networks for transmitter matching

Complete data on building networks for matching the impedance of your exciter to the impedance of your power amplifier

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Most transmitters are designed for 50-ohm output loads and the use of 50-ohm coax cable has become quite standard on most antenna systems used by amateurs. As the typical transmitter these days has 100 to 175 watts output, it is often used as an exciter to drive a linear amplifier to higher output power. These units normally are cathode-driven and are characterized by an input impedance that falls in the region of 20 to 200 ohms. Although in many cases the exciter can drive such an amplifier directly with satisfactory results, the use of a properly-terminated matching network can be most beneficial in a variety of ways: It allows maximum energy transfer (most output), presents the best load to the exciter, minimizes harmonic radiation (tvi, etc.) and allows barefoot operation without retuning.

Perhaps other advantages will come to mind. Some exciters have only a 50-ohm output, and cannot be retuned for other impedances.

input impedance

The input impedance of linear amplifiers is rarely the same from one band to another. Some amplifiers are not operated at zero-bias and actually drive the grid through a passive resistor. These systems, of course, usually present about the same impedance from one band to another, but are rarely 50 ohms to start with.

Formulas have been given to enable the calculation of the input impedance of a grounded-grid, cathode-driven amplifier. However, such formulas are all but worthless since they do not take the frequency into consideration. Measurements taken at the input of such amplifiers usually show a rather impressive variation from 10 to 80 meters, indicating that a formula would be quite misleading. These variations are caused by the manner in which the rf is isolated from the filament transformer (and hence the house wiring). Two methods are used to accomplish this: filament chokes, such as bifilar-wound coils, or low-capacitance filament transformers.

The best uniformity is normally obtained with the low-capacitance filament transformer, but such a transformer is not always available, and in any event would need to be mounted within a few inches of the tube base. This is not always convenient, so filament chokes are more commonly used. These chokes range from commercially-available units to homemade — the latter usually being two number-12 double-enameled wires wound simultaneously around a round ferrite rod until 11 turns (you would count 22 with the two wires) are on the rod. With proper bypassing these chokes allow the 60-Hz filament current to pass, but do not allow the high-frequency rf signal into the filament transformer.

Factors which seem to contribute to variations in input impedance from band to band include the voltage on the final amplifier, the type of tube or tubes being used, the frequency involved and the type of rf chokes used.

matching

I once had a Johnson Pacemaker 90-watt ssb transmitter. This unit could tune as high as 300 ohms on the output. I did not think any type of matching network to my linear was needed, but one day, while operating on 10 meters, I got a bad rf burn on my mouth when I came too close to the microphone. This led to an investigation of the input impedance, and I found on that particular transmitter it was only 15 ohms on 28 MHz; the Pacemaker could not handle this low impedance at all. A simple pi-network was used, and when incorporated for other bands, I found I not only had better output power, but could also then switch immediately from high power to barefoot, a distinct advantage over the previous system.

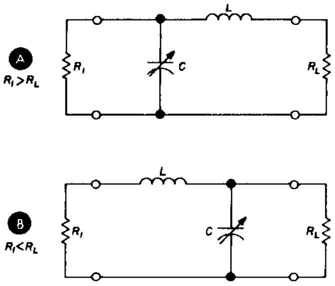


fig. 1. L-networks. The circuit in A is a step-down L-network; B shows a step-up L-network.

One company recommended that a particular length of coax should be used between the exciter and the amplifier. I personally always thought that this was a cop-out since it would be adequate (at best) on only one band!

Various articles have been written regarding the use of networks between the exciter and the linear, and this is now standard practice for most commercial units. These usually have input networks incorporated into the design, and are often adjustable if you wish to optimize them for your specific part of the band. They are usually switched automatically as you change the band selector.

Such networks are usually made up of pi-networks although a few use the more simple L-network. The pi-newtork is usually preferred as greater control and uniformity are possible from band-to-band since the Q can be predetermined for consistent performance over a wider variety of impedances. The L-network is more simple, but at the same time it is somewhat more difficult to adjust for optimum swr.

networks

L-networks have been covered adequately in other texts, including the ARRL Handbook, so only an example will be shown here (see **fig. 1**). Although this is a very simple circuit, it has several minor disadvantages.

