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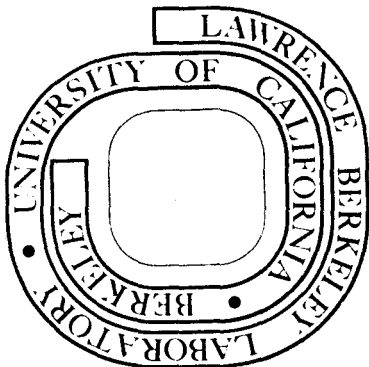
THE INFRARED SPECTRUM OF BERKELIUM-249

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Pierre Camus, and Jean Verges

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## THE INFRARED SPECTRUM OF BERKELIUM-249

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The berkelium spectrum, excited in an electrodeless lamp, has been recorded between 3,700 and 12,000  $\text{cm}^{-1}$  on a high resolution Fourier Transform spectrometer. The spectrometer is located at Laboratoire Aimé Cotton. Approximately 200 micrograms of  $^{249}\text{Bk}$  as the triiodide were sealed under vacuum in a quartz tube of 3 mm inside diameter and 25 mm length.<sup>1</sup> The lamp was operated in a cavity at 2,450 MHz with about 80 watts of input power.

Two experiments were run with different spectrometer settings to have the best coverage of the region. One region covered 3,700 to 8,960  $\text{cm}^{-1}$ , and the second was between 8,960 and 12,000  $\text{cm}^{-1}$ . The region higher than 12,000  $\text{cm}^{-1}$  was recorded but it is not as intense as the spectrum recorded on photographic plates. In the 3700-9000  $\text{cm}^{-1}$  region, 900,000 data points were recorded in a run lasting 13 hr 15 min. For the second region 500,300 data points were taken in 7 hr 22 min. The spectrometer was operated in air at atmospheric pressure and the values have been corrected to vacuum. The same electrodeless lamp was

used throughout this investigation.

A computer program performed the Fourier transform and selected the peaks. It printed out a listing of the peak values and their intensities. A paper chart recorded of the spectrum was plotted. It is necessary to check the listing against the plot since some features of the background get recorded as peaks. The intensity has been estimated from the chart recording. The intensity is on a 0-9 scale. Shifts between the two runs are between  $0.004$  and  $0.008 \text{ cm}^{-1}$ , the second run giving the higher wavenumber values.

The complete line list is in Table I. The first column is the vacuum wavenumber in units of  $\text{cm}^{-1}$ . The second column is the line width information. An E in front of the width indicates an estimate of the width, a C indicates the presence of off-diagonal or weak components, and a D indicates a complex pattern, probably a low J or a multiple line pattern. A \* is where no degradation was observed in the hyperfine structure. The units are  $10^{-3} \text{ cm}^{-1}$ . Column three is the estimated intensity on a scale of 0-9. Column four is a code for the character of the line. A 1 is for a sharp line, a 3 for a blended line, and a 4 is for a wide line. A 5 indicates the hyperfine structure is degraded to higher wavenumbers and a 6 is a pattern degraded to lower wavenumbers. A 7 is for a peculiar pattern that is not covered by the other codes. In column 5 is the J value of the odd level and column 6 is J of the even level. Column 7 is the energy value for the odd level and column 8 is the energy value of the even level.

The ground state of Bk I is  ${}^6\text{H}_{15/2}$  of the  $5f^9 7s^2$  configuration. The Bk II ground state is  ${}^7\text{H}_8$  of the  $5f^9 7s$  configuration.<sup>2</sup> All entries in Table I with J values of half integers are Bk I lines and whole integer values are Bk II. Of special note is the line  $6530.720 \text{ cm}^{-1}$ . This is a transition within the same configuration. The transition is between the ground state  ${}^6\text{H}_{15/2}$  and  ${}^6\text{H}_{13/2}$ , both belonging to the configuration  $5f^9 7s^2$ . Similar parity forbidden transactions have been observed in Cm and Cf.<sup>4,5</sup>

The odd energy levels of Bk I are listed in Table II and the even levels of Bk I in Table III. In the first column of these two tables is listed the value of the level in  $\text{cm}^{-1}$ , in column 2 is the J value, column 3 is the width in units of  $10^{-3} \text{ cm}^{-1}$ . Column 4 is the A value and column 5 is the B value derived from the hyperfine structure. Column 6 is the configuration and column 7 is the term designation. The values of the levels for Bk II are from Worden and Conway.<sup>3</sup>

Berkelium-249 decays with a 318 day half life so that a combination of incomplete chemical separation and a half life short enough to grow in some daughter element between separation and experimental result in the occurrence of many  ${}^{249}\text{Cf}$  lines and a few  ${}^{245}\text{Cm}$  lines from the  $\alpha$  decay of  ${}^{249}\text{Cf}$  (340 y half life).<sup>4</sup> These have been removed from the list. The curium had to take into account the isotope shift. The available data are from the 244 and 246 isotopes of curium. The californium is to be published.<sup>5</sup>

#### ACKNOWLEDGEMENTS

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#### REFERENCES

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2. E. F. Worden, R. G. Gutmacher, R. W. Loughheed and J. G. Conway, J. Opt. Soc. Am. 60, 1555 (1970).
3. E. F. Worden and J. G. Conway, private communication.
4. J. G. Conway, J. Blaise and J. Verges, Spectrochimica Acta B (in press).
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Table I. The infrared line list of Bk-249.

BK LINE LIST						
WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
3729.118	E 300	0	5			
3755.810		0	7			
3866.769	E1100	0	6			
3875.531	E 600	0	6			
3884.86	E 120	0	7	13/2	13/2	18717-22602
3892.875	983	0	6	15/2	15/2	23072-19179
3910.788	E4000	0	5			
3915.20	E 210	0	6	15/2	17/2	26298-22382
3918.432	814	1	5	13/2	13/2	29683-25765
3924.106	E5800	0	5	13/2	13/2	25430-21506
3935.670	E2800	0	6	17/2	15/2	25103-29038
3952.504	3006	0	5			
3953.887	941	1	6	13/2	15/2	19993-16039
3955.724	E1000	0	6	13/2	13/2	19993-16038
3967.263	E2720	0	6	13/2	11/2	28725-24758
3970.358	2714	0	5			
3981.744	E1000	0	5			
3983.436	1066	0	5	15/2	13/2	20021-16038
3987.693	817	0	5	11/2	13/2	26590-22602
4022.56	E 160	0	5			
4023.71	E1650	0	5			
4024.996	2798	0	5	15/2	13/2	28235-24210
4033.375	E1150	0	6			
4035.423	2342	0	5			
4038.039	4390	1	6			
4038.143	2001	1	6	9/2	11/2	22771-18733
4049.764	8710	1	6	11/2	9/2	23226-19177
4052.635	E 900	0	5			
4057.009	381	1	6	17/2	17/2	26439-22382
4065.925	2218	0	5			
4068.852	E4300	0	6	17/2	17/2	25103-29172
4070.461	826	1	5	17/2	19/2	26439-22369
4073.454		0	3	11/2	9/2	26590-22516
4081.468	644	0	5	13/2	13/2	27550-23468
4082.66	1700	1	6	13/2	15/2	24652-20569
4083.582	3534	0	6	19/2	17/2	19373-15290
4098.894	2791	0	6	11/2	11/2	17777-21876
4108.484	802	0	6			
4109.789	2670	1	5	11/2	13/2	28319-24210
4110.231	903	0	6			
4112.118	930	1	6			
4132.364	27800	9	5	17/2	15/2	21046-16913
4146.67	1958	0	5			
4147.567	670	1	6	9/2	7/2	22771-18624
4152.097		1	1			



OK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
4158.325	19080	2	5	11/2	13/2	25664-21506
4165.254	E 850	0	6			
4172.464	3349	1	5	19/2	17/2	22752-26925
4172.893	903	0	5			
4182.460	2880	9	5	17/2	15/2	23361-19179
4189.820	673	1	5	13/2	13/2	29683-25493
4192.397	684	0	6	13/2	15/2	18717-22910
4196.117		1	1			
4214.165	E 3370	0	5	13/2	15/2	28725-24521
4204.485	E1000*	0	7			
4204.574	1822	1	5			
4216.534	1133	0	5	15/2	15/2	24786-20569
4216.782	E 800	0	6			
4224.318	1079	1	6	13/2	11/2	17993-13769
4232.230		0	1			
4250.991	E2500	0	6	17/2	15/2	27161-22910
4253.652		0	1			
4262.215	712	0	5	13/2	11/2	27668-23406
4262.728		0	4			
4278.710	24430	2	5	17/2	15/2	28800-24521
4293.263	1221	1	6			
4299.699		0	1			
4299.882		0	1			
4311.983	3110	0	6			
4320.574	E 780	0	6			
4324.285		0	1			
4332.279	E 1050	0	6			
4338.319	4170	2	5	11/2	9/2	17777-13439
4339.821	1500	2	5	13/2	11/2	27668-23329
4342.685	E1400	0	6			
4346.526	E1900	0	6	11/2	11/2	29625-25279
4354.679	2922	0	6			
4360.282	800*	1	7			
4368.760	E 700	0	6			
4371.297	E1380	2	5	9/2	9/2	26598-22227
4372.610	1198	1	6	13/2	13/2	18717-23090
4379.828	E3050	1	5			
4385.827	2891	0	6	15/2	17/2	24786-29172
4399.600	4861	0	6	17/2	17/2	23361-27761
4400.619	886	0	6	11/2	11/2	20878-25279
4403.323	E 220*	0	7			
4403.947	258	2	6	15/2	15/2	26298-21894
4404.402	E 750	0	6			
4432.037	959	1	6			
4437.747	1690	1	6			

