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Design Data for Constant-k Band-Suppression Filters

PART V

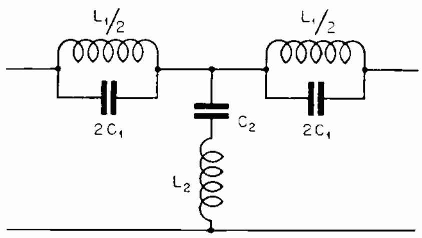
(Parts I-IV were published in Sept.-Oct. 1942 to February 1943 issues)

By the Engineering Department, Aerovox Corporation

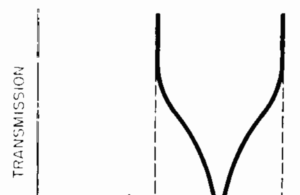
THE CIRCUIT Components Chart in this article lists capacitance and inductance values for band-suppression filter sections of the constant-k type. Values are those required at twenty-three common mid-frequencies, from 100 cycles to 10 megacycles, and twelve convenient bandwidths from 0.05 to 0.9. Circuit diagram of the constant-K band-suppression filter is shown in Figure 9. Ideal response curve is given by Figure 9-A.

USE OF TABLE

Inductance listings in the table are in henries and capacitance listings in microfarads, except in the 1- and 10-Mc. columns where listings are in micromicrofarads and millihenries. All values, as read, are for band-suppression sections of 500 ohms characteristic impedance. However, component values may be found for sections having other characteristic impedance values by finding first the 500-ohm values from the table and then multiplying the listed L values by R/500 and dividing listed C values by R/500. Thus, when a given filter section is to be operated at 10.000 cycles instead of 500, the factor whereby all L values are multiplied and all C values divided becomes 10,000/500, or 20. Values of components for mid-frequencies other than those appearing in the chart heading may be obtained by interpolation, all component values being inversely proportional to the mid-frequencies.



CONSTANT-K BAND-SUPPRESSION FILTER
FIG. 9



IDEAL RESPONSE CURVE, BAND-SUPPRESSION FILTER (CONSTANT-K)
FIG. 9-A

ILLUSTRATIVE EXAMPLES

To illustrate use of the table, the following examples are offered. L and C values obtained for a constant-K band-suppression filter having a characteristic impedance of 500 ohms, bandwidth of 0.25, and operating at a mid-frequency of 2000 cycles are found from the table to be: L_1 0.0796 henry, L_2 0.0199 henry, C_1 0.0796 mfd., and C_2 0.3187 mfd. Substituting in the circuit diagram (Figure 9), each of the two shunt-circuit inductances are equal to 0.0796/2 or 39.8 m.h., while each of the shunt-circuit capacitances are equal to 0.0796/2 or 0.0398 mfd. The series-circuit inductance is 19.9 m.h., and the series-circuit capacitance 0.3187 mfd.

If it is desired to operate this filter section at some characteristic impedance other than 500 ohms, all L and C values must be modified accordingly. That is, for 5000 ohms, all C values will be divided by 5000/500 or 10; all L values multiplied by this figure. The shunt-circuit inductances each then become 398 m.h.; each of the shunt-circuit capacitances 3980 mmfd. The series-circuit inductance becomes 199 m.h.; the series-circuit capacitance 0.03187 mfd.

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CHART 3 — Constant-k Type Band-Suppression Filters (R=500 Ohms)

