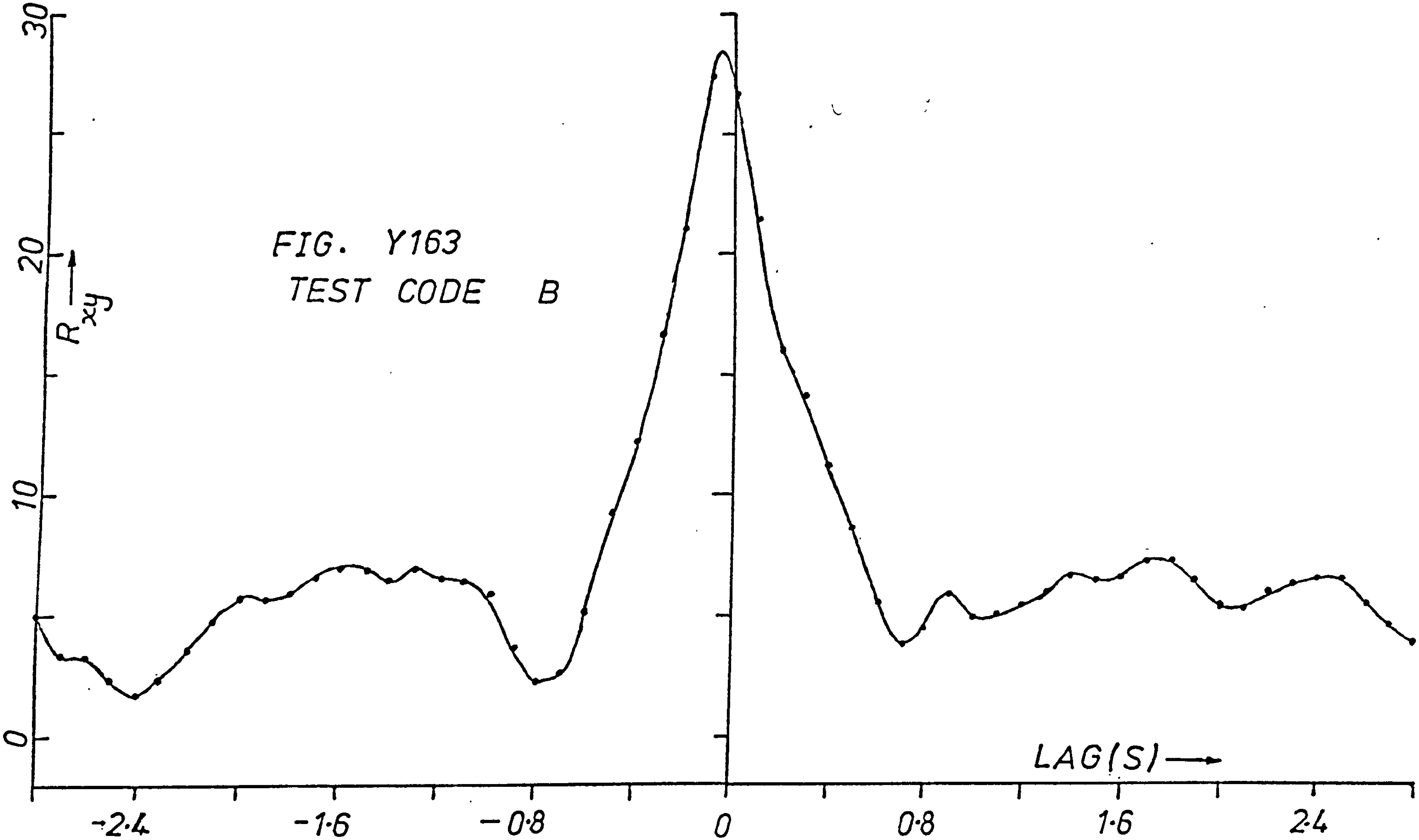


FIG. Y163
TEST CODE B

FIG Y164

1001

CS PWR	FRQCY	CROSS SPECTRA VS FRQNCY OF PC AND P1	CRS COR	LAGG	CROSS CORLN FUNCTION OF PJ AND P1
3.83	0.049		26.704	0.000	
0.87	0.098		16.506	0.025	
3.12	0.146		5.984	0.050	
3.06	0.195		12.198	0.075	
4.23	0.244		21.423	0.100	
6.32	0.293		12.090	0.125	
6.25	0.342		0.970	0.150	
6.49	0.391		6.424	0.175	
6.52	0.439		15.927	0.200	
5.13	0.488		7.282	0.225	
3.36	0.537		-2.288	0.250	
8.38	0.586		3.476	0.275	
8.51	0.635		14.165	0.300	
7.36	0.684		6.243	0.325	
6.18	0.732		-3.907	0.350	
1.74	0.781		1.577	0.375	
3.24	0.830		11.288	0.400	
2.98	0.879		3.285	0.425	
1.78	0.928		-7.005	0.450	
1.31	0.977		-1.367	0.475	
0.29	1.025		8.660	0.500	
0.59	1.074		0.562	0.525	
0.88	1.123		-9.997	0.550	
0.49	1.172		-4.726	0.575	
0.32	1.221		5.551	0.600	
0.28	1.270		-1.830	0.625	
0.13	1.319		-11.996	0.650	
0.13	1.367		-6.868	0.675	
0.07	1.416		3.815	0.700	
0.05	1.465		-2.723	0.725	
0.09	1.514		-12.392	0.750	
0.09	1.562		-6.764	0.775	
0.13	1.611		4.486	0.800	
0.12	1.660		-1.157	0.825	
0.21	1.709		-10.644	0.850	
0.21	1.758		-5.270	0.875	
0.15	1.807		5.911	0.900	
0.14	1.855		0.027	0.925	
0.54	1.904		-9.911	0.950	
0.55	1.953		-5.446	0.975	
0.18	2.002		4.957	1.000	
0.24	2.051		-0.295	1.025	
0.66	2.100		-10.125	1.050	
0.64	2.148		-5.575	1.075	
0.28	2.197		5.175	1.100	
0.21	2.246		0.496	1.125	
0.04	2.295		-9.243	1.150	
0.06	2.344		-4.902	1.175	
0.10	2.393		5.571	1.200	
0.08	2.441		1.085	1.225	
0.04	2.490		-8.642	1.250	
0.05	2.539		-4.673	1.275	
0.03	2.588		6.008	1.300	
0.02	2.637		2.093	1.325	
0.03	2.686		-7.324	1.350	
0.03	2.734		-3.562	1.375	
0.02	2.783		6.743	1.400	
0.02	2.832		2.834	1.425	
0.02	2.881		-6.761	1.450	

