

14.3.1 キャッシュ・フローおよび収支バランス

・本 案

年毎の収支バランスは営業開始年（1998年）から13年間赤字を繰り返す、14年目より黒字に転じている。また累計収支バランスは初年度より39年間赤字が続き、40年目から黒字となり、50年間でUS\$ 74,045 Millions の黒字を生むことになる。

・参考ケース 1

年毎の収支バランスはCase 1 同様、営業開始年（1998年）から9年間赤字を繰り返す、10年目から黒字に転じている。累計収支バランスでは36年間赤字が続き、50年間でUS\$ 94,184 Millions の黒字を生むことになる。

・参考ケース 2

年毎の収支バランスでは営業開始年（1998年）から13年間赤字を示しているが、14年目から黒字に転じている。累計収支バランスでは42年目から黒字となり、50年間で黒字US\$ 59,481 Millions を示す。

・参考ケース 3

年毎の収支バランスは営業開始年（1998年）から8年間赤字を繰り返す、9年目から黒字に転ずる。累計収支バランスでは37年目から黒字となり、50年間でUS\$ 94,042 Millions となっている。

14.3.2 第2期計画の収益率

上記の損益計算書をもとに、営業期間中の稼働固定資産と営業利益との比率を示すと以下の通りとなる。

Table 14-13 Rate of Return

(%)

項目 \ 期間	10年間	20年間	30年間	40年間	50年間
	平均	平均	平均	平均	平均
本 案	2.363	2.658	3.038	3.545	4.253
参考ケース1	2.604	2.962	3.385	3.950	4.740
参考ケース2	2.298	2.585	2.954	3.447	4.136
参考ケース3	2.423	2.726	3.116	3.635	4.362

上記の Table から参考ケース1が最も有利であり、次に、参考ケース3、本案、参考ケース2の順となる。

詳細はTable 14-14, Table 14-15, Table 14-16, Table 14-17に示す通りである。

Table 14-14 Rate of Return (Principal Case)

(US\$M)

No.	Year	Average Net Fixed Assets in Operation					Profit		Rate of Return (%)
		Beginning Balance	Depreciation	Ending Balance	Average Yearly	Accumulative Average	Yearly	Accumulative Profit	
1	1998	174.329	3.487	170.842	172.586	172.586	3.707	3.707	
2	1999	170.842	3.487	167.356	169.099	341.685	3.707	7.415	
3	2000	167.356	3.487	163.869	165.613	507.298	3.707	11.122	
4	2001	163.869	3.487	160.383	162.126	669.424	3.707	14.830	
5	2002	160.383	3.487	156.896	158.639	828.063	3.707	18.537	
6	2003	156.896	3.487	153.410	155.153	983.216	3.707	22.245	
7	2004	153.410	3.487	149.923	151.666	1134.882	3.707	25.952	
8	2005	149.923	3.487	146.436	148.180	1283.062	3.707	29.660	
9	2006	146.436	3.487	142.950	144.693	1427.755	3.707	33.367	
10	2007	142.950	3.487	139.463	141.207	1568.962	3.707	37.075	2.363
11	2008	139.463	3.487	135.977	137.720	1706.682	3.707	40.782	
12	2009	135.977	3.487	132.490	134.233	1840.915	3.707	44.490	
13	2010	132.490	3.487	129.004	130.747	1971.662	3.707	48.197	
14	2011	129.004	3.487	125.517	127.260	2098.922	3.707	51.905	
15	2012	125.517	3.487	122.030	123.774	2222.696	3.707	55.612	
16	2013	122.030	3.487	118.544	120.287	2342.983	3.707	59.320	
17	2014	118.544	3.487	115.057	116.800	2459.783	3.707	63.027	
18	2015	115.057	3.487	111.571	113.314	2573.097	3.707	66.735	
19	2016	111.571	3.487	108.084	109.827	2682.924	3.707	70.442	
20	2017	108.084	3.487	104.597	106.341	2789.265	3.707	74.150	2.658
21	2018	104.597	3.487	101.111	102.854	2892.119	3.707	77.857	
22	2019	101.111	3.487	97.624	99.368	2991.487	3.707	81.565	
23	2020	97.624	3.487	94.138	95.881	3087.368	3.707	85.272	
24	2021	94.138	3.487	90.651	92.394	3179.762	3.707	88.980	
25	2022	90.651	3.487	87.165	88.908	3268.670	3.707	92.687	
26	2023	87.165	3.487	83.678	85.421	3354.091	3.707	96.394	
27	2024	83.678	3.487	80.191	81.935	3436.026	3.707	100.102	
28	2025	80.191	3.487	76.705	78.448	3514.474	3.707	103.809	
29	2026	76.705	3.487	73.218	74.962	3589.436	3.707	107.517	
30	2027	73.218	3.487	69.732	71.475	3660.911	3.707	111.224	3.038
31	2028	69.732	3.487	66.245	67.988	3728.899	3.707	114.932	
32	2029	66.245	3.487	62.758	64.502	3793.401	3.707	118.639	
33	2030	62.758	3.487	59.272	61.015	3854.416	3.707	122.347	
34	2031	59.272	3.487	55.785	57.529	3911.944	3.707	126.054	
35	2032	55.785	3.487	52.299	54.042	3965.986	3.707	129.762	
36	2033	52.299	3.487	48.812	50.555	4016.542	3.707	133.469	
37	2034	48.812	3.487	45.326	47.069	4063.611	3.707	137.177	
38	2035	45.326	3.487	41.839	43.582	4107.193	3.707	140.884	
39	2036	41.839	3.487	38.352	40.096	4147.289	3.707	144.592	
40	2037	38.352	3.487	34.866	36.609	4183.898	3.707	148.299	3.545
41	2038	34.866	3.487	31.379	33.123	4217.020	3.707	152.007	
42	2039	31.379	3.487	27.893	29.636	4246.656	3.707	155.714	
43	2040	27.893	3.487	24.406	26.149	4272.806	3.707	159.422	
44	2041	24.406	3.487	20.919	22.663	4295.468	3.707	163.129	
45	2042	20.919	3.487	17.433	19.176	4314.645	3.707	166.837	
46	2043	17.433	3.487	13.946	15.690	4330.334	3.707	170.544	
47	2044	13.946	3.487	10.460	12.203	4342.537	3.707	174.252	
48	2045	10.460	3.487	6.973	8.716	4351.254	3.707	177.959	
49	2046	6.973	3.487	3.487	5.230	4356.484	3.707	181.667	
50	2047	3.487	3.487	0.000	1.743	4358.227	3.707	185.374	4.253
Total		4445.391	174.329	4271.062	4358.227		185.374		

Table 14-15 Rate of Return (Principal Case 1)

No.	Year	Average Net Fixed Assets in Operation					Profit		Rate of Return (%)
		Beginning Balance	Depreciation	Ending Balance	Average Yearly	Accumulative Average	Yearly	Accumulative Profit	
1	1998	164.631	3.293	161.338	162.985	162.985	3.901	3.901	
2	1999	161.338	3.293	158.046	159.692	322.677	3.901	7.803	
3	2000	158.046	3.293	154.753	156.400	479.076	3.901	11.704	
4	2001	154.753	3.293	151.461	153.107	632.183	3.901	15.606	
5	2002	151.461	3.293	148.168	149.814	781.998	3.901	19.507	
6	2003	148.168	3.293	144.875	146.522	928.519	3.901	23.409	
7	2004	144.875	3.293	141.583	143.229	1071.748	3.901	27.310	
8	2005	141.583	3.293	138.290	139.936	1211.685	3.901	31.212	
9	2006	138.290	3.293	134.997	136.644	1348.329	3.901	35.113	
10	2007	134.997	3.293	131.705	133.351	1481.680	3.901	39.014	2.604
11	2008	131.705	3.293	128.412	130.059	1611.738	3.901	42.916	
12	2009	128.412	3.293	125.120	126.766	1738.504	3.901	46.817	
13	2010	125.120	3.293	121.827	123.473	1861.978	3.901	50.719	
14	2011	121.827	3.293	118.534	120.181	1982.158	3.901	54.620	
15	2012	118.534	3.293	115.242	116.888	2099.046	3.901	58.522	
16	2013	115.242	3.293	111.949	113.595	2212.642	3.901	62.423	
17	2014	111.949	3.293	108.657	110.303	2322.945	3.901	66.324	
18	2015	108.657	3.293	105.364	107.010	2429.955	3.901	70.226	
19	2016	105.364	3.293	102.071	103.718	2533.672	3.901	74.127	
20	2017	102.071	3.293	98.779	100.425	2634.097	3.901	78.029	2.962
21	2018	98.779	3.293	95.486	97.132	2731.230	3.901	81.930	
22	2019	95.486	3.293	92.193	93.840	2825.069	3.901	85.832	
23	2020	92.193	3.293	88.901	90.547	2915.617	3.901	89.733	
24	2021	88.901	3.293	85.608	87.254	3002.871	3.901	93.635	
25	2022	85.608	3.293	82.316	83.962	3086.833	3.901	97.536	
26	2023	82.316	3.293	79.023	80.669	3167.502	3.901	101.437	
27	2024	79.023	3.293	75.730	77.377	3244.879	3.901	105.339	
28	2025	75.730	3.293	72.438	74.084	3318.963	3.901	109.240	
29	2026	72.438	3.293	69.145	70.791	3389.754	3.901	113.142	
30	2027	69.145	3.293	65.852	67.499	3457.253	3.901	117.043	3.385
31	2028	65.852	3.293	62.560	64.206	3521.459	3.901	120.945	
32	2029	62.560	3.293	59.267	60.914	3582.372	3.901	124.846	
33	2030	59.267	3.293	55.975	57.621	3639.993	3.901	128.748	
34	2031	55.975	3.293	52.682	54.328	3694.322	3.901	132.649	
35	2032	52.682	3.293	49.389	51.036	3745.357	3.901	136.550	
36	2033	49.389	3.293	46.097	47.743	3793.100	3.901	140.452	
37	2034	46.097	3.293	42.804	44.450	3837.551	3.901	144.353	
38	2035	42.804	3.293	39.511	41.158	3878.708	3.901	148.255	
39	2036	39.511	3.293	36.219	37.865	3916.574	3.901	152.156	
40	2037	36.219	3.293	32.926	34.573	3951.146	3.901	156.058	3.950
41	2038	32.926	3.293	29.634	31.280	3982.426	3.901	159.959	
42	2039	29.634	3.293	26.341	27.987	4010.413	3.901	163.860	
43	2040	26.341	3.293	23.048	24.695	4035.108	3.901	167.762	
44	2041	23.048	3.293	19.756	21.402	4056.510	3.901	171.663	
45	2042	19.756	3.293	16.463	18.109	4074.619	3.901	175.565	
46	2043	16.463	3.293	13.170	14.817	4089.436	3.901	179.466	
47	2044	13.170	3.293	9.878	11.524	4100.960	3.901	183.368	
48	2045	9.878	3.293	6.585	8.232	4109.192	3.901	187.269	
49	2046	6.585	3.293	3.293	4.939	4114.131	3.901	191.171	
50	2047	3.293	3.293	0.000	1.646	4115.777	3.901	195.072	4.740
Total		4198.092	164.631	4033.461	4115.777		195.072		

Table 14-16 Rate of Return (Principal Case 2)

No.	Year	Average Net Fixed Assets in Operation					Profit		Rate of Return (%)
		Beginning Balance	Depreciation	Ending Balance	Average Yearly	Accumulative Average	Yearly	Accumulative Profit	
1	1998	176.848	3.537	173.311	175.079	175.079	3.657	3.657	2.298
2	1999	173.311	3.537	169.774	171.542	346.621	3.657	7.314	
3	2000	169.774	3.537	166.237	168.005	514.627	3.657	10.971	
4	2001	166.237	3.537	162.700	164.468	679.095	3.657	14.628	
5	2002	162.700	3.537	159.163	160.931	840.026	3.657	18.286	
6	2003	159.163	3.537	155.626	157.394	997.421	3.657	21.943	
7	2004	155.626	3.537	152.089	153.857	1151.278	3.657	25.600	
8	2005	152.089	3.537	148.552	150.320	1301.598	3.657	29.257	
9	2006	148.552	3.537	145.015	146.784	1448.382	3.657	32.914	
10	2007	145.015	3.537	141.478	143.247	1591.629	3.657	36.571	
11	2008	141.478	3.537	137.941	139.710	1731.338	3.657	40.228	
12	2009	137.941	3.537	134.404	136.173	1867.511	3.657	43.885	
13	2010	134.404	3.537	130.867	132.636	2000.146	3.657	47.542	
14	2011	130.867	3.537	127.330	129.099	2129.245	3.657	51.200	
15	2012	127.330	3.537	123.793	125.562	2254.807	3.657	54.857	
16	2013	123.793	3.537	120.256	122.025	2376.832	3.657	58.514	
17	2014	120.256	3.537	116.719	118.488	2495.320	3.657	62.171	
18	2015	116.719	3.537	113.182	114.951	2610.271	3.657	65.828	
19	2016	113.182	3.537	109.646	111.414	2721.685	3.657	69.485	
20	2017	109.646	3.537	106.109	107.877	2829.562	3.657	73.142	
21	2018	106.109	3.537	102.572	104.340	2933.902	3.657	76.799	
22	2019	102.572	3.537	99.035	100.803	3034.705	3.657	80.456	
23	2020	99.035	3.537	95.498	97.266	3131.971	3.657	84.114	
24	2021	95.498	3.537	91.961	93.729	3225.700	3.657	87.771	
25	2022	91.961	3.537	88.424	90.192	3315.893	3.657	91.428	
26	2023	88.424	3.537	84.887	86.655	3402.548	3.657	95.085	
27	2024	84.887	3.537	81.350	83.118	3485.666	3.657	98.742	
28	2025	81.350	3.537	77.813	79.581	3565.248	3.657	102.399	
29	2026	77.813	3.537	74.276	76.044	3641.292	3.657	106.056	
30	2027	74.276	3.537	70.739	72.508	3713.800	3.657	109.713	
31	2028	70.739	3.537	67.202	68.971	3782.770	3.657	113.370	
32	2029	67.202	3.537	63.665	65.434	3848.204	3.657	117.028	
33	2030	63.665	3.537	60.128	61.897	3910.101	3.657	120.685	
34	2031	60.128	3.537	56.591	58.360	3968.460	3.657	124.342	
35	2032	56.591	3.537	53.054	54.823	4023.283	3.657	127.999	
36	2033	53.054	3.537	49.517	51.286	4074.569	3.657	131.656	
37	2034	49.517	3.537	45.980	47.749	4122.318	3.657	135.313	
38	2035	45.980	3.537	42.443	44.212	4166.530	3.657	138.970	
39	2036	42.443	3.537	38.906	40.675	4207.205	3.657	142.627	
40	2037	38.906	3.537	35.370	37.138	4244.343	3.657	146.284	
41	2038	35.370	3.537	31.833	33.601	4277.944	3.657	149.941	
42	2039	31.833	3.537	28.296	30.064	4308.008	3.657	153.599	
43	2040	28.296	3.537	24.759	26.527	4334.535	3.657	157.256	
44	2041	24.759	3.537	21.222	22.990	4357.525	3.657	160.913	
45	2042	21.222	3.537	17.685	19.453	4376.978	3.657	164.570	
46	2043	17.685	3.537	14.148	15.916	4392.895	3.657	168.227	
47	2044	14.148	3.537	10.611	12.379	4405.274	3.657	171.884	
48	2045	10.611	3.537	7.074	8.842	4414.116	3.657	175.541	
49	2046	7.074	3.537	3.537	5.305	4419.422	3.657	179.198	
50	2047	3.537	3.537	0.000	1.768	4421.190	3.657	182.855	
Total		4509.614	176.848	4332.766	4421.190		182.855		4.136

Table 14-17 Rate of Return (Reference Case 3)

(US\$M)