Band Width		f_m = 100	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
0.05	L_1	7.950	0.7950	0.530	0.3975	0.3180	0.265	0.2271	0.1987	0.1766	0.1590	0.1445	0.1325
	L_2	0.0796	0.00796	0.00531	0.00398	0.00318	0.00265	0.00227	0.00199	0.00177	0.00159	0.00145	0.00133
	C_1	0.3184	0.03184	0.02123	0.01592	0.01274	0.01061	0.00909	0.00796	0.00707	0.00637	0.00579	0.0053
	C_2	31.75	3.175	2.117	1.587	1.270	1.058	0.9071	0.7937	0.7055	0.6350	0.5773	0.5292
0.1	L_1	3.975	0.3975	0.2650	0.1987	0.1590	0.1325	0.1136	0.0994	0.0883	0.0795	0.0723	0.0662
	L_2	0.1592	0.01592	0.0106	0.00796	0.00637	0.00530	0.00455	0.00398	0.00354	0.00318	0.00289	0.00265
	C_1	0.6360	0.0636	0.0424	0.0318	0.0254	0.0212	0.0182	0.0159	0.0141	0.0127	0.01156	0.0106
	C_2	15.925	1.5925	1.0616	0.7962	0.6370	0.5308	0.4550	0.3981	0.3538	0.3185	0.2895	0.2654
0.15	L_1	2.650	0.2650	0.1766	0.1325	0.1060	0.0883	0.0757	0.0662	0.0589	0.0530	0.0482	0.0442
	L_2	0.2388	0.02388	0.0159	0.0119	0.00955	0.0079	0.0068	0.00597	0.00530	0.00478	0.00434	0.00398
	C_1	0.9520	0.0952	0.0635	0.0476	0.0381	0.0317	0.0272	0.0238	0.0211	0.0190	0.0173	0.0158
	C_2	10.60	1.060	0.7066	0.530	0.4240	0.3533	0.3028	0.2650	0.2355	0.2120	0.1927	0.1767
0.2	L_1	1.99	0.1990	0.1327	0.0995	0.0796	0.0663	0.0568	0.0497	0.0442	0.0398	0.0362	0.0332
	L_2	0.3184	0.03184	0.0213	0.0159	0.0127	0.0106	0.00910	0.00796	0.00707	0.00637	0.00579	0.00530
	C_1	1.272	0.1272	0.0848	0.0636	0.0509	0.0424	0.0363	0.0318	0.0283	0.0254	0.0231	0.0212
	C_2	7.95	0.795	0.530	0.3975	0.3180	0.2650	0.2271	0.1987	0.1767	0.1590	0.1445	0.1325
0.25	L_1	1.5925	0.15925	0.1062	0.0796	0.0637	0.0531	0.0455	0.0398	0.0354	0.0318	0.0289	0.0265
	L_2	0.3980	0.0398	0.0265	0.0199	0.0159	0.0133	0.0114	0.0099	0.0088	0.0079	0.0072	0.0066
	C_1	1.5920	0.1592	0.1061	0.0796	0.0637	0.0531	0.0455	0.0398	0.0354	0.0318	0.0289	0.0265
	C_2	6.375	0.6375	0.4250	0.3187	0.2550	0.2125	0.1821	0.1594	0.1417	0.1275	0.1159	0.1062
0.3	L_1	1.3275	0.13275	0.0885	0.0664	0.0531	0.0442	0.0379	0.0332	0.0295	0.0265	0.0241	0.0221
	L_2	0.476	0.0476	0.0317	0.0238	0.0190	0.0159	0.0136	0.0119	0.0106	0.0095	0.0086	0.0079
	C_1	1.908	0.1908	0.1272	0.0954	0.0763	0.0636	0.0545	0.0477	0.0424	0.0382	0.0347	0.0318
