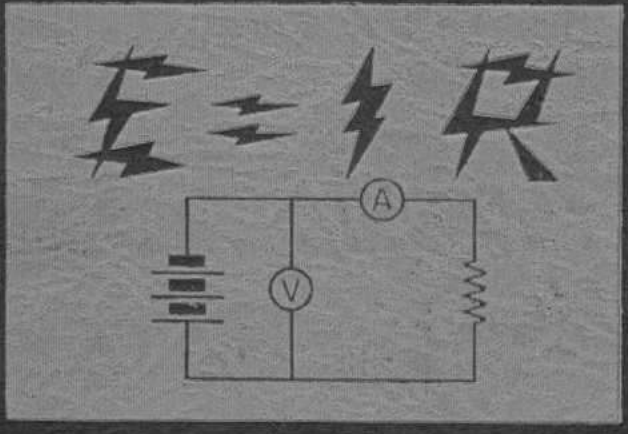
ALLIED'S ELECTRONICS DATA HANDBOOK



ALLIED RADIO CORPORATION
CHICAGO

ALLIED'S ELECTRONICS DATA HANDBOOK

Formerly Allied's Radio Data Handbook

A Compilation of Formulas and Data Most Commonly Used in the Field of Radio and Electronics

Written and Compiled by the
Publications Division
ALLIED RADIO CORPORATION
Under the Direction of
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FOREWORD

Allied Radio Corporation has long recognized the need for a comprehensive and condensed handbook of formulas and data most commonly used in the field of radio and electronics. It was felt also that such a book should serve entirely as a convenient source of information and reference and that all attempts to teach or explain the basic principles involved should be left to classroom instruction and to the many already existing publications written for this distinct purpose.

The *Electronics Data Handbook*, therefore, consists of formulas, tables, charts and data. Every effort has been made to present this information clearly and to arrange it in a convenient manner for instant reference. All material was carefully selected and prepared by *Allied's* technical staff to serve the requirements of many specific groups in the radio and electronics field. It is hoped that our objectives have been successfully attained and that this *Handbook* will serve as: (1) A valuable adjunct to classroom study and laboratory work for the student and instructor; (2) A dependable source of information for the beginner, experimenter and set builder; (3) A reliable guide for the service engineer and maintenance man in his everyday work; (4) A time-saving and practical reference for the radio amateur, technician and engineer, both in the laboratory and in the field of operations.

The publishers are indebted to the McGraw-Hill Book Company, Inc., for their permission to use material selected from "*Mathematics for Electricians and Radiomen*" by Nelson M. Cooke. *Allied* also takes this opportunity to thank those manufacturers who so generously permitted our use of current data prepared by their engineering personnel. Special recognition and our sincere appreciation are extended to Commander Cooke for his helpful suggestions and generous contribution of his time and specialized knowledge in editing the material contained in this book.

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Mathematical Symbols

$\times$ or $\cdot$	Multiplied by
$\div$ or :	Divided by
$+$	Positive. Plus. Add
$-$	Negative. Minus. Subtract
$\pm$	Positive or negative. Plus or minus
$\mp$	Negative or positive. Minus or plus
$=$ or ::	Equals
$\equiv$	Identity
$\cong$	Is approximately equal to
$\neq$	Does not equal
$>$	Is greater than
$\gg$	Is much greater than
$<$	Is less than
$\ll$	Is much less than
$\geq$	Greater than or equal to
$\leq$	Less than or equal to
$\therefore$	Therefore
$\angle$	Angle
Δ	Increment or Decrement
$\perp$	Perpendicular to
$\parallel$	Parallel to
$\lvert n \rvert$	Absolute value of n

Mathematical Constants

$\pi = 3.14$	$\sqrt{\pi} = 1.77$
$2\pi = 6.28$	$\sqrt{\frac{\pi}{2}} = 1.25$
$(2\pi)^2 = 39.5$	
$4\pi = 12.6$	$\sqrt{2} = 1.41$
$\pi^2 = 9.87$	$\sqrt{3} = 1.73$
$\frac{\pi}{2} = 1.57$	$\frac{1}{\sqrt{2}} = 0.707$
$\frac{1}{\pi} = 0.318$	$\frac{1}{\sqrt{3}} = 0.577$
$\frac{1}{2\pi} = 0.159$	$\log \pi = 0.497$
$\frac{1}{\pi^2} = 0.101$	$\log \frac{\pi}{2} = 0.196$
	$\log \pi^2 = 0.994$
$\frac{1}{\sqrt{\pi}} = 0.564$	$\log \sqrt{\pi} = 0.248$