No.	Year	Average Net Fixed Assets in Operation					Profit		Rate of Return (%)
		Beginning Balance	Depreciation	Ending Balance	Average Yearly	Accumulative Average	Yearly	Accumulative Profit	
1	1998	172.060	3.441	168.619	170.340	170.340	3.753	3.753	
2	1999	168.619	3.441	165.178	166.899	337.238	3.753	7.506	
3	2000	165.178	3.441	161.737	163.457	500.696	3.753	11.259	
4	2001	161.737	3.441	158.296	160.016	660.712	3.753	15.011	
5	2002	158.296	3.441	154.854	156.575	817.287	3.753	18.764	
6	2003	154.854	3.441	151.413	153.134	970.421	3.753	22.517	
7	2004	151.413	3.441	147.972	149.693	1120.113	3.753	26.270	
8	2005	147.972	3.441	144.531	146.251	1266.365	3.753	30.023	
9	2006	144.531	3.441	141.090	142.810	1409.175	3.753	33.776	
10	2007	141.090	3.441	137.648	139.369	1548.544	3.753	37.529	2.423
11	2008	137.648	3.441	134.207	135.928	1684.472	3.753	41.281	
12	2009	134.207	3.441	130.766	132.487	1816.958	3.753	45.034	
13	2010	130.766	3.441	127.325	129.045	1946.004	3.753	48.787	
14	2011	127.325	3.441	123.884	125.604	2071.608	3.753	52.540	
15	2012	123.884	3.441	120.442	122.163	2193.771	3.753	56.293	
16	2013	120.442	3.441	117.001	118.722	2312.492	3.753	60.046	
17	2014	117.001	3.441	113.560	115.280	2427.773	3.753	63.799	
18	2015	113.560	3.441	110.119	111.839	2539.612	3.753	67.551	
19	2016	110.119	3.441	106.677	108.398	2648.010	3.753	71.304	
20	2017	106.677	3.441	103.236	104.957	2752.967	3.753	75.057	2.726
21	2018	103.236	3.441	99.795	101.516	2854.483	3.753	78.810	
22	2019	99.795	3.441	96.354	98.074	2952.557	3.753	82.563	
23	2020	96.354	3.441	92.913	94.633	3047.190	3.753	86.316	
24	2021	92.913	3.441	89.471	91.192	3138.382	3.753	90.068	
25	2022	89.471	3.441	86.030	87.751	3226.133	3.753	93.821	
26	2023	86.030	3.441	82.589	84.310	3310.443	3.753	97.574	
27	2024	82.589	3.441	79.148	80.868	3391.311	3.753	101.327	
28	2025	79.148	3.441	75.707	77.427	3468.738	3.753	105.080	
29	2026	75.707	3.441	72.265	73.986	3542.724	3.753	108.833	
30	2027	72.265	3.441	68.824	70.545	3613.269	3.753	112.586	3.116
31	2028	68.824	3.441	65.383	67.104	3680.373	3.753	116.338	
32	2029	65.383	3.441	61.942	63.662	3744.035	3.753	120.091	
33	2030	61.942	3.441	58.501	60.221	3804.256	3.753	123.844	
34	2031	58.501	3.441	55.059	56.780	3861.036	3.753	127.597	
35	2032	55.059	3.441	51.618	53.339	3914.375	3.753	131.350	
36	2033	51.618	3.441	48.177	49.898	3964.272	3.753	135.103	
37	2034	48.177	3.441	44.736	46.456	4010.729	3.753	138.856	
38	2035	44.736	3.441	41.295	43.015	4053.744	3.753	142.608	
39	2036	41.295	3.441	37.853	39.574	4093.318	3.753	146.361	
40	2037	37.853	3.441	34.412	36.133	4129.451	3.753	150.114	3.635
41	2038	34.412	3.441	30.971	32.691	4162.142	3.753	153.867	
42	2039	30.971	3.441	27.530	29.250	4191.392	3.753	157.620	
43	2040	27.530	3.441	24.088	25.809	4217.201	3.753	161.373	
44	2041	24.088	3.441	20.647	22.368	4239.569	3.753	165.126	
45	2042	20.647	3.441	17.206	18.927	4258.496	3.753	168.878	
46	2043	17.206	3.441	13.765	15.485	4273.981	3.753	172.631	
47	2044	13.765	3.441	10.324	12.044	4286.025	3.753	176.384	
48	2045	10.324	3.441	6.882	8.603	4294.629	3.753	180.137	
49	2046	6.882	3.441	3.441	5.162	4299.790	3.753	183.890	
50	2047	3.441	3.441	0.000	1.721	4301.511	3.753	187.643	4.362
Total		4387.541	172.060	4215.481	4301.510		187.643		

14.4 財務的等価割引率 (FIRR) 15%を得るための電力単価

営業開始後50年間各年の収益および費用を一定と設定した。まず、50年間の建設費および、維持管理費および燃料費からなる費用を第2期計画業務開始年の1991年初頭に累積現在価値換算を行ない、費用としてUS\$ 114.70 Millions を得た。便益がこの費用の累積現在価値と同額となるためには、発電端電力量450GWhの場合、Table 14-18 に示す通り P2. 13584/kWh となる。

Table 14-18 Unit Price of Electricity Viewed from FIRR
P2. 13584/kWh

(In US\$M)

No.	Year	Operating Income	Cost			Present value Dis. rate:15%	
			Con. Cost	O/M&Fuel	Total	Benefit (B)	Cost (C)
1	1991		0.57		0.57		0.53
2	1992		0.57		0.57		0.46
3	1993		12.91		12.91		9.10
4	1994		24.75		24.75		15.18
5	1995		39.12		39.12		20.86
6	1996		45.45		45.45		21.07
7	1997		18.13		18.13		7.57
1	1998	42.72		14.87	14.87		
2	1999	42.72		14.87	14.87		
3	2000	42.72		14.87	14.87		
4	2001	42.72		14.87	14.87		
5	2002	42.72		14.87	14.87		
6	2003	42.72		14.87	14.87		
7	2004	42.72		14.87	14.87		
8	2005	42.72		14.87	14.87		
9	2006	42.72		14.87	14.87		
10	2007	42.72		14.87	14.87	※ 114.70	※ 39.93
*	*	*		*	*		
*	*	*		*	*		
*	*	*		*	*		
49	2046	42.72		14.87	14.87		
50	2047	42.72		14.87	14.87		
Total		2,135.84	141.50	743.50	885.00	114.70	114.70
B - C						0.0	

※ 耐用年数50年間は収益、費用ともにコンスタントなので、年度収益（費用）に次の式によって算出される年金現価率を乗じて50年間の累積現価額を求めた。

$$\frac{(1+r)^{50} - 1}{r(1+r)^{50}} \times \frac{1}{(1+r)^{6.5}}$$

r = 割引率 = 0.15

A P P E N D I X

APPENDIX 1 ホーリング 柱状図

GEOLOGIC LOG OF DRILL HOLE

Kalayaan Stage 2 PROJECT HOLE No. ST2-1 (SHEET 1 OF 4)

LOCATION _____ DEPTH OF HOLE 70.35 m COMMENCED 4-04-90

ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 5-05-90

COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPOCOR

ANGLE FROM HORIZONTAL 45 ° TOTAL LENGTH OF CORE _____ m LOGGED BY P.E. PNIA

BEARING OF ANGLE HOLE S50 E CORE RECOVERY _____ %

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF BIT CASING	OBSERVATION OF CORE				DESCRIPTION	WATER TABLE		DEPTH	ELEVATION
					COLOR	WEATHERING	HARDNESS	CORE CUTTING		WATER TABLE	WATER PRESSURE TEST		
0m			0-100								0	40	0m
1				HQ					<p>Fill materials consisting of subrounded, fragmental sizes of basalt clasts/gravel to boulder embedded in a highly plastic clay</p> <p>3.98 Brownish return water.</p> <p>6.43</p> <p>7.18</p> <p>9.63</p> <p>11.13 Fine silty clay; highly plastic. Sludge samples received at 9.63-11.13 m.</p> <p>12.63 yellowish brown, fine grained, highly weathered and fragmental</p> <p>15.58 medium grained clasts and medium grained. Highly fractured</p> <p>16.78</p> <p>18.08 Brownish to grayish return water.</p> <p>19.53</p>				
2				HQ									
3				HQ									
4				HQ	Brownish								
5				HQ									
6				HQ									
7				HQ									
8				HQ									
9				HQ									
10				HQ									
11				HQ	yellowish brown								
12				HQ									
13				HQ		4	4	5					
14				HQ									
15				HQ		4	3	4					
16				HQ		4	3	4					
17				HQ	Brownish								
18				HQ		4	3	4					
19				HQ									
20				HQ		4	3	4					

Fill materials

driller's note 4

1 (stick) 2 (substick) 3 (piece) 4 (fragment) 5 grain

1 (hard) ~ 5 (soft)

1 (fresh) ~ 5 (decomposed)

core loss

RQD

GEOLOGIC LOG OF DRILL HOLE

Kalayzan Stage 2 PROJECT HOLE No. *ST2-1* (SHEET 2 OF 4)

LOCATION _____ DEPTH OF HOLE 70.35 m COMMENCED 4-04-90
 ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 5-05-90
 COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPOCOR
 ANGLE FROM HORIZONTAL 45° TOTAL LENGTH OF CORE _____ m LOGGED BY P. E. PAÑA
 BEARING OF ANGLE HOLE S50°E CORE RECOVERY _____ %

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF BIT CASING	OBSERVATION OF CORE					DESCRIPTION	WATER TABLE		DEPTH	ELEVATION
					COLOR	WEATHERING	HARDNESS	CORE CUTTING	WATER PRESSURE TEST		LEAKAGE OF DRILLING WATER	DEPTH		
0-2.0m			0-100%									0	2.0m	
1	Fill materials	S.O.S.	100%	↑	Brownish	4	3	5	21.13					
2						5	4	5	21.83					
3						4	3	5	23.33					
4	Volcanic Breccia	Δ	100%	↑	Brownish	4	3	3	24.18	Volcanic Breccias, grayish, medium grained clasts and coarse sandy tuff matrix.				
5						3	3	3	26.38					
6						3	3	3	26.38		Brownish to grayish return water.			
7						3	3	3	28.65					
8						3	3	3	27.35					
9	Volcanic Breccia	Δ	100%	↑	grayish	2	2	3	32.40					
2						2	2	2	35.45					
3						1	2	2	38.50					
4														

driller's note 4
 1 (stick) 2 (substick) 3 (piece) 4 (fragment) 5 grain
 1 (hard) - 5 (soft)
 1 (fresh) - 5 (decomposed)

core loss
 nqo

GEOLOGIC LOG OF DRILL HOLE

Kalayaan Stage 2 PROJECT HOLE No. *ST2-1* (SHEET 3 OF 4)

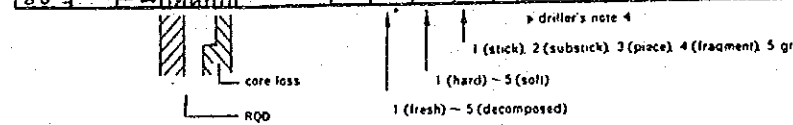
LOCATION _____ DEPTH OF HOLE 70.35 m COMMENCED 4-04-90
 ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 5-05-90
 COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPOCOR
 ANGLE FROM HORIZONTAL 45° TOTAL LENGTH OF CORE _____ m LOGGED BY P. E. PANA
 BEARING OF ANGLE HOLE S50°E CORE RECOVERY _____ %

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF BIT CASING	OBSERVATION OF CORE				DESCRIPTION	WATER TABLE		DEPTH	ELEVATION
					COLOR	WEATHERING	HARDNESS	CORE CUTTING		WATER PRESSURE TEST	LEAKAGE OF DRILLING WATER		
0m			0-100%										
1		Δ							41.55				
2		Δ Δ							Volcanic Breccia; grayish medium grained clasts and coarse grained sandy tuff matrix.				
3													
4		Δ							Brownish to grayish return water.				
5													
6		Δ Δ							Face flow was observed at 47.65 m depth, discharge of				
7									47.65 0.14 lit/sec.				
8		Δ											
9		Δ Δ											
10													
11		Δ							50.70				
12													
13		Δ Δ											
14									53.75				
15		Δ											
16													
17		Δ Δ							56.80				
18													
19		Δ											
20													
21		Δ Δ							59.85				
22													

Volcanic Breccia

NO coring bit

grayish

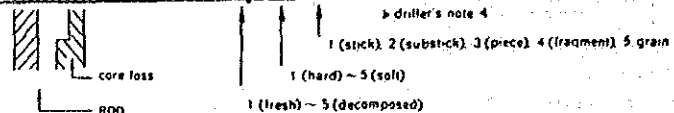


GEOLOGIC LOG OF DRILL HOLE

Kalayaan Stage 2 PROJECT HOLE No. ST2-1 (SHEET 4 OF 4)

LOCATION _____ DEPTH OF HOLE 70.35 m COMMENCED 4-04-90
 ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 5-05-90
 COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPOCOR
 ANGLE FROM HORIZONTAL 45° TOTAL LENGTH OF CORE _____ m LOGGED BY P.E. PARIJA
 BEARING OF ANGLE HOLE S50E CORE RECOVERY _____ %

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF BIT CASING	OBSERVATION OF CORE					DESCRIPTION	WATER TABLE			DEPTH	ELEVATION
					COLOR	WEATHERING	HARDNESS	CORE CUTTING	WATER PRESSURE TEST		LEAKAGE OF DRILLING WATER	LUGEON			
0m			0-100%										0m	4.3	
1	Volcanic Breccia	Δ								Volcanic Breccia; grayish, very well cemented, medium grained clasts, and coarse sandy tuff matrix.					
2		Δ Δ								61.35					
3		Δ									62.70				
4		Δ									64.40				
6		Δ Δ									65.75				
9		Δ Δ									69.0				
0	Δ									70.35					
1										End of Hole					



GEOLOGIC LOG OF DRILL HOLE

Kalayaan Stage 2 PROJECT HOLE No. ST2-2 (SHEET 1 OF 3)

LOCATION _____ DEPTH OF HOLE _____ m COMMENCED 3-5-90

ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 4-7-90

COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPOLOK

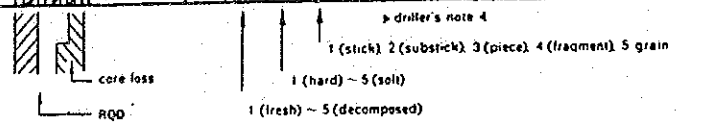
ANGLE FROM HORIZONTAL 90° TOTAL LENGTH OF CORE _____ m LOGGED BY PE. PANA

BEARING OF ANGLE HOLE _____ CORE RECOVERY _____ %

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF BIT CASING	OBSERVATION OF CORE					DESCRIPTION	WATER TABLE		DEPTH	ELEVATION
					COLOR	WEATHERING	HARDNESS	CORE CUTTING	WATER PRESSURE TEST		LEAKAGE OF DRILLING WATER			
0m			0-100%									0	0m	
1	Sand, gravel									Concrete with mixture of sand and gravel				
2														
3														
4										Volcanic breccia; medium grained clasts and medium sandy tuff matrix.				
5														
6														
7										Brownish gray return water				
8														
9														
10														
11														
12														
13														
14														
15														
16										Encountered free flowing at 15.63 - 17.05 m depth, discharge = 1.3 lit/min.				
17														
18														
19														
20														

Volcanic Breccia

grayish



GEOLOGIC LOG OF DRILL HOLE

Kalayaan Stage 2 PROJECT

HOLE No. ST-2-2 (SHEET 2 OF 3)

LOCATION _____	DEPTH OF HOLE _____ m	COMMENCED <u>3-5-90</u>
ELEVATION _____ m	DEPTH OF OVERBURDEN _____ m	COMPLETED <u>4-7-90</u>
COORDINATE _____	LENGTH OF ROCK DRILLING _____ m	DRILLED BY <u>NAPOCOR</u>
ANGLE FROM HORIZONTAL <u>90°</u>	TOTAL LENGTH OF CORE _____ m	LOGGED BY <u>P.E. PAÑA</u>
BEARING OF ANGLE HOLE _____	CORE RECOVERY _____ %	

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF BIT CASING	OBSERVATION OF CORE				DESCRIPTION	WATER TABLE		DEPTH	ELEVATION
					COLOR	WEATHERING	HARDNESS	CORE CUTTING		WATER PRESSURE TEST	LEAKAGE OF DRILLING WATER		
2.0m			0-100%										
1	Volcanic Breccia	Δ			grayish	1	3	2	20.45				
2		Δ											
3		Δ											
4		Δ							23.45				
5					"								
6		Δ				2	3	2	26.45				
7													
8		Δ			"								
9		Δ				3	3	2	29.45				
10	Lapilli Tuff	Δ			brownish orange				Lapilli Tuff; brownish orange, well cemented.				
1		Δ							Brownish to grayish return water.				
2		Δ					1	2	2	32.50			
3		Δ											
4					"								
5		Δ				3	3	3	35.55				
6													
7		Δ			"								
8		Δ				3	3	4	38.60				
9		Δ			grayish								
10		Δ											

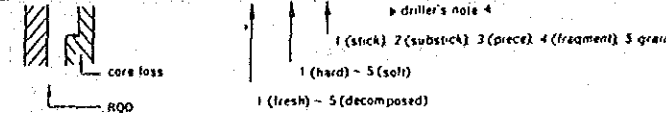
↓ driller's note ↓
 1 (stick) 2 (subrock) 3 (piece) 4 (fragment) 5 grain
 1 (hard) - 5 (soft)
 1 (fresh) - 5 (decomposed)

GEOLOGIC LOG OF DRILL HOLE

Kalsayan Stage 2 PROJECT HOLE No. ST2-2 (SHEET 3 of 3)

LOCATION _____ DEPTH OF HOLE _____ m COMMENCED 3-5-90
 ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 4-7-90
 COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPCOR
 ANGLE FROM HORIZONTAL 90° TOTAL LENGTH OF CORE _____ m LOGGED BY P.E. PAÑA
 BEARING OF ANGLE HOLE _____ CORE RECOVERY _____ %

DEPTH 40m	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF BIT CASING	OBSERVATION OF CORE				DESCRIPTION	WATER TABLE				DEPTH	ELEVATION	
					COLOR	WEATHERING	HARDNESS	CORE CUTTING		WATER PRESSURE TEST	LEAKAGE OF DRILLING WATER					
			0-100%							LUGEON						
										0	10	20	30	40	40m	
1	Volcanic Breccia	Δ			grayish	2	3	2	41.65	Volcanic Breccia; grayish very well cemented, medium grained clasts and coarse grained sandy tuff.	[Hatched area]				1	
2		Δ Δ			"										2	
3		Δ			"										3	
4		Δ Δ			"										4	
5		Δ Δ			"				44.70						5	
6		Δ			"										6	
7		Δ			"										7	
8		Δ Δ			"				47.75						8	
9	Δ			"					9							
50	Δ Δ			"					50							
1									End of Hole at 50.80 m.					1		
2														2		
3														3		
4														4		
5														5		
6														6		
7														7		
8														8		
9														9		
0														0		



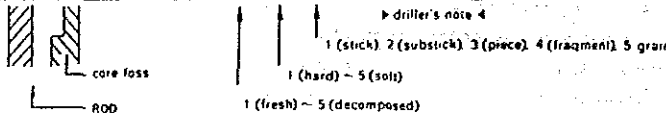
GEOLOGIC LOG OF DRILL HOLE

Kalayaan Stage 2 PROJECT

HOLE No. ST2-3 (SHEET 1 OF 2)