	C_2	5.30	0.530	0.3533	0.2650	0.2120	0.1766	0.1514	0.1325	0.1177	0.1060	0.0963	0.0883
0.4	L_1	0.995	0.0995	0.0663	0.0497	0.0398	0.0332	0.0243	0.0249	0.0221	0.0199	0.0181	0.0166
	L_2	0.636	0.0636	0.0424	0.0318	0.0254	0.0212	0.0182	0.0159	0.0413	0.0127	0.0116	0.0106
	C_1	2.548	0.2548	0.1698	0.1274	0.1019	0.0849	0.0728	0.0637	0.0566	0.0509	0.0463	0.0425
	C_2	3.975	0.0397	0.2650	0.1987	0.1590	0.1325	0.1136	0.0994	0.0883	0.0795	0.0723	0.0662
0.5	L_1	0.795	0.0795	0.0530	0.0397	0.03180	0.0265	0.0227	0.0199	0.0177	0.0159	0.0144	0.0132
	L_2	0.796	0.0796	0.0531	0.0398	0.03184	0.02653	0.02274	0.0199	0.0177	0.01592	0.0145	0.0133
	C_1	3.184	0.3184	0.2123	0.1592	0.1274	0.1061	0.0909	0.0796	0.0707	0.0637	0.0579	0.0531
	C_2	3.175	0.3175	0.2167	0.1587	0.1270	0.1058	0.0907	0.0794	0.0705	0.0635	0.0577	0.0529
0.6	L_1	0.6625	0.0622	0.0442	0.0331	0.0265	0.0221	0.0189	0.0166	0.0147	0.0132	0.0124	0.0110
	L_2	0.9560	0.0956	0.0637	0.0478	0.0382	0.0319	0.0273	0.0239	0.0212	0.0191	0.0174	0.0159
	C_1	3.820	0.3820	0.2547	0.1910	0.1528	0.1273	0.1091	0.0955	0.0849	0.0764	0.0694	0.0637
	C_2	2.650	0.2650	0.1767	0.1325	0.1060	0.0883	0.0757	0.0662	0.0589	0.0530	0.0482	0.0417
0.7	L_1	0.5675	0.0567	0.0378	0.0284	0.0227	0.0189	0.0162	0.0142	0.0126	0.0113	0.0103	0.0094
	L_2	1.116	0.1116	0.0744	0.0558	0.0446	0.0372	0.0319	0.0279	0.0248	0.0223	0.0203	0.0186
	C_1	4.44	0.444	0.296	0.222	0.1776	0.148	0.1268	0.1110	0.0987	0.0888	0.0807	0.0740
	C_2	2.272	0.2272	0.1515	0.1136	0.0909	0.0757	0.0649	0.0568	0.0505	0.0454	0.0413	0.0379
0.8	L_1	0.4975	0.0497	0.0332	0.0249	0.0199	0.0166	0.0142	0.0124	0.0110	0.0099	0.0090	0.0083
	L_2	1.272	0.1272	0.0848	0.0636	0.0509	0.0424	0.0363	0.0318	0.0283	0.0254	0.0231	0.0212
	C_1	5.08	0.5080	0.3387	0.2540	0.2032	0.1693	0.1451	0.1270	0.1129	0.1016	0.0924	0.0847
	C_2	1.990	0.1990	0.1327	0.0995	0.0796	0.0663	0.0568	0.0497	0.0442	0.0398	0.0362	0.0332
0.9	L_1	0.4425	0.04425	0.02950	0.0221	0.0177	0.0147	0.0126	0.0111	0.0098	0.0088	0.0080	0.0074
	L_2	1.432	0.1432	0.0955	0.0716	0.0573	0.0477	0.0409	0.0358	0.0318	0.0286	0.0260	0.0239
	C_1	5.72	0.572	0.3813	0.286	0.2288	0.1907	0.1634	0.1430	0.1271	0.1144	0.1040	0.0953
	C_2	1.767	0.1767	0.1178	0.8840	0.0707	0.0589	0.0505	0.0442	0.0393	0.0321	0.0294	0.0272