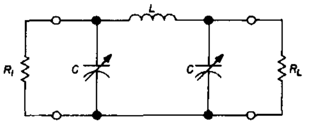


Fig. 2. A typical pi-network. R_i is the input load, R_L the output load.

For one thing, in the L-network Q cannot be controlled, and is usually very low. Also, if the network is used for all hf amateur bands, the capacitor often has to be switched from one end of the coil to the other. Further, the L-network has very little exciter loading due to the low Q and it offers very little harmonic suppression.

A typical pi-network is shown in **fig. 2**. It offers predictable performance as the Q may be preselected. It also offers additional harmonic suppression, presents a good load for exciter stability and can easily be used for all hf amateur bands.

input impedance

The input impedance of the network may be determined by testing; use of formulas should be avoided because the calculations rarely approximate the observed results.

The easiest and quickest method of measuring input impedance would be to use a variable impedance bridge, such as the long-since discountinued Heath AM-1. The ARRL Handbook also contains an excellent rf impedance bridge that may be easily built. These rf impedance bridges are basically a small swr bridge with a variable leg in the bridge so you can match the load impedance. Since an rf impedance bridge usually takes only a few milliwatts of power, they are easily driven from a grid-dip meter or ssb transmitter with the output cranked down.

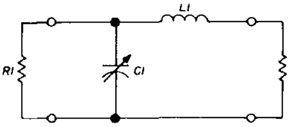
Sufficient rf is introduced (with the load disconnected) to give either fullscale meter reading or nearly so. The load is then connected and the knob dialed for minimum meter reading. The impedance is then read directly from the calibrated dial. The high voltage must be running on the amplifier, and the meter hooked as close as possible to the place the network will be added.

There are probably no typical impedances, but as a general rule I have found that most amplifiers I tested fell in to the neighborhood of 150 to 200 ohms on 80 meters, and around 15 to 30 ohms on 10 meters. The rest of the bands came somewhere in between. In many cases 20 meters offers a fairly decent match with no network at all.

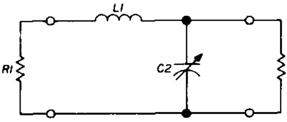
If the input impedance is measured directly at the filament of the power tube it will be considerably less than 50 ohms on ten meters, and considerably more than 50 ohms on 80. The data shown below is for my own 4-1000A linear with 6000 volts on the plate. The amplifier uses a low-capacitance filament transformer. The first column of figures is the impedance measured right at the tube base; the second column shows the impedance at the end of a 6-foot piece of

	impedance at tube base (ohms)	**impedance at network (ohms)**
80 meters	180	100
40 meters	155	60
20 meters	75	22
15 meters	50	40
10 meters	40	65

table 1. L-network component values. Data is for matching a 50-ohm transmitter to a cathode-driven amplifier. The Q is set by the ratio of the input and output impedances and is shown for approximately the middle of each amateur radiotelephone band. The Q at the top of the band would be slightly less, at the bottom of the band it would be slightly greater.



R1 OHMS	F MHZ	C1 PF	L1 UH	C2 PF	R2 OHMS	'Q' QUAL.
50	1.9	4188	2.09	--	10	2.0
50	3.8	2094	1.05	--	10	2.0
50	7.2	1105	0.55	--	10	2.0
50	14.2	560	0.28	--	10	2.0
50	21.2	375	0.19	--	10	2.0
50	28.5	279	0.14	--	10	2.0
50	1.9	3420	3.42	--	20	1.2
50	3.8	1710	1.71	--	20	1.2
50	7.2	902	0.90	--	20	1.2
50	14.2	458	0.46	--	20	1.2
50	21.2	306	0.31	--	20	1.2
50	28.5	228	0.23	--	20	1.2
50	1.9	3420	5.13	--	30	0.8
50	3.8	1710	2.56	--	30	0.8
50	7.2	902	1.35	--	30	0.8
50	14.2	458	0.69	--	30	0.8
50	21.2	306	0.46	--	30	0.8
50	28.5	228	0.34	--	30	0.8
50	1.9	4188	8.38	--	40	0.5
50	3.8	2094	4.19	--	40	0.5
50	7.2	1105	2.21	--	40	0.5
50	14.2	560	1.12	--	40	0.5
50	21.2	375	0.75	--	40	0.5
50	28.5	279	0.56	--	40	0.5