## JK LINE LIST

WAVE NUMBER	WILTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
4441.223	E 55J	0	5			
4443.864	2987	2	6	11/2	9/2	17777-22227
4405.077		0	1			
4469.131	E1800	0	6			
4471.080		1	1			
4502.169	1478	1	6			
4509.333	1095	0	6	8	7	22428-26938
4520.534	2059	0	5			
4531.332	1032C	2	6	15/2	13/2	23072-18540
4532.890	810C	0	5			
4533.512	3400	1	5	17/2	15/2	25103-20569
4537.415	E3900	0	6			
4545.358	E 800	0	6			
4547.141	E1200	0	5			
4557.154	778	0	5	15/2	15/2	31275-26718
4578.470	2486C	1	5	13/2	13/2	27668-23090
4583.851	1289C	0	5			
4594.499	E 2400	0	5			
4600.895	E 200*	0	7			
4604.474	1684	1	6			
4604.032	346	1	6			
4609.015		1	1	13/2	13/2	17993-22602
4610.440	E 240*	0	7			
4611.271	1134C	1	5	13/2	11/2	18717-23329
4616.479	E2500	0	5			
4617.790	1484	1	5			
4621.16	E 400	0	6			
4627.164	600	0	6			
4636.148	1837	0	6	11/2	9/2	28895-24259
4639.549	E 280*	1	7			
4640.057	E 900	0	5	13/2	15/2	27550-22910
4603.115		0	1			
4603.530	E 300*	0	7			
4604.319	E 900	0	6			
4670.535	1032	0	6	11/2	13/2	24005-19334
4672.494		0	4			
4677.190	511C	2	6	9/2	11/2	22236-17559
4683.917	2901	1	6			
4680.162	E1300	1	6			
4686.233	1777	2	6	11/2	13/2	27026-18540
4687.18	706	1	6			
4688.805	570	1	5	13/2	11	18717-23406
4689.740		0	1			
4699.836	1625	1	5	13/2	13/2	27302-22602
4714.80	E 220	1	5	17/2	19/2	27084-22369

BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-0	J-E	ODD-EVEN LEVELS
4722.265	11530	4	5	9/2	11/2	26598-21876
4723.810	14170	2	5	13/2	11/2	27622-22298
4728.220	1124	1	6	8	8	22428-27157
4731.292	1528	1	5	15/2	17/2	20021-15290
4732.761	E 100	0	6			
4734.494		3	1			
4740.630	6470	1	5	13/2	13/2	28950-24210
4750.981	383	1	6	13/2	13/2	18717-23468
4758.690	1972	0	5	13/2	15/2	27668-22910
4766.207	1546	3	5	15/2	13/2	28235-23468
4772.639	4073	1	6	15/2	15/2	23672-27844
4772.918	1946	4	6	15/2	13/2	24107-19334
4777.622		0	1			
4778.376	599	1	3	17/2	17/2	27161-22382
4781.084	2292	0	6			
4783.945	E 140	1	6	11/2	13/2	27874-23090
4788.333	1183	0	6			
4790.942	1970	1	6			
4791.604	7610	3	6	15/2	13/2	26298-21506
4797.190	E1950	0	6			
4799.080	E 650	0	5			
4801.119	E 400*	1	7			
4802.091	E1900	0	6	11/2	13/2	30567-25765
4806.694	E 750	0	6			
4807.418		0	1			
4822.261	723	0	5			
4822.825	687	0	5	15/2	15/2	31541-26718
4824.062		0	1			
4828.561	E 1500	0	5			
4835.206	937	1	6	15/2	17/2	17547-22382
4840.418	2177	1	5	11/2	13/2	20878-16038
4847.500	E 600	0	5			
4848.434		0	4			
4849.524	1203	1	5			
4851.011	1506	2	6	11/2	13/2	28319-23468
4860.765	2277	2	6	13/2	15/2	25430-20569
4866.376	E2100	1	6	11/2	11/2	29625-24758
4880.470	E2380	0	6			
4884.829	3835	1	6	15/2	13/2	23672-27956
4910.590	505	1	6	13/2	15/2	17993-22910
4928.430	1745	4	6	15/2	15/2	24107-19179
4931.297	2154	1	6	15/2	15/2	24107-29038
4936.726	E 250	1	6			
4942.659	E2700	0	6			
4946.475	E 700	0	5			

## BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-0	J-E	ODD-EVEN LEVELS
4949.501	442	0	6			
4955.960	E 425	0	5			
4967.572	E 250*	0	7			
4973.954		0	1			
4974.716		0	1			
4988.467	653	0	6			
5004.242	2728	2	5	13/2	11/2	27302-22298
5006.293	351	3	5	17/2	15/2	21046-16039
5010.330		2	4			
5015.224	E 2500	0	5	9/2	11/2	22574-17559
5019.422		0	1			
5034.134	636	1	6			
5035.627		1	4			
5037.130	998	1	6	13/2	13/2	24371-19334
5055.0	1613	0	5	15/2	13/2	17547-22602
5055.058		9	1			
5061.575	252	1	6	6	7	18755-23817
5064.475	3596	1	6	15/2	17/2	24107-29172
5074.363	858	1	6			
5086.837	28960	9	5	19/2	17/2	22752-17665
5096.819	E1000	0	6	13/2	13/2	17993-23090
5105.622	3057	2	6	6	7	18755-23861
5119.944	E 800	1	6			
5179.021	E 600	0	6			
5186.955	934	9	6	17/2	19/2	17182-22369
5200.347	318	8	5	17/2	17/2	17182-22382
5212.523	E 3100	3	6	9/2	11/2	22771-17559
5219.755	E 4000	0	6			
5222.109	2736	0	5			
5229.385	6880	1	6	11/2	13/2	28319-23090
5239.227	3505	1	5			
5241.249	924	0	5			
5252.260	E 235	1	5			
5257.036		1	1	13/2	13/2	28725-23468
5266.840	10010	4	6			
5268.221	E1200	0	5			
5271.736	1090	1	6	11/2	13/2	27874-22602
5273.822	E3700	0	6			
5279.678	E2600	0	6			
5285.316	2298	0	5	13/2	11/2	19993-25279
5294.935	922	1	5			
5295.140		2	1			
5310.995	E 500	0	6			
5312.637	E2470	0	6	11/2	13/2	17777-23090
5317.694	1689	2	6	13/2	13/2	24652-19334

JK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
5319.158	E 950	0	6	13/2	11/2	28725-23406
5328.147		0	1			
5333.593	E1200	0	6			
5336.15	2221	3	5			
5345.589	E1200	0	6			
5362.605	E1000	0	5	15/2	15/2	17547-22910
5370.673	2516	3	5	13/2	11/2	27668-22298
5382.273	E2700	0	5			
5396.76	E1560	1	6	13/2	11/2	28725-23329
5406.163	4789C	3	5	15/2	17/2	23072-17665
5416.640	1166	1	5	11/2	13/2	24555-29973
5422.667	2140	2	6			
5427.854		0	7			
5430.510	E 600	0	6			
5442.052	E1200	0	5			
5447.419		9	1			
5458.761	E1800	0	6			
5464.499	E 900	0	6	11/2	13/2	24005-18540
5473.585	E2700	0	5	13/2	13/2	29683-24210
5481.846	591	0	6	15/2	13/2	28950-23468
5484.700	2402	2	5			
5485.705	1852	0	6			
5502.373	E1300	0	5			
5508.600	E 200*	0	7			
5514.674	*	0	7			
5528.583	E1400	0	6	8	7	16360-21888
5539.985	523	1	6	15/2	13/2	23072-17532
5542.826	542	5	5	15/2	13/2	17547-23090
5543.265		2	1			
5551.108	E1350	0	5			
5551.778	2996	2	6	15/2	13/2	33110-27558
5556.078	2098	1	5			
5563.566	7112	1	6	17/2	17/2	32468-26925
5566.882	1791C	2	6	15/2	13/2	24107-18540
5571.550	E 800	0	5			
5587.835	2496	0	5			
5602.535	E1000	0	5			
5607.036	776	0	5			
5609.527	E2600	1	6			
5611.559	561	3	5	7/2	9/2	22153-16541
5629.473		0	1			
5631.755	1865	3	5			
5638.464	E2600	1	5			
5638.568	E 700	0	6	9/2	11/2	28967-23329
5641.019		1	4			