* **C**: Mmfds. in last two columns. **L**: Millihenries in last two columns. Mfds. and Henries in all other columns.

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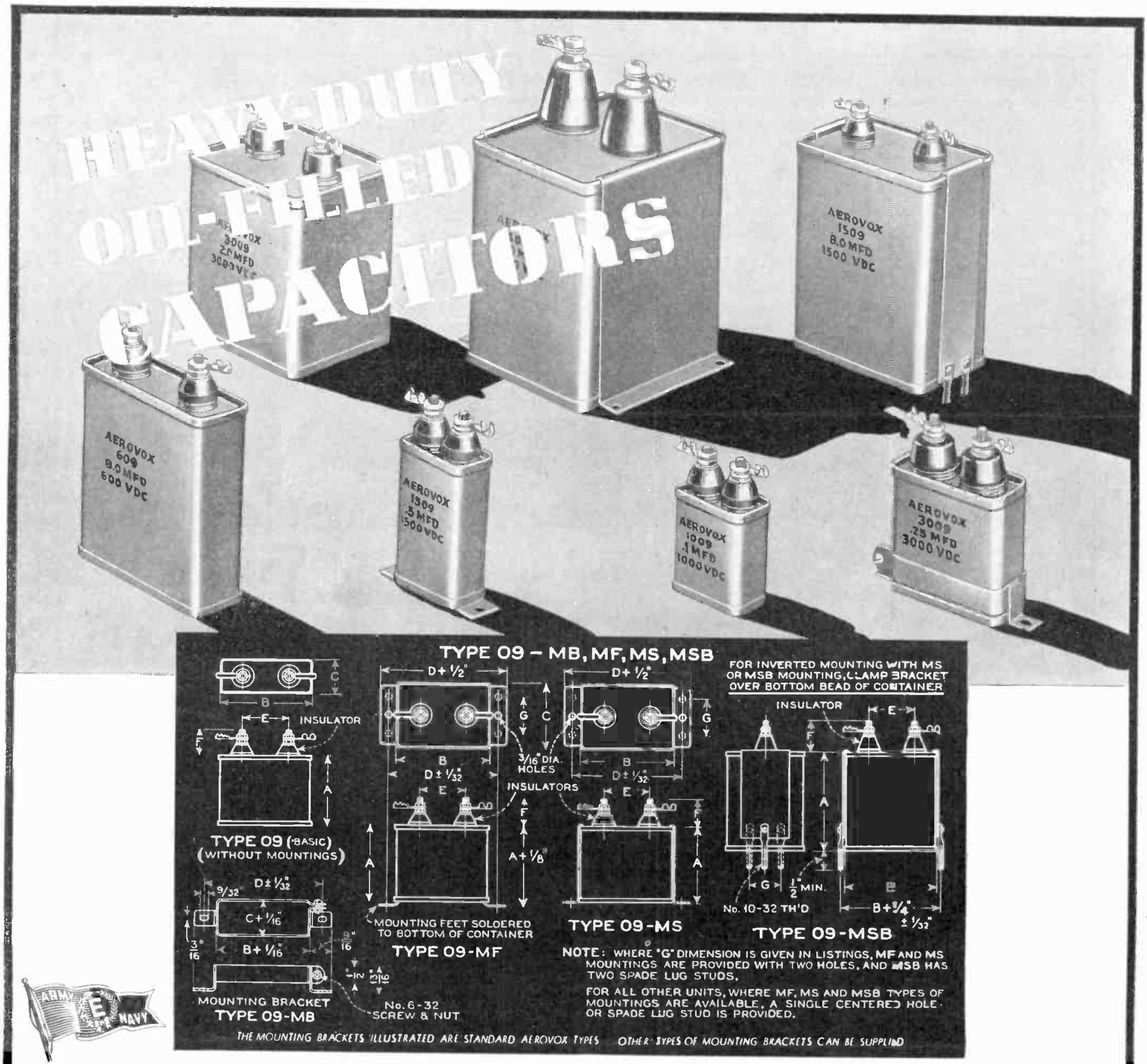
CHART 3 — Constant-k Type Band-Suppression Filters (R=500 Ohms)