R1 OHMS	F MHZ	C1 PF	L1 UH	C2 PF	R2 OHMS	'Q' QUAL.
50	1.9	--	11.24	3746	60	0.4
50	3.8	--	5.62	1873	60	0.4
50	7.2	--	2.97	989	60	0.4
50	14.2	--	1.50	501	60	0.4
50	21.2	--	1.01	336	60	0.4
50	28.5	--	0.75	250	60	0.4
50	1.9	--	9.27	2649	70	0.6
50	3.8	--	4.64	1324	70	0.6
50	7.2	--	2.45	699	70	0.6
50	14.2	--	1.24	354	70	0.6
50	21.2	--	0.83	237	70	0.6
50	28.5	--	0.62	177	70	0.6
50	1.9	--	8.65	2163	80	0.8
50	3.8	--	4.33	1081	80	0.8
50	7.2	--	2.28	571	80	0.8
50	14.2	--	1.16	289	80	0.8
50	21.2	--	0.78	194	80	0.8
50	28.5	--	0.58	144	80	0.8
50	1.9	--	8.43	1873	90	0.9
50	3.8	--	4.21	937	90	0.9
50	7.2	--	2.22	494	90	0.9
50	14.2	--	1.13	251	90	0.9
50	21.2	--	0.76	168	90	0.9
50	28.5	--	0.56	125	90	0.9
50	1.9	--	8.38	1675	100	1.0
50	3.8	--	4.19	838	100	1.0
50	7.2	--	2.21	442	100	1.0
50	14.2	--	1.12	224	100	1.0
50	21.2	--	0.75	150	100	1.0
50	28.5	--	0.56	112	100	1.0
50	1.9	--	8.41	1529	110	1.1
50	3.8	--	4.21	765	110	1.1
50	7.2	--	2.22	404	110	1.1
50	14.2	--	1.13	205	110	1.1
50	21.2	--	0.75	137	110	1.1
50	28.5	--	0.56	102	110	1.1
50	1.9	--	8.50	1416	120	1.2
50	3.8	--	4.25	708	120	1.2
50	7.2	--	2.24	374	120	1.2
50	14.2	--	1.14	189	120	1.2
50	21.2	--	0.76	127	120	1.2
50	28.5	--	0.57	94	120	1.2
50	1.9	--	8.61	1324	130	1.3
50	3.8	--	4.30	662	130	1.3
50	7.2	--	2.27	350	130	1.3
50	14.2	--	1.15	177	130	1.3
50	21.2	--	0.77	119	130	1.3
50	28.5	--	0.57	88	130	1.3
50	1.9	--	8.74	1249	140	1.3
50	3.8	--	4.37	624	140	1.3
50	7.2	--	2.31	330	140	1.3
50	14.2	--	1.17	167	140	1.3
50	21.2	--	0.78	112	140	1.3
50	28.5	--	0.58	83	140	1.3
50	1.9	--	8.88	1185	150	1.4
50	3.8	--	4.44	592	150	1.4
50	7.2	--	2.34	313	150	1.4
50	14.2	--	1.19	159	150	1.4
50	21.2	--	0.80	106	150	1.4
50	28.5	--	0.59	79	150	1.4
50	1.9	--	9.04	1129	160	1.5
50	3.8	--	4.52	565	160	1.5
50	7.2	--	2.38	298	160	1.5
50	14.2	--	1.21	151	160	1.5
50	21.2	--	0.81	101	160	1.5
50	28.5	--	0.60	75	160	1.5
50	1.9	--	9.19	1081	170	1.5
50	3.8	--	4.60	541	170	1.5
50	7.2	--	2.43	285	170	1.5
50	14.2	--	1.23	145	170	1.5
50	21.2	--	0.82	97	170	1.5
50	28.5	--	0.61	72	170	1.5
50	1.9	--	9.35	1039	180	1.6
50	3.8	--	4.68	519	180	1.6
50	7.2	--	2.47	274	180	1.6
50	14.2	--	1.25	139	180	1.6
50	21.2	--	0.84	93	180	1.6
50	28.5	--	0.62	69	180	1.6
50	1.9	--	9.51	1001	190	1.7
50	3.8	--	4.76	501	190	1.7
50	7.2	--	2.51	264	190	1.7
50	14.2	--	1.27	134	190	1.7
50	21.2	--	0.85	90	190	1.7
50	28.5	--	0.63	67	190	1.7
50	1.9	--	9.67	967	200	1.7
50	3.8	--	4.84	484	200	1.7
50	7.2	--	2.55	255	200	1.7
50	14.2	--	1.29	129	200	1.7
50	21.2	--	0.87	87	200	1.7
50	28.5	--	0.64	64	200	1.7
50	1.9	--	9.83	937	210	1.8
50	3.8	--	4.92	468	210	1.8
50	7.2	--	2.59	247	210	1.8
50	14.2	--	1.32	125	210	1.8
50	21.2	--	0.88	84	210	1.8
50	28.5	--	0.66	62	210	1.8
50	1.9	--	9.99	909	220	1.8
50	3.8	--	5.00	454	220	1.8
50	7.2	--	2.64	240	220	1.8
50	14.2	--	1.34	122	220	1.8
50	21.2	--	0.90	81	220	1.8
50	28.5	--	0.67	61	220	1.8
50	1.9	--	10.15	883	230	1.9
50	3.8	--	5.08	441	230	1.9
50	7.2	--	2.68	233	230	1.9
50	14.2	--	1.36	118	230	1.9
50	21.2	--	0.91	79	230	1.9
50	28.5	--	0.68	59	230	1.9
50	1.9	--	10.31	859	240	1.9
50	3.8	--	5.16	430	240	1.9
50	7.2	--	2.72	227	240	1.9
50	14.2	--	1.38	115	240	1.9
50	21.2	--	0.92	77	240	1.9
50	28.5	--	0.69	57	240	1.9
50	1.9	--	10.47	838	250	2.0
50	3.8	--	5.24	419	250	2.0
50	7.2	--	2.76	221	250	2.0
50	14.2	--	1.40	112	250	2.0
50	21.2	--	0.94	75	250	2.0
50	28.5	--	0.70	56	250	2.0