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## JK LINE LIST

WAVE NUMBER	WILTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
5653.231		1	1			
5658.244	*	0	7			
5667.819	735C	2	6	11/2	11/2	23226-17559
5675.553	E 300	1	5			
5678.753	578	3	6	11/2	9/2	25118-19439
5683.068	*	0	3			
5694.887	1268C	8	6	11/2	13/2	23226-17532
5700.950	E1450	0	5			
5714.208		0	1			
5719.910		0	1	17/2	13/2	28800-23090
5717.182	1762	1	6	11/2	13/2	28319-22602
5727.744	2310C	3	5	17/2	15/2	17182-22910
5728.295	E3360	0	6	15/2	15/2	26298-20569
5751.335	C10930	2	5	5/2	7/2	25026-19275
5767.131	1667C	2	5			
5769.564	E3720	1	6	15/2	13/2	25104-19334
5774.821	E 100	2	5			
5783.321	1650C	4	6	11/2	13/2	25118-19334
5791.410		0	4			
5794.190	E 500	0	5	8	8	22428-28223
5802.576		1	1			
5803.857	3797	2	6	13/2	15/2	18717-24521
5806.861		0	4			
5810.450	5638	0	6	17/2	17/2	23361-29172
5813.316	E 250	0	6			
5815.630	E 250	0	5	13/2	15/2	28725-22910
5815.941		0	4			
5818.181	E1000	0	5			
5830.367	E 700	0	6			
5831.092	840	0	6	13/2	13/2	24371-18540
5837.840	3917	1	5			
5838.899	2707	1	5			
5843.243	5811	0	6	17/2	15/2	32488-26645
5857.596	E 150	1	6			
5860.457		0	1			
5876.176	3230	8	5	7/2	5/2	22153-16276
5879.151	1188C	3	5	17/2	17/2	21046-26925
5884.680	3914	0	6			
5890.174	665	0	6	17/2	15/2	28800-22910
5890.824		1	1			
5900.380	E1050	0	6			
5903.886	170*	1	7			
5906.417		0	4			
5918.765	E 500	0	6	13/2	11/2	24652-18733
5921.191	1347	0	5	15/2	13/2	17547-23468

JK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
5921.561	4163	1	5			
5924.056	991	7	6			
5925.093	3926	2	6	15/2	15/2	25104-19179
5934.164	1819C	1	6			
5937.992	2194	0	5			
5940.819	583	2	6	11/2	9/2	25118-19177
5944.492		0	1	11/2	11/2	29351-23406
5966.842	E2900	0	6	15/2	15/2	23672-29038
5977.697	E3000	0	6			
5978.965	*	1	6			
5981.80	E 750	0	6			
5991.005	E1300	0	6			
5994.158	*	1	7			
5994.814	2310	2	5			
6011.853	754	1	6			
6014.460	2779C	3	6	11/2	13/2	24555-18540
6032.932	E 150C	7	6	9/2	9/2	22574-16541
6037.061	E 450	0	6			
6039.423		0	1			
6040.436	296	1	6	15/2	15/2	28950-22910
6050.552	E4400	1	6			
6052.293	2346	2	5			
6056.050		0	1			
6064.740	E 100	1	6			
6066.698	E 750	0	6			
6074.970		0	4			
6081.601		0	1			
6081.674		0	1			
6081.765		0	4			
6090.275	E1400	0	6			
6091.648	E 600	0	5			
6095.799	3800	1	6	13/2	13/2	25430-19334
6104.056	1840	3	6	7/2	9/2	25543-19439
6106.10	E 500	0	6			
6106.408	E 500	0	5			
6110.472	E1300	0	5	5/2	7/2	25386-19275
6111.656	1534	0	6	13/2	13/2	24652-18540
6116.40	E1440	0	6	13/2	13/2	17993-24210
6123.738	660	0	6	11/2	13/2	25458-19334
6125.397	E 750	0	6			
6127.559	E 750*	0	7			
6132.214		0	4			
6135.360	374*	0	7			
6136.670	E3400	0	6			
6156.752	E 600	1	5	11/2	13/2	29625-23468

## BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
6158.317	2510C	5	5	15/2	15/2	23072-16913
6160.418	1020	0	5			
6164.62	E 700	0	6	15/2	15/2	26734-20569
6166.954	2965	2	6			
6170.330	2866	1	5			
6171.887	E1500	0	6			
6190.190	1371	1	5			
6202.48	E1450	0	5	13/2	13/2	23671-23468
6206.408	E1550	0	6			
6209.271	E 900	0	6	11/2	9/2	28695-22686
6211.402		1	1			
6211.471		1	1			
6212.365		0	4			
6214.803	1680	0	5	13/2	13/2	29683-23468
6216.150		1	3			
6225.468	1102C	3	6	11/2	9/2	25664-19439
6226.415	E1200	0	6			
6230.235	4450	6	6	9/2	9/2	27771-16541
6234.698	1917	1	6			
6245.533	2496	0	3	15/2	13/2	24786-18540
6245.933	1910	0	5			
6248.387	4890	7	6	9/2	11/2	22236-15987
6250.439	81	1	6	11/2	11/2	24005-30255
6256.596	1038	1	6			
6264.601	E 500	0	5	13/2	11/2	29671-23406
6267.422	5640	3	7			
6268.890	E2700	0	6			
6275.091	1397	0	6			
6278.025	E2200	0	5			
6280.14	E 600	0	6			
6281.670	1241	1	5	9/2	9/2	28967-22686
6286.867	1462	1	6			
6297.119		0	4			
6302.775		0	4			
6311.926	E 1000	1	6			
6315.962		0	1			
6318.046	3122	1	5			
6318.264		0	1			
6318.370		0	1			
6319.109	3480	5	5	3/2	5/2	25517-19198
6329.266	14910	6	6	17/2	15/2	28223-21894
6330.037	E2180	1	6	11/2	13/2	25664-19334
6332.505	907	0	5			
6333.496		0	1			
6337.276	E 2900	4	6	7/2	9/2	25776-19439



UK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
6342.195		0	1	13/2	11/2	29671-23329
6344.999	E 250	3	7			
6345.290		3	4	7/2	5/2	25543-19198
6348.398	2780	1	5			
6350.195	*	0	7			
6359.201	E1400	0	5			
6364.542	E 650	0	5	8	7	22428-28793
6366.166	2080	3	6	7/2	9/2	25543-19177
6370.290		0	1			
6372.140	E 700	3	5			
6374.503	E2900	0	6			
6388.260	E3200	0	5			
6389.795	E 400	0	6			
6391.262	5150	3	5			
6402.850	7000	3	5	5/2	7/2	25026-18624
6417.567	1321	0	5	17/2	17/2	28800-22382
6426.443		0	1			
6441.654	40280	3	5	15/2	17/2	24107-17665
6447.897	3788	5	5	17/2	15/2	23361-16913
6452.838		0	3	11/2	11/2	9535-15987
6456.196	E 400	0	5			
6459.262	E5200	0	5			
6459.312	E 350	2	6			
6460.112	E4200	0	5			
6461.315	638	1	6			
6464.676	3785	1	6	15/2	15/2	33110-26645
6467.877		0	1			
6468.692	603	0	6	11/2	9/2	25407-19439
6470.005	E 050	0	6			
6472.136		0	3			
6473.152	E 450	0	6	11/2	13/2	24005-17532
6474.707	E 600	0	5			
6476.486	E 2500	0	5	11/2	13/2	29945-23468
6479.485	U 252*	1	7	7/2	9/2	25918-19439
6482.257	2960	3	7	5/2	7/2	25757-19275
6486.042	125	1	5			
6487.531	1111	1	6	11/2	9/2	25664-19177
6489.263	1406	0	5			
6490.887	E 700	0	5			
6500.610	2326	0	5			
6500.909	350	1	6	7/2	7/2	25776-19275
6502.800		1	1	11/2	13/2	9535-16038
6503.858		0	3			
6507.527		0	1			
6509.893	E1000*	0	7			

## BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
6511.449		0	3			
6513.285	E1300	0	5			
6521.889		0	3			
6528.516	1171	1	6	9	8	19065-25593
6530.720	E 130	1	5	15/2	13/2	0- 6530
6543.766	8900	1	5			
6546.126	E2800	0	5			
6549.679	417	0	5			
6555.991	3342	0	5	13/2	13/2	34114-27558
6559.430	4075	0	5			
6559.920	6150	3	6	5/2	5/2	25757-19198
6563.545	E3570	1	6	15/2	13/2	25104-18540
6566.811	E1000	0	3			
6569.806	E 800	0	6			
6575.534	1283	0	6	15/2	13/2	24107-17532
6577.284	14930	1	6	11/2	13/2	25118-18540
6586.415	E 3000	4	5	9/2	11/2	22574-15987
6588.884	2670	4	7			
6595.136	3539	1	6	17/2	15/2	17182-10587
6599.340	E 3200	3	6	7/2	9/2	25776-19177
6614.857	E 2000	9	7			
6616.197	1279	0	6	11/2	11/2	29945-23329
6618.732	* 7930	1	7	9/2	9/2	29135-22516
6619.884	678	0	6			
6623.363	E2800	1	6			
6624.696	741	1	5	13/2	13/2	29227-22602
6632.986	E1100	0	5			
6633.701	E2600	0	6			
6636.458	E 300*	0	7			
6643.155	E 300*	0	7	7/2	7/2	25918-19275
6650.160		6	4			
6651.876	1191	0	5	13/2	15/2	19993-26645
6662.392		0	4	15/2	13/2	17547-24210
6666.683	E 450	1	6			
6667.828	2318	1	5	11/2	9/2	28895-22227
6669.156		0	1			
6685.334	8530	5	6	11/2	9/2	23226-16541
6688.413	E 600	0	5			
6715.132	3851	1	6	17/2	17/2	21046-27761
6720.873		0	1			
6722.801	E3100	0	6			
6722.986		0	4			
6725.729		0	4			
6727.507	E 600	0	6			
6729.561	E 750	0	6			

BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
6733.868		0	3			
6746.521	584	0	6			
6741.627	3460	2	5			
6748.342	E1350	0	5			
6751.180	E1050	0	6			
6751.364		0	3	11/2	13/2	19013-25765
6754.715	E1200	0	6			
6755.176		0	1			
6755.451		0	1	13/2	13/2	21287-17532
6761.984	U10660	1	5	5/2	7/2	25386-18624
6775.961	E 600	0	5	13/2	13/2	18717-25493
6777.584	E2000	3	5			
6779.709	29980	2	6	13/2	15/2	25958-19179
6783.720	E 3000	8	6	9/2	11/2	22771-15987
6787.058	884*	5	7			
6808.998	858	2	6			
6812.678	E 200	2	5	13/2	11/2	24371-17559
6814.379	E 50	1	5			
6813.653	2517	1	5			
6816.950	*	0	7			
6828.753	E 800	0	6			
6831.761	2209	1	5	13/2	15/2	28725-21894
6834.719	1300	1	6			
6833.708	E 200	3	5			
6839.745	327	4	6	13/2	13/2	24371-17532
6844.932		0	1			
6845.307	201*	3	7			
6845.926		0	1			
6840.753	1043	0	5			
6849.154	E1100	0	5	13/2	11/2	28725-21876
6854.858	1051	1	5	11/2	13/2	29945-23090
6856.959	5920	8	6			
6867.040	E 200*	8	5	9/2	9/2	26044-19177
6868.699		0	1			
6874.562		0	1			
6879.269	440	1	6			
6881.215	8540	1	6			
6892.028		0	1			
6892.115		0	3			
6902.019		0	1			
6903.914	E 400*	1	7			
6907.953	E2000	1	5	9/2	9/2	29135-22227
6910.978	781*	6	7			
6917.702	E 400*	1	6	11/2	13/2	25458-18540
6919.290	4780	3	6	7/2	7/2	25543-18624

## BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
6929.973	E 600	0	5			
6937.959	157	3	7			
6941.512	*	1	7			
6951.831	E 500	0	6	9/2	11/2	28967-22015
6957.561	E 223*	4	7			
6958.869	963	3	6			
6960.276	2284	3	6	15/2	15/2	17547-10587
6988.293	3250	3	6			
6991.236	4300	3	6			
6993.323	E 175	2	6			
6997.008		0	4			
6999.000	2320	1	5	11/2	9/2	29227-22227
7011.811		0	1			
7015.815	E 300*	3	7	7	7	16801-23817
7022.429		1	1			
7041.850	4980	9	5	11/2	9/2	17777-10735
7059.868	2989	3	6	7	7	16801-23861
7068.851		0	1			
7069.241		1	1			
7081.764	2330	2	6	13/2	13/2	26416-19334
7093.243	492	3	6	13/2	11/2	24652-17559
7108.051		1	1			
7108.407		1	1			
7113.217	E1800	1	5	7/2	9/2	29799-22586
7120.304	1626	3	6	13/2	13/2	24652-17532
7124.000	E2000	0	6	11/2	13/2	25664-18540
7133.80	496*	2	7	5/2	7/2	25757-18624
7149.047	E1000	0	6			
7152.592	559*	2	7	7/2	7/2	25776-18624
7160.15	4798	0	6			
7163.407	7120	6	5			
7177.059	766	0	5			
7178.563		0	1			
7183.801	E2000	0	6			
7186.223	E3100	0	6			
7186.592	E 550*	1	7			
7188.982	7180	8	6	11/2	13/2	23226-16038
7197.101	2544	1	6	9/2	11/2	23185-15987
7199.810	E 800	1	6			
7219.43	E1700	0	5	13/2	13/2	28725-21506
7227.061	740	2	6	15/2	13/2	34785-27558
7232.913	E 3000	2	5	7/2	7/2	22153-14920
7237.275	2125	1	6	13/2	15/2	26416-19179
7239.017	713	3	6	11/2	11/2	23226-15987
7248.514	215	1	5			

UK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
7255.334	E 700	0	5			
7255.624	1320	1	6	11/2	13/2	26590-19334
7260.635	4861	1	6	17/2	15/2	26439-19179
7266.688	0650	3	6			
7277.710	E 400	0	6			
7285.797	E 900	0	5			
7291.580	2472	1	6			
7294.976	387*	2	7			
7309.664		1	4	13/2	13/2	29912-22602
7314.431	E 550	1	5	15/2	13/2	34872-27558
7315.70	E2600	0	6			
7316.470	E 300*	1	7			
7321.824	13680	1	5	17/2	15/2	23361-16039
7339.208	E 800*	0	7	17/2	15/2	17162-24521
7342.656		6	1	11/2	13/2	29945-22602
7373.875	240*	2	5	13/2	15/2	24287-16913
7399.656	2319	2	6	15/2	13/2	26734-19334
7406.281	7250	9	7	13/2	15/2	17493-10587
7428.409	854	2	6	11/2	9/2	29945-22516
7438.317	2354	3	5	15/2	17/2	25104-17665
7439.461		1	1			
7446.723	E2000	1	6			
7449.667	E 300*	3	7			
7457.35	271*	1	6	8	7	16360-23817
7458.077	2698	2	5	13/2	15/2	24371-16913
7460.844		4	1			
7463.808		1	1	11/2	9/2	24005-16541
7468.886	2553	1	5	13/2	15/2	34114-26645
7475.726	E 800*	1	7			
7476.429		1	3			
7501.384	3065	2	6	8	7	16360-23861
7536.447	3765	0	6			
7542.555	6740	2	5	5/2	3/2	25026-17484
7547.399	E 400	0	6			
7551.552	5409	1	5	19/2	17/2	19373-26925
7552.091		0	4			
7555.167	2109	1	6	15/2	15/2	26734-19179
7558.871	4500	8	6	11/2	11/2	25118-17559
7560.095	1002	2	5			
7563.953	E 750	1	6			
7571.001	27820	3	5	13/2	15/2	29465-21894
7572.167	E2960	0	6	15/2	13/2	25104-17532
7576.240		1	1			
7576.392		0	1			
7585.937	9850	3	6	11/2	13/2	25118-17532

## JK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
7588.405	1627	1	5	13/2	11/2	29465-21876
7596.965	E 600	0	5			
7611.123	92	1	6			
7616.487	3421	1	6	15/2	13/2	33110-25493
7624.462	E 450	1	6			
7625.353		0	1			
7626.854	E 300*	1	7			
7628.680	1154	1	6			
7643.771		1	1			
7643.872		1	1			
7643.962		1	1			
7644.238		0	1			
7644.712	E 100*	3	7			
7654.214		9	1	9/2	7/2	22574-14920
7654.627	2094	3	5	13/2	15/2	29548-21894
7660.330	E 150*	3	7			
7672.625	940C	3	5	13/2	11/2	29548-21876
7682.03	177	1	5	9/2	9/2	5757-13439
7687.337	1822	1	6	13/2	13/2	27622-19334
7691.998		1	1			
7717.630	1561	1	5	11/2	9/2	29945-22227
7724.158	557	0	5			
7730.354	654	2	5			
7738.639	2006	4	5	13/2	15/2	24652-16913
7747.824	E1600	0	5			
7748.865	1680	1	5	11/2	11/2	29625-21876
7754.437	789	1	5	6	7	18755-26510
7763.791	E1100	0	5			
7778.936		0	1			
7781.939	E 4850	2	5	15/2	17/2	23072-15290
7794.276	441	1	6			
7794.593	2540	1	5	13/2	11/2	29671-21876
7799.719		0	1			
7799.791		0	1			
7814.161		0	1			
7814.963		0	1			
7819.769	E 1500	0	5			
7827.303	E 150	0	5			
7839.883	E2250	0	6			
7842.848	1617	1	6			
7844.449		0	1			
7851.612	E3050	1	6	13/2	15/2	19993-27844
7851.531	590C	0	6	9/2	7/2	22771-14920
7857.753		0	4			
7860.272	2838C	4	6	15/2	17/2	34785-26925