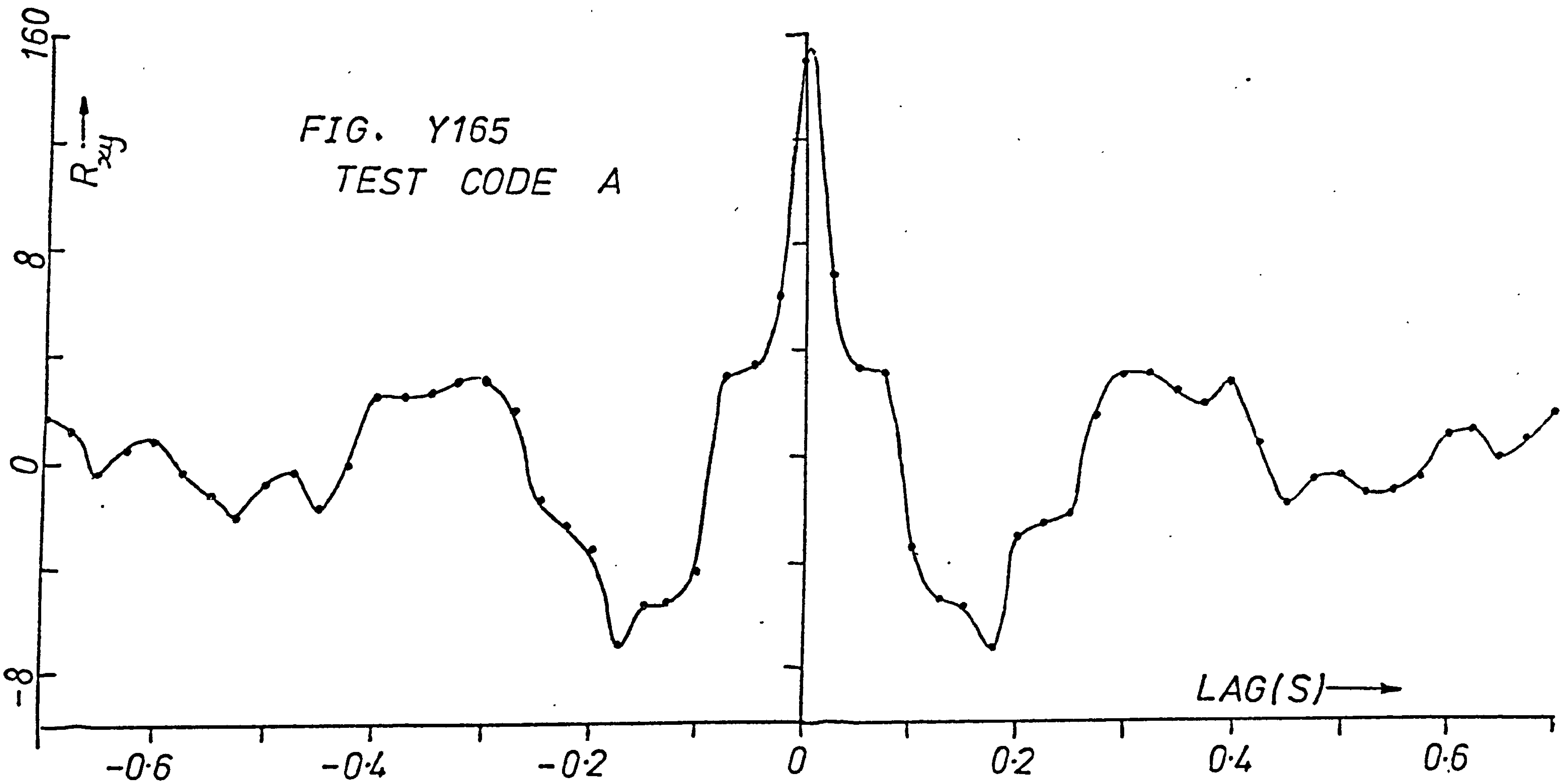


FIG. Y165
TEST CODE A

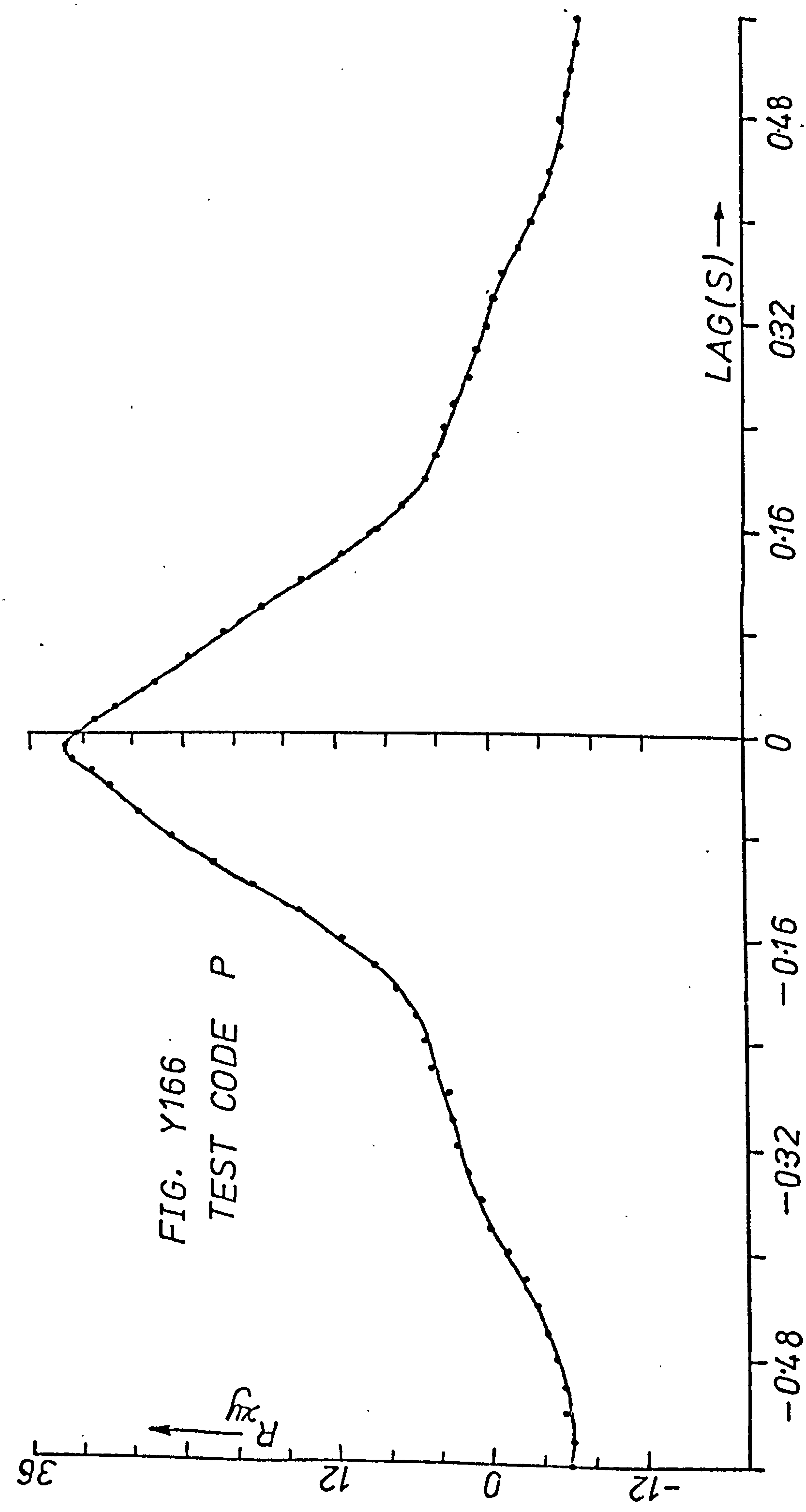


FIG. Y166
TEST CODE P
LAG(S) →
R_{xy}
36
12
0
-12
-0·48
-0·32
-0·16
0
0·16
0·32
0·48

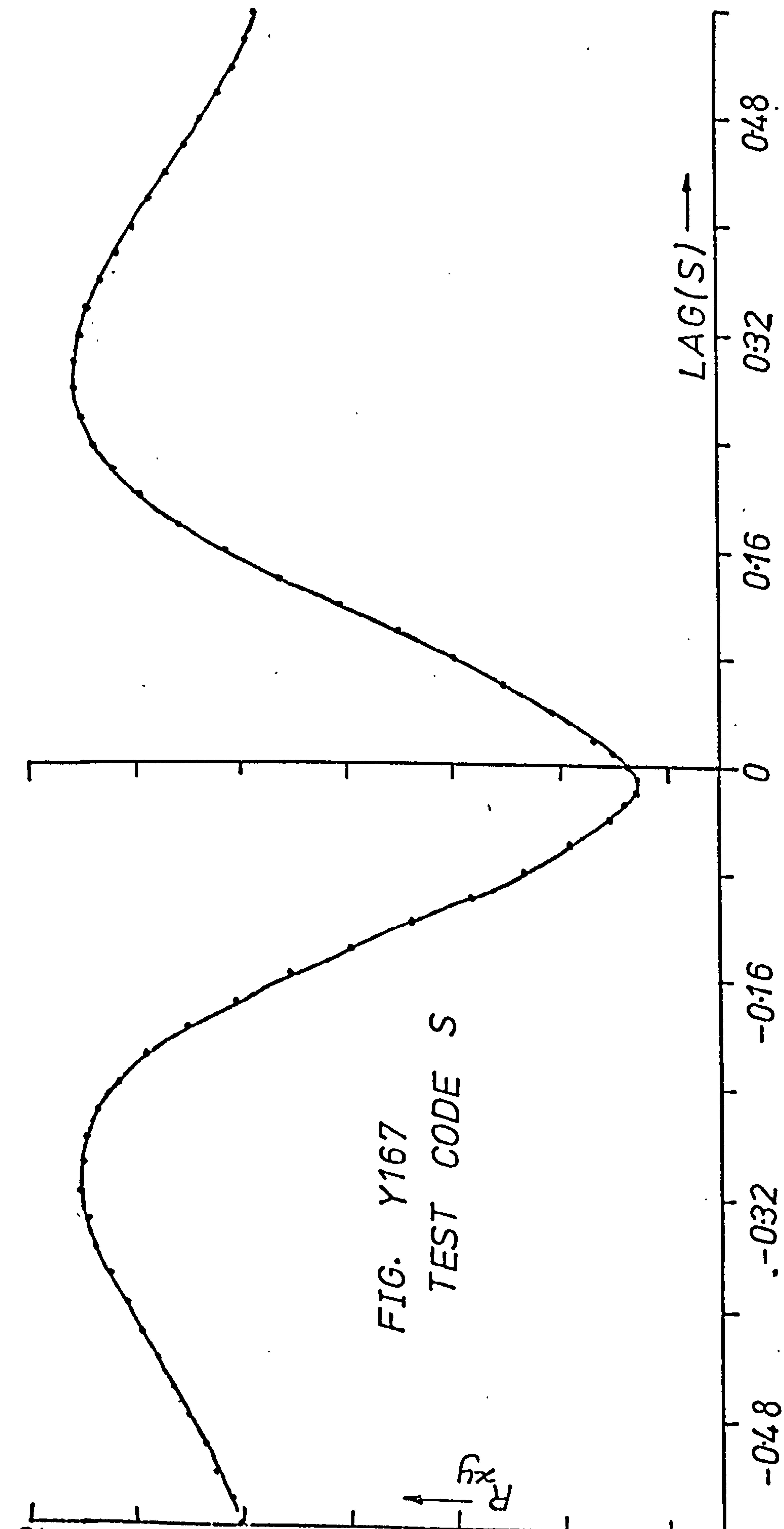


FIG. Y167
TEST CODE S

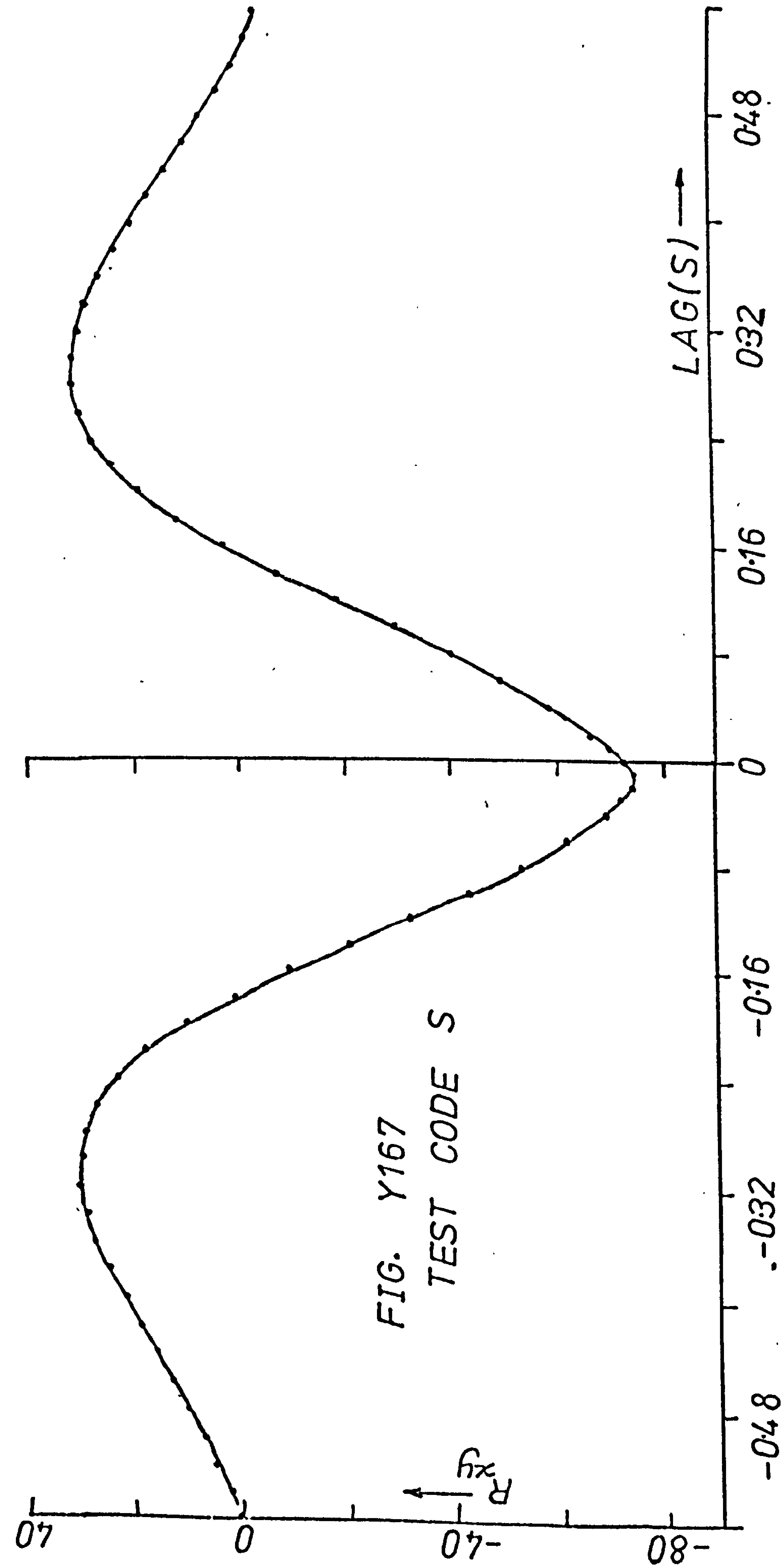