LOCATION _____ DEPTH OF HOLE 30.20 m COMMENCED 4-19-90
 ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 5-03-90
 COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPOCOR
 ANGLE FROM HORIZONTAL 90 ° TOTAL LENGTH OF CORE _____ m LOGGED BY P.E. PANA
 BEARING OF ANGLE HOLE _____ CORE RECOVERY _____ %

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION KIND OF CASING	COLOR	WEATHERING	HARDNESS	CORE CUTTING	DESCRIPTION	OBSERVATION OF CORE			DEPTH	ELEVATION	
										WATER TABLE	WATER PRESSURE TEST	LEAKAGE OF DRILLING WATER			
0m			0-100							LUGEON			0m	4.3	
1	Basalt			NW casing bit	reddish gray to dark gray	3	3	5	Basalt; reddish gray to gray and porphyritic. Noted to fracture with the core axis.	0	0	0	1	4.3	
2									3.00						
3									Grayish return water.						
4									5.05						
5															
6															
7															
8									8.10						
9	Tuff	▲▲	▲▲	NB casing bit	reddish orange	3	3	3	Tuff; baked, reddish orange	0	0	0	9	4.3	
10									10.65						
1	Volcanic Breccia	▲▲	▲▲	NB casing bit	reddish gray to grayish	3	3	3	Volcanic Breccia; medium to coarse clasts of porphyritic basalt and coarse grained sandy tuff matrix.	0	0	0	1	4.3	
2									11.15						
3															
4									14.20						
5															
6									Brownish to grayish return water.						
7									17.25						
8															
9															
20															20



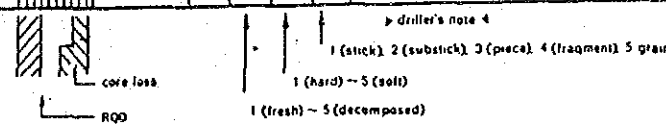
GEOLOGIC LOG OF DRILL HOLE

Katayuan Stage 2 PROJECT

HOLE No. *ST2-3* (SHEET 2 OF 2)

LOCATION _____ DEPTH OF HOLE 30.20 m COMMENCED 4-19-90
 ELEVATION _____ m DEPTH OF OVERBURDEN _____ m COMPLETED 5-03-90
 COORDINATE _____ LENGTH OF ROCK DRILLING _____ m DRILLED BY NAPOCOR
 ANGLE FROM HORIZONTAL 90 ° TOTAL LENGTH OF CORE _____ m LOGGED BY P. E. PAÑA
 BEARING OF ANGLE HOLE _____ CORE RECOVERY _____ %

DEPTH	ROCK NAME	LOG	CORE RECOVERY	OBSERVATION OF CORE				DESCRIPTION	WATER TABLE WATER PRESSURE TEST LEAKAGE OF DRILLING WATER	DEPTH	ELEVATION
				CEMENTATION KIND OF BIT CASING	COLOR	WEATHERING	HARDNESS				
0.05			0-100						0	2.0m	
1	Volcanic Breccia	Δ						20.30m		1	
2		Δ Δ					Volcanic Breccia; medium grained clast and coarse sandy tuff matrix.		2		
3		Δ			3	3	4	23.35		3	
4								Brownish to grayish returns water.		4	
5		Δ Δ								5	
6		Δ						26.40		6	
7										7	
8		Δ Δ								8	
9		Δ				3	3	2	29.45		9
30						3	3	2	30.20		30
1								End of Hole		1	
2										2	
3										3	
4										4	
5										5	
6										6	
7										7	
8										8	
9										9	
0										0	



APPENDIX 2 発破試験結果

MEASURING RESULTS OF BLASTING TESTS

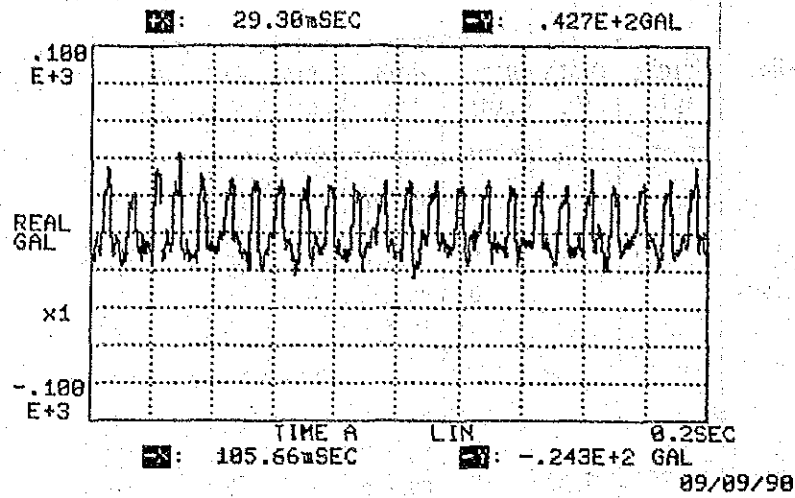
Case-No.	Weight (g)	Drill Depth (m)	Dis. (m)	Meas. Point No.	Acceleration(α) (gal=cm/s ²)	Frequencies(f) (Hertz)	Velocity ($V=\alpha/2\pi f$) (kine=cm/s)	K
Case-A (Explosive)	750	1.30	54	No. 1-H	43	120	0.06	201.5
			54	No. 1-V	22	120	0.03	103.1
			67	No. 2-H	32	120	0.04	230.8
			63	No. 3-H	35	120	0.05	223.2
			63	No. 3-V	15	120	0.02	95.7
Case-B (Explosive)	1,200	1.30	56	No. 1-H	220	120	0.29	810.3
			56	No. 1-V	49	120	0.06	180.5
			69	No. 2-H	52	120	0.07	290.8
			64	No. 3-H	55	120	0.07	264.6
			64	No. 3-V	55	120	0.07	264.6
Case-E (Explosive)	1,800	1.30	34	No. 1-H	59	120	0.08	61.1
			34	No. 1-V	209	120	0.28	216.6
			48	No. 2-H	205	120	0.27	423.3
			46	No. 3-H	220	120	0.29	417.2
			46	No. 3-V	272	120	0.36	515.9
Case-F (Explosive)	2,100	1.50	43	No. 1-H	70	80	0.14	157.0
			43	No. 1-V	67	25	0.43	480.9
			56	No. 2-H	80	25	0.51	973.9
			53	No. 3-H	251	110	0.36	622.1
			53	No. 3-V	164	80	0.33	558.9
Case-I (Calmmite)	25,560	1.50			More effectively			
Case-J (Calmmite)	64,440	1.50			Effectively			

Generating	No. 1-H	43	60	0.11
	No. 1-V	40	60	0.11
	No. 2-H	36	30	0.19
	No. 3-H	33	105	0.05
	No. 3-V	61	105	0.09

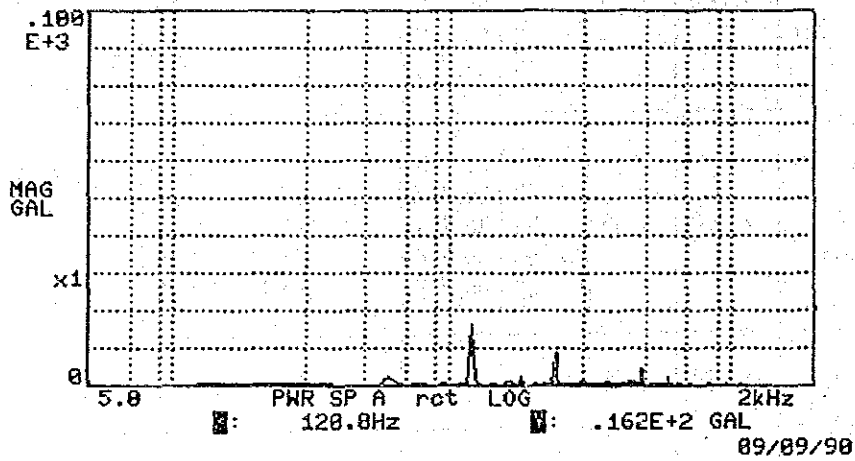
Non Generating	No. 1-H	7	120	0.01
	No. 1-V	21	120	0.03
	No. 2-H	21	120	0.03
	No. 3-H	22	120	0.03
	No. 3-V	23	120	0.03

Measuring point No.1 ; Power house's wall -H ; Horizontal component
 No.2 ; Switch control box -V ; Vertical component
 No.3 ; Generator room

KALAYAN P.S.P.P (II) BLASTING TEST CASE-A NO.-1H

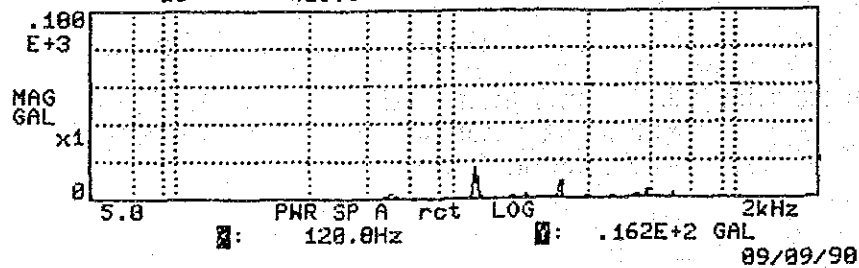


KALAYAN P.S.P.P (II) BLASTING TEST CASE-A NO.-1H

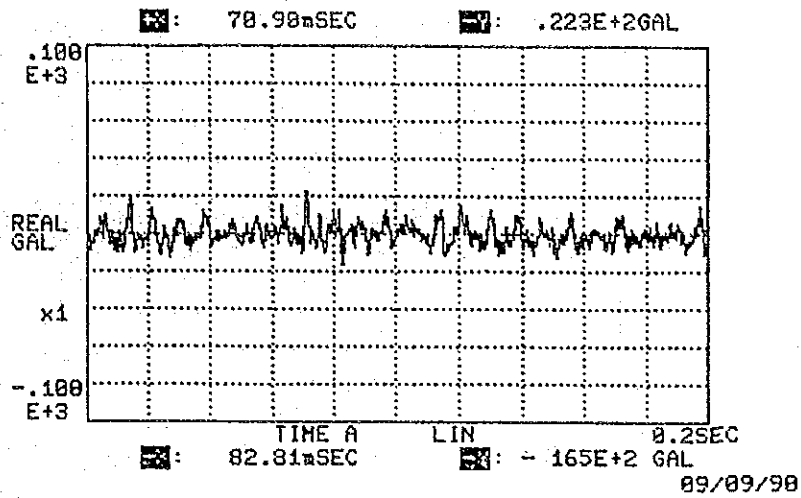


KALAYAN P.S.P.P (II) BLASTING TEST CASE-A NO.-1H

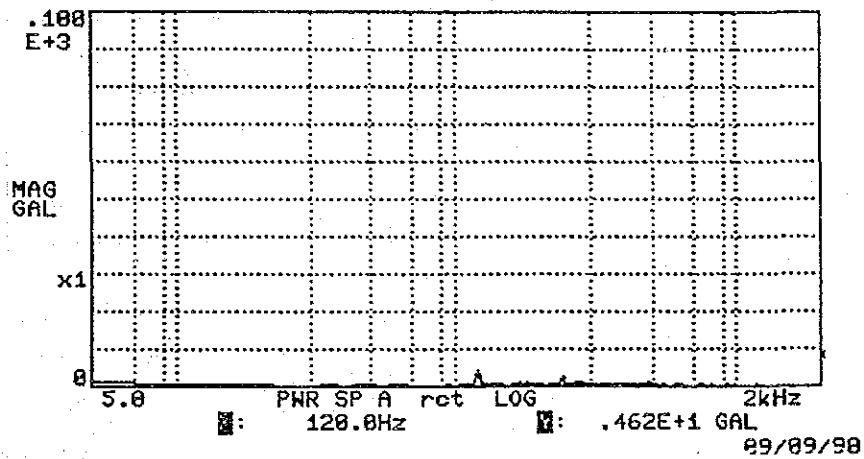
PWR SPECTRUM	ChA	
1	120.0Hz	.162E+2 GAL
2	240.0	.872E+1
3	480.0	.414E+1
4	60.0	.279E+1
5	180.0	.280E+1
6	600.0	.270E+1
7	360.0	.150E+1
8	165.0	.116E+1
9	295.0	.119E+1
10	435.0	.948E+0



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-1V

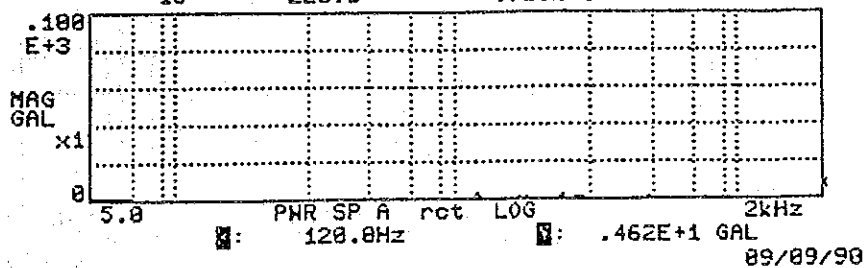


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-1V

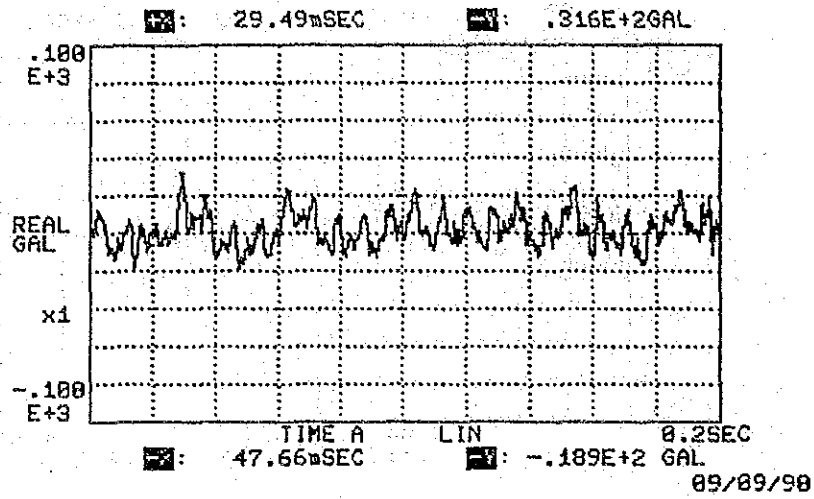


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-1V

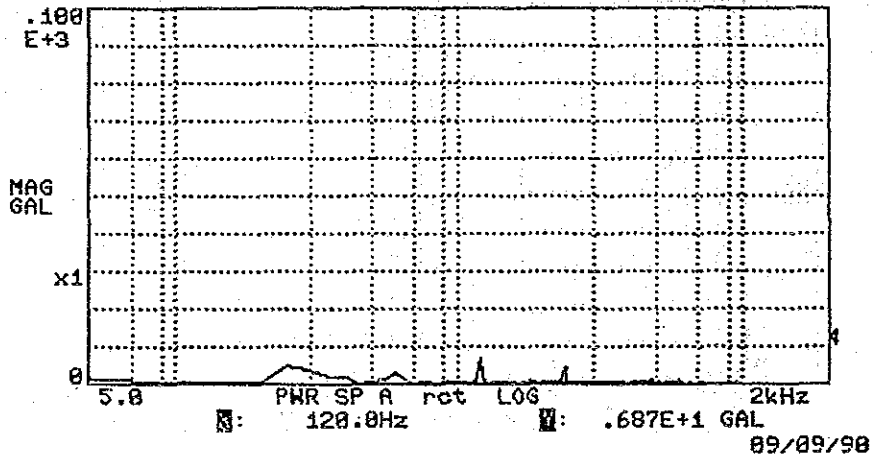
PWR SPECTRUM	Cha	
1	120.0Hz	.462E+1 GAL
2	240.0	.263E+1
3	265.0	.127E+1
4	480.0	.130E+1
5	170.0	.101E+1
6	180.0	.974E+0
7	285.0	.103E+1
8	60.0	.786E+0
9	160.0	.696E+0
10	220.0	.716E+0