RG-58A/U where my matching network is placed.

You can instantly see the futility in trying to cut a piece of coax to just the right length to provide proper matching on a number of different bands. This table also illustrates how unpredictable it would be to try to use a formula to find the impedance!

In one rig I built, using a pair of 813s and a commercial FC-30 filament choke, the impedance varied widely, from 12 ohms on ten meters to over 200 ohms on 80 meters. Replacing the commercial filament choke with a homemade bifilar-wound unit gave results that varied much less, from about 30 ohms minimum on one band to 130 ohms on 80 meters. These figures are given only to illustrate the wide impedance variations possible from 3.5 through 29 MHz, and are unlikely to be typical of what you may experience with your own particular amplifier.

wattmeter method

The majority of you will not have access to an rf impedance bridge. You can still match the exciter to the amplifier, but it will take longer. The name of the game is low swr between the two units, so a wattmeter makes a good trial-and-error method of initially tuning the network. Once the settings have been found, you can mark them on the box and paste on tabs or use the sheet of paper I use.

In this case you observe, from the computer charts, the approximate inductance and capacitance, and start out by setting the inductance somewhere near what you think would be appropriate. With about half-power on the transmitter, rotate the variable capacitors while observing the reflected power. If it does not go to zero, tap up or down on the inductor and try again (the tap on the coil should be temporary until properly selected). This same technique is used on each different band.

using a swr bridge

This is the least desirable of the various methods. It will usually work, but is the most time-consuming of all and can be misleading. If you think you have gotten it just right, switch to the exciter barefoot and see if the antenna presents approximately the same load, plate current, output power, etc. without returning the exciter. This will provide a check on your accuracy, and is, of course, the desired end result anyway – the ability to switch from antenna to amplifier with similar results.

network placement

In commercial rf power amplifiers the matching network is usually quite near the tubes in the amplifier, and usually there is a separate network for each band. The appropriate network is switched in automatically with the band-selector knob.

It is not at all necessary to have the networks in the same cabinet with the rest of the transmitter. You may find it considerably more convenient to have it a few feet away from the amplifier where a simple network can be changed quickly whenever you bandswitch. This is the arrangement I have used successfully for a number of years. I have a short piece of coax connecting the network minibox to the input of the amplifier. The length of the coax is in no way critical, but once the network is adjusted, of course, the coax length should then remain the same.

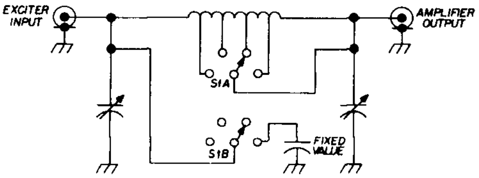
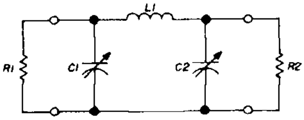


fig. 3 A typical pi-network for transmitter matching. The switch selects the proper tap for the various bands; the second switch section may be used to switch in parallel fixed values on the lower frequency bands.

A piece of paper was temporarily placed on the front panel of the minibox, the correct settings for the various bands found and the paper marked. Then a table 2. Pi-network component values. Data is for matching a 50-ohm transmitter to a cathode-driven amplifier. The Q has been chosen quite low to obtain broadband characteristics. The Q figure in the last column shows the worst-case condition at the bottom of the band using the inductance value shown.