Band Width		f_m = 6500	7000	7500	8000	8500	9000	9500	10 kc.	100 kc.	1 Mc.*	10 Mc.*
0.05	L_1	0.1223	0.1136	0.1060	0.0994	0.0935	0.0883	0.0837	0.0795	0.00795	0.795	0.0795
	L_2	0.00122	0.00114	0.00106	0.00099	0.00094	0.00088	0.000837	0.000796	0.0000796	0.00796	0.000796
	C_1	0.00489	0.00455	0.00424	0.00398	0.00374	0.00354	0.00335	0.00318	0.000318	31.84	3.184
	C_2	0.4885	0.4536	0.4233	0.3969	0.3735	0.3528	0.3342	0.3175	0.03175	3175	317.5
0.1	L_1	0.0615	0.0568	0.0530	0.0497	0.0468	0.0442	0.0418	0.0397	0.00397	0.3975	0.0397
	L_2	0.00245	0.0023	0.00212	0.00199	0.00187	0.00177	0.00167	0.00159	0.000159	0.0159	0.00159
	C_1	0.00978	0.00908	0.00848	0.00795	0.00748	0.00706	0.00669	0.00636	0.000636	63.6	6.36
	C_2	0.2450	0.2275	0.2123	0.1991	0.1873	0.1769	0.1676	0.1592	0.0159	1592	159.2
0.15	L_1	0.0408	0.0378	0.0353	0.0331	0.0312	0.0294	0.0279	0.0265	0.00265	0.265	0.0265
	L_2	0.00367	0.00341	0.00318	0.00298	0.00281	0.00265	0.00251	0.00239	0.000239	0.0239	0.00239
	C_1	0.0146	0.0136	0.0127	0.0119	0.0112	0.0106	0.0100	0.0095	0.00095	95.2	9.52
	C_2	0.1631	0.1514	0.1413	0.1325	0.1247	0.1178	0.1116	0.1060	0.0106	1060	106.0
0.2	L_1	0.0361	0.0284	0.0265	0.0249	0.0234	0.0211	0.0209	0.0199	0.00199	0.199	0.0199
	L_2	0.00489	0.00455	0.0042	0.00398	0.00374	0.00354	0.00335	0.00318	0.000318	0.0318	0.00318
	C_1	0.0196	0.0182	0.0169	0.0159	0.0149	0.01413	0.01339	0.01272	0.00127	127.2	12.72
	C_2	0.1223	0.1136	0.1060	0.0994	0.0935	0.0883	0.0837	0.0795	0.00795	795	79.5
0.25	L_1	0.0245	0.0227	0.0212	0.0199	0.0187	0.0177	0.0167	0.01592	0.001592	0.1592	0.01592
	L_2	0.0061	0.0057	0.0053	0.0049	0.0047	0.0044	0.0042	0.00390	0.000398	0.0398	0.00398
	C_1	0.0245	0.0227	0.0212	0.0199	0.0187	0.0177	0.0167	0.01592	0.00159	159.2	15.92
	C_2	0.0981	0.0911	0.8500	0.0797	0.0750	0.0708	0.0671	0.0637	0.00637	637.5	63.75
0.3	L_1	0.0204	0.0189	0.0177	0.0166	0.0156	0.0147	0.0139	0.0133	0.0013	0.1327	0.01327
	L_2	0.0073	0.0068	0.0063	0.0059	0.0056	0.0053	0.0050	0.0048	0.00048	0.0480	0.0048
	C_1	0.0293	0.0272	0.0254	0.0238	0.0224	0.0212	0.0200	0.01908	0.001908	190.8	19.08
	C_2	0.0815	0.0757	0.0707	0.0662	0.0623	0.0589	0.0558	0.0530	0.0053	530	53.0
0.4	L_1	0.0154	0.0142	0.0133	0.0124	0.0117	0.0110	0.0105	0.00995	0.000995	0.0995	0.00995
	L_2	0.0098	0.0091	0.0085	0.0079	0.0075	0.0071	0.0067	0.00636	0.000636	0.0636	0.00636
	C_1	0.0392	0.0364	0.0339	0.0318	0.0299	0.0283	0.0268	0.0255	0.00255	254.8	25.48
	C_2	0.0611	0.0568	0.0530	0.0497	0.0466	0.0417	0.0418	0.0397	0.00397	397.5	39.75
0.5	L_1	0.0122	0.01136	0.01060	0.00994	0.00935	0.00880	0.00837	0.00795	0.000795	0.0795	0.00795
	L_2	0.01224	0.01137	0.01061	0.00995	0.00936	0.00884	0.00839	0.00796	0.000796	0.0796	0.00796