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-2H

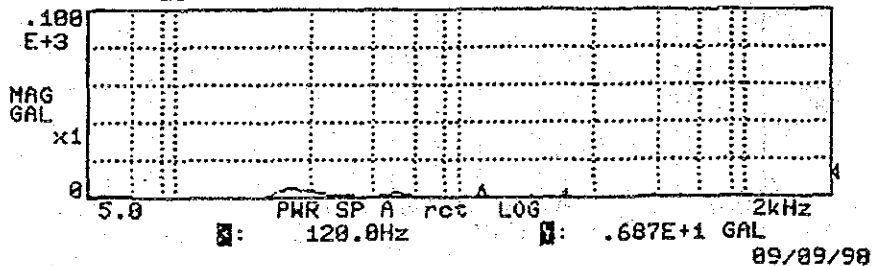


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-2H

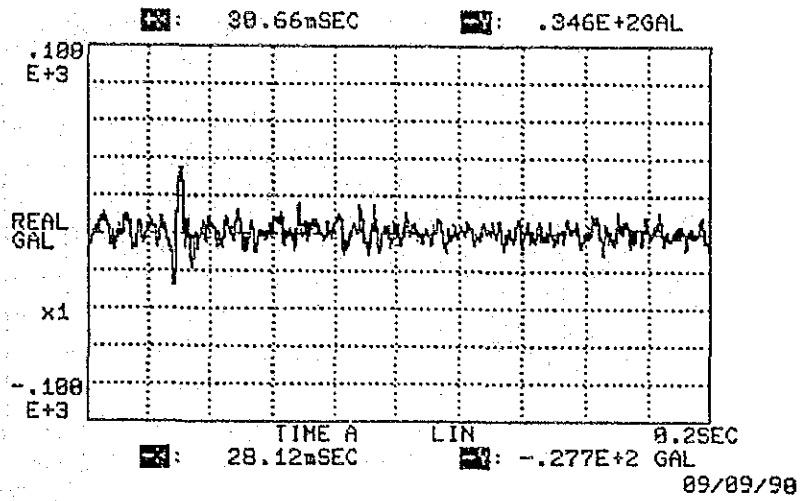


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-2H

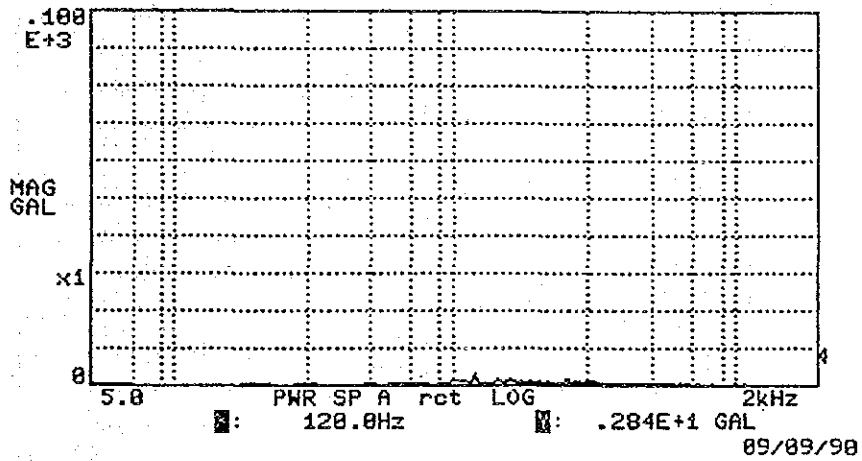
PWR SPECTRUM	ChA	
1	120.0Hz	.687E+1 GAL
2	25.0	.498E+1
3	248.0	.453E+1
4	60.0	.316E+1
5	480.0	.151E+1
6	180.0	.104E+1
7	600.0	.103E+1
8	15.0	.748E+0
9	80.0	.639E+0
10	100.0	.803E+0



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-3H

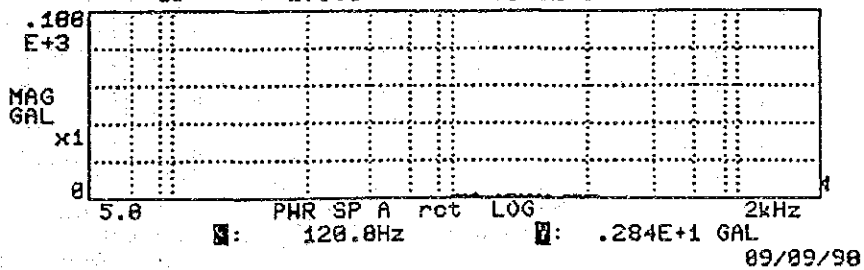


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-3H

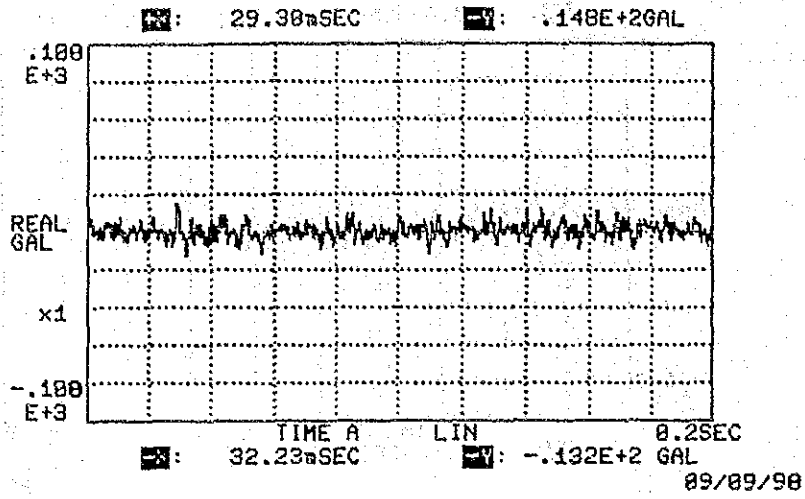


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-3H

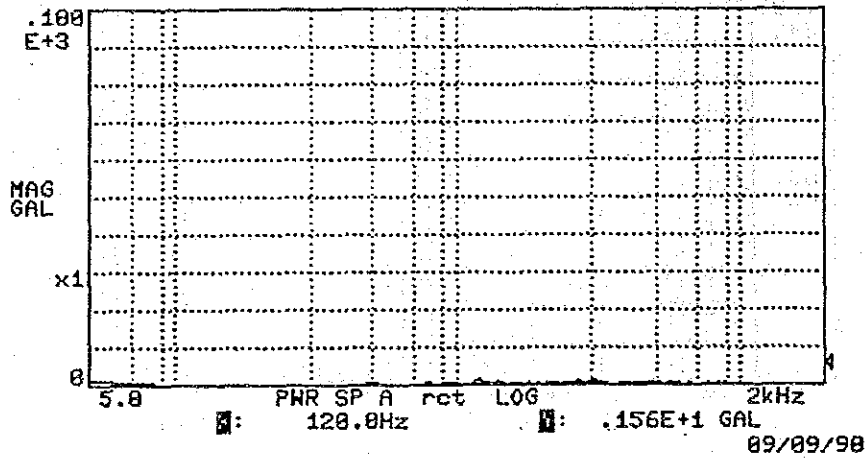
PWR SPECTRUM	ChA	
1	120.0Hz	.284E+1 GAL
2	145.0	.168E+1
3	160.0	.163E+1
4	255.0	.166E+1
5	110.0	.129E+1
6	205.0	.133E+1
7	215.0	.139E+1
8	175.0	.121E+1
9	190.0	.102E+1
10	275.0	.968E+0



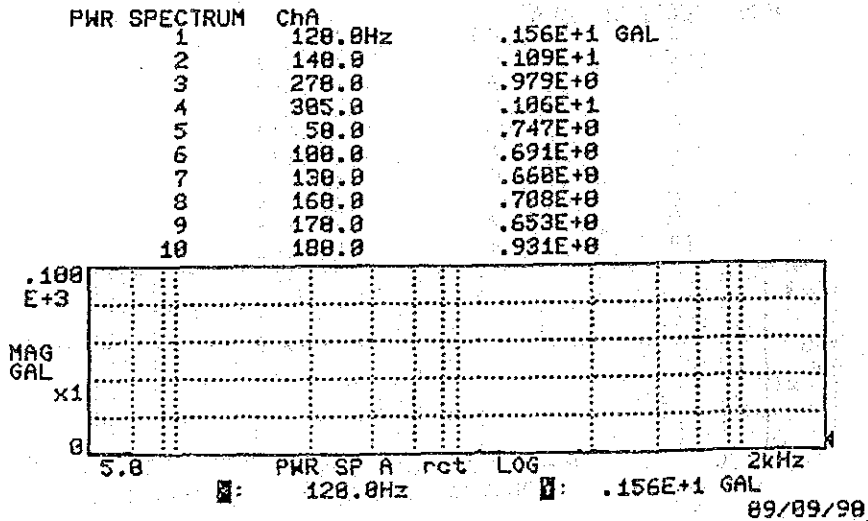
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-3V



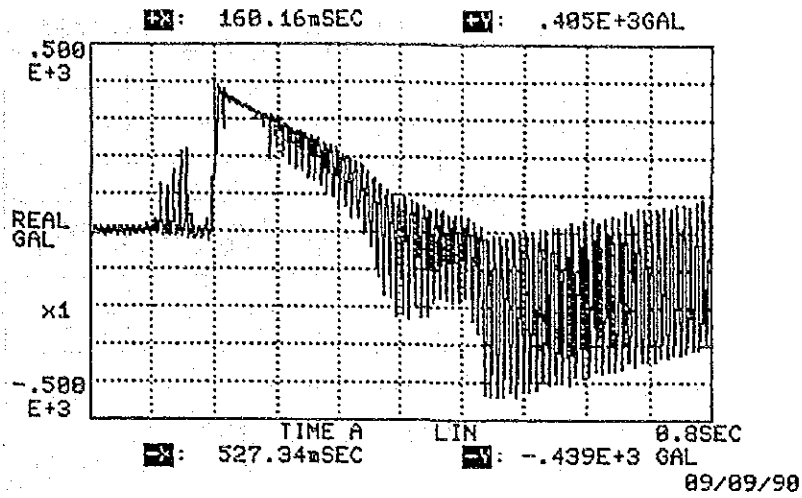
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-3V



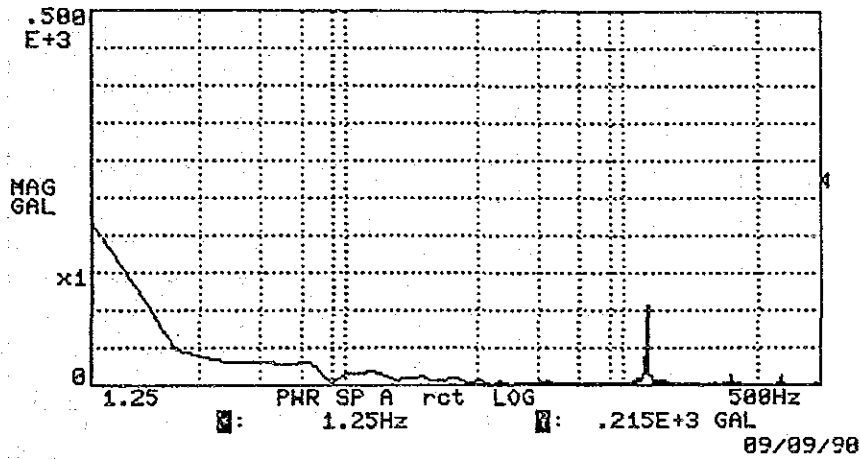
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-A NO.-3V



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-1H

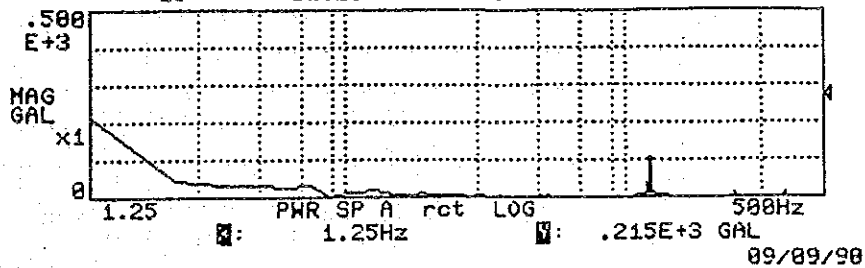


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-1H

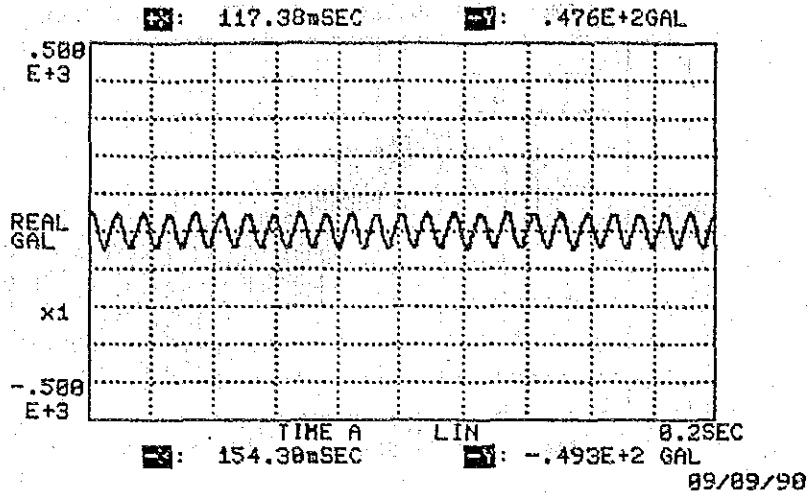


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-1H

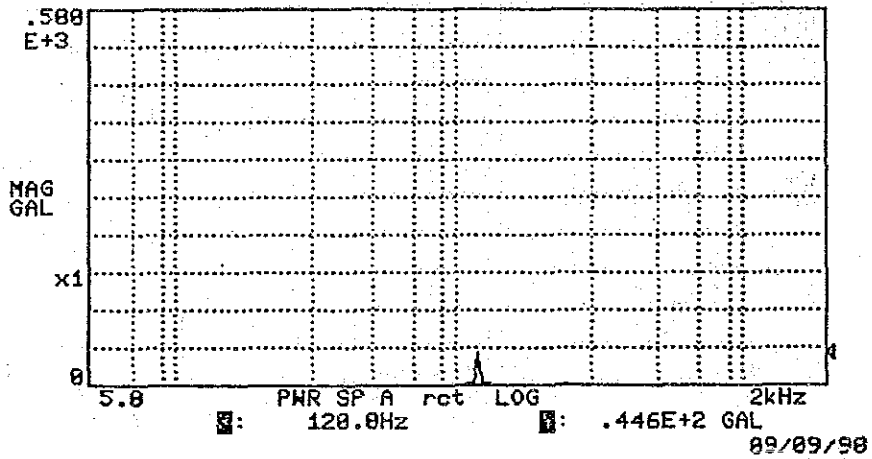
PWR SPECTRUM		
	ChA	
1	120.00Hz	.185E+3 GAL
2	7.50	.299E+2
3	12.50	.280E+2
4	18.75	.139E+2
5	240.00	.141E+2
6	362.50	.113E+2
7	112.50	.104E+2
8	25.00	.840E+1
9	360.00	.934E+1
10	31.25	.494E+1



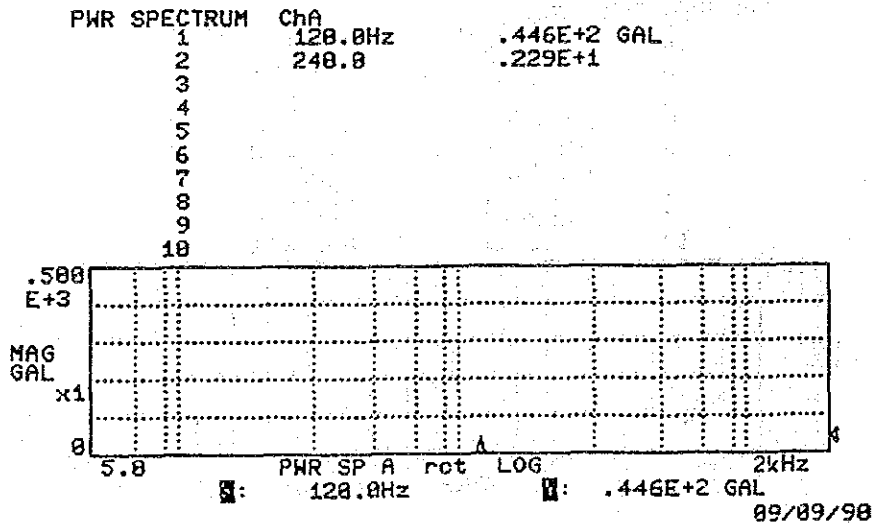
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-1V



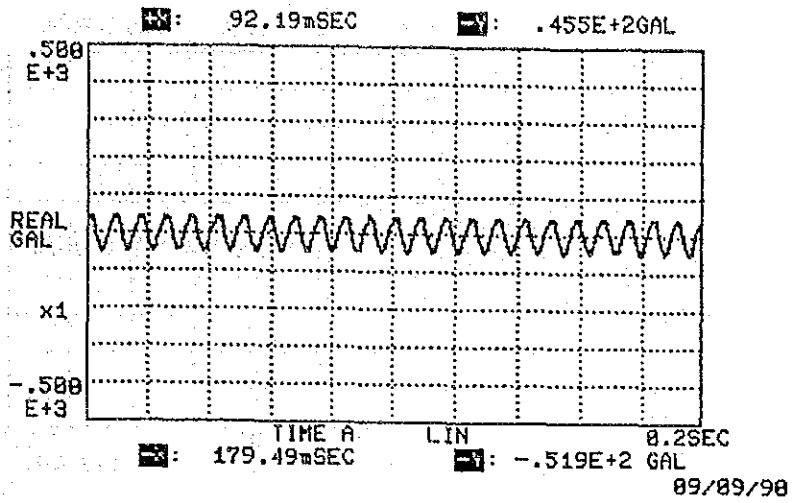
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-1V



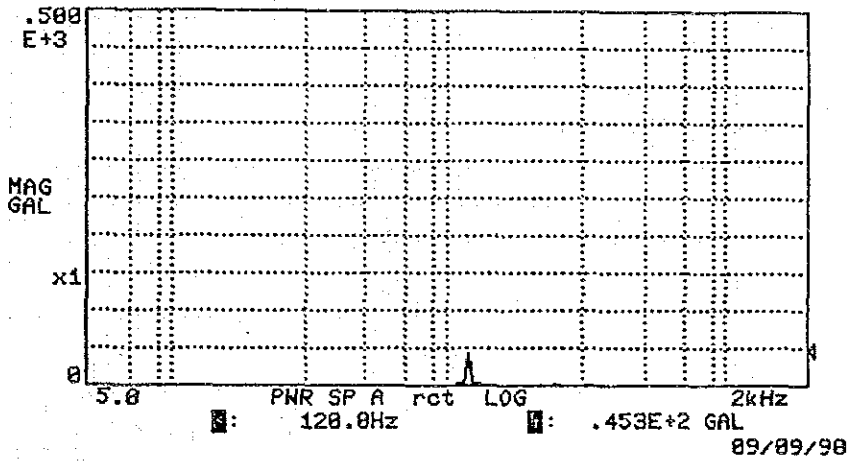
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-1V