JK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
7864.313		0	1			
7864.655		0	1			
7865.404		0	3			
7865.655		0	1			
7871.347	E2600	0	6	13/2	11/2	25430-17559
7875.730	E2200	0	6	13/2	13/2	26416-18540
7886.121	3063	1	5			
7893.079	E 250	3	6	9/2	9/2	30410-22516
7896.805		0	3			
7897.951		0	1			
7899.28	E 520*	0	5	11/2	11/2	25458-17559
7900.637		0	1			
7901.815	8230	1	5	5/2	3/2	25386-17484
7906.731	E2100	1	6			
7926.342		0	4	11/2	13/2	25458-17532
7927.767	E 950	0	5	13/2	15/2	18717-26645
7929.271	11140	-2	6			
7947.646	1280	4	6	15/2	17/2	34872-26925
7950.185	E 450	0	5			
7952.865		0	1			
7958.667	2282	2	5	13/2	13/2	29465-21506
7961.958		0	1			
7964.058		2	1			
7964.650	1245	1	6	11/2	13/2	30567-22602
7967.24	E 150	2	5	11/2	13/2	24605-16038
7967.765	508	3	6	13/2	13/2	27302-19334
7973.964	E 50	1	4	13/2	13/2	18717-26691
7974.68	E 150	1	5	9/2	7/2	26598-18624
7980.145	2518	1	6			
7982.005	936	0	6			
7989.831		1	1			
7992.794	E3200	0	6	17/2	15/2	21046-29038
8003.544	E1300	0	6			
8009.219	1166	1	5			
8013.762	E1860	0	6	11/2	9/2	24555-16541
8018.213	24500	2	5	13/2	15/2	29912-21894
8022.86	E 280	0	5	11/2	9/2	5416-13439
8024.026		0	1	11/2	11/2	9535-17559
8024.325		0	1			
8032.837	2330	3	7	3/2	3/2	25517-17484
8035.600	1297	1	5	13/2	11/2	29912-21876
8042.286	15940	4	5	13/2	13/2	29548-21506
8050.385	2091	0	6	11/2	9/2	30567-22516
8053.275	E 550*	1	7			
8054.227	798	0	6			

## BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
8067.072	995	0	6	15/2	15/2	34785-26718
8068.599	1331	1	5	11/2	11/2	29945-21876
8081.650		0	1			
8085.600	E 300C	0	5			
8089.190	287	0	5			
8091.914	2481	2	5	9	8	19065-27157
8097.765	E 350	1	5	9/2	11/2	30113-22015
8105.567	973C	3	6	11/2	11/2	25664-17559
8100.487	942C	3	6	13/2	15/2	18717-10587
8102.692	1597	1	6	11/2	13/2	25664-17532
8139.950	1538	1	6	15/2	15/2	34785-26645
8144.154	E 150*	0	7			
8156.824		1	1			
8164.857	3201	0	5	13/2	13/2	29671-21506
8170.480	2503	0	6			
8180.417		0	4			
8182.500	1378C	3	6	6	7	18755-26938
8189.492	2503C	1	5	17/2	15/2	25103-16913
8190.520		1	4	15/2	15/2	25104-16913
8193.630	E 2150	0	6	15/2	13/2	26734-18540
8215.568	1750	1	6	13/2	13/2	27550-19334
8222.080	E 5000	9	5	7/2	5/2	22153-13931
8225.725	E 250C	5	6			
8226.305	E 350	0	6			
8227.319	E 350	2	6	15/2	15/2	34872-26645
8229.342	E 100	1	5			
8242.960	E 700	0	5			
8247.769	2154	1	6	13/2	15/2	24287-16039
8249.607	2146	0	6	13/2	13/2	24287-16038
8254.072	E 150	2	6			
8264.913	2835	1	6	9/2	7/2	23185-14920
8271.101	E 350	0	6			
8273.53	U 727C	1	6	5/2	3/2	25757-17484
8277.785	E 150C	8	7	11/2	9/2	19013-10735
8281.330	E 1750	0	6			
8300.339	1989	1	5	13/2	11/2	34114-25814
8306.316	2460	1	6			
8311.219	3496	0	5	13/2	15/2	30205-21894
8332.01	286	8	5	13/2	15/2	24371-16039
8333.833	E 200	0	5	13/2	13/2	24371-16038
8339.614	E 356C	6	5	11/2	9/2	30567-22227
8348.341	E 600	0	6			
8348.800	E 550	0	6	11/2	11/2	25907-17559
8371.078	E 1500	0	6	13/2	15/2	27550-19179
8375.876	1610	0	6	11/2	13/2	25907-17532



JK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
8383.88	E 200	0	5	13/2	11/2	23471-15987
8387.533	E 440	0	5	19/2	17/2	19373-27761
8394.052	E 150	3	5	9/2	11/2	30410-22015
8399.805	E2000	0	6	13/2	11/2	25958-17559
8405.871	19490	2	5	13/2	13/2	29912-21506
8433.309	E2800	0	5			
8445.644	E1000	0	6			
8477.223	6190	9	5	11/2	11/2	17777- 9300
8485.075	E 350*	8	5	9/2	11/2	26044-17559
8489.619	511	1	5			
8517.210	1720	0	6	11/2	13/2	24555-16038
8522.105	*	2	7			
8539.663	3222	2	6	11/2	13/2	27874-19334
8551.245	2360	0	6			
8572.969		2	1			
8573.140		2	1			
8576.582	567	2	6	11/2	9/2	25118-16541
8612.566	4070	7	6	13/2	15/2	24652-16039
8613.425	E 150	1	6			
8614.466	E 490	5	6	13/2	13/2	24652-16038
8629.301	E 6500	1	5			
8636.690	677	9	5	11/2	13/2	17777- 9141
8644.805	E 650	0	6			
8664.437	E 450	1	6	13/2	11/2	24652-15987
8690.582	E 150	4	5	11/2	11/2	30567-21876
8693.043	806	9	6	13/2	11/2	17993- 9300
8713.517	596	8	5	7/2	9/2	22153-13439
8724.833	E 650	0	5	13/2	15/2	17993-26718
8748.276	1441	1	6	15/2	13/2	24786-16038
8750.014	E 9000	2	5	5/2	5/2	25026-16276
8790.566	E 950	0	6			
8792.235	4957	1	6	7	8	16801-25593
8796.858	E 6000	8	6	9/2	9/2	22236-13439
8805.05	E 150	8	6	9/2	11/2	22574-13769
8817.500	E 3000	3	5	15/2	17/2	24107-15290
8828.925	1182	1	5			
8835.443	E1450	1	5	13/2	11/2	34114-25279
8852.509	8120	9	6	13/2	13/2	17993- 9141
8895.360	E 350*	2	5	13/2	15/2	29465-20569
8900.243	1168	3	6	15/2	13/2	33110-24210
8907.725	E1430	0	6	13/2	11/2	34186-25279
8952.358	E 350	0	6	15/2	15/2	28131-19179
8961.090	E 950	6	5	7/2	7/2	22153-13191
8976.972	1023	3	6	13/2	15/2	29548-20569
8980.211	*	0	7			

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## BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
8985.118	3899	0	6	11/2	13/2	28319-19334
8995.326	*	0	7			
9001.472	815	2	5			
9002.378	4000	6	6	9/2	11/2	22771-13769
9005.625	1119	0	5	11/2	13/2	9535-18540
9044.435	597	6	6	9/2	7/2	22236-13191
9045.265	E 500	1	5	13/2	15/2	25958-16913
9066.838	746	1	5	11/2	13/2	30567-21506
9066.299	E2400	0	6	15/2	13/2	25104-16038
9069.647		0	1			
9080.337	4130	8	6	11/2	13/2	25118-16038
9097.976	2721	1	5	15/2	15/2	17547-26645
9101.548	E 570	0	5	13/2	15/2	29671-20569
9102.31	E 600	0	6			
9109.110	E1200	3	5	5/2	5/2	25386-16276
9109.183	E 700*	1	3			
9116.283	1003	1	6			
9123.304	1091	2	6	11/2	9/2	25664-16541
9125.165	E1400	1	6			
9126.900	E3200	6	6	13/2	15/2	18717-27844
9130.670	433	1	6	11/2	11/2	25118-15987
9134.896	E 200*	8	7	9/2	9/2	22574-13439
9141.113	E 300	1	5	15/2	13/2	0- 9141
9144.162	E1500	0	5	15/2	13/2	17547-26691
9146.618		1	3			
9146.896		0	1			
9151.682	E10000	1	5			
9157.879	4088	1	5	9	8	19065-28223
9180.673	132	1	6			
9180.481	E 550	1	6			
9191.417	995	1	6			
9202.302	E 200	0	6	15/2	13/2	26734-17532
9224.329	E 300	2	6			
9233.754	50360	6	6	8	8	16360-25593
9260.404	E 800*	2	7	7/2	5/2	25543-16276
9283.133	E1400	0	6			
9291.792	1170	1	6	15/2	13/2	34785-25493
9296.492	751	1	6			
9302.140		1	5			
9308.345	74	8	6			
9318.676		0	1			
9319.155	E 350	1	6			
9332.201	E 420	2	6	9/2	9/2	22771-13439
9334.708		0	1			
9335.335		0	1			