Decimal Inches

Inches $\times$ 2.540 = Centimeters
Inches $\times$ 1.578×10^{-5} = Miles
Inches $\times$ 10^3 = Mils

Inches			Decimal Equivalent	Millimeter Equivalent
1/64			.0156	0.397
	1/32		.0313	0.794
3/64			.0469	1.191
		1/16	.0625	1.588
5/64			.0781	1.985
	3/32		.0938	2.381
7/64			.1094	2.778
		1/8	.1250	3.175
9/64			.1406	3.572
	5/32		.1563	3.969
11/64			.1719	4.366
		3/16	.1875	4.762
13/64			.2031	5.159
	7/32		.2188	5.556
15/64			.2344	5.953
		1/4	.2500	6.350
17/64			.2656	6.747
	9/32		.2813	7.144
19/64			.2969	7.541
		5/16	.3125	7.937
21/64			.3281	8.334
	11/32		.3438	8.731
23/64			.3594	9.128
		3/8	.3750	9.525
25/64			.3906	9.922
	13/32		.4063	10.319
27/64			.4219	10.716
		7/16	.4375	11.112
29/64			.4531	11.509
	15/32		.4688	11.906
31/64			.4844	12.303
		1/2	.5000	12.700
33/64			.5156	13.097
	17/32		.5313	13.494
35/64			.5469	13.891
		9/16	.5625	14.287
37/64			.5781	14.684
	19/32		.5938	15.081
39/64			.6094	15.478
		5/8	.6250	15.875
41/64			.6406	16.272
	21/32		.6563	16.669
43/64			.6719	17.067
		11/16	.6875	17.463
45/64			.7031	17.860
	23/32		.7188	18.238
47/64			.7344	18.635
		3/4	.7500	19.049
49/64			.7656	19.446
	25/32		.7813	19.842
51/64			.7969	20.239
		13/16	.8125	20.636
53/64			.8281	21.033
	27/32		.8438	21.430
55/64			.8594	21.827
		7/8	.8750	22.224
57/64			.8906	22.621
	29/32		.9063	23.018
59/64			.9219	23.415
		15/16	.9375	23.812
61/64			.9531	24.209
	31/32		.9688	24.606
63/64			.9844	25.004
		1/0	1.0000	25.400

Algebra

Exponents and Radicals

$a^x \times a^y = a^{(x+y)}$. $\qquad \dfrac{a^x}{a^y} = a^{(x-y)}$.

$(ab)^x = a^x b^x$. $\qquad \left(\dfrac{a}{b}\right)^x = \dfrac{a^x}{b^x}$.

$\sqrt[x]{\dfrac{a}{b}} = \dfrac{\sqrt[x]{a}}{\sqrt[x]{b}}$. $\qquad a^{-x} = \dfrac{1}{a^x}$.

$(a^x)^y = a^{xy}$. $\qquad \sqrt[y]{\sqrt[x]{a}} = \sqrt[xy]{a}$.

$\sqrt[x]{ab} = \sqrt[x]{a}\sqrt[x]{b}$. $\qquad a^{\frac{x}{y}} = \sqrt[y]{a^x}$.

$a^{\frac{1}{x}} = \sqrt[x]{a}$. $\qquad a^0 = 1$.

Solution of a Quadratic

Quadratic equations in the form

$$ax^2 + bx + c = 0$$

may be solved by the following:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Transposition of Terms

If $A = \dfrac{B}{C}$, then $B = AC$, $C = \dfrac{B}{A}$.

If $\dfrac{A}{B} = \dfrac{C}{D}$, then $A = \dfrac{BC}{D}$,

$B = \dfrac{AD}{C}$, $C = \dfrac{AD}{B}$, $D = \dfrac{BC}{A}$.

If $A = \dfrac{1}{D\sqrt{BC}}$, then $A^2 = \dfrac{1}{D^2BC}$.

$B = \dfrac{1}{D^2A^2C}$, $C = \dfrac{1}{D^2A^2B}$, $D = \dfrac{1}{A\sqrt{BC}}$.