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-2H



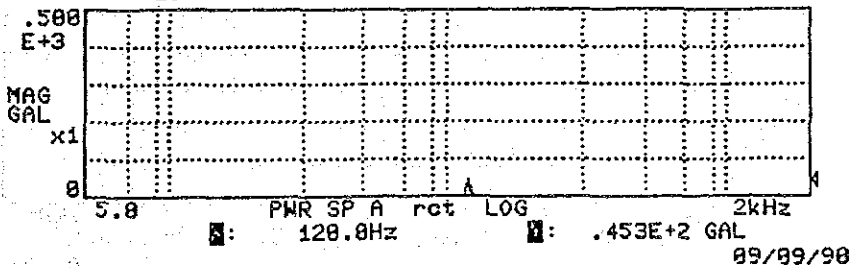
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-2H



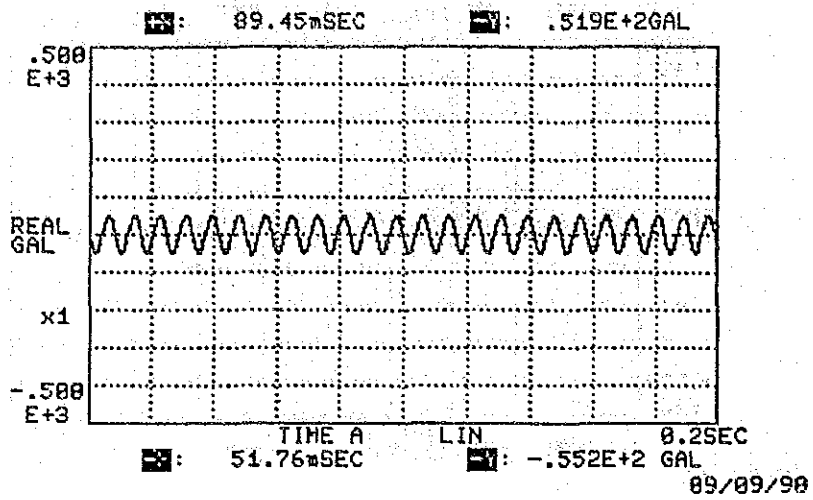
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-2H

PWR SPECTRUM Cha

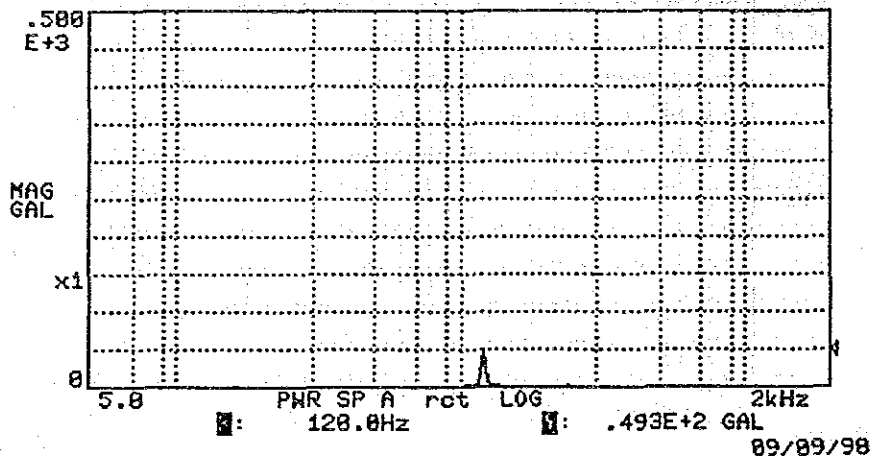
Channel	Frequency (Hz)	Amplitude (GAL)
1	128.0	0.453E+2
2	248.8	0.210E+1
3		
4		
5		
6		
7		
8		
9		
10		



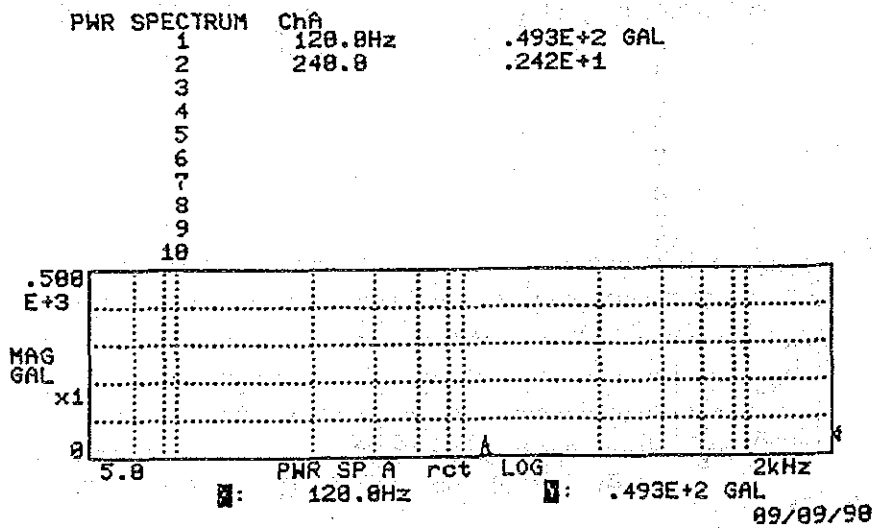
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-3H



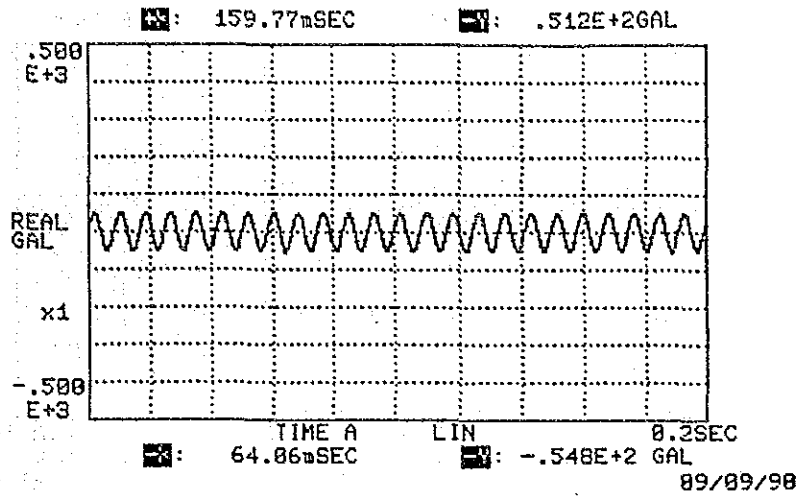
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-3H



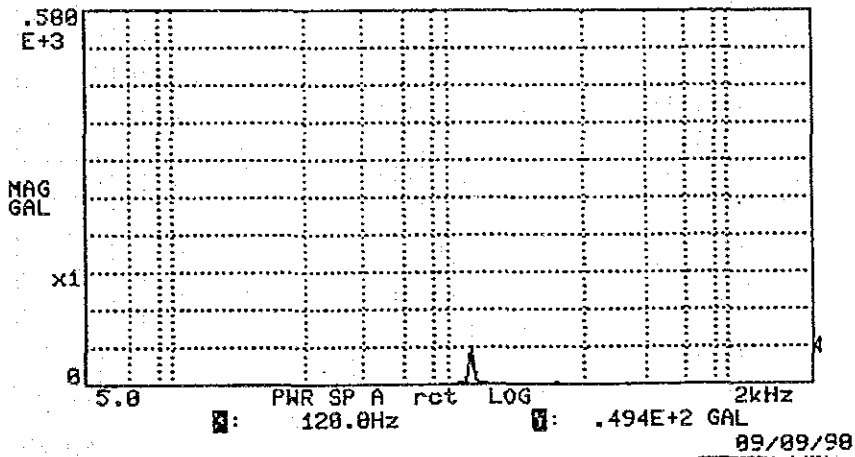
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-3H



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-3V

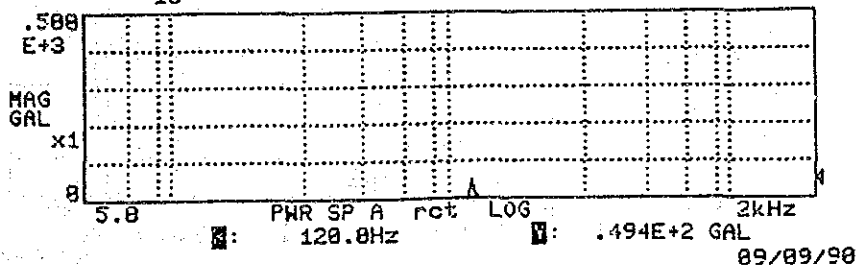


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-3V

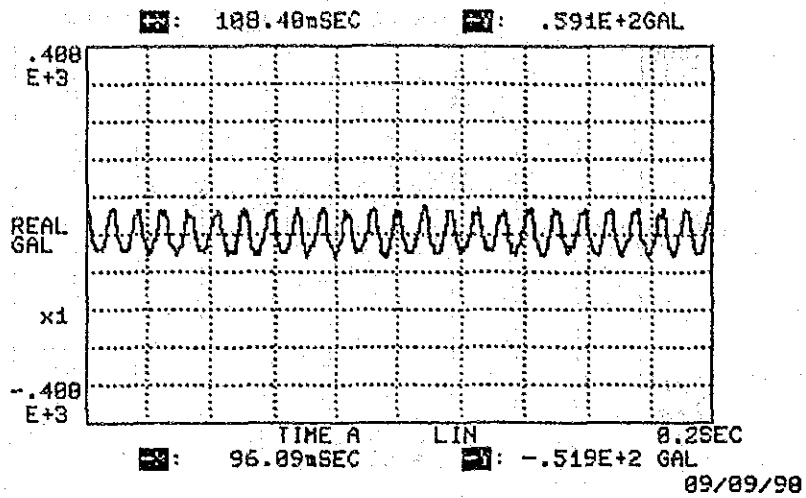


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-B NO.-3V

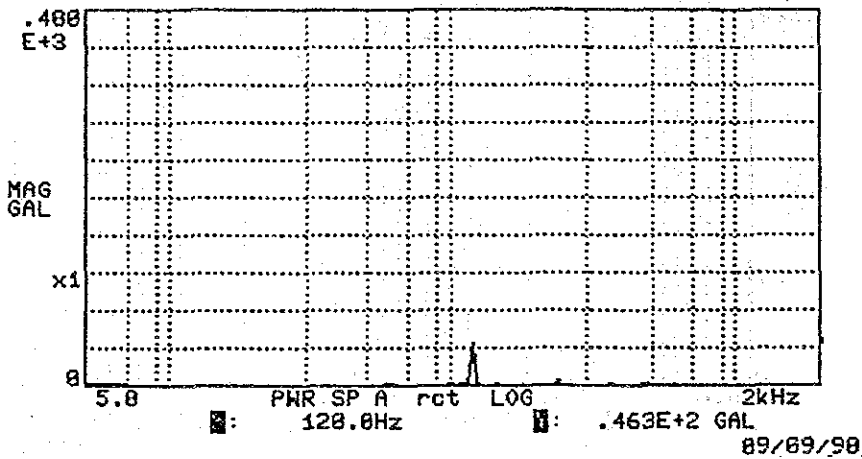
PHR SPECTRUM	Cha	
1	120.0Hz	.494E+2 GAL
2	240.8	.278E+1
3		
4		
5		
6		
7		
8		
9		
10		



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-1H

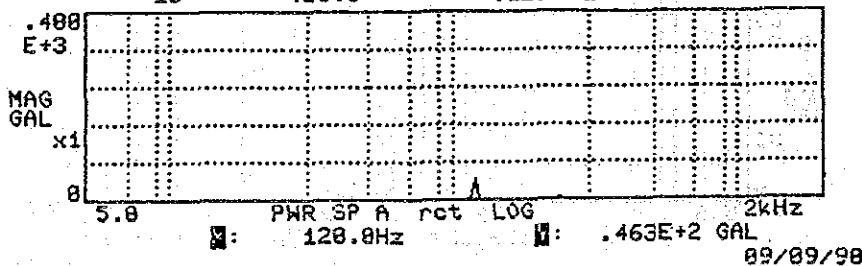


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-1H

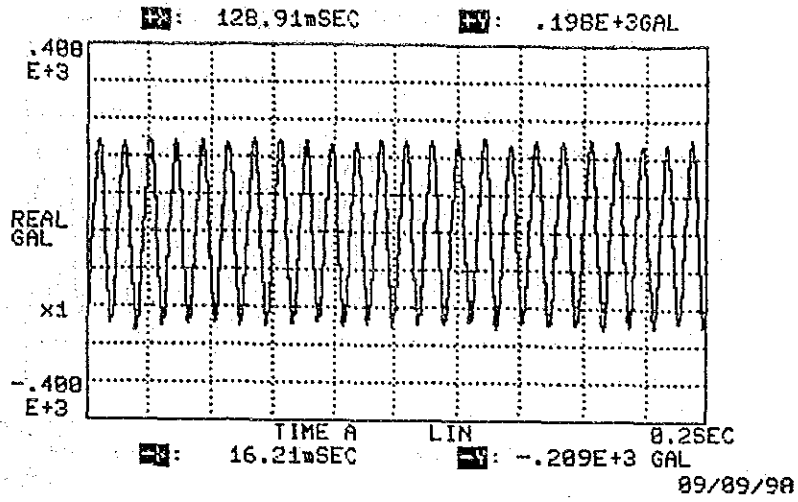


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-1H

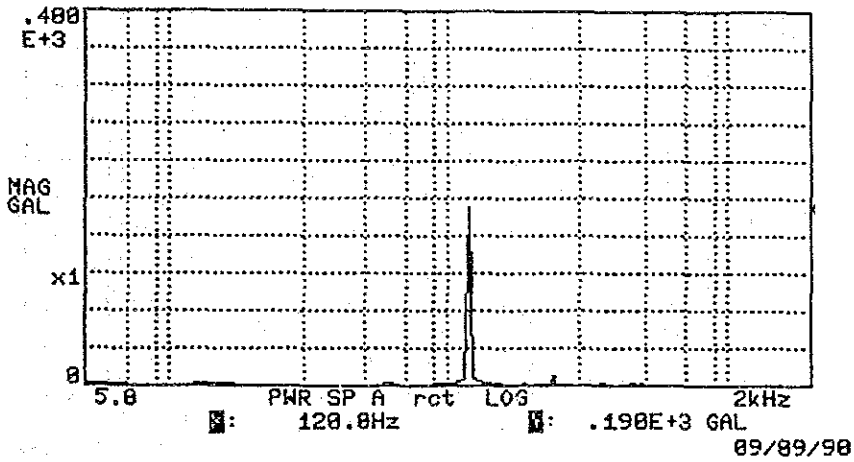
PWR SPECTRUM	ChA	
1	128.0Hz	$.463 \times 10^2 \text{ GAL}$
2	240.0	$.599 \times 10^1$
3	480.0	$.328 \times 10^1$
4	680.0	$.277 \times 10^1$
5	60.0	$.217 \times 10^1$
6	100.0	$.136 \times 10^1$
7	145.0	$.127 \times 10^1$
8	180.0	$.222 \times 10^1$
9	360.0	$.132 \times 10^1$
10	468.0	$.129 \times 10^1$



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-1V

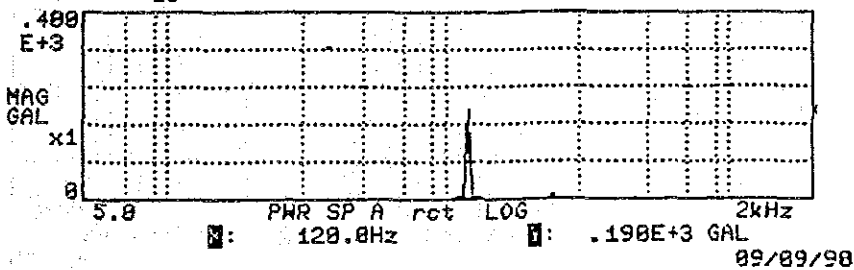


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-1V

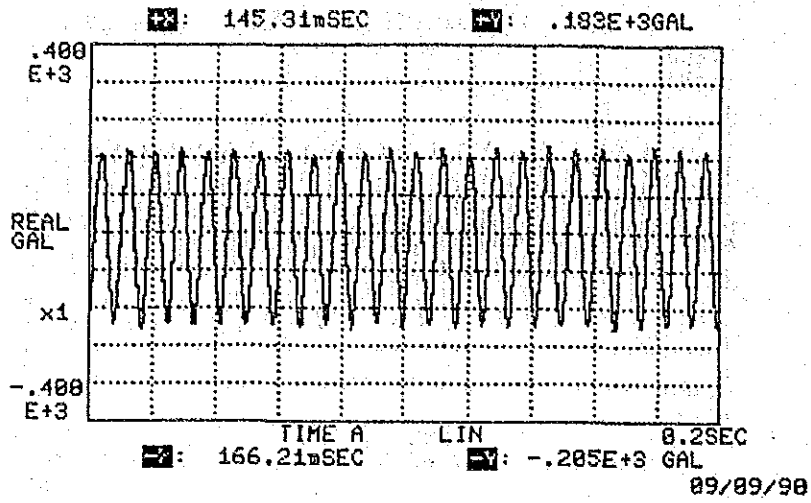


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-1V

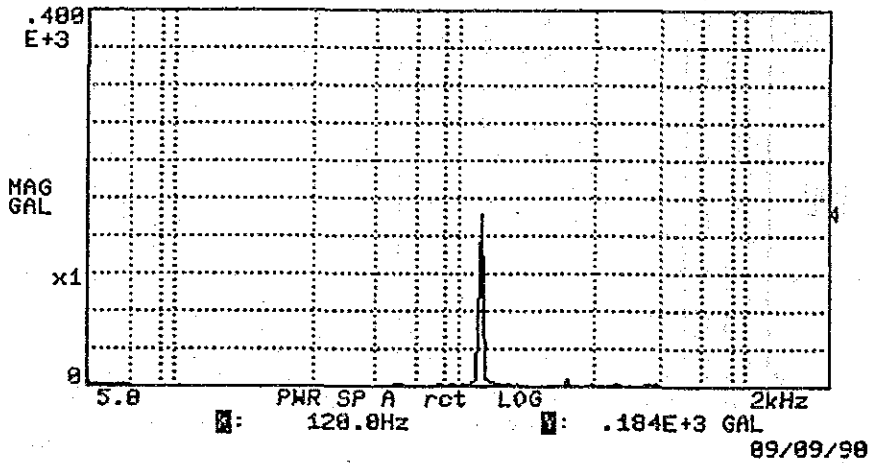
PWR SPECTRUM	Cha	
1	120.0Hz	.198E+3 GAL
2	240.0	.986E+1
3	360.0	.356E+1
4	15.0	.134E+1
5	60.0	.211E+1
6	185.0	.138E+1
7	460.0	.148E+1
8	480.0	.192E+1
9		
10		