R1 OHMS	F MHZ	C1 PF	L1 UH	C2 PF	R2 OHMS	'Q' QUAL.
50	1.8	4909	1.85	7612	10	3.6
50	3.5	2600	0.94	4153	10	3.8
50	7.0	1179	0.49	1678	10	3.3
50	14.0	579	0.25	801	10	3.2
50	21.0	384	0.16	528	10	3.2
50	28.0	300	0.12	439	10	3.4
50	1.8	3828	2.56	4992	20	3.3
50	3.5	2028	1.30	2679	20	3.4
50	7.0	920	0.68	1157	20	3.0
50	14.0	451	0.34	562	20	3.0
50	21.0	300	0.25	372	20	3.0
50	28.0	234	0.17	298	20	3.1
50	1.8	3403	3.08	3978	30	3.3
50	3.5	1802	1.56	2120	30	3.4
50	7.0	817	0.82	940	30	3.0
50	14.0	401	0.41	459	30	3.0
50	21.0	266	0.27	305	30	3.0
50	28.0	208	0.20	241	30	3.1
50	1.8	3090	3.54	3310	40	3.2
50	3.5	1636	1.79	1757	40	3.3
50	7.0	742	0.94	790	40	3.0
50	14.0	364	0.47	387	40	3.0
50	21.0	242	0.32	257	40	3.0
50	28.0	189	0.23	202	40	3.1
50	1.8	2872	3.95	2872	50	3.2
50	3.5	1521	2.00	1521	50	3.3
50	7.0	690	1.04	690	50	3.0
50	14.0	339	0.53	339	50	3.0
50	21.0	225	0.35	225	50	3.0
50	28.0	176	0.26	176	50	3.1
50	1.8	2689	4.35	2542	60	3.2
50	3.5	1427	2.20	1346	60	3.3
50	7.0	643	1.15	611	60	3.0
50	14.0	315	0.58	300	60	3.0
50	21.0	209	0.39	199	60	3.0
50	28.0	157	0.29	149	60	3.0
50	1.8	2559	4.68	2306	70	3.3
50	3.5	1361	2.37	1221	70	3.4
50	7.0	609	1.24	554	70	3.0
50	14.0	298	0.62	272	70	3.0
50	21.0	198	0.42	181	70	3.0
50	28.0	148	0.31	135	70	3.0
50	1.8	2432	5.01	2104	80	3.3
50	3.5	1295	2.54	1114	80	3.4
50	7.0	576	1.33	506	80	3.0
50	14.0	281	0.67	248	80	3.0
50	21.0	187	0.45	165	80	3.0
50	28.0	140	0.34	124	80	3.0
50	1.8	2319	5.34	1939	90	3.3
50	3.5	1237	2.71	1027	90	3.4
50	7.0	546	1.42	466	90	3.0
50	14.0	267	0.71	229	90	3.0
50	21.0	177	0.48	152	90	3.0
50	28.0	133	0.36	114	90	3.0
50	1.8	2216	5.66	1799	100	3.3
50	3.5	1184	2.87	953	100	3.4
50	7.0	520	1.50	432	100	3.0
50	14.0	253	0.76	212	100	3.0
50	21.0	168	0.50	141	100	3.0
50	28.0	126	0.38	106	100	3.0
50	1.8	2120	5.96	1679	110	3.3
50	3.5	1135	3.02	889	110	3.4
50	7.0	495	1.58	403	110	3.0
50	14.0	241	0.80	198	110	3.0
50	21.0	160	0.55	131	110	3.0
50	28.0	120	0.40	99	110	3.0
50	1.8	2036	6.26	1577	120	3.3
50	3.5	1092	3.17	835	120	3.4
50	7.0	473	1.66	379	120	3.0
50	14.0	230	0.84	186	120	3.0
50	21.0	152	0.56	123	120	3.0