OK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
9335.510		0	1			
9342.561	668C	7	6	13/2	15/2	29912-20569
9350.657	1040	1	5	11/2	13/2	30857-21506
9355.897	1249	2	5	13/2	11/2	34114-24758
9361.000		0	1			
9361.873		0	1			
9371.43	472	7	7	3/2	1/2	25517-16145
9372.990	E 450	0	6			
9377.658	4022	3	5	15/2	17/2	17547-26925
9379.139		4	4	15/2	13/2	34872-25493
9381.539	E3830	1	5	15/2	15/2	31275-21894
9382.464	L 1500	8	5	9/2	7/2	22574-13191
9384.273	E1210	0	6	15/2	15/2	26298-16913
9390.675	2524	3	6	13/2	15/2	25430-16039
9392.569	2583	1	6	13/2	13/2	25430-16038
9396.317	E 450	1	6			
9398.909	E1900	0	6	13/2	11/2	34157-24758
9400.107	9320	5	5	5/2	3/2	25025-15626
9417.251	E 700	1	6	13/2	11/2	18717- 9300
9417.651	E2000	1	6			
9431.709	E1000	1	6			
9434.091	1515	1	5	15/2	15/2	20021-10587
9441.021	*	1	7			
9457.670	8250	9	6	11/2	11/2	23226-13769
9463.122	3975	3	5	17/2	15/2	17182-26645
9496.137	9790	9	6	15/2	17/2	24786-15290
9509.121	253	3	5	13/2	15/2	6530-16039
9516.622	E1000	0	6			
9520.665	1191	2	6			
9522.134		1	4			
9529.480	E2500	0	6	13/2	11/2	39785-30255
9532.398	1703	1	6			
9535.995	3232	1	5	17/2	15/2	17182-26718
9560.580	14760	4	6	11/2	13/2	28895-19334
9564.847	13350	4	5	13/2	13/2	17993-27558
9576.621	4144	8	6	17/2	15/2	32488-22910
9581.138	11020	6	6			
9593.242	6497	1	5	5	6	6051-15644
9607.065	E 100*	1	7			
9619.052	E5800	1	6			
9623.950		0	1			
9626.751	9590	7	6	11/2	13/2	25664-16038
9635.568	E 500	4	5	13/2	15/2	30205-20569
9641.467	24210	3	6	15/2	13/2	33110-23468
9647.210	E3830	1	5	15/2	15/2	31541-21894

## JK LINE LIST

WAVE NUMBER	WILTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
9663.617		1	4			
9676.788	9610	3	6	11/2	11/2	25664-15987
9691.284	E3600	0	6	15/2	15/2	39291-29600
9692.242	*	1	7			
9704.962	1854	2	6			
9708.685	859	7	5	7	7	16801-26510
9713.209	E 40*	9	7	11/2	11/2	19013- 9300
9715.080		0	4			
9718.075	E 350	0	6	11/2	9/2	28895-19177
9725.649	E3600*	1	3			
9742.799	5270	4	5	17/2	17/2	17182-26925
9744.975	E1900	1	6			
9746.582	E2650	2	6	9/2	9/2	23185-13439
9747.424	E1800	1	5			
9759.201	11340	5	5	5/2	3/2	25386-15626
9760.576	E 150	3	5			
9765.932	974	2	5			
9769.200	3346	1	5	15/2	13/2	31275-21506
9770.379	E 104	2	5	13/2	13/2	27302-17532
9771.450	2799	2	6	15/2	15/2	28950-19179
9779.077	E3750	1	6	11/2	13/2	28319-18540
9787.499	8100	5	6	11/2	9/2	23226-13439
9791.264	1008	2	5			
9793.225		2	1			
9798.35	3300	1	6	19/2	17/2	19373-29172
9799.579	E1200	0	5	11/2	13/2	9535-19334
9810.510	217	6	6			
9814.152	19220	9	6	15/2	17/2	25104-15290
9820.569	E1400	1	6	15/2	15/2	26734-16913
9855.491	E3950	1	6			
9869.979	E 500	1	6	11/2	13/2	25907-16038
9872.664		9	1	11/2	13/2	19013- 9141
9890.410	4970	6	7	3/2	3/2	25517-15626
9892.070	E2100	1	6			
9900.614	*	2	7			
9901.342	664	7	6			
9904.455	51750	6	5	13/2	13/2	34114-24210
9910.300	E2900	1	5			
9914.307	E 550	1	5			
9916.418	E 250*	2	7			
9920.008	E 520	1	6	11/2	11/2	25907-15987
9924.198	E 900	1	6			
9926.847		1	1			
9947.469	E1990	1	5	13/2	13/2	34157-24210
9958.400	E 650	0	6	9/2	9/2	29135-19177

BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
9976.732	2282	1	5	13/2	13/2	34186-24210
9993.150	2672C	6	6	9/2	7/2	23185-13191
10003.254	1043C	7	6			
10012.278	4555C	4	5			
10019.842	1633C	4	6	15/2	13/2	33110-23090
10034.866	E3250	1	5	15/2	13/2	31541-21506
10037.186		0	1			
10037.718	E 415*	1	5	6	7	18755-28793
10040.678		1	1			
10046.321	6620	2	5	6	6	5598-15644
10048.083	1482	1	6	11/2	15/2	29227-19179
10052.923	E 450	1	6			
10053.600	E1800	1	6			
10055.501	E1250	1	5			
10056.273	E 300*	3	7	9/2	11/2	26044-15987
10060.983	E 800	1	6			
10063.198	2248	2	6			
10084.554	1670C	2	5			
10106.013	2155C	9	6	17/2	17/2	32488-22382
10108.288	E1900C	3	5	13/2	15/2	27022-16913
10112.522	E 350	3	6			
10116.953	1813	2	6			
10119.411	899C	9	6	17/2	19/2	32488-22369
10124.563	1733	2	6			
10131.448		1	1			
10136.749	1306C	9	6	7	7	16851-26938
10142.464	2183	1	5	11/2	9/2	20678-10735
10146.846	1108C	3	6			
10150.199	778	4	5	8	7	16360-26510
10153.785		2	1			
10153.862	2640	1	5			
10160.268	1276C	7	6			
10161.657	E 400	3	6	11/2	11/2	28895-18733
10170.117		0	1			
10170.189		0	1			
10184.844	1276C	2	6	13/2	15/2	39785-29600
10188.828	E4400	0	5	5	6	6051-16240
10200.659	2121C	9	6	15/2	15/2	33110-22910
10208.122		2	1			
10209.091		1	1			
10213.350	E1800	1	5			
10213.649	E1000	1	6	15/2	17/2	17547-27761
10214.003	E2550	1	6	13/2	13/2	29548-19334
10230.518	E 100*	5	7	9/2	11/2	5757-15987
10234.028	E 450	5	6	9/2	11/2	28967-18733

## OK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
10235.950		5	4	11/2	11/2	24005-13769
10236.861	E 500	1	6			
10238.874		1	6			
10247.449	1504	2	6	17/2	15/2	27161-16913
10252.685	2141	2	6	15/2	15/2	39291-29038
10260.043	3691	2	6	15/2	13/2	26298-16038
10285.901	1655	1	6	13/2	15/2	29465-19179
10290.850	1793	1	6	11/2	13/2	29625-19334
10297.111	1512	1	6	15/2	15/2	17547-27844
10299.282		2	4			
10300.006	4850	7	6			
10303.579	E 750	1	5			
10304.819		2	1			
10306.161	L 250	0	5			
10309.129	4481	1	6			
10323.510	E 950	1	6			
10327.430	3670	1	5			
10340.820	4914	2	5			
10343.829		1	1			
10344.050		1	1			
10345.112		2	1			
10354.549	1321C	8	6	11/2	13/2	28695-18540
10355.007	E1350	8	6	7	8	16801-27157
10364.725		1	4			
10370.641	E1060	1	6	13/2	15/2	26416-16039
10379.884	1362	1	5			
10383.050	2154C	3	6	13/2	15/2	6530-16913
10394.010	E1450	1	6			
10397.027	E1600	1	5			
10401.970	E 550	0	6	9/2	11/2	29135-18733
10409.288	1280	2	6	15/2	13/2	17547-27956
10413.967		1	1			
10445.650		0	1			
10445.785		0	1			
10445.921		0	1			
10451.303	E3600	0	6			
10455.763	E 150	2	6			
10458.781	E 550	1	5	17/2	15/2	21046-10587
10460.348	901	1	5			
10488.395		0	1			
10493.690	E 350	2	6	11/2	11/2	29227-18733
10499.632	3411	2	6			
10507.640	2881	0	6	15/2	13/2	33110-22602
10513.057		0	1			
10513.390	2935	1	5	13/2	15/2	29683-19170

OK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
10530.394	E 800	1	6			
10537.418		1	1			
10538.722	E 150	1	5			
10549.862	E 4400	1	6			
10554.929	E1300	1	6			
10565.766		3	1	11/2	9/2	24005-13439
10571.243	E 200	2	6	11/2	11/2	5416-15987
10578.265	13880	8	6	8	7	16360-26938
10584.320	E1400	1	6			
10587.344	E 200	3	5	15/2	15/2	0-10587
10593.991	E 900	1	5			
10597.079	E1900	1	5			
10601.266	E 200*	1	7			
10602.521	E 200	9	5	13/2	11/2	24371-13769
10610.586	2153	1	6	11/2	13/2	29945-19334
10612.253		0	4			
10617.535	E 450	1	6	11/2	11/2	29351-18733
10621.30	E 120	3	5	11/2	13/2	5416-16038
10621.993	E 200*	2	7	7/2	9/2	29799-19177
10625.508		1	1			
10636.513	1933	1	5	13/2	15/2	27550-16913
10641.917	4533	2	5	6	0	5598-16240
10645.674	39190	3	5	13/2	13/2	34114-23468
10662.218	E 250	2	6	17/2	15/2	17182-27844
10669.72	E 300	1	5			
10686.586	12390	7	6	11/2	13/2	29227-18540
10688.351	E 600	1	5			
10688.882	721	2	5	13/2	13/2	34157-23468
10688.877	E1000	0	6			
10704.819	E2000	3	6			
10707.786	29580	6	5	13/2	11/2	34114-23406
10715.452	E1500	1	5			
10727.443	E 1500	9	6	15/2	17/2	33110-22382
10733.106	1990	2	6	13/2	15/2	29912-19179
10740.055	E 400	1	5			
10740.153	1924	1	6			
10744.533	E 150	1	5			
10746.268		3	4	13/2	15/2	39785-29038
10750.835	E 300	1	5	13/2	11/2	34157-23406
10756.548	1648	1	6	6	7	18755-29512
10765.079	E1100	1	6	11/2	9/2	29945-19177
10780.064	E 70	5	5	13/2	11/2	34186-23406
10784.016		2	4	9/2	9/2	5757-16541
10785.364	2402	2	5	13/2	11/2	34114-23329
10785.898	E1800	0	6	11/2	11/2	24555-13769