FIG. Y167
TEST CODE S

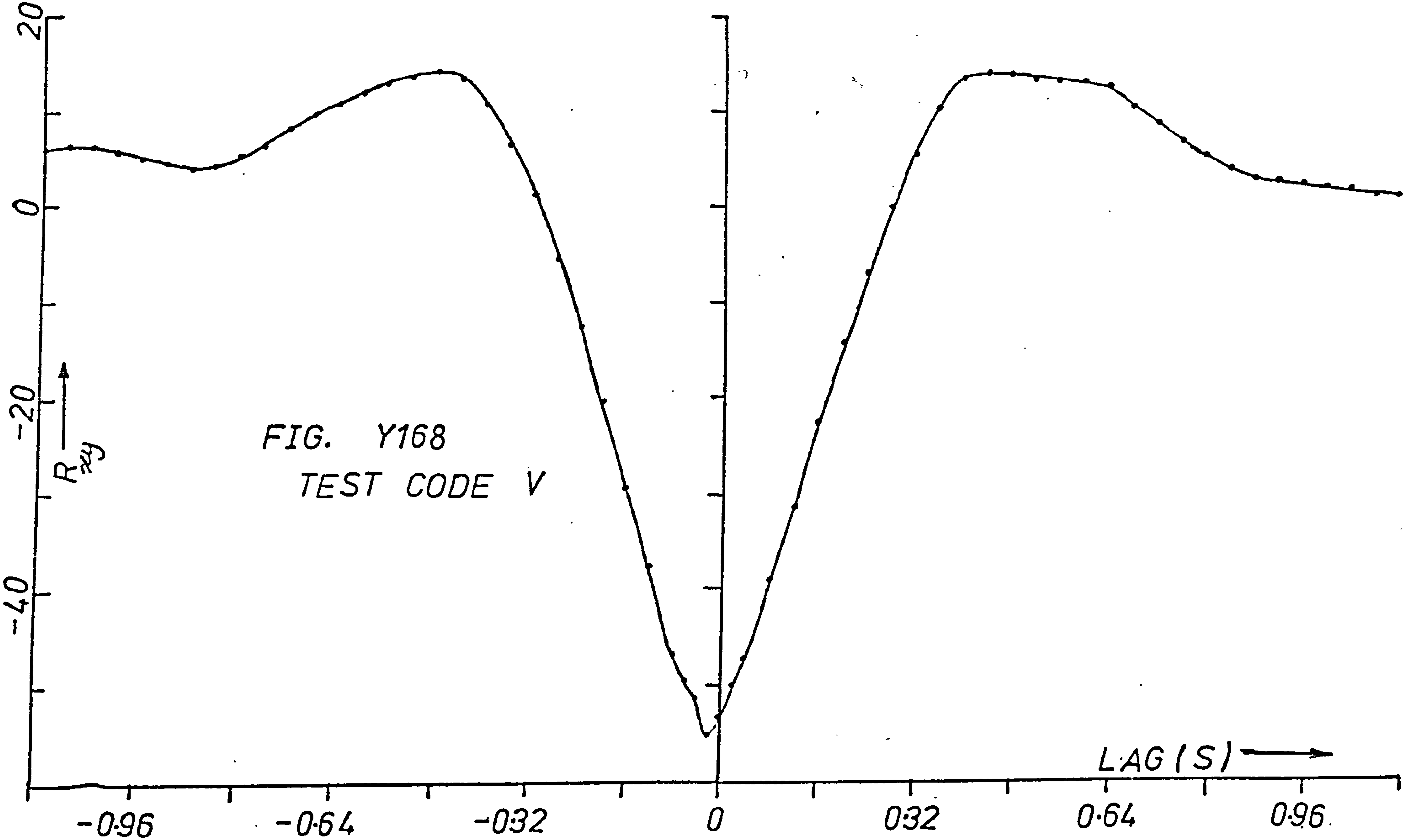


FIG. Y168
TEST CODE V

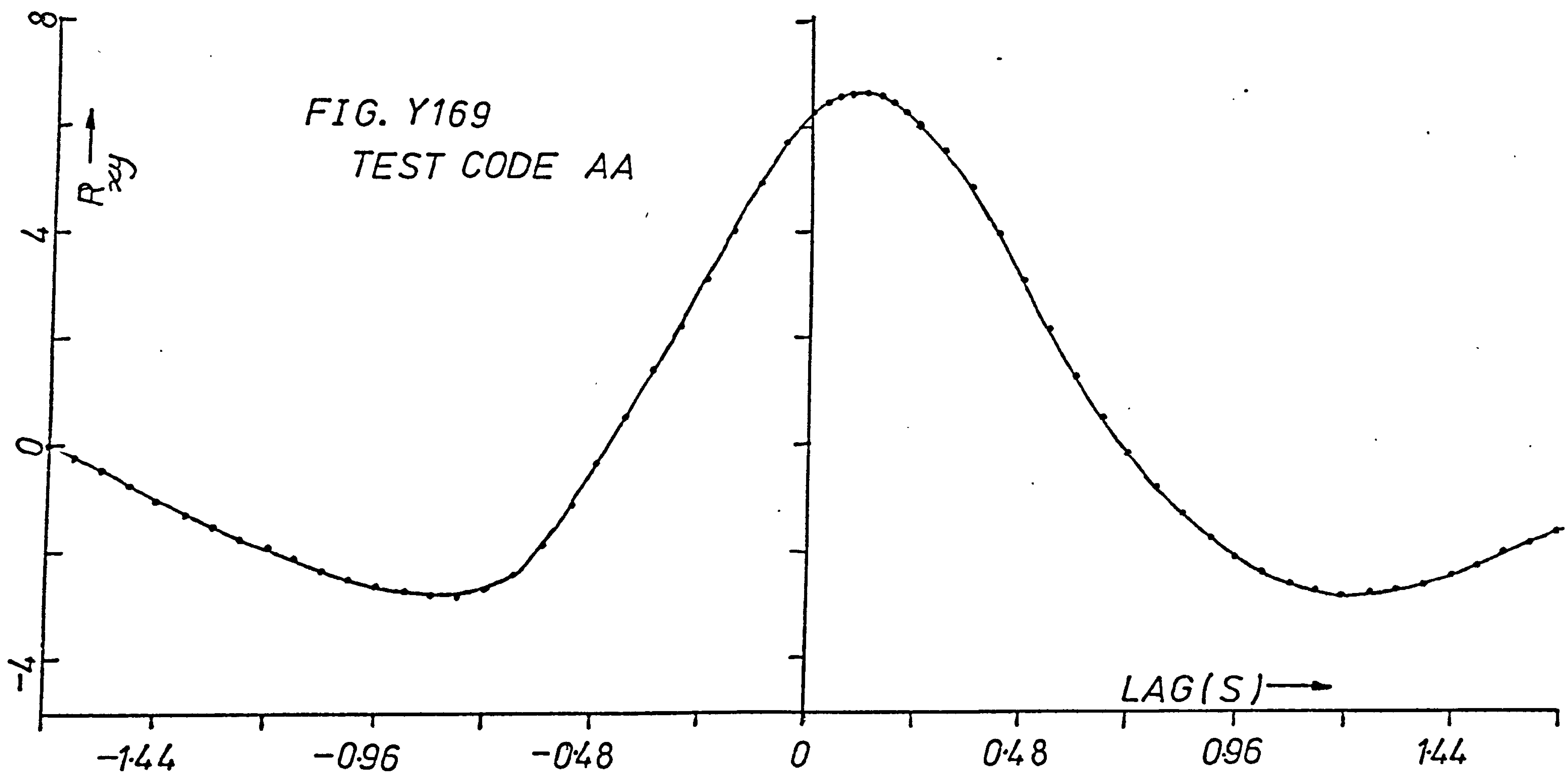


FIG. Y169
TEST CODE AA

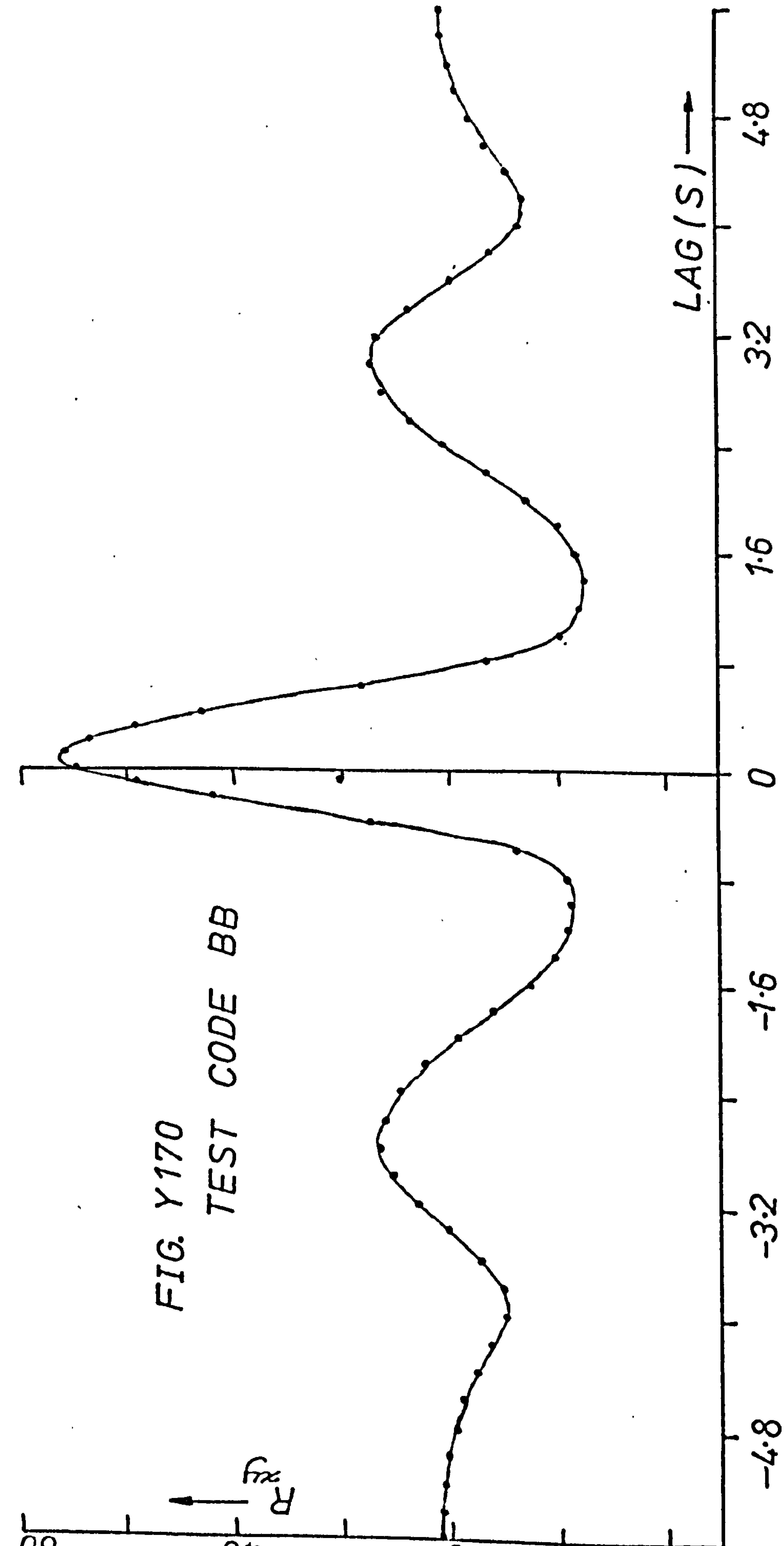


FIG. Y170
TEST CODE BB

APPENDIX Z SOLUTIONS OF THE FLOW PATTERN DEPENDENT PRESSURE DROP MODELS

APPENDIX Z SOLUTIONS OF THE FLOW PATTERN DEPENDENT PRESSURE DROP MODELS

Z.1 ANNULAR FLOWS

It was shown in Chapter 8 (equation 8.45) that

$$\phi_f^2 = \frac{(-\partial p/\partial Z)}{(-\partial p/\partial Z)_{f_1}} = \frac{\bar{\tau}_{wf}}{\tau_{wf_1}} \tag{Z1}$$