50	28.0	114	0.42	93	120	3.0
50	1.8	1959	6.54	1488	130	3.3
50	3.5	1052	3.32	788	130	3.4
50	7.0	453	1.74	358	130	3.0
50	14.0	220	0.87	175	130	3.0
50	21.0	146	0.58	117	130	3.0
50	28.0	109	0.44	87	130	3.0
50	1.8	1887	6.82	1410	140	3.3
50	3.5	1015	3.46	747	140	3.4
50	7.0	434	1.81	339	140	3.0
50	14.0	210	0.91	166	140	3.0
50	21.0	139	0.61	110	140	3.0
50	28.0	104	0.46	83	140	3.0
50	1.8	1821	7.09	1542	150	3.3
50	3.5	981	3.60	710	150	3.4
50	7.0	417	1.88	322	150	3.0
50	14.0	201	0.95	158	150	3.0
50	21.0	133	0.63	105	150	3.0
50	28.0	100	0.47	79	150	3.0
50	1.8	1757	7.36	1279	160	3.3
50	3.5	949	3.73	678	160	3.4
50	7.0	400	1.95	307	160	3.0
50	14.0	193	0.98	151	160	3.0
50	21.0	128	0.66	100	160	3.0
50	28.0	96	0.49	75	160	3.0
50	1.8	1697	7.62	1223	170	3.3
50	3.5	918	3.86	648	170	3.4
50	7.0	384	2.02	294	170	3.0
50	14.0	185	1.02	144	170	3.0
50	21.0	122	0.68	96	170	3.0
50	28.0	92	0.51	72	170	3.0
50	1.8	1641	7.88	1173	180	3.3
50	3.5	890	3.99	621	180	3.4
50	7.0	369	2.08	282	180	3.0
50	14.0	178	1.05	138	180	3.0
50	21.0	117	0.70	92	180	3.0
50	28.0	88	0.53	69	180	3.0
50	1.8	1589	8.12	1127	190	3.3
50	3.5	863	4.12	597	190	3.4
50	7.0	355	2.15	271	190	3.0
50	14.0	170	1.08	133	190	3.0
50	21.0	113	0.72	88	190	3.0
50	28.0	84	0.54	66	190	3.0
50	1.8	1538	8.37	1085	200	3.3
50	3.5	837	4.24	575	200	3.4
50	7.0	342	2.21	261	200	3.0
50	14.0	163	1.11	128	200	3.0
50	21.0	108	0.74	85	200	3.0
50	28.0	81	0.56	64	200	3.0
50	1.8	1512	8.58	1054	210	3.4
50	3.5	824	4.35	558	210	3.5
50	7.0	335	2.27	253	210	3.1
50	14.0	160	1.14	124	210	3.0
50	21.0	105	0.76	83	210	3.0
50	28.0	79	0.57	62	210	3.0
50	1.8	1515	8.75	1035	220	3.4
50	3.5	826	4.43	548	220	3.6
50	7.0	335	2.32	249	220	3.1
50	14.0	160	1.17	122	220	3.1
50	21.0	106	0.78	81	220	3.0
50	28.0	79	0.58	61	220	3.0
50	1.8	1518	8.91	1016	230	3.5
50	3.5	828	4.52	538	230	3.6
50	7.0	335	2.36	244	230	3.2
50	14.0	160	1.19	120	230	3.1
50	21.0	106	0.79	80	230	3.1
50	28.0	79	0.60	60	230	3.1
50	1.8	1520	9.08	999	240	3.6
50	3.5	829	4.60	529	240	3.7
50	7.0	335	2.41	240	240	3.3
50	14.0	160	1.21	118	240	3.2
50	21.0	106	0.81	78	240	3.2
50	28.0	79	0.61	59	240	3.2