## UK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	000-EVEN LEVELS
10797.152	1418	7	6	8	8	16360-27157
10810.429	1372	3	6	11/2	13/2	29351-18540
10828.399	804	0	6	13/2	11/2	34157-23329
10835.602		0	1			
10837.700	E 400*	1	7	5/2	7/2	25757-14920
10852.013	848	1	6	13/2	13/2	19993- 9141
10857.002	484	1	6	13/2	11/2	34186-23329
10863.034	E 250	1	5			
10868.903	3282	1	5			
10873.780	738	2	6	15/2	17/2	33256-22382
10882.326	12430	8	6			
10883.10	E 550	6	6	13/2	11/2	24652-13769
10891.051	E2000	1	5			
10899.973	E4400	1	5			
10903.199	E 250*	0	7			
10933.804		1	1			
10930.160	E3100	1	5			
10939.716		1	1			
10942.290	E2000	0	5			
10952.190		1	4			
10963.337	2173	1	6			
10984.902		0	1			
10987.299		1	1			
10987.397		1	3			
10988.517		0	1			
10998.000	E 150*	1	7	7/2	7/2	25918-14920
11001.382	882	1	5	13/2	13/2	6530-17532
11003.474	E1050	0	5			
11007.899	3220	1	6	15/2	17/2	26298-15290
11024.046	4730	6	5	13/2	13/2	34114-23090
11044.175	E1250	1	6			
11067.095	15410	2	5	13/2	13/2	34157-23090
11084.191	E1500	0	6			
11090.380	E1900	0	5			
11095.701	E 900	1	5			
11096.840	E1450	0	5			
11099.022		2	1			
11099.310		2	1			
11124.030	E 150	6	6	9/2	7/2	26044-14920
11130.541	794	1	6	13/2	13/2	29671-18540
11137.400	781	1	6	8	7	22428-33566
11148.211	8253	1	5	7	7	6809-17957
11149.699	3392	1	6	17/2	17/2	26439-15290
11155.008	2528	1	6			
11160.679	15130	1	5	13/2	11/2	28725-17559



UK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
11174.835	1000	1	6			
11175.188	E 155	3	5	7/2	7/2	29793-18624
11178.715	E1250	1	6	13/2	11/2	29912-18733
11179.351		1	1			
11193.385	474	5	6			
11194.717	10710	2	6			
11195.638		2	1			
11196.248	13270	1	6	7	6	21743-32940
11204.260	42180	7	5	13/2	15/2	34114-22910
11219.192	E 100	2	6			
11232.843	E 150	1	5			
11234.894	E 200	1	5			
11237.273	E1750	0	6			
11238.555		J	4			
11247.272	1028	1	5	13/2	15/2	34157-22910
11264.479	E 700	0	5	13/2	13/2	27302-16038
11276.536	13270	1	5	13/2	15/2	34186-22910
11283.699	2711	1	5			
11286.862		1	4			
11291.524		1	4			
11294.707		0	1			
11298.457	E 200	6	6			
11314.734	E1250	0	5			
11316.775		1	4	15/2	13/2	34785-23468
11318.065	E3200	1	6			
11328.344	E 900	1	6			
11336.160	E 300	2	6	11/2	11/2	28895-17559
11348.724	E 5300	5	6	11/2	11/2	25118-13769
11354.011	E2800	0	5			
11362.365	9750	4	6	15/2	15/2	33256-21894
11363.198	E 820	2	6	11/2	13/2	28895-17532
11371.554	E2050	1	6	13/2	13/2	29912-18540
11386.998	E1850	1	5			
11390.054	2337	1	6	11/2	9/2	30567-19177
11404.111	E1100	0	5	15/2	13/2	34872-23468
11417.051	E 700	1	5	7/2	9/2	22153-10735
11421.601	E 300	2	5	7	8	16861-28223
11427.430		1	1			
11427.545		1	1			
11435.380	E2100	0	5			
11471.073		1	1	13/2	11/2	30205-18733
11518.234		1	1			
11522.380	E2950	1	6	11/2	13/2	30857-19334
11524.980	E 300	1	4			
11528.225	E 900	0	6			

## UK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-0	J-E	ODD-EVEN LEVELS
11538.087	E 200	1	5			
11541.313		1	1			
11577.843	E2260	1	5	11/2	11/2	20878- 9300
11585.689		1	1			
11607.653		0	1			
11624.481	1791	1	6	15/2	17/2	17547-29172
11655.230	1484	1	6			
11665.186	E1500	1	6			
11668.161	E 250	1	6	11/2	11/2	29227-17559
11676.433	E 150	2	5			
11678.542	E 950	1	6	11/2	9/2	25118-13439
11678.820	E1400	1	6	9/2	7/2	26598-14920
11689.539	E 450	2	6			
11699.239	7280	1	6	11/2	13/2	29227-17532
11698.918		1	4			
11703.526		2	1			
11732.170		1	1			
11732.472		1	1			
11737.309	2343	1	5	11/2	13/2	20878- 9141
11738.167	2080	1	6			
11743.372	E 450	1	6			
11750.012	E1500	1	6	15/2	13/2	33256-21506
11761.486	13300	7	6			
11767.258		0	1			
11777.824	900	1	5			
11807.691	2906	1	5			
11813.579		0	1			
11814.571		0	1			
11819.084	868	1	6	11/2	13/2	29351-17532
11822.427	1301	1	6	7	7	21743-33566
11827.004		0	1			
11835.100	E12000	0	5	5/2	7/2	25026-13191
11838.428	328	1	5	9/2	9/2	22574-10735
11849.352	E1104	0	6			
11856.457	E 950	0	5	17/2	15/2	17182-29038
11863.12	E 250	4	5	8	8	16360-28223
11875.347		2	4	15/2	15/2	34785-22910
11895.441	9620	5	6	11/2	11/2	25664-13769
11905.948	656	1	6	13/2	11/2	29465-17559
11912.343		2	1			
11916.182		0	1			
11919.103	5341	1	6	17/2	15/2	32488-20569
11924.703	3132	1	6			
11929.000	E1000	0	6			
11922.695	E1400	0	5	15/2	15/2	34872-22910

BK LINE LIST

WAVE NUMBER	WIDTH	INT	CODE	J-O	J-E	ODD-EVEN LEVELS
11970.707	2213	1	5			
11977.680		2	1			
11987.700		0	1			
11987.804		0	1	7/2	5/2	25918-13931
11991.9	E 400	0	5	7	7	16801-26793
12009.082		1	1			
12012.030	1379	1	5	13/2	13/2	6530-18540
12014.077		1	1			

Table II. The odd energy levels of BkI.

BK ODD LEVELS						
WAVE NUMBER	J	WIDTH	A	B	CONFIGURATION	DESIG.
0.000	15/2	1150	19.74	35.42	5F9 7S2	6H
5416.690	11/2	823			5F9 7S2	6F
5757.443	9/2	774			5F9 7S2	6F
6530.720	13/2	1020			5F9 7S2	6H
9535.130	11/2	695			5F9 7S2	6H
10635.570	9/2	775			5F9 7S2	6H
17182.482	17/2	4472	71.18	126.7	5F9 6U 7S	6H
17547.622	15/2	3218	57.71	123.2	5F9 6D 7S	6H
17777.808	11/2	157	4.68	243.7	5F8 7S2 7P	
17933.628	13/2	1653	34.16	156.6	5F8 7S2 7P	
18717.833	13/2	1475	30.66	202.4	5F9 6U 7S	6H
19013.785	11/2	849	20.72	130.9		
19373.730	19/2	4676	67.08	226.1	5F9 6U 7S	6I
19933.688	13/2	1688	34.95	184.6		
20021.434	15/2	-386	-6.67	113.5		
20878.420	11/2	-1503	-34.9	225.8	5F9 6U 7S	6H
21046.130	17/2	388	6.46	190.1	5F9 6D 7S	6I
22153.005	7/2	-14	-0.9	39.74		
22236.350	9/2	1178	33.57	-24.46		
22574.380	9/2	370	10.95	03.6		
22752.817	19/2	2549	36.82	327.3		
22771.688	9/2	988	28.10	-23.14	5F8 7S2 7P	
23072.085	15/2	667	11.98	118.	5F9 6U 7S	
23185.065	9/2	3233	92.73	60.42		
23226.985	11/2	1400	33.41	40.	5F8 7S2 7P	
23361.667	17/2	-619	-9.36	294.3	5F9 6U 7S	6I
24035.295	11/2	560	13.59	66.67		
24107.632	15/2	1416	25.54	124.5	5F8 7S2 7P	
24287.590	13/2	2886	58.99	31.25		
24371.842	13/2	468	9.83	98.70		
24555.210	11/2	2403	57.44	58.9		
24652.405	13/2	1157	24.07	164.4	5F8 6D 7S 7P	
24786.279	15/2	2118	38.45	309.5	5F8 6U 7S 7P	
25026.967	5/2	-569	-28.5	-1.7		
2513.260	17/2	7663	10.38	195.6	5F9 6D 7S	
25104.290	15/2	3198	56.48	147.3	5F8 6D 7S 7P	
25118.035	11/2	1118	26.86	63.		
25386.061	5/2	-772	-38.6	-1.2		
25430.510	13/2	3253	66.51	42.08	5F8 6D 7S 7P	
25458.445	11/2	126	3.01	3.3	5F8 6U 7S 7P	
25517.270	3/2	-143	-12.85	-40.35		
25543.386	7/2	759	27.19	7.33		
25604.750	11/2	1637	39.36	100.8	5F8 6U 7S 7P	
25757.890	5/2	796	39.57	-17.29		
25776.560	7/2	854	30.82	31.7		