To evaluate the shear stresses, let us assume that the

average velocity of the film, $U_f = \dfrac{\text{volume flowrate in the film}}{\text{C/S area of the film}}$

(Z2a)

and the

average velocity of the mixture

in the core, $U_c = \dfrac{\text{volume flowrate in the core}}{\text{C/S area of the core}}$

(Z3a)

i.e. $$U_f = \frac{(1-k_e)Q_f}{\frac{\pi}{4}D^2(1-\frac{d^2}{D^2})} = \frac{(1-k_e)}{(1-\frac{\alpha}{K_c})} U_{sf} \tag{Z2b}$$

$$U_c = \frac{Q_g + k_e Q_f}{\frac{\pi}{4}d^2} = \frac{(1+k_e\frac{Q_f}{Q_g})}{(\frac{\alpha}{K_c})} U_{sg} \tag{Z3b}$$

The interfacial shear stress $\bar{\tau}_i$ can be expressed in terms of the average velocities as

$$\bar{\tau}_i = \frac{\lambda_i}{8} \rho_c (U_c - U_i)^2 = \frac{\lambda_i}{8} \rho_c U_c^2 (1 - \frac{U_i}{U_c})^2 \tag{Z4a}$$

Let

$$U_i = k_1 U_f \tag{Z4b}$$

where k_1 is a factor introduced to allow for slip at the interface.

Also $$\rho_c = \frac{M_c}{Q_c} = \frac{M_c}{Q_g} k_c = \frac{M_c}{M_g} k_c \; \rho_g$$

$$\therefore \quad \rho_c = (1 + k_e \frac{M_f}{M_g}) \, k_c \; \rho_g \tag{Z4c}$$

Substitute in (Z4a),

$$\bar{\tau}_i = \frac{\lambda_i}{8} \;\; g \;\; U_{sg}^2 \;\; (\frac{k_c}{\alpha})^2 \; F^2 \tag{Z4d}$$

where

$$F^2 = k_c (1 + k_e \frac{M_f}{M_g}) (1 + k_e \frac{Q_f}{Q_g})^2 \left[1 - \frac{(\frac{\alpha}{k_c}) \; k_1 (1 - k_e)}{(1 - \frac{\alpha}{k_c})(1 + k_e \frac{Q_f}{Q_g})} \; \frac{Q_f}{Q_g} \right] \tag{Z4e}$$

The wall friction shear stress $\bar{\tau}_{wf}$ is expressed in terms of the average liquid velocity in the film,

$$\bar{\tau}_{wf} = \frac{\lambda_f}{8} \rho_f \; U_f^2 = \frac{\lambda_f}{8} \; \rho_f \; U_{sf}^2 \; \frac{(1 - k_e)^2}{(1 - \frac{\alpha}{k_c})^2} \tag{Z5}$$

Also for the tube full condition based on the total liquid flowrate Q_f,

$$\tau_{wf_1} = \frac{\lambda_{f_1}}{8} \; \rho_f \;\; U_{sf}^2 \tag{Z6}$$

From equation (Z4d) and (Z5)

$$\frac{\bar{\tau}_i}{\bar{\tau}_{wf}} = (\frac{\lambda_i}{\lambda_f}) (\frac{\rho_g}{\rho_f}) (\frac{Q_g}{Q_f})^2 \; \frac{(1 - \frac{\alpha}{k_c})^2 \; F^2}{(\frac{\alpha}{k_c})^2 \;\; (1 - k_e)^2} \tag{Z7}$$

But from equation (8.43)

$$\frac{\bar{\tau}_i}{\bar{\tau}_{wf}} = \sqrt{\frac{\alpha}{k_c}} \tag{Z8}$$

and substituting in equation (Z7) and rearranging gives

$$\frac{(\frac{\alpha}{k_c})^2 \sqrt{\frac{\alpha}{k_c}}}{(1 - \frac{\alpha}{k_c})^2} = (\frac{\lambda_i}{\lambda_f}) (\frac{\rho_g}{\rho_f}) (\frac{Q_g}{Q_f})^2 \frac{F^2}{(1 - k_e)^2} \qquad (Z9)$$

Also from equations (Z5) and (Z6)

$$\frac{\overline{\tau}_{wf}}{\tau_{wf_1}} = \frac{\lambda_f}{\lambda_{f_1}} \frac{(1 - k_e)^2}{(1 - \frac{\alpha}{k_c})^2}$$

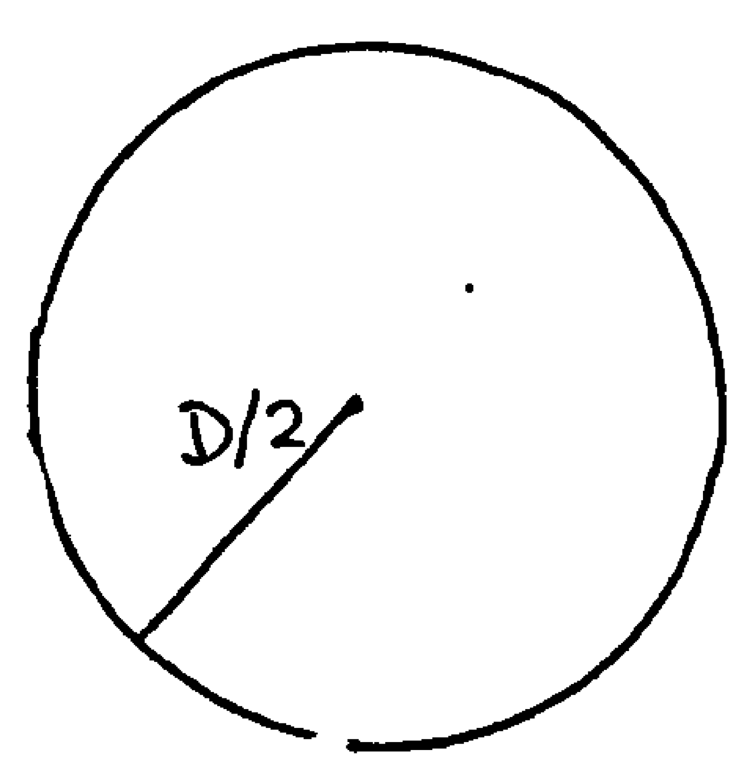
and from equation (Z1),

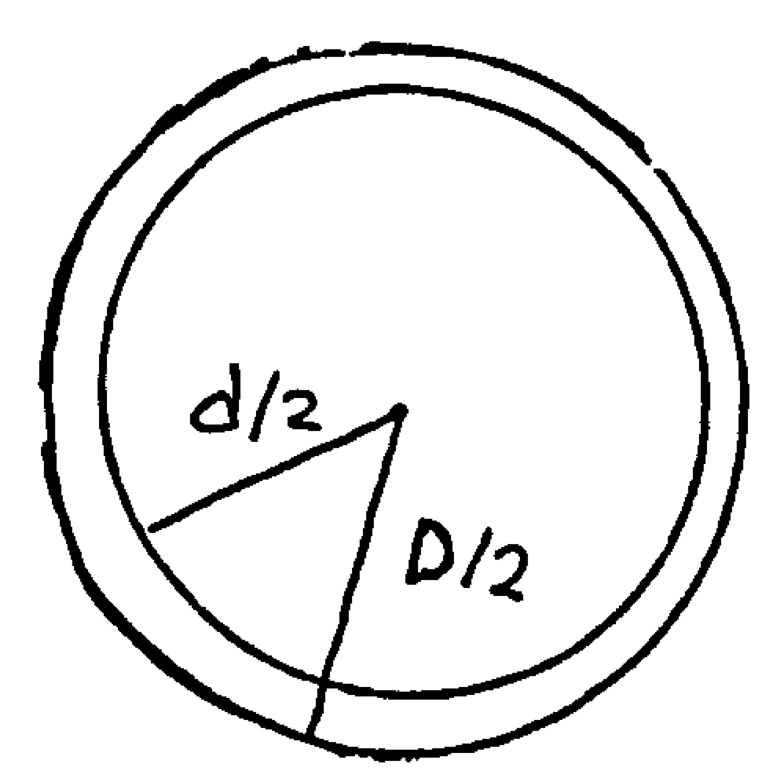
$$\phi_f^2 = \frac{\lambda_f}{\lambda_{f_1}} \frac{(1 - k_e)^2}{(1 - \frac{\alpha}{k_c})^2} \qquad (Z10)$$