If $A = \sqrt{B^2 + C^2}$, then $A^2 = B^2 + C^2$,

$B = \sqrt{A^2 - C^2}$, $C = \sqrt{A^2 - B^2}$.

Decibels

The number of db by which two power outputs P_1 and P_2 (in watts) may differ, is expressed by

$$10 \log \frac{P_1}{P_2};$$

or in terms of volts,

$$20 \log \frac{E_1}{E_2};$$

or in current,

$$20 \log \frac{I_1}{I_2}.$$

While power ratios are independent of source and load impedance values, voltage and current ratios in these formulas hold true only when the source and load impedances Z_1 and Z_2 are equal. In circuits where these impedances differ, voltage and current ratios are expressed by,

$$db = 20 \log \frac{E_1\sqrt{Z_2}}{E_2\sqrt{Z_1}} \quad \text{or,} \quad 20 \log \frac{I_1\sqrt{Z_1}}{I_2\sqrt{Z_2}}$$

DB Expressed in Watts & Volts

DB*	Above Zero Level		Below Zero Level	
	Watts	Volts	Watts	Volts
0	0.00600	1.73	6.00×10^{-3}	1.73
1	0.00755	1.94	4.77×10^{-3}	1.54
2	0.00951	2.18	3.78×10^{-3}	1.38
3	0.0120	2.45	3.01×10^{-3}	1.23
4	0.0151	2.74	2.39×10^{-3}	1.09
5	0.0190	3.08	1.90×10^{-3}	0.974
6	0.0239	3.46	1.51×10^{-3}	0.868
7	0.0301	3.88	1.20×10^{-3}	0.774
8	0.0378	4.35	9.51×10^{-4}	0.690
9	0.0477	4.88	7.55×10^{-4}	0.614
10	0.0600	5.48	6.00×10^{-4}	0.548
11	0.0755	6.14	4.77×10^{-4}	0.488
12	0.0951	6.90	3.78×10^{-4}	0.435
13	0.120	7.74	3.01×10^{-4}	0.388
14	0.151	8.68	2.39×10^{-4}	0.346
15	0.190	9.74	1.90×10^{-4}	0.308
16	0.239	10.93	1.51×10^{-4}	0.275
17	0.301	12.26	1.20×10^{-4}	0.245
18	0.378	13.76	9.51×10^{-5}	0.218
19	0.477	15.44	7.55×10^{-5}	0.194
20	0.600	17.32	6.00×10^{-5}	0.173
25	1.90	30.8	1.90×10^{-5}	0.0974
30	6.00	54.8	6.00×10^{-6}	0.0548
35	19.0	97.4	1.90×10^{-6}	0.0308
40	60.0	173	6.00×10^{-7}	0.0173
45	190	308	1.90×10^{-7}	0.00974
50	600.	548	6.00×10^{-8}	0.00548
50	6,000	1,730	6.00×10^{-9}	0.00173
70	60,000	5,480	6.00×10^{-10}	0.000548
80	600,000	17,300	6.00×10^{-11}	0.000173

*Zero db = 6 milliwatts into a 500 ohm load. Power ratios hold for any impedance, but voltages must be referred to an impedance load of 500 ohms.