	C_1	0.0489	0.0455	0.0424	0.0398	0.0374	0.0354	0.0335	0.0318	0.00318	318.4	31.84
	C_2	0.0488	0.0453	0.0423	0.0397	0.0373	0.0353	0.0334	0.0317	0.00317	317.5	31.75
0.6	L_1	0.0102	0.0095	0.0088	0.0083	0.0078	0.0074	0.0069	0.0066	0.00066	0.0662	0.00662
	L_2	0.0147	0.0136	0.0127	0.0119	0.0112	0.0106	0.0100	0.0096	0.00096	0.096	0.0096
	C_1	0.0588	0.0546	0.0509	0.0477	0.0449	0.0424	0.0402	0.0382	0.00382	382.0	38.2
	C_2	0.0408	0.0379	0.0353	0.0331	0.0312	0.0294	0.0279	0.0265	0.00265	265.0	26.5
0.7	L_1	0.0087	0.0081	0.0076	0.0071	0.0067	0.0063	0.0059	0.00567	0.000567	0.0567	0.00567
	L_2	0.0172	0.0159	0.0149	0.0139	0.0131	0.0124	0.0117	0.01116	0.001116	0.1116	0.01116
	C_1	0.0683	0.0634	0.0592	0.0555	0.0522	0.0493	0.0467	0.0444	0.00444	444.0	44.4
	C_2	0.0349	0.0325	0.0303	0.0284	0.0267	0.0252	0.0239	0.0227	0.00227	227.2	22.72
0.8	L_1	0.0076	0.0071	0.0066	0.0062	0.0058	0.0055	0.0052	0.0049	0.00049	0.0497	0.00497
	L_2	0.0196	0.0182	0.0169	0.0159	0.0149	0.0141	0.0134	0.01272	0.001272	0.1272	0.01272
	C_1	0.0781	0.0726	0.0677	0.0635	0.0597	0.0564	0.0535	0.0508	0.00508	508.0	50.8
	C_2	0.0306	0.0284	0.0265	0.0249	0.0234	0.0221	0.0209	0.0199	0.00199	199.0	19.9
0.9	L_1	0.0068	0.0063	0.0059	0.0055	0.0052	0.0049	0.0046	0.00442	0.000442	0.0442	0.00442
	L_2	0.0220	0.0204	0.0191	0.0179	0.0168	0.0159	0.0151	0.0143	0.00143	0.1432	0.01432
	C_1	0.0880	0.0817	0.0763	0.0715	0.0673	0.0635	0.0602	0.0572	0.0057	572.0	57.2
	C_2	0.0252	0.0236	0.0221	0.0208	0.0196	0.0186	0.0177	0.0017	0.0017	176.7	17.67

* **C:** Mmfds. in last two columns. **L:** Millihenries in last two columns. Mfds. and Henries in all other columns.



● **VERSATILITY**—with economy of chassis space and assembly operations a prime factor—distinguishes Aerovox Type 09 oil-filled capacitors. Although mass-produced, this type is available in such an outstanding range of voltage and capacitance ratings, as well as mountings, that it is virtually custom-made for most high-voltage heavy-duty applications.

Note particularly the choice of mounting means. Mounting means brackets shown in drawing are Aerovox standard; other types can be supplied.

Voltage ratings from 600 to 7500 D.C.W. Widest selection of capacitance values. Impregnants and fills available are HYVOL (Vegetable) or HYVOL M (mineral oil). The exclusive Aerovox terminal construction means units that pass the standard immersion tests required by various Governmental services. Terminal assembly is non-removable, an integral part of the capacitor.

These capacitors provide maximum capacitance at minimum cost. Widely used for continuous-service in transmitters, amplifiers, rectifier filters and similar applications.

● *Literature on Request*