The friction factors are calculated using a Blausius type relationship

$$\lambda_f = k_f \, Re^{-n}$$

where Reynold's numbers are based on the average velocities and hydraulic diameters of an annulus and a circular pipe respectively, as shown below,





Hydraulic diameter $= D_H = \frac{4 \times \text{Area}}{\text{Wetted perimeter}}$

$$\text{For pipe } D_H = \frac{4 \;.\; \frac{\pi}{4} D^2}{\pi D} = D,$$

$$\text{For annulus } D_H = \frac{4 \;.\; \frac{\pi}{4}(D^2 - d^2)}{\pi\,(D + d)} = D - d$$

$$Re_{f_1} = \frac{D\ U_{sf}}{\nu} \qquad Re_f = \frac{(D - d)(1 - k_e)U_{sf}}{\nu\,(1 - \frac{\alpha}{k_c})}$$

$$\text{Hence } \frac{\lambda_f}{\lambda_{f_1}} = \left(\frac{Re_f}{Re_{f_1}}\right)^{-n} = \left[\frac{(1 - k_e)(1 - \frac{d}{D})}{(1 - \frac{\alpha}{k_c})}\right]^{-n}$$

or

$$\frac{\lambda_f}{\lambda_{f_1}} = \left[\frac{1 - k_e}{1 + \frac{\alpha}{k_c}}\right]^{-n} \tag{Z11}$$

Hence equation (Z10) becomes

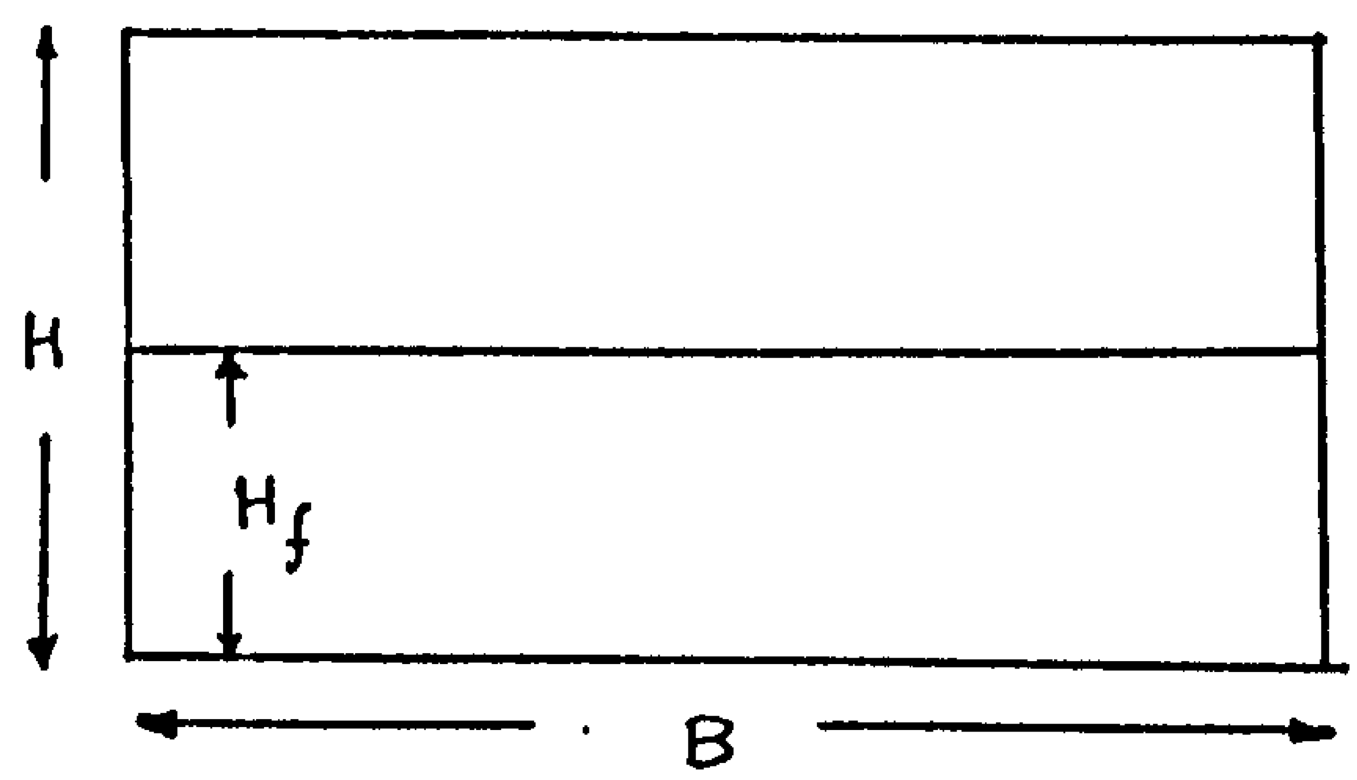
$$\phi_f^2 = \frac{(1 - k_e)^{2-n}\ (1 + \sqrt{\frac{\alpha}{k_c}})^n}{(1 - \frac{\alpha}{k_c})^2} \tag{Z12}$$

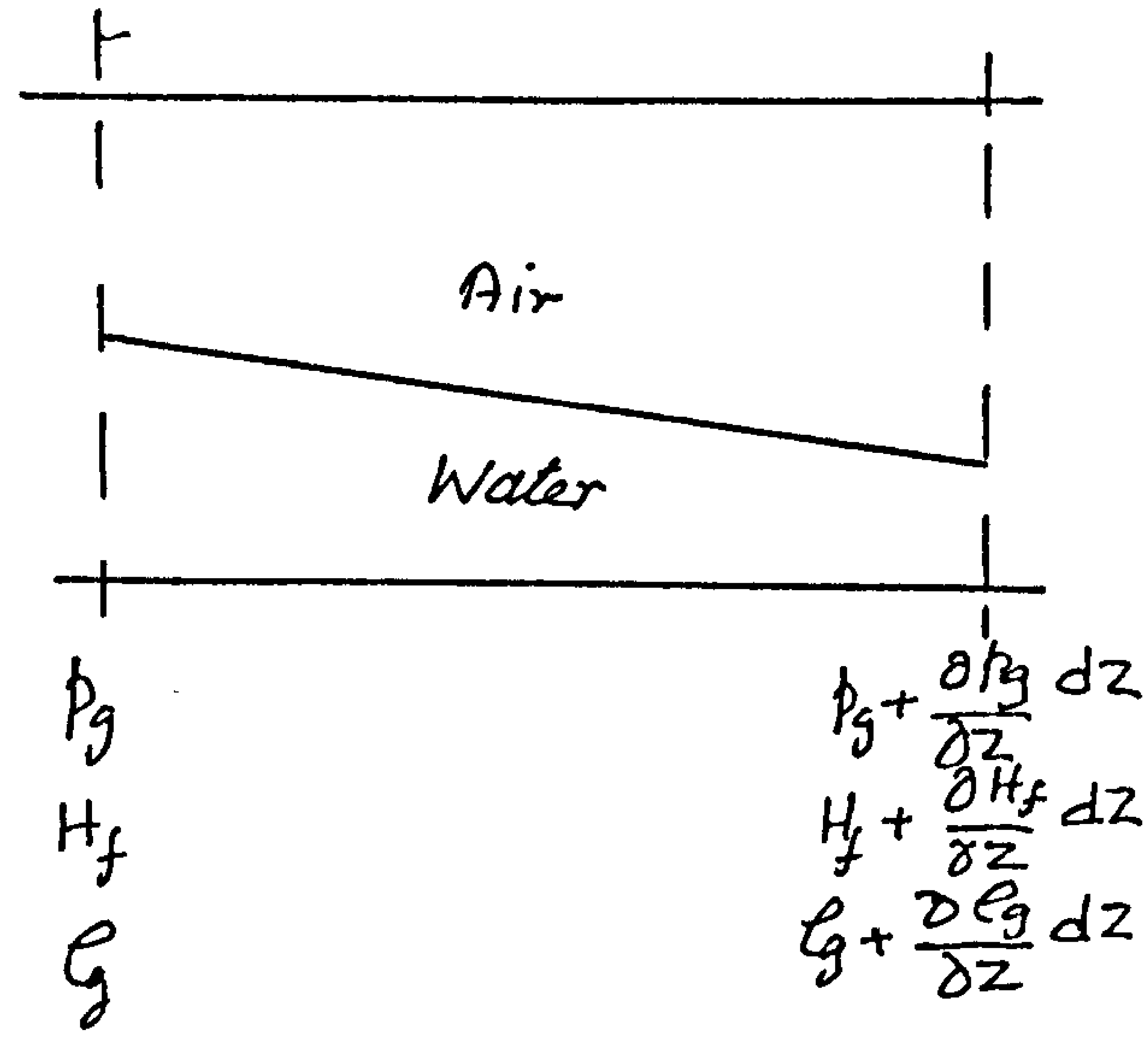
If entrainment and stratification effects are neglected, equation (Z12) becomes