BK ODD LEVELS

HAVE NUMBER	J	WIDTH	A	B	CONFIGURATION	DESIG.
25907.978	11/2	1151	27.33	107.1		
25918.800	7/2	200				
25958.976	13/2	2670	54.59	34.32		
26044.245	9/2	380	12.60	290.		
26238.040	15/2	4359	77.90	28.	5F8 6D 7S 7P	
26416.478	13/2	1799	36.88	61.7		
26439.838	17/2	4535	72.23	157.8		
26590.332	11/2	788	19.14	98.7		
26598.465	9/2	1792	52.73	258.		
26734.375	15/2	1790	32.11	74.83		
27022.050	13/2					
27084.210	17/2					
27161.215	17/2	4672	74.41	159.4		
27332.475	13/2	-26	-0.39	51.98		
27550.280	13/2	1232	22.17	81.0		
27668.915	13/2	185	3.96	69.		
27874.375	11/2	2690	64.44	102.1		
28223.288	17/2	5592	83.8	21.34		
28235.018	15/2	313	5.90	156.		
28319.825	11/2	3363	80.6	135.	5F8 6D 7S 7P	
28725.858	13/2	1893	38.81	64.3		
28800.390	17/2	2833	45.4	273.1		
28895.291	11/2	944	22.77	75.9	5F8 6D 7S 7P	
28950.660	13/2	2460	50.39	70.2		
28967.705	9/2	1032	29.73	42.		
29135.612	9/2	1118	32.24	51.79		
29227.335	11/2	863	21.	116.	5F8 6D 7S 7P	
29351.179	11/2	998	23.96	47.8		
29465.103	13/2	1316	26.94	23.1		
29548.720	13/2	2006	41.57	232.9		
29625.565	11/2	1271	30.59	84.23		
29671.295	13/2	404	8.51	94.55		
29683.615	13/2	183	4.17	158.		
29799.236	7/2	415				
29912.305	13/2	1650	34.18	185.9		
29945.300	11/2	1620	39.12	158.		
30113.700	9/2	110	3.37	37.56		
30205.283	13/2	602	12.64	127.3		
30410.000	9/2	400				
30567.275	11/2	2851	68.30	108.8		
30857.098	11/2	2555	60.69	-38.5		
31275.633	15/2	253	4.95	24.2		
31541.302	15/2	343	6.55	205.1		
32488.850	17/2	6306	100.5	254.8	5F9 7S 8S	
33110.280	15/2	4278	76.89	242.9	5F9 7S 8S	

## BK ODD LEVELS

WAVE NUMBER	J	WIDTH	A	B	CONFIGURATION	DESIG.
33256.452	15/2	5077	91.21	267.6		
34114.485	13/2	-2061	-41.82	88.11	5F9 7S	8S
34157.500	13/2	1131	23.47	142.		
34186.760	13/2	824	17.16	126.2		
34785.550	15/2	2035	36.5	86.5	5F9 7S	8S
34872.925	15/2	780	14.33	195.4		
39291.600	15/2	5712	102.4	196.6	5F9 7S	8S
39442.180	11/2	1000				
39785.150	13/2	3400			5F9 7S	8S

Table III. The even energy levels of BkI.

BK EVEN LEVELS							
WAVE NUMBER	J	WIDTH	A	B	CONFIGURATION	DESIG.	
9141.115	13/2	836	17.48	153.	5F8 6D 7S2	8G	
9300.585	11/2	785	19.21	132.7	5F8 6D 7S2	8G	
10587.345	15/2	927	17.18	254.7	5F8 6D 7S2	8G	
10735.955	9/2	683	21.30	300.	5F8 6D 7S2	8G	
13191.915	7/2	567	20.61	33.33	5F8 6D 7S2	8D	
13459.485	9/2	585	16.66	-11.04	5F8 6D 7S2		
13769.315	11/2	571	13.59	-3.46	5F8 6D 7S2		
13931.000	5/2	494	25.80	76.67			
14920.166	7/2	395					
15290.142	17/2	1138	18.73	421.3	5F8 6D 7S2	8H	
15626.860	3/2	360	29.8	-10.			
15987.970	11/2	689	16.86	118.9	5F8 6D 7S2	8F	
16038.000	13/2	676	14.07	81.5			
16059.840	15/2	732	13.76	338.3	5F8 6D 7S2	8H	
16145.840	1/2	306	76.5				
16276.960	5/2	305	13.56	-117.5			
16541.450	9/2	543	15.36	-25.76			
16913.770	15/2	3168	37.05	232.	5F9 7S 7P		
17484.350	3/2	44	1.7	-82.93			
17532.100	13/2	131	3.28	220.	5F8 6D 7S2	8H	
17559.160	11/2	664	16.09	73.8			
17605.980	17/2	5445	86.47	26.6	5F9 7S 7P		
18540.750	13/2	-376	-7.22	165.2	5F9 7S 7P		
18624.117	7/2	318	10.23	-109.			
18733.630	11/2	555	13.36	9.88			
19170.210	15/2	-328	-5.18	331.3			
19177.220	9/2	527	15.56	83.82			
19198.160	5/2	218	9.82	-74.42			
19275.632	7/2	490	18.2	69.			
19334.710	13/2	-532	-10.44	150.3	5F9 7S 7P		
19439.284	9/2	537	16.54	117.5			
20569.745	15/2	976	18.12	335.	5F9 7S 7P		
21506.436	13/2	3596	73.72	123.2			
21876.700	11/2	2945	70.88	197.9			
21894.093	15/2	4100	73.46	116.9			
22015.941	11/2	506	12.41	93.24			
22227.660	9/2	3174	91.97	218.4			
22298.240	11/2	2703	64.6	63.5			
22369.436	19/2	5405	77.82	486.	5F9 7S 7P		
22382.830	17/2	4154	66.29	221.	5F9 7S 7P		
22516.876	9/2	763	21.88	14.84			
2262.640	13/2	1599	33.3	242.6	5F8 6D 7S2		
22686.520	9/2	2350			5F9 7S 7P		
22910.225	15/2	2160	38.89	155.4	5F9 7S 7P		
23090.450	13/2	2671	54.43	-28.77	5F9 7S 7P		

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## BK EVEN LEVELS

WAVE NUMBER	J	WIDTH	A	B	CONFIGURATION	DESIG.
23329.100	11/2	340	8.69	152.		
23416.695	11/2	896	21.88	139.5	5F9 7S	7P
23468.810	13/2	1858	38.28	132.7	5F9 7S	7P
24210.030	13/2	3105	63.64	95.42	5F9 7S	7P
24259.140	9/2	-864	-24.59	17.41		
24521.690	15/2	5276	94.23	10.51	5F9 7S	7P
24758.590	11/2	-811	-18.87	111.1		
25279.040	11/2	-618	-14.1	156.3		
25493.793	13/2	852	17.89	181.6	5F9 7S	7P
25765.190	13/2	994	21.55	276.	5F9 7S	7P
25814.140	11/2	-67	-1.09	128.3	5F9 7S	7P
26601.780	13/2					
26645.607	15/2	893	9.08	135.	5F9 7S	7P
26718.477	15/2	1030	18.73	159.5	5F9 7S	7P
26925.284	17/2	-803	-12.23	327.4	5F9 7S	7P
27558.500	13/2	1292	27.	226.2		
27761.250	17/2	4239	67.43	86.4		
27844.730	15/2					
27956.900	13/2	4491	91.74	30.2		
29038.930	15/2	3569	64.17	214.8	5F9 7S	7P
29172.103	17/2	5012	80.12	357.7	5F9 7S	7P
29600.310	15/2	2000				
29973.850	13/2	3500				
30255.690	11/2				5F9 7S	7P



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