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-2H

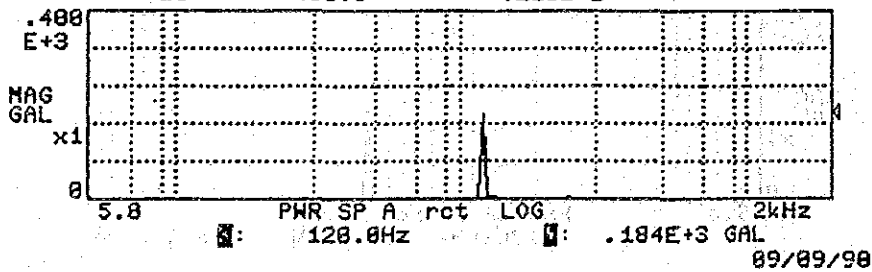


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-2H

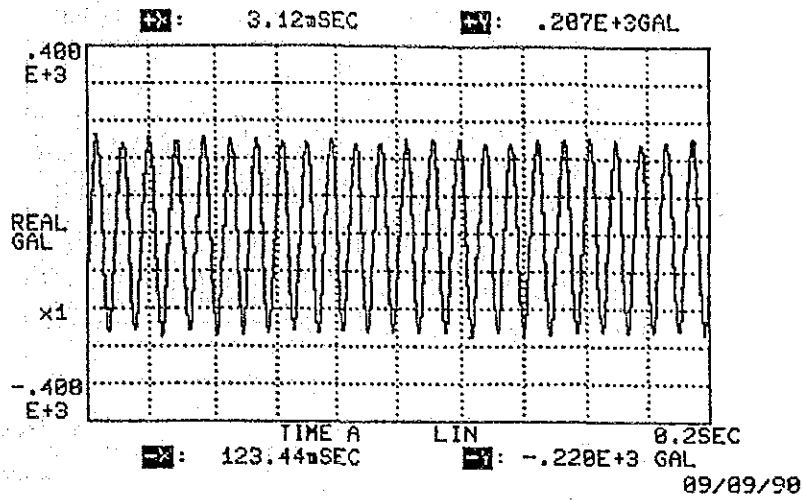


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-2H

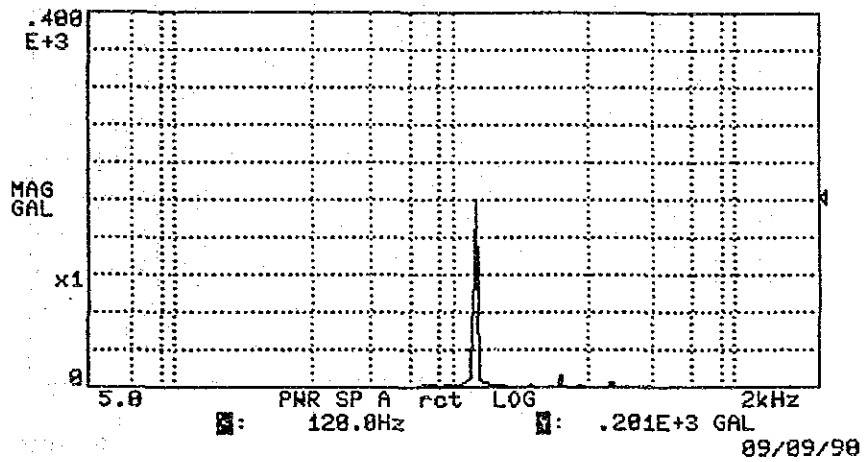
PWR SPECTRUM	ChA	
1	120.0Hz	.184E+3 GAL
2	240.0	.829E+1
3	60.0	.305E+1
4	360.0	.337E+1
5	85.0	.141E+1
6	95.0	.169E+1
7	160.0	.135E+1
8	290.0	.148E+1
9	460.0	.137E+1
10	480.0	.220E+1



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-3H

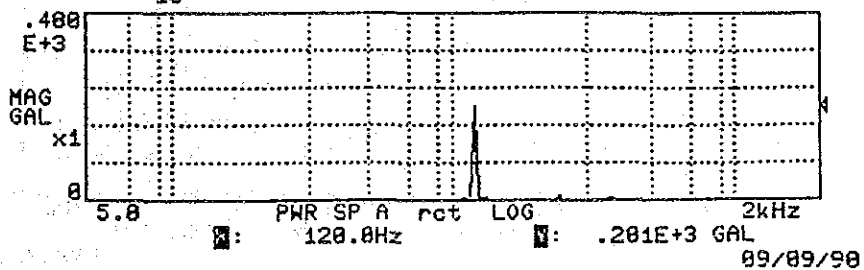


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-3H

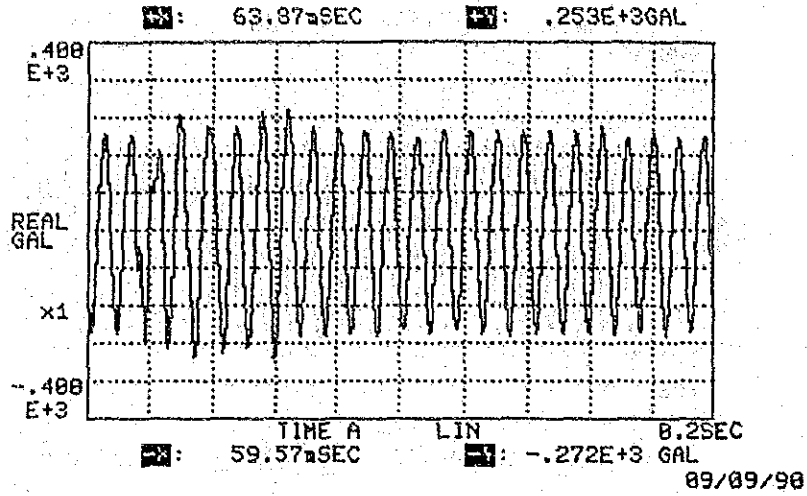


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-3H

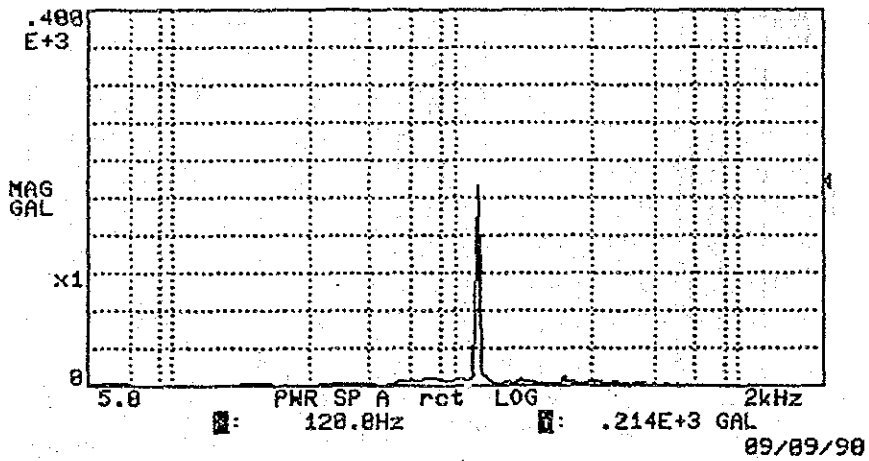
PWR SPECTRUM	ChA	
1	120.0Hz	.201E+3 GAL
2	240.0	.122E+2
3	360.0	.418E+1
4	85.0	.131E+1
5	190.0	.139E+1
6	285.0	.130E+1
7	480.0	.172E+1
8		
9		
10		



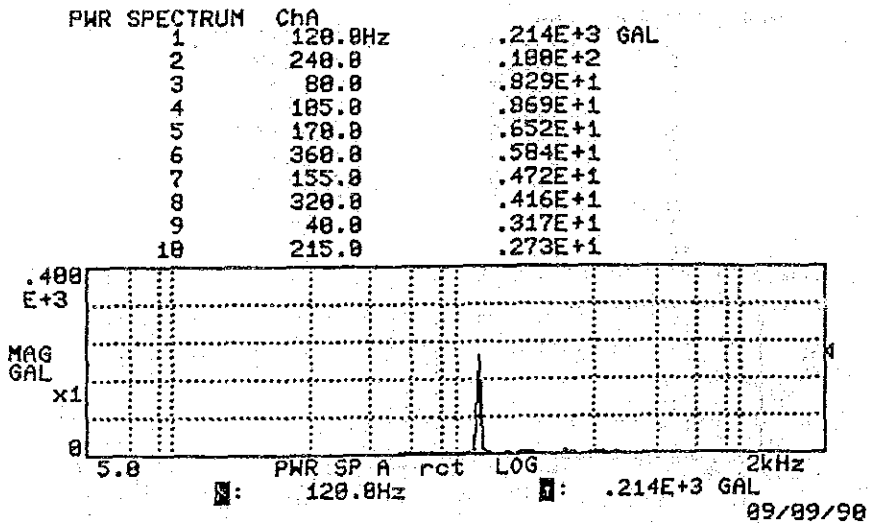
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-3V



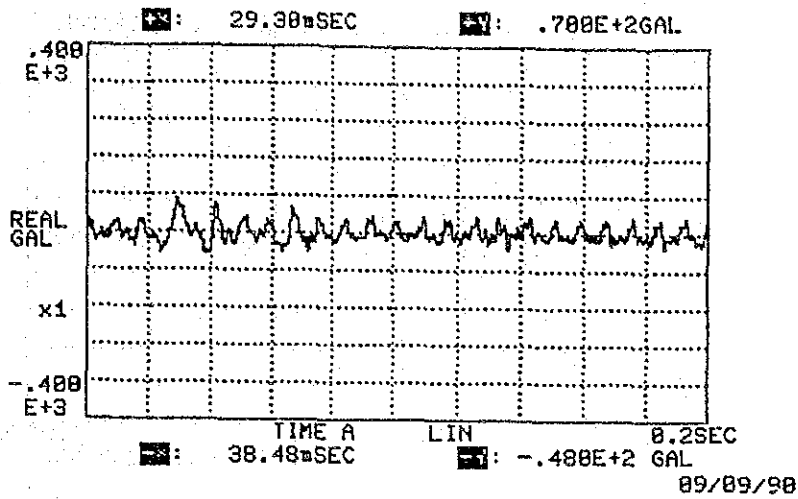
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-3V



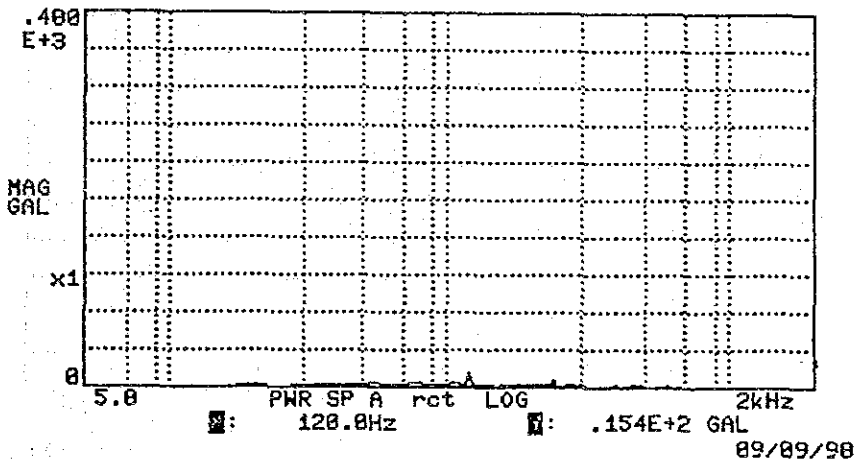
KALAYAAN P.S.P.P (II) BLASTING TEST CASE-E NO.-3V



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-1H

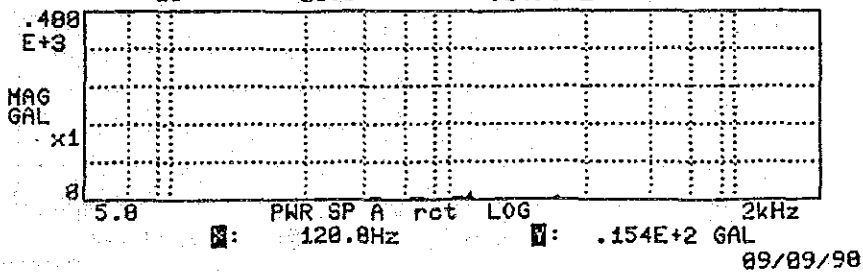


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-1H

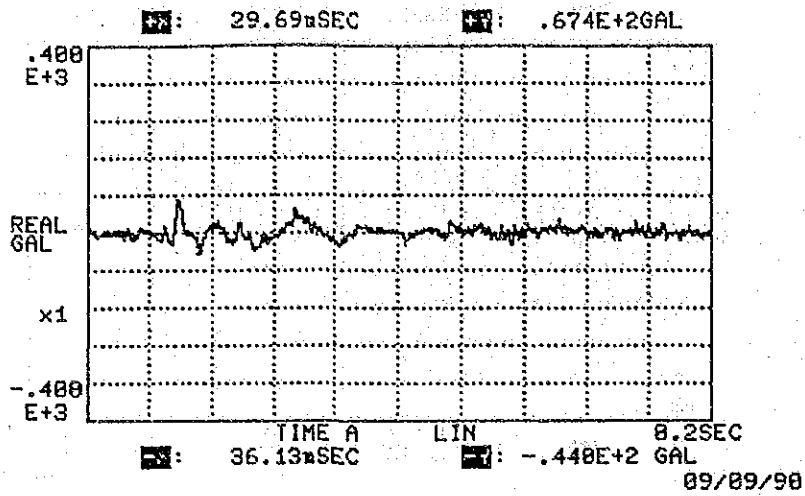


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-1H

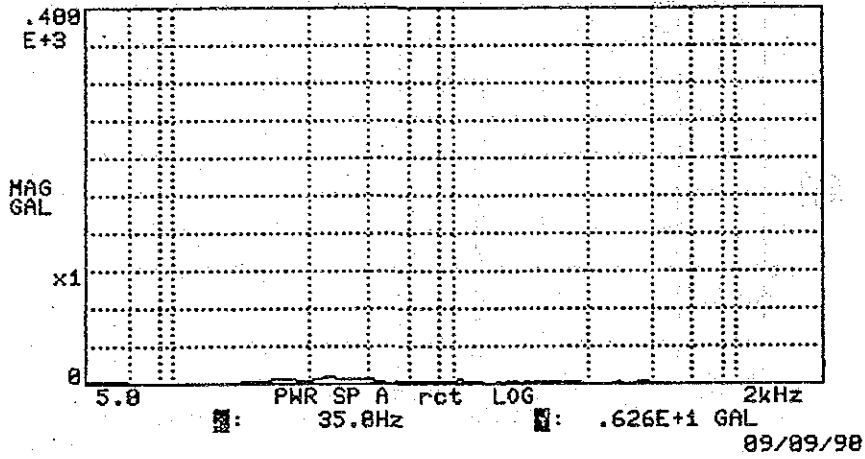
PWR SPECTRUM	Cha	
1	120.0Hz	.154E+2 GAL
2	240.0	.827E+1
3	80.0	.533E+1
4	185.0	.525E+1
5	55.0	.405E+1
6	155.0	.303E+1
7	170.0	.264E+1
8	465.0	.320E+1
9	400.0	.330E+1
10	20.0	.143E+1