$$\phi_f^2 = \frac{(1 + \sqrt{\alpha}\ )^n}{(1 - \alpha\ )^2} \tag{Z13}$$

Z.2 SEPARATED FLOWS

Consider a steady state separated flow in a horizontal rectangular channel of width B and height H as shown below. Variations in liquid density are neglected.





(i) Pressure Forces:

The nett pressure force in the direction of motion =

$$p_g(H - H_f)B + (p_g + \tfrac{1}{2}\rho_f g H_f)BH_f - (p_g + \frac{\partial p_g}{\partial Z} dZ)(H - H_f - \frac{\partial H_f}{\partial Z} dZ)B$$

$$- \left[p_g + \frac{\partial p_g}{\partial Z} dZ + \tfrac{1}{2} \rho_f g (H_f + \frac{\partial H_f}{\partial Z} dZ)\right] \left[H_f + \frac{\partial H_f}{\partial Z} dZ\right] B$$

$$= -HB \frac{\partial p_g}{\partial Z} dZ - \rho_f g B \frac{\partial H_f}{\partial Z} (H_f + \tfrac{1}{2} \frac{\partial H_f}{\partial Z} dZ)dZ \qquad \text{(Z14)}$$

and consists of two components, one due to a pressure change over section length and the other due to a head difference over the section length.

(ii) Friction (Wall) Forces:

Nett force in the direction of motion =

$$- \left(\tau_{wg} + \tfrac{1}{2}\frac{\partial \tau_{wg}}{\partial Z} dZ\right)\left[B + 2\left(H - H_f - \tfrac{1}{2}\frac{\partial H_f}{\partial Z} dZ\right)\right] dZ$$

$$- \left(\tau_{wf} + \tfrac{1}{2}\frac{\partial \tau_{wf}}{\partial Z} dZ\right)\left[B + 2\left(H_f + \tfrac{1}{2}\frac{\partial H_f}{\partial Z} dZ\right)\right] dZ$$

$$\tau_{wf} = f_f \tfrac{1}{2} \rho_f U_f^2 = \frac{\lambda_f}{8} \frac{M_f^{\ 2}}{\rho_f B^2 H_f^2}$$

$$\therefore \frac{\partial \tau_{wf}}{\partial Z} = - \frac{\lambda_f}{4} \frac{M_f^{\ 2}}{\rho_f B^2 H_f^3} \frac{\partial H_f}{\partial Z}$$

$\therefore$ Nett force in the direction of motion is

$$= - F_{wg} - \frac{\lambda_f}{8} \frac{M_f^{\ 2}}{\rho_f B^2 H_f^2} \left(1 - \frac{1}{H_f}\frac{\partial H_f}{\partial Z} dZ\right)\left(B + 2H_f + \frac{\partial H_f}{\partial Z} dZ\right) dZ \tag{Z15}$$

where $F_{wg} = \left(\tau_{wg} + \tfrac{1}{2}\frac{\partial \tau_{wg}}{\partial Z} dZ\right)\left[B + 2\left(H - H_f - \tfrac{1}{2}\frac{\partial H_f}{\partial Z} dZ\right)\right] dZ$

(iii) Gravity Forces are zero for horizontal flows (Z16)

(iv) Transient Forces are zero for steady state flow (Z17)

(v) Rate of Change in Momentum:

Total rate of change in momentum $= \frac{\partial}{\partial Z}(M_g U_g + M_f U_f) dZ$

$$\frac{\partial}{\partial Z}(M_f U_f) dZ = M_f \frac{\partial U_f}{\partial Z} dZ = \frac{M_f^2}{\rho_f} \frac{\partial}{\partial Z}\left(\frac{1}{A_f}\right) dZ$$

$$= - \frac{M_f^2}{\rho_f B H_f^{\ 2}} \frac{\partial H_f}{\partial Z} dZ$$

$\therefore$ rate of change in momentum =

$$= \frac{\partial}{\partial Z}(M_g U_g) dZ - \frac{M_f^{\ 2}}{\rho_f B H_f^{\ 2}} \frac{\partial H_f}{\partial Z} dZ \tag{Z18}$$

Conservation of momentum for combined flow gives

$$- BH \frac{\partial p_g}{\partial Z} dZ - \rho_f \, g \, B \frac{\partial H_f}{\partial Z} (H_f + \tfrac{1}{2} \frac{\partial H_f}{\partial Z} dZ) \, dZ - F_{wg}$$

$$- \frac{\lambda_f \, M_f^2}{8 \rho_f \, B^2 H_f^2} (1 - \frac{1}{H_f} \frac{\partial H_f}{\partial Z} dZ) (B + 2H_f + \frac{\partial H_f}{\partial Z} dZ) dZ$$

$$= \frac{\partial}{\partial Z} (M_g \, U_g) dZ - \frac{M_f^2}{\rho_f \, B \, H_f^2} \frac{\partial H_f}{\partial Z} dZ \qquad (Z.19)$$

Applying the conservation of momentum to the gas phase alone gives,

$$p_g (H - H_f) B - (p_g + \frac{\partial p_g}{\partial Z} dZ) (H - H_f - \frac{\partial H_f}{\partial Z} dZ) B - F_{wg} - F_{ig}$$

$$= \frac{\partial}{\partial Z} (M_g \, U_g) \, dZ \qquad (Z\ 20)$$

where F_{ig} is the interfacial shear force given by

$$F_{ig} = \tau_i \, B \, dZ = \frac{\lambda_i}{8} \rho_g (U_g - U_f)^2 \, B \, dZ$$

Expanding equation (Z20), gives

$$p_g \frac{\partial H_f}{\partial Z} dZ \, B - HB \frac{\partial p_g}{\partial Z} dZ + H_f \, B \frac{\partial p_g}{\partial Z} dZ + B \frac{\partial p_g}{\partial Z} dZ^2 \frac{\partial H_f}{\partial Z}$$

$$- F_{wg} - \frac{\lambda_{ig}}{8} \rho_g (U_g - U_f)^2 \, B \, dZ = \frac{d}{dZ} (M_g \, U_g) dZ \qquad (Z21)$$

Substituting equation (Z21) into (Z19)gives,

$$- BH \frac{\partial p_g}{\partial Z} dZ - \rho_f \, g \, B \frac{\partial H_f}{\partial Z} (H_f + \tfrac{1}{2} \frac{\partial H_f}{\partial Z} dZ) dZ - \frac{\lambda_f \, M_f^2}{8 \rho_f B^2 H_f^2}$$

$$(1 - \frac{1}{H_f} \frac{\partial H_f}{\partial Z} dZ) (B + 2H_f + \frac{\partial H_f}{\partial Z} dZ) dZ + \frac{\lambda_{ig}}{8} \rho_g (U_g - U_f)^2 B dZ$$

$$- p_g B \frac{\partial H_f}{\partial Z} dZ + HB \frac{\partial p_g}{\partial Z} dZ - H_f B \frac{\partial p_g}{\partial Z} dZ - B \frac{\partial p_g}{\partial Z} dZ \frac{\partial H_f}{\partial Z} dZ$$

$$= - \frac{M_f^{\,2}}{\rho_f\, B\, H_f^{\,2}} \frac{\partial H_f}{\partial Z}\, dZ$$

or

$$B \frac{\partial p_g}{\partial Z} dZ \left(H_f + \frac{\partial H_f}{\partial Z} dZ\right) = \frac{M_f^{\,2}}{\rho_f\, B\, H_f^{\,2}} \left[\frac{\partial H_f}{\partial Z} dZ - \frac{\lambda_f}{8B} \right.$$