Decibel—Voltage, Current and Power Ratio Table

—		DB	+		—		DB	+	
Voltage or Current Ratio	Power Ratio		Voltage or Current Ratio	Power Ratio	Voltage or Current Ratio	Power Ratio		Voltage or Current Ratio	Power Ratio
1.0000	1.0000	**0**	1.000	1.000	.4898	.2399	**6.2**	2.042	4.169
.9886	.9772	**.1**	1.012	1.023	.4842	.2344	**6.3**	2.065	4.266
.9772	.9550	**.2**	1.023	1.047	.4786	.2291	**6.4**	2.089	4.365
.9661	.9333	**.3**	1.035	1.072	.4732	.2239	**6.5**	2.113	4.467
.9550	.9120	**.4**	1.047	1.096	.4677	.2188	**6.6**	2.138	4.571
.9441	.8913	**.5**	1.059	1.122	.4624	.2138	**6.7**	2.163	4.677
.9333	.8710	**.6**	1.072	1.148	.4571	.2089	**6.8**	2.188	4.786
.9226	.8511	**.7**	1.084	1.175	.4519	.2042	**6.9**	2.213	4.898
.9120	.8318	**.8**	1.096	1.202	.4467	.1995	**7.0**	2.239	5.012
.9016	.8128	**.9**	1.109	1.230	.4416	.1950	**7.1**	2.265	5.129
.8913	.7943	**1.0**	1.122	1.259	.4365	.1905	**7.2**	2.291	5.248
.8810	.7762	**1.1**	1.135	1.288	.4315	.1862	**7.3**	2.317	5.370
.8710	.7586	**1.2**	1.148	1.318	.4266	.1820	**7.4**	2.344	5.495
.8610	.7413	**1.3**	1.161	1.349	.4217	.1778	**7.5**	2.371	5.623
.8511	.7244	**1.4**	1.175	1.380	.4169	.1738	**7.6**	2.399	5.754
.8414	.7079	**1.5**	1.189	1.413	.4121	.1698	**7.7**	2.427	5.888
.8318	.6918	**1.6**	1.202	1.445	.4074	.1660	**7.8**	2.455	6.026
.8222	.6761	**1.7**	1.216	1.479	.4027	.1622	**7.9**	2.483	6.166
.8128	.6607	**1.8**	1.230	1.514	.3981	.1585	**8.0**	2.512	6.310
.8035	.6457	**1.9**	1.245	1.549	.3936	.1549	**8.1**	2.541	6.457
.7943	.6310	**2.0**	1.259	1.585	.3890	.1514	**8.2**	2.570	6.607
.7852	.6166	**2.1**	1.274	1.622	.3846	.1479	**8.3**	2.600	6.761
.7762	.6026	**2.2**	1.288	1.660	.3802	.1445	**8.4**	2.630	6.918
.7674	.5888	**2.3**	1.303	1.698	.3758	.1413	**8.5**	2.661	7.079
.7586	.5754	**2.4**	1.318	1.738	.3715	.1380	**8.6**	2.692	7.244
.7499	.5623	**2.5**	1.334	1.778	.3673	.1349	**8.7**	2.723	7.413
.7413	.5495	**2.6**	1.349	1.820	.3631	.1318	**8.8**	2.754	7.586
.7328	.5370	**2.7**	1.365	1.862	.3589	.1288	**8.9**	2.786	7.762
.7244	.5248	**2.8**	1.380	1.905	.3548	.1259	**9.0**	2.818	7.943
.7161	.5129	**2.9**	1.396	1.950	.3508	.1230	**9.1**	2.851	8.128