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-1V

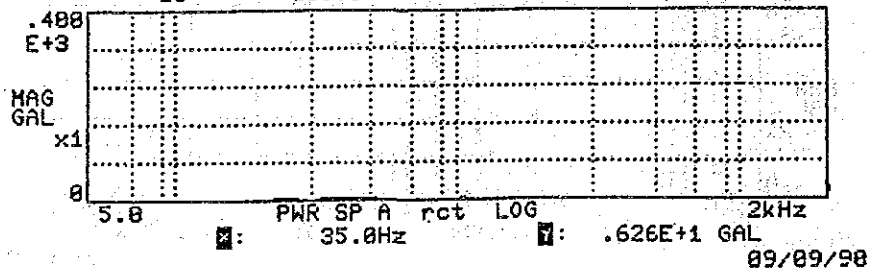


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-1V

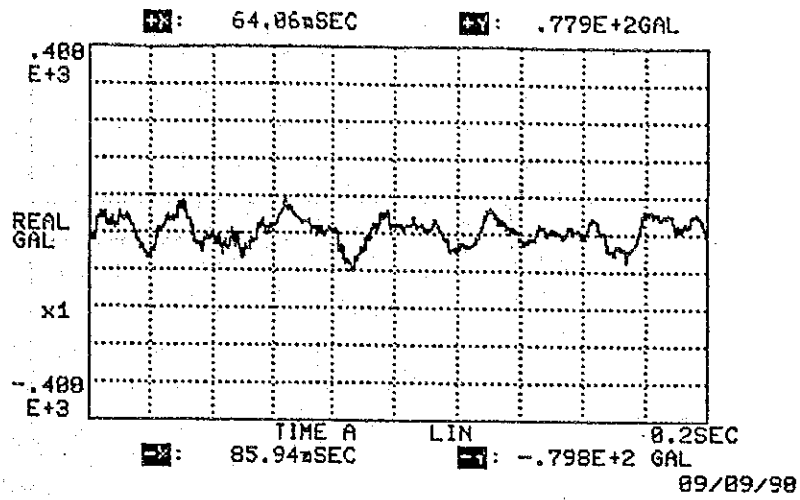


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-1V

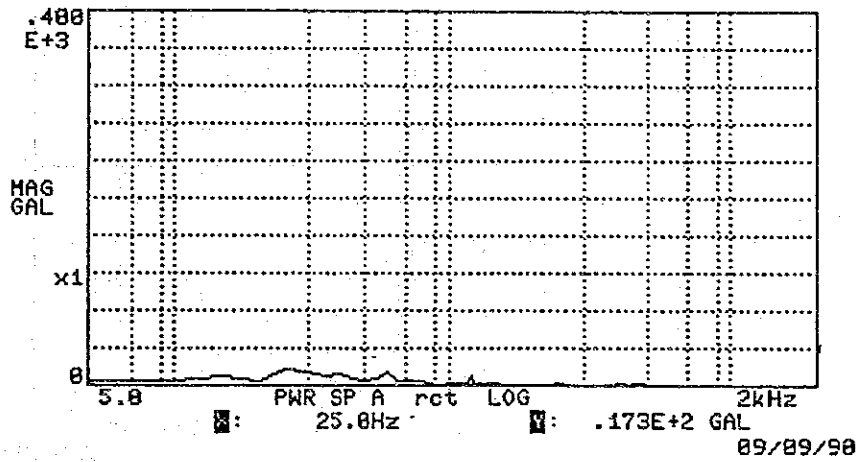
PWR SPECTRUM	ChA	
1	35.0Hz	.626E+1 GAL
2	25.0	.463E+1
3	105.0	.391E+1
4	90.0	.373E+1
5	120.0	.250E+1
6	240.0	.313E+1
7	465.0	.321E+1
8	145.0	.161E+1
9	170.0	.129E+1
10	185.0	.138E+1



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-2H

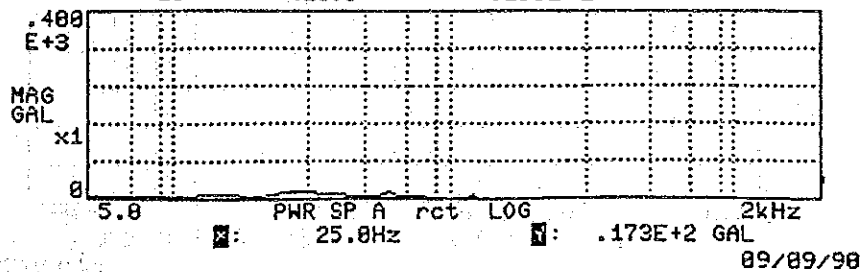


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-2H

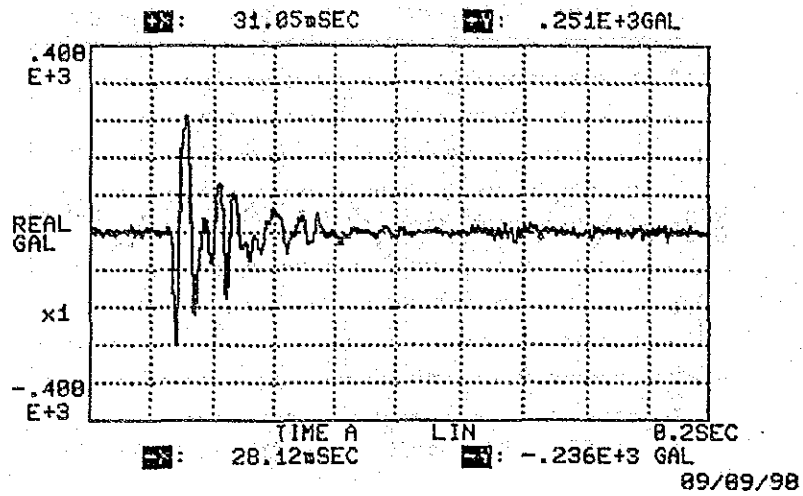


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-2H

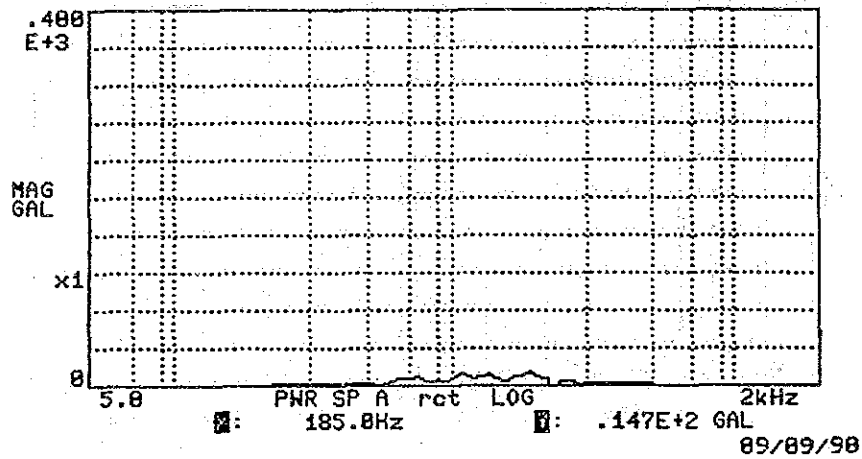
PWR SPECTRUM	ChA	
1	25.0Hz	.173E+2 GAL
2	60.0	.151E+2
3	40.0	.116E+2
4	120.0	.103E+2
5	15.0	.970E+1
6	135.0	.320E+1
7	240.0	.360E+1
8	465.0	.313E+1
9	400.0	.130E+1
10	410.0	.130E+1



KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-3H

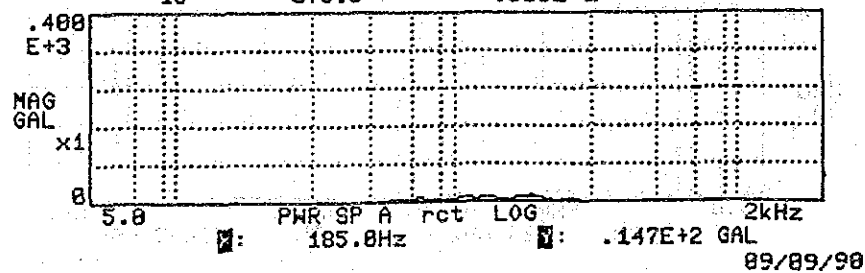


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-3H

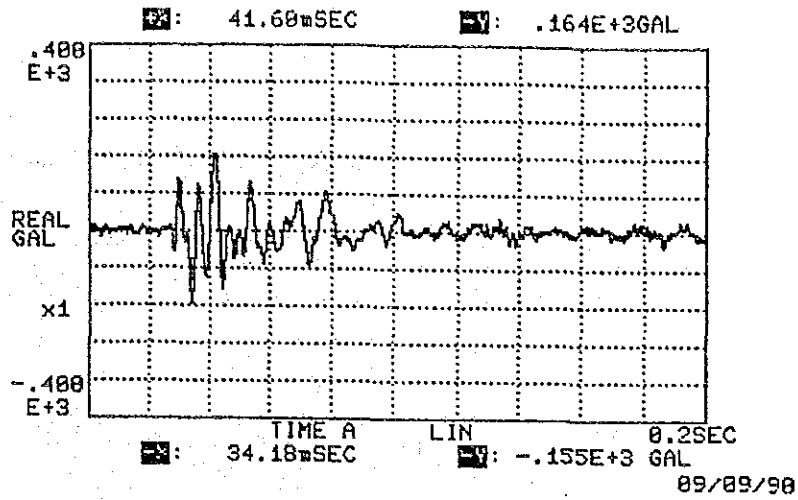


KALAYAAN P.S.P.P (II) BLASTING TEST CASE-F NO.-3H

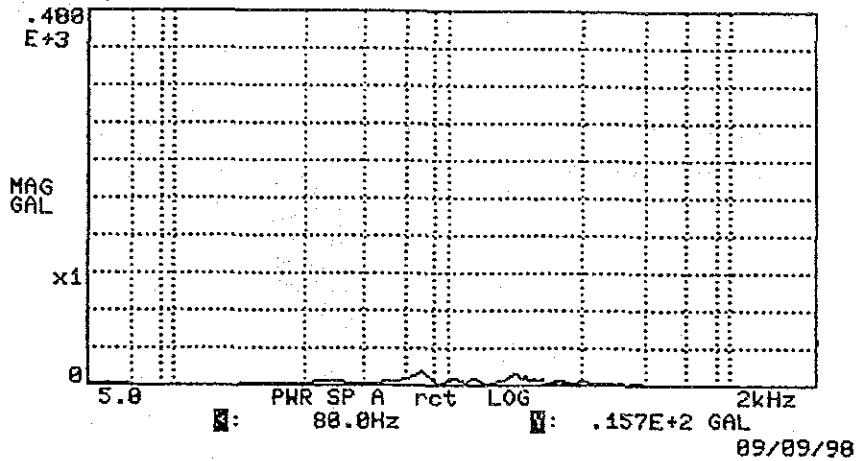
PWR SPECTRUM	ChA	
1	185.8Hz	.147E+2 GAL
2	110.0	.122E+2
3	135.0	.116E+2
4	75.0	.889E+1
5	255.0	.689E+1
6	35.0	.331E+1
7	310.0	.264E+1
8	340.0	.272E+1
9	360.0	.384E+1
10	375.0	.386E+1



KALAYAN P.S.P.P (II) BLASTING TEST CASE-F NO.-3V

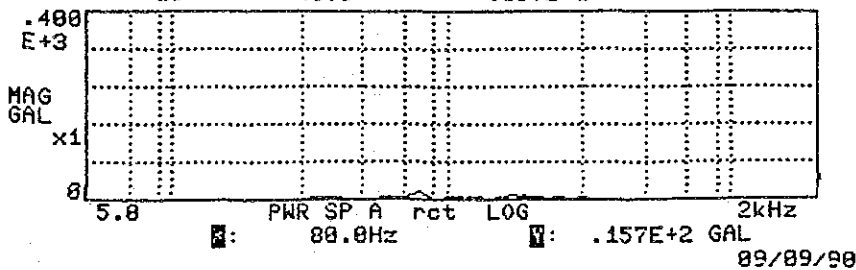


KALAYAN P.S.P.P (II) BLASTING TEST CASE-F NO.-3V

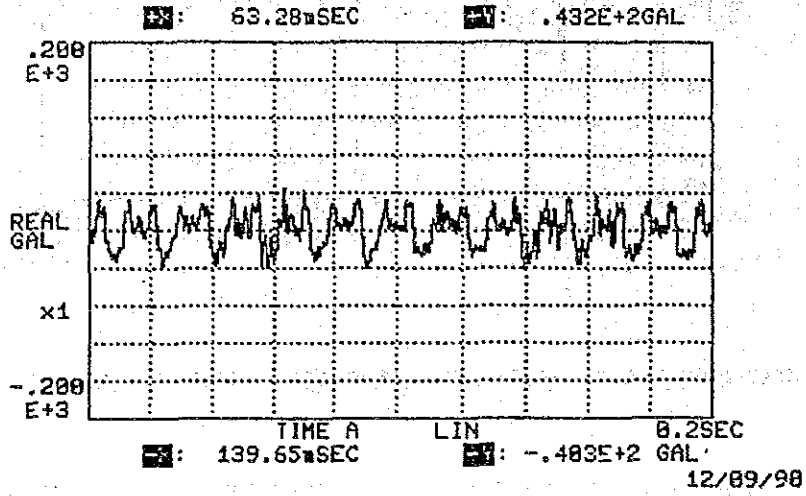


KALAYAN P.S.P.P (II) BLASTING TEST CASE-F NO.-3V

PWR SPECTRUM	Cha	
1	88.0Hz	.157E+2 GAL
2	170.0	.131E+2
3	185.0	.961E+1
4	120.0	.767E+1
5	105.0	.685E+1
6	205.0	.742E+1
7	215.0	.747E+1
8	150.0	.533E+1
9	245.0	.538E+1
10	40.0	.397E+1

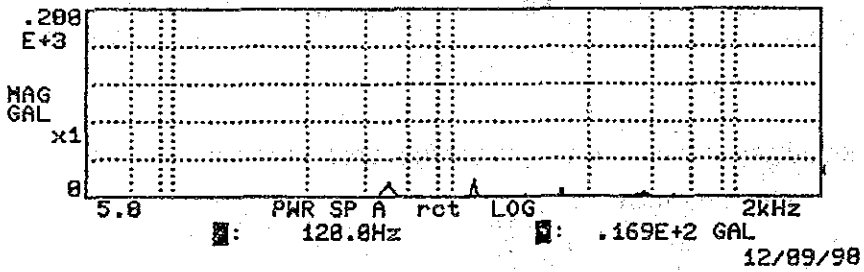


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-1H

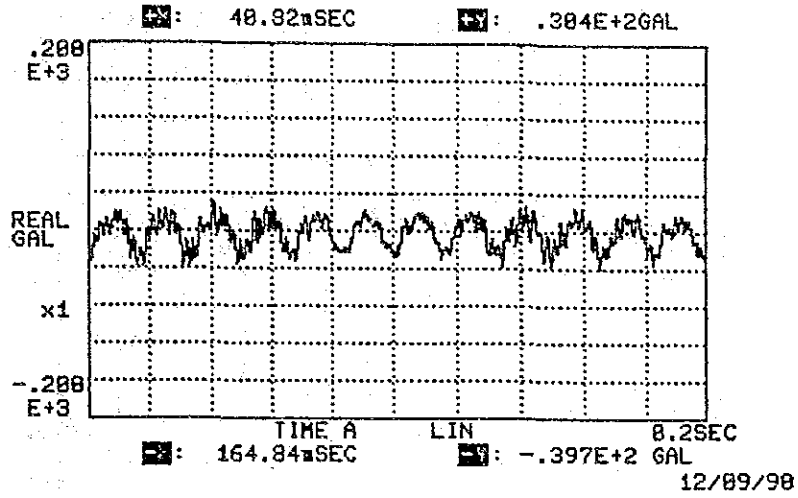


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-1H

PWR SPECTRUM	ChA	
1	120.0Hz	.169E+2 GAL
2	60.0	.155E+2
3	240.0	.847E+1
4	465.0	.448E+1
5	480.0	.403E+1
6	180.0	.315E+1
7	455.0	.296E+1
8	600.0	.271E+1
9	445.0	.238E+1
10	100.0	.169E+1

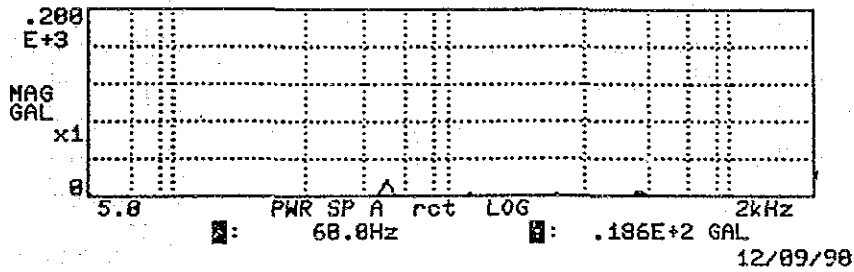


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-1V

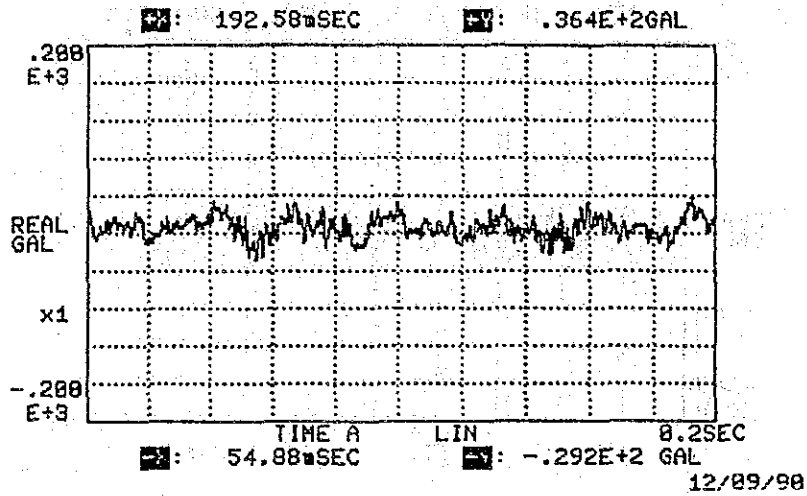


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-1V

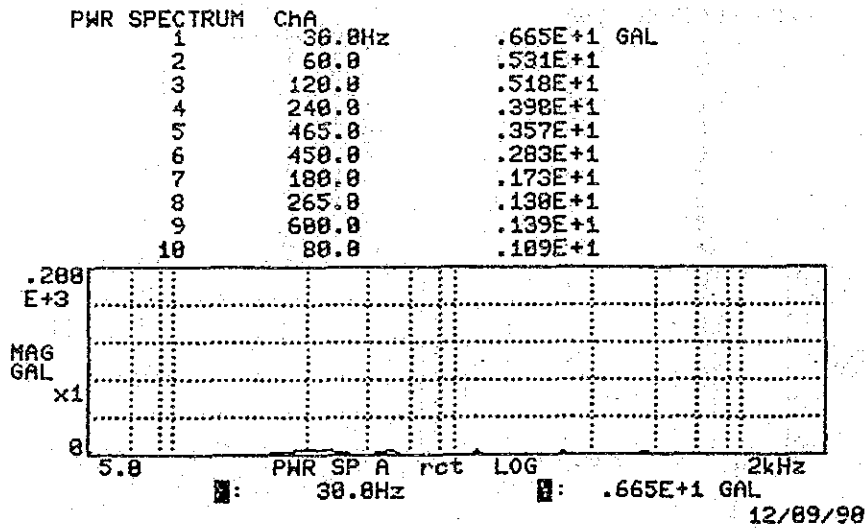
PWR SPECTRUM	ChA	
1	68.8Hz	.186E+2 GAL
2	455.8	.521E+1
3	465.8	.472E+1
4	128.8	.422E+1
5	248.8	.331E+1
6	488.8	.238E+1
7	445.8	.139E+1
8	88.8	.758E+0
9	145.8	.834E+0
10	178.8	.838E+0