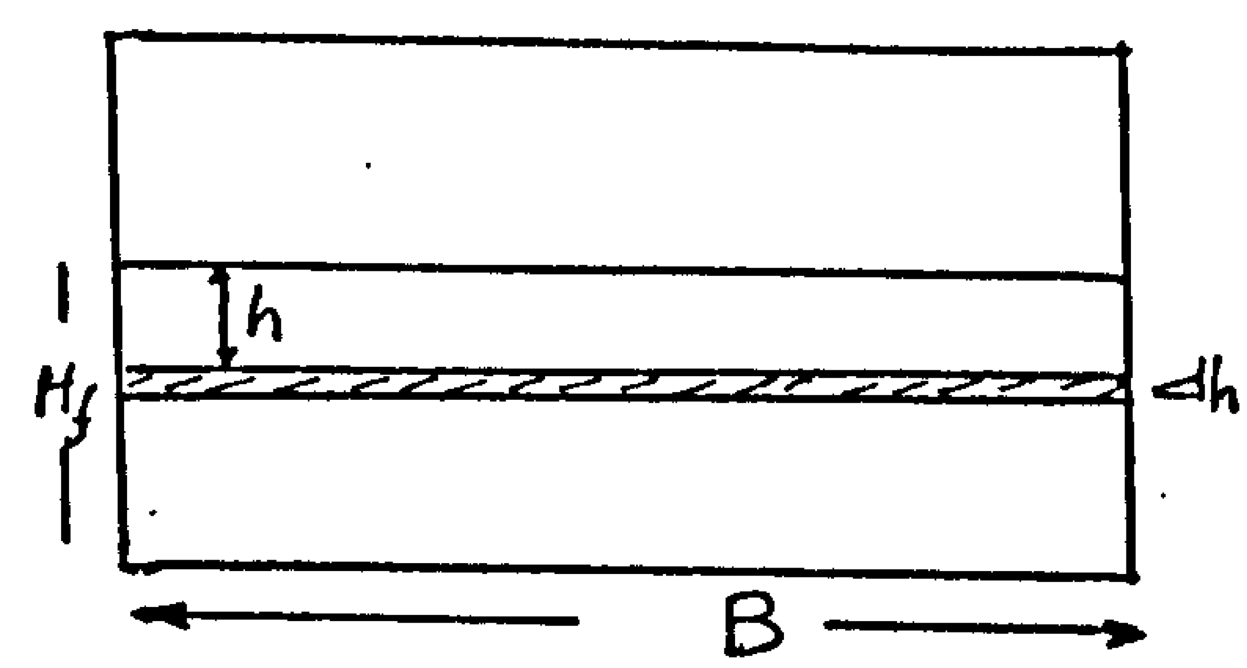
$$\left. \left(1 - \frac{1}{H_f} \frac{\partial H_f}{\partial Z} dZ\right) \left(B + 2H_f + \frac{\partial H_f}{\partial Z} dZ\right) \right] - B \frac{\partial H_f}{\partial Z} dZ$$

$$\left[p_g + \rho_f g \left(H_f + \tfrac{1}{2} \frac{\partial H_f}{\partial Z} dZ\right) \right] + \frac{\lambda_{ig}}{8} \rho_g (U_g - U_f)^2\, B\, dZ \qquad \text{(Z22)}$$

Z.3 ROUND TUBE GEOMETRY

Consider first the rectangular channel shown below, then the pressure force acting on the liquid is

$$F_p = - \int_{H_f}^{0} (p_g + \rho_f g h) B\, dh \qquad \text{(Z23)}$$



Hence

$$F_p = p_g\, B H_f + \tfrac{1}{2} \rho_f g B\, H_f^{\,2}$$

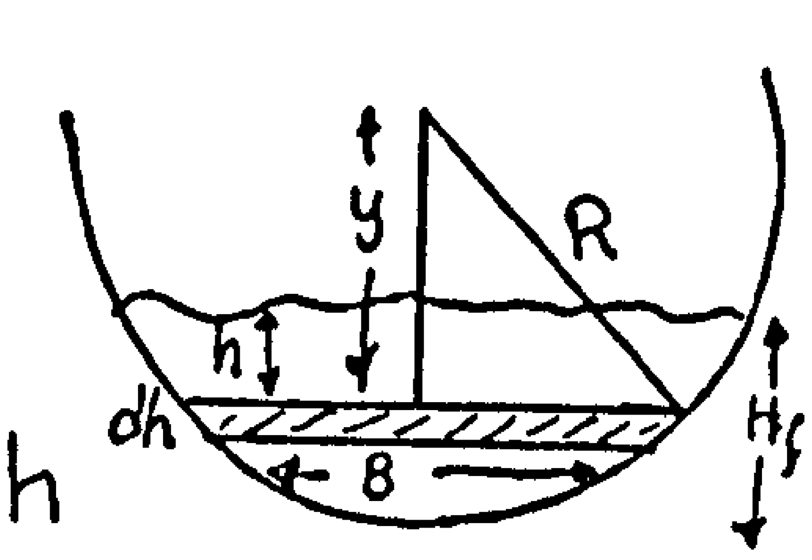
or

$$F_p = \left(p_g + \tfrac{1}{2} \rho_f g H_f\right) B H_f \qquad \text{(Z24)}$$

Equation (Z24) was used in section Z.2.for determining the appropriate forces. However for the round tubes, this equation cannot be applied, *and*

$$F_p = - \int_{H_f}^{0} (p_g + \rho g h)\, B\, dh$$

$$= \int_{0}^{H_f} (p_g + \rho g h) \sqrt{R^2 - \left[R - (H_f - h)\right]^2}\, dh$$



or

$$F_p = \int_0^{H_f} (p_g + \rho g h) \sqrt{\bar{A}h^2 + \bar{B}h + \bar{C}}\ dh$$

where $\bar{A} = -1$, $\bar{B} = -2(R-H_f)$, $\bar{C} = H_f(2R-H_f)$

$$\therefore F_p = p_g \int_0^{H_f} \sqrt{\bar{A}h^2 + \bar{B}h + \bar{C}}\ dh$$

$$+ 2\rho_f g \int_0^{H_f} h \sqrt{\bar{A}h^2 + \bar{B}h + \bar{C}}\ dh \qquad \text{(Z25)}$$

Using the following standard integral results*

(i) $$\int x \sqrt{ax^2 + bx + c}\ dx = \frac{(ax^2 + bx + c)^{3/2}}{3a} - \frac{b}{2a} \int \sqrt{ax^2 + bx + c}\ dx$$

(ii) $$\int \sqrt{ax^2 + bx + c}\ dx = \frac{2ax + b}{4a} \sqrt{ax^2 + bx + c} + \frac{4ac - b^2}{8a} \int \frac{dx}{\sqrt{ax^2 + bx + c}}$$

(iii) $$\int \frac{dx}{\sqrt{ax^2 + bx + c}} = \frac{1}{\sqrt{-a}} \operatorname{Sin}^{-1} \frac{-2ax - b}{\sqrt{b^2 - 4ac}} \qquad a < 0$$

Equation (Z25) becomes

$$F_p = 2p_i \left[-\frac{\pi}{2} R^2 - \tfrac{1}{2} H_f(R - H_f)(2R - H_f) - R^2 \sin^{-1}\left(1 - \frac{H_f}{R}\right) \right]$$

$$+ 2 \rho_f g \left\{ \frac{\pi}{4} (R - H_f)R^2 - \frac{1}{3} (2RH_f - H_f^{\,2})^{3/2} + (R - H_f) \right.$$

$$\left. \left[\tfrac{1}{2}(R - H_f)(2RH_f - H_f^{\,2})^{\frac{1}{2}} + R^2 \sin^{-1}\left(1 - \frac{H_f}{R}\right) \right] \right\} \qquad \text{(Z26)}$$

which is very complex compared to the simple relationship given in equation (Z24).

*Quoted from 'Mathematic Dictionary', by James and James.