.7079	.5012	**3.0**	1.413	1.995	.3467	.1202	**9.2**	2.884	8.318
.6998	.4898	**3.1**	1.429	2.042	.3428	.1175	**9.3**	2.917	8.511
.6918	.4786	**3.2**	1.445	2.089	.3388	.1148	**9.4**	2.951	8.710
.6839	.4677	**3.3**	1.462	2.138	.3350	.1122	**9.5**	2.985	8.913
.6761	.4571	**3.4**	1.479	2.188	.3311	.1096	**9.6**	3.020	9.120
.6683	.4467	**3.5**	1.496	2.239	.3273	.1072	**9.7**	3.055	9.333
.6607	.4365	**3.6**	1.514	2.291	.3236	.1047	**9.8**	3.090	9.550
.6531	.4266	**3.7**	1.531	2.344	.3199	.1023	**9.9**	3.126	9.772
.6457	.4169	**3.8**	1.549	2.399	.3162	.1000	**10.0**	3.162	10.000
.6383	.4074	**3.9**	1.567	2.455	.2985	.08913	**10.5**	3.350	11.22
.6310	.3981	**4.0**	1.585	2.512	.2818	.07943	**11.0**	3.548	12.59
.6237	.3890	**4.1**	1.603	2.570	.2661	.07079	**11.5**	3.758	14.13
.6166	.3802	**4.2**	1.622	2.630	.2512	.06310	**12.0**	3.981	15.85
.6095	.3715	**4.3**	1.641	2.692	.2371	.05623	**12.5**	4.217	17.78
.6026	.3631	**4.4**	1.660	2.754	.2239	.05012	**13.0**	4.467	19.95
.5957	.3548	**4.5**	1.679	2.818	.2113	.04467	**13.5**	4.732	22.39
.5888	.3467	**4.6**	1.698	2.884	.1995	.03981	**14.0**	5.012	25.12
.5821	.3388	**4.7**	1.718	2.951	.1884	.03548	**14.5**	5.309	28.18
.5754	.3311	**4.8**	1.738	3.020	.1778	.03162	**15.0**	5.623	31.62
.5689	.3236	**4.9**	1.758	3.090	.1585	.02512	**16.0**	6.310	39.81
.5623	.3162	**5.0**	1.778	3.162	.1413	.01995	**17.0**	7.079	50.12
.5559	.3090	**5.1**	1.799	3.236	.1259	.01585	**18.0**	7.943	63.10
.5495	.3020	**5.2**	1.820	3.311	.1122	.01259	**19.0**	8.913	79.43
.5433	.2951	**5.3**	1.841	3.388	.1000	.01000	**20.0**	10.000	100.00
.5370	.2884	**5.4**	1.862	3.467	.03162	.00100	**30.0**	31.620	1,000.00
.5309	.2818	**5.5**	1.884	3.548	.01	.00010	**40.0**	100.00	10,000.00
.5248	.2754	**5.6**	1.905	3.631	.003162	.00001	**50.0**	316.20	10^5
.5188	.2692	**5.7**	1.928	3.715	.001	10^{-6}	**60.0**	1,000.00	10^6
.5129	.2630	**5.8**	1.950	3.802	.0003162	10^{-7}	**70.0**	3,162.00	10^7
.5070	.2570	**5.9**	1.972	3.890	.0001	10^{-8}	**80.0**	10,000.00	10^8
.5012	.2512	**6.0**	1.995	3.931	.00003162	10^{-9}	**90.0**	31,620.00	10^9
.4955	.2455	**6.1**	2.018	4.074	10^{-5}	10^{-10}	**100.0**	10^5	10^{10}