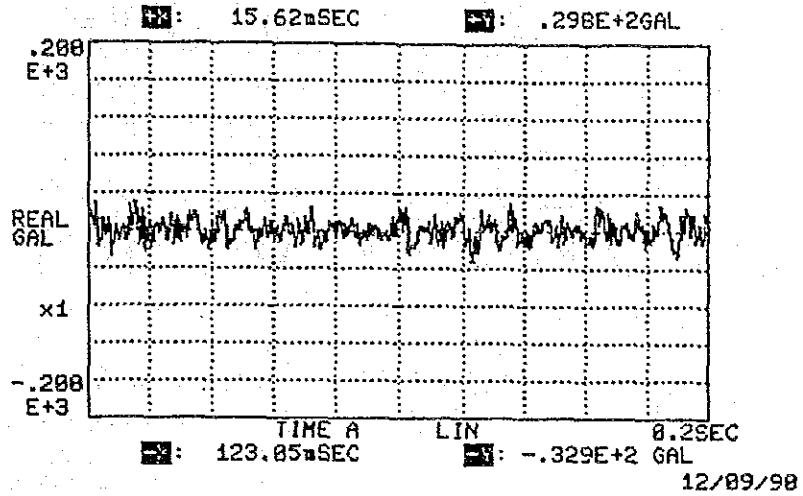
KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-2H



KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-2H

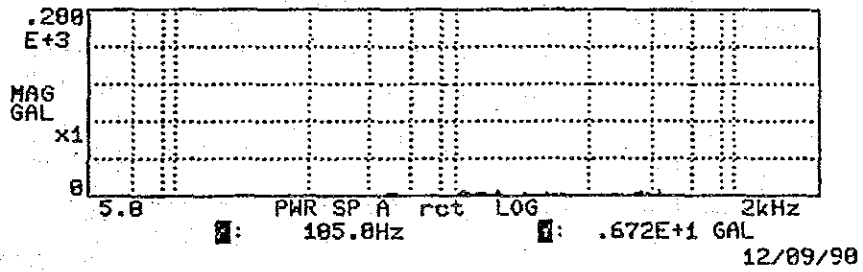


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-3H

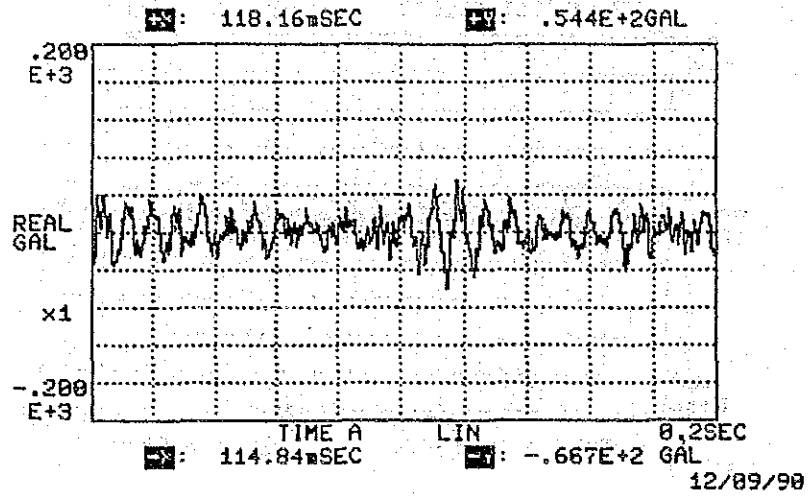


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-3H

PWR SPECTRUM	ChA	
1	185.8Hz	.672E+1 GAL
2	148.8	.543E+1
3	535.8	.561E+1
4	468.8	.486E+1
5	68.8	.397E+1
6	128.8	.315E+1
7	248.8	.284E+1
8	458.8	.294E+1
9	175.8	.288E+1
10	218.8	.211E+1

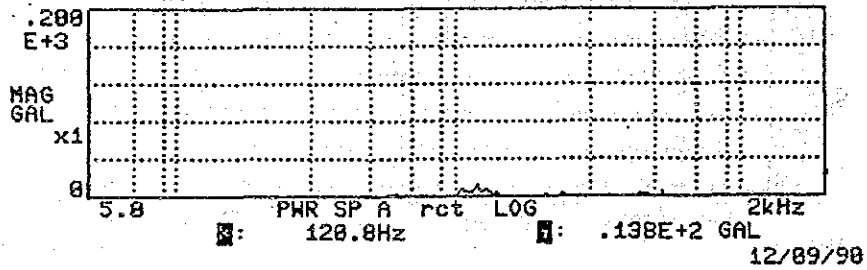


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-3V

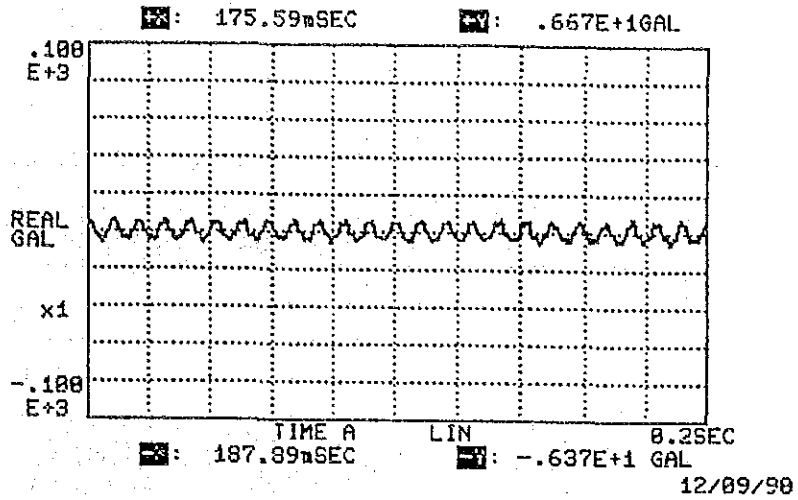


KALAYAAN P.S.P.P (II) BLASTING TEST POWER ON NO.-3V

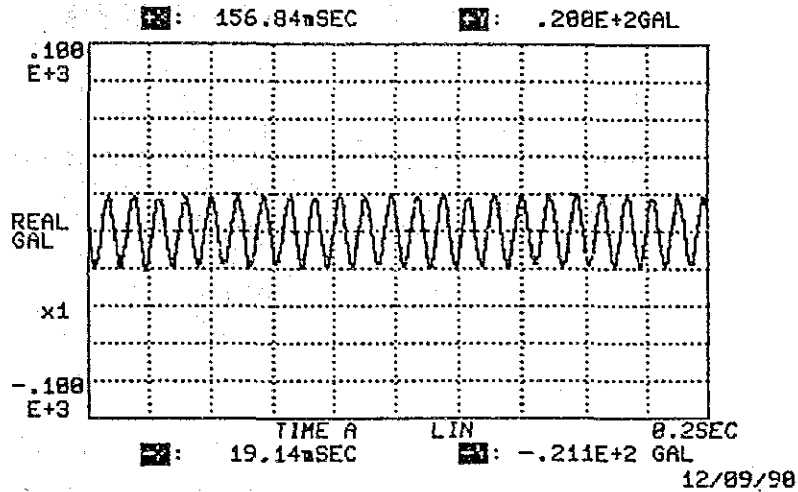
PWR SPECTRUM	Cha	
1	120.0Hz	.138E+2 GAL
2	105.0	.711E+1
3	130.0	.783E+1
4	140.0	.662E+1
5	535.0	.577E+1
6	60.0	.422E+1
7	460.0	.386E+1
8	210.0	.320E+1
9	450.0	.320E+1
10	240.0	.288E+1



KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-1H

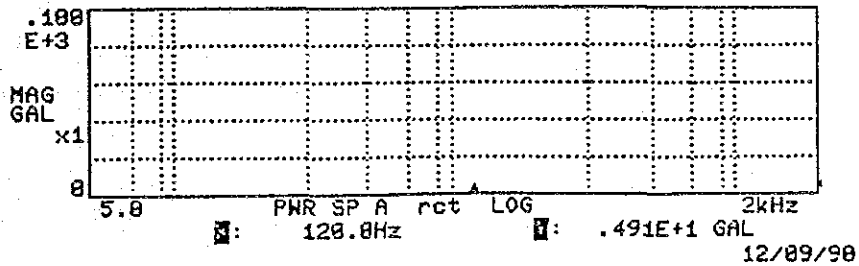


KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-1V

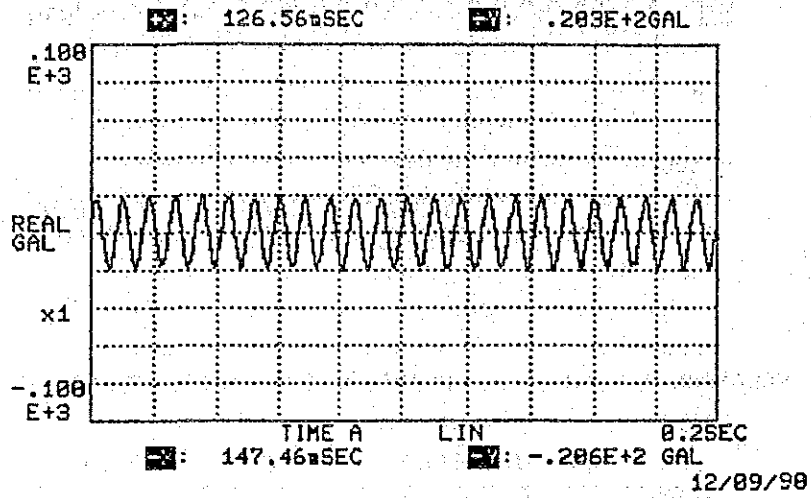


KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-1H

PWR SPECTRUM	Cha	
1	120.0Hz	.491E+1 GAL
2	460.0	.912E+0
3	100.0	.323E+0
4	240.0	.555E+0
5	480.0	.483E+0
6		
7		
8		
9		
10		

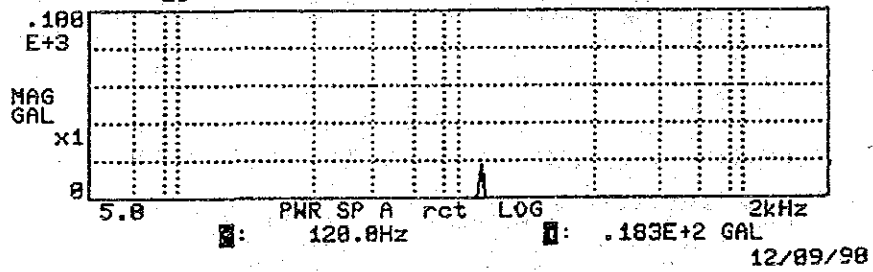


KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-2H

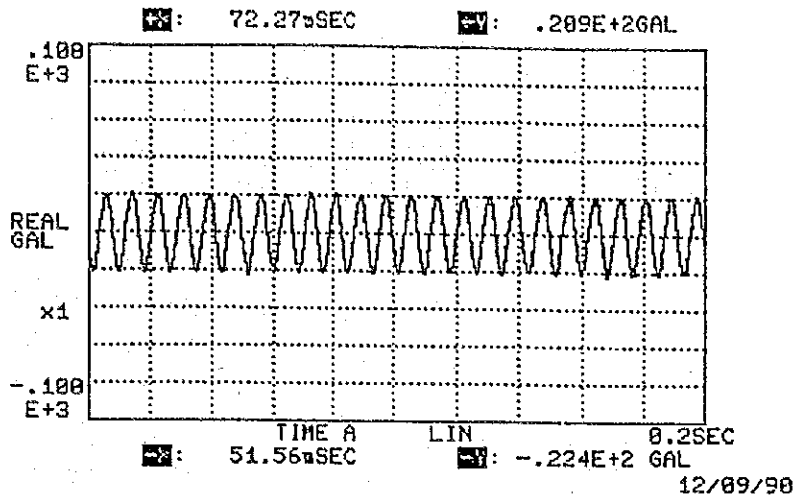


KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-2H

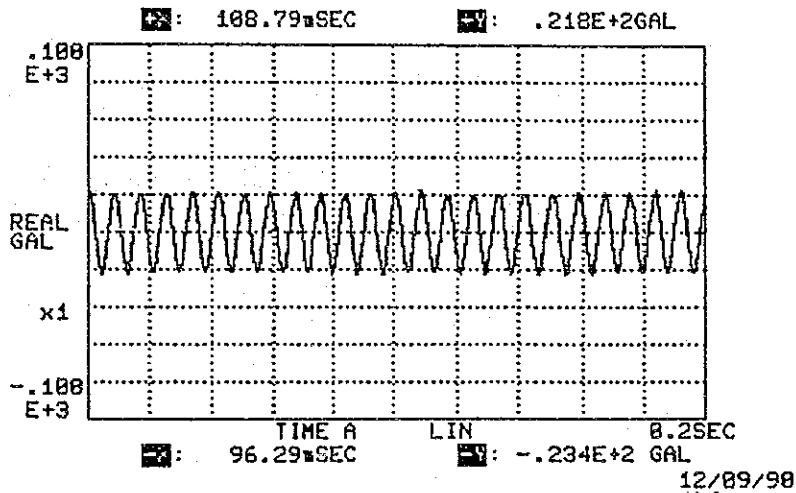
PWR SPECTRUM	ChA	
1	120.0Hz	.183E+2 GAL
2	240.0	.897E+0
3	460.0	.987E+0
4	360.0	.397E+0
5		
6		
7		
8		
9		
10		



KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-3H



KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-3V

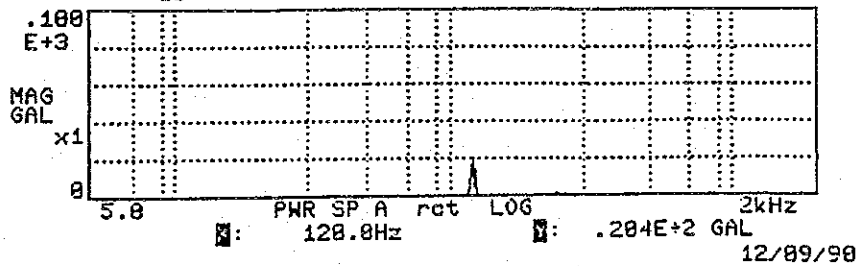


KALAYAAN P.S.P.P (II) BLASTING TEST POWER OFF NO.-3H

2kHz A:AC/ 5V B:AC/ 2V INST 0/16 DUAL 1k

PWR SPECTRUM ChA

Line	Frequency (Hz)	Power (GAL)
1	128.0Hz	.284E+2 GAL
2	248.0	.112E+1
3	360.0	.481E+0
4	465.0	.688E+0
5		
6		
7		
8		
9		
10		



APPENDIX 3 水質試驗結果

Results of field Survey (Water Quality)

Water Quality

Some kinds of water quality tests were carried out at Intake, Caliraya Reservoir and Tailrace.

The results were as follows.

		Jan. 22	23	24	25
Intake	CONDUCT. (us/cm)	176.1	195.0	161.6	X
	D.O. (ppm)	8.4	8.2	8.2	
	TEMP. (° c)	29.0	27.0	27.5	
	P.H.	6.4	6.7	6.9	
	TURB. (ppm)	150	200	100	
Caliraya Reservoir	CONDUCT. (us/cm)	106.8	X	X	82.7
	D.O. (ppm)	_____			5.5
	TEMP. (° c)	_____			24.5
	P.H.	_____			6.6
	TURB. (ppm)	_____			110
Tailrace	CONDUCT. (us/cm)	119.9	199.9	231.0	165.3
	D.O. (ppm)	_____	6.1	6.8	8.2
	TEMP. (° c)	_____	30.5	26.5	27.0
	P.H.	_____	6.6	6.9	7.5
	TURB. (ppm)	_____	240	230	100

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