nicer looking paper was drawn up with markings for those settings, typewritten with the band-markings, and attached to the minibox. This allows very rapid setting of the box whenever I bandswitch, yet only one coil and two variable capacitors are used.

Other methods may come to mind that will work adequately for your purpose. Trying to put the networks into the amplifier usually makes additional problems with regard to space, synchronizing with the bandswitch, etc. Thus, the remote minibox idea may appeal to some of you who do not have space in the amplifier or the technical capability of providing mechanical selection when the bandswitch is rotated.

components

Even with 100 watts output, there is only about 1.4 rf amps flowing. Consequently, rather small inductors, such as B&W stock can be used successfully. B&W type 3018 comes in 4-inch lengths, 8 turns per inch; the full 4 inches is 9.4 microhenries. Price is well under $2. B&W type 3014 is also 8 turns per inch, 3-inches long, and 4.8 microhenries; cost is approximately $1.50. These should give you ideas, and a wide variety of similar inductances are available.

Even with 100 watts output, the voltage across 50 ohms is only about 70 rms. Almost any type of variable capacitor, including the common 365 pF broadcast type will be more than adequate. You can easily find these for free from junker a-m radios of another era, and usually in gangs of two or three on the same shaft.

You will probably want a bandswitch for the network. Any type of switch capable of handling small amounts of rf will be adequate, and the additional pole/poles may be used to switch in fixed values for the lower frequencies, if desired. Ceramic or steatite switches are recommended.

Fixed capacitors should be rated for at least 150 or 200 volts, and capable of handling rf currents. Mica transmitting types are excellent. Low-cost door-knob capacitors are also good and are usually capable of handling kilowatt outputs.

Some commercial amplifiers use fixed capacitors and a slug-tuned variable inductor. Unless you have some means of determining the actual impedance to be matched, tuneup could be very time consuming, and fairly costly unless a large supply of capacitors suitable for rf is available. Also, many of the available slug-tuned inductors will not handle the amp or two of rf current without damage.

summary

Some method of matching the 50-ohm output impedance to the input of a linear amplifier should be offered. A good, simple but effective method is to build a single, variable pi-network and place it in a convenient place a few feet from the amplifier. A rf wattmeter may be used for initial tuneup, and simple markings placed on the box containing the network so rapid band changes can be made. Tables are included for both pi-networks and L-networks. These were computer-derived and include values for 1.9 through 29.7 MHz.

ham radio

"You're not interested in ham radio! How did that stupid computer ever match us up?"