Table of Values for Attenuator Network Formulas

db	A	B	C	D	E	db	A	B	C	D	E
.1	.98855	.011447	86.360	.005756	86.857	**27.0**	.044668	.95533	.046757	.91448	.089515
.2	.97724	.022763	42.931	.011512	43.426	**27.5**	.042170	.95783	.044026	.91907	.084490
.25	.97163	.028372	34.247	.014390	34.739	**28.0**	.039811	.96019	.041461	.92343	.079748
.3	.96605	.034046	28.456	.017268	28.947	**30.0**	.031623	.96838	.032655	.93869	.063309
.4	.95499	.045008	21.219	.023022	21.707	**32.0**	.025119	.97488	.025766	.95099	.050269
.5	.94406	.055939	16.876	.028774	17.362	**32.5**	.023714	.97629	.024290	.95367	.047454
.6	.93325	.066745	13.982	.034525	14.428	**33.0**	.022387	.97761	.022900	.95621	.044797
.7	.92257	.077429	11.915	.040274	12.395	**34.0**	.019953	.98005	.020359	.96088	.039921
.75	.91728	.082724	11.088	.043147	11.567	**35.0**	.017783	.98222	.018105	.96506	.035577
.8	.91201	.087989	10.365	.046019	10.842	**36.0**	.015849	.98415	.016104	.96880	.031706
.9	.90157	.098429	9.1596	.051762	9.6337	**37.5**	.013335	.98666	.013515	.97368	.026675
1.0	.89125	.10875	8.1955	.057501	8.6667	**38.0**	.012589	.98741	.012750	.97513	.025183
1.5	.84140	.15860	5.3050	.086133	5.7619	**39.0**	.011220	.98878	.011348	.97781	.022443
2.0	.79433	.20567	3.8621	.11462	4.3048	**40.0**	.010000	.99000	.010101	.98020	.020002
2.5	.74989	.25011	2.9983	.14293	3.4268	**42.0**	.0079433	.99206	.0080069	.98424	.015888
3.0	.70795	.29205	2.4240	.17100	2.8385	**42.5**	.0074989	.99250	.0075556	.98511	.014999
3.5	.66834	.33166	2.0152	.19879	2.4158	**44.0**	.0063096	.99369	.0063496	.98746	.012620
4.0	.63096	.36904	1.7097	.22627	2.0966	**45.0**	.0056234	.99438	.0056552	.98882	.011247
4.5	.59566	.40434	1.4732	.25340	1.8465	**47.5**	.0042170	.99578	.0042348	.99160	.0084341
5.0	.56234	.43766	1.2849	.28013	1.6448	**48.0**	.0039811	.99602	.0039970	.99207	.0079623
6.0	.50119	.49881	1.0048	.33228	1.3386	**50.0**	.0031623	.99684	.0031723	.99370	.0063246
7.0	.44668	.55332	.80728	.38247	1.1160	**51.0**	.0028184	.99718	.0028264	.99438	.0056368
7.5	.42170	.57830	.72920	.40677	1.0258	**52.0**	.0025119	.99749	.0025182	.99499	.0050238
8.0	.39811	.60189	.66143	.43051	.94617	**54.0**	.0019953	.99800	.0019993	.99602	.0039905
9.0	.35481	.64519	.54994	.47622	.81183	**55.0**	.0017783	.99822	.0017815	.99645	.0035566
10.0	.31623	.68377	.46248	.51949	.70273	**56.0**	.0015849	.99842	.0015874	.99684	.0031698
11.0	.28184	.71816	.39244	.56026	.61231	**57.0**	.0014125	.99859	.0014145	.99718	.0028251
12.0	.25119	.74881	.33545	.59848	.53621	**60.0**	.0010000	.99900	.00100100	.99800	.0020000
12.5	.23714	.76286	.31085	.61664	.50253	**64.0**	.00063096	.99937	.00063136	.99874	.0012619
13.0	.22387	.77613	.28845	.63416	.47137	**65.0**	.00056234	.99944	.00056266	.99888	.0011247
14.0	.19953	.80047	.24926	.66732	.41560	**66.0**	.00050119	.99950	.00050144	.99900	.0010024
15.0	.17783	.82217	.21629	.69804	.36727	**68.0**	.00039811	.99960	.00039827	.99920	.0007962
16.0	.15849	.84151	.18834	.72639	.32515	**70.0**	.00031623	.99968	.00031633	.99937	.0006325
17.0	.14125	.85875	.16449	.75246	.28826	**72.0**	.00025119	.99975	.00025125	.99950	.0005024
17.5	.13335	.86665	.15387	.76468	.27153	**75.0**	.00017783	.99982	.00017786	.99964	.0003557
18.0	.12589	.87411	.14402	.77637	.25584	**76.0**	.00015849	.99984	.00015851	.99968	.0003170
19.0	.11220	.88780	.12638	.79823	.22726	**78.0**	.00012589	.99987	.00012591	.99975	.0002518
20.0	.100000	.90000	.111111	.81818	.20202	**80.0**	.00010000	.99990	.00010000	.99980	.0002000
21.0	.089125	.91087	.097846	.83634	.17968	**84.0**	.00006310	.99994	.00006310	.99987	.0001262
22.0	.079433	.92057	.086287	.85282	.15987	**85.0**	.00005623	.99994	.00005624	.99989	.0001125
22.5	.074989	.92501	.081069	.86048	.15083	**90.0**	.00003162	.99997	.00003162	.99994	.00006325
24.0	.063096	.93690	.067345	.88130	.12670	**95.0**	.00001778	.99998	.00001778	.99996	.00003557
25.0	.056234	.94377	.059585	.89352	.11283	**96.0**	.00001585	.99998	.00001585	.99997	.00003170
26.0	.050119	.94988	.052763	.90455	.10049	**100.0**	.00001000	.99999	.00001000	.99998	.00002000

Attenuator Networks

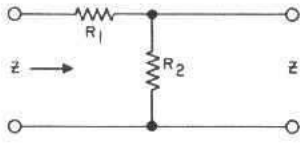
For Insertion Between Equal Impedances

For data covering networks between unequal impedances, see Minimum Loss Pads on page 10. See also Decibel—Voltage Current and Power Ratio Table on page 6.

See table on page 7 for values of A, B, C, D, E used in the following attenuator network formulas.

In the case of L and U networks where only the input or output can be matched, as required, the matched side is indicated by an arrow pointing toward the pad. On all other networks, both the input and output circuits are matched.

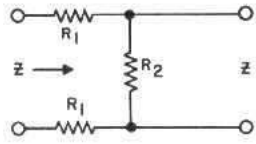
L



$R_1 = ZB$

$R_2 = ZC$

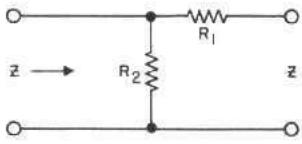
U



$R_1 = \frac{ZB}{2}$

$R_2 = ZC$

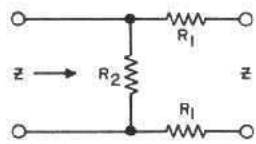
L



$R_1 = \frac{Z}{C}$

$R_2 = \frac{Z}{B}$

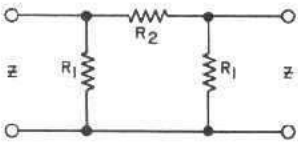
U



$R_1 = \frac{Z}{2C}$

$R_2 = \frac{Z}{B}$

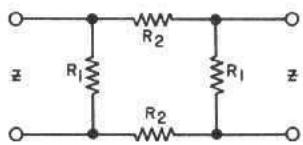
π



$R_1 = \frac{Z}{D}$

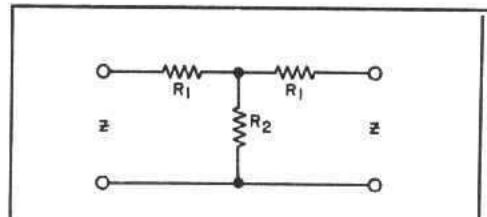
$R_2 = \frac{Z}{E}$

O



$R_1 = \frac{Z}{D}$

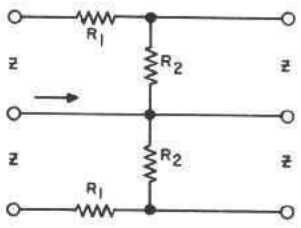
$R_2 = \frac{Z}{2E}$



$R_1 = ZD$

$R_2 = ZE$

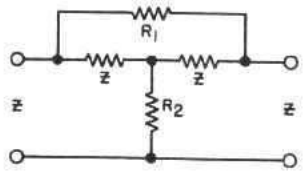
T



$R_1 = \frac{ZB}{2}$

$R_2 = \frac{ZC}{2}$

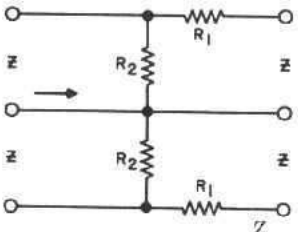
Balanced U



$R_1 = \frac{Z}{C}$

$R_2 = ZC$

Bridged T



$R_1 = \frac{Z}{2C}$

$R_2 = \frac{Z}{2B}$

Balanced U

Constant Impedance Attenuators in Parallel

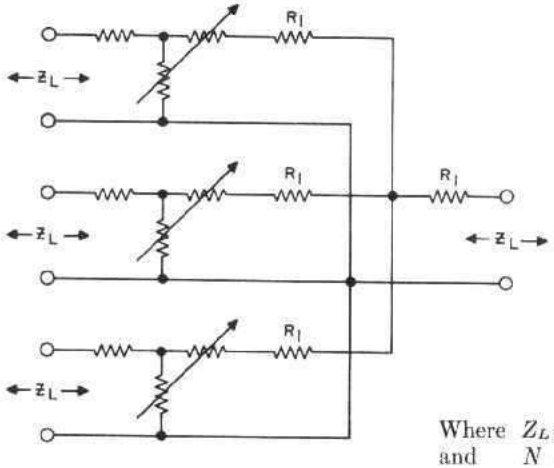


Table of R_1 Values in Ohms

Z	Number of Channels				
	2	3	4	5	6
30	10	15	18	20	21.5
50	16.6	25	30	33.3	35.7
150	50	75	90	100	107
200	66.6	100	120	133	143
250	83.3	125	150	166	179
500	166	250	300	333	357
600	200	300	360	400	428
Network db Loss	6	9.5	12	14	15.5

$$R_1 = Z_L\left(\frac{N-1}{N+1}\right)$$ Insertion loss in $db = 20 \log_{10} N$

Where Z_L = identical line and load impedances;
and N = number of channels in parallel.