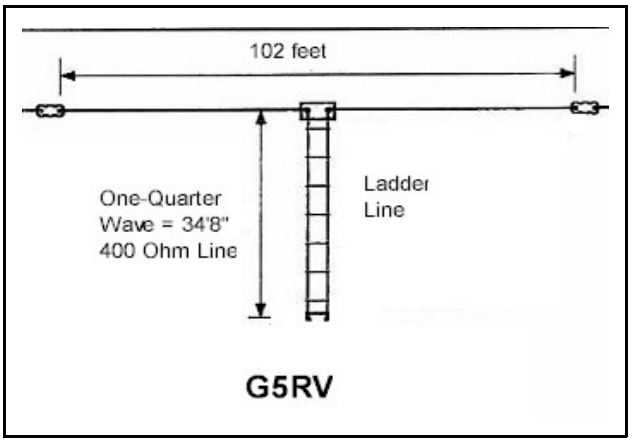
Baluns And Antennas For Hams

I can't believe it has been a year. My, how time flies when you're having fun. For those that I haven't bored to death, or lost completely, welcome, and I am in hopes that this year may be better for us than this past year.

Listening to HF and VHF frequencies while I work in the shop, I have been hearing a lot of discussion on antennas. Seems the most favorite is the G5RV (designed in England by Louis Varney (G5RV) some years ago). It is a good antenna, and on 20-meters is of course longer than a standard half wave dipole and it exhibits about 2 db more gain compared to that dipole.



For this reason, and the fact that most hams are like me broke and can't afford big yagi antennas to run with the big boys, then this is the poor man's special. In this article, I will discuss the building of a G5RV from scratch, and how to use them with a manual tuner, or how they can be used with an auto-tuner.

"What's that," you say, "My G5RV works with my auto-tuner, does it?" What makes it work with an auto-tuner is a device known as a balun.

What is a balun? Let's find out.

BALUN: Meaning: BAL for Balanced and Un for Unbalanced

Am I playing both sides of the fence with this "Balanced and Unbalanced"?

No, believe it or not, they both work together (I wish my checkbook did the same thing…)

A balun is a device that is used at the feedpoint of a balanced antenna when an unbalanced feedline is used to feed the antenna. A common example of where a balun would be used is at the feedpoint of a dipole antenna when a coaxial transmission line is used.

If a balun is not used it is possible for common mode currents to be present on the feedline. The effect of this could be undesirable if the directional properties of the balanced antenna are to be maintained. Since the feedline usually leads into the shack, RF could be present in the shack to create RFI (Radio Frequency Interference) as well as the possibility of receiving excessive amounts of RFI from indoor noise sources.

It is often found that a balun is not necessary and everything works just fine feeding the balanced antenna directly with coax cable. When this is possible it may be found that the feedline is an odd multiple of one-quarter wavelength. In this case the transmitter end of the feedline is usually grounded and from this point on the coax

which is one-quarter wavelength or a multiple thereof will appear as a high impedance.

When this high impedance point occurs at the feedpoint, chances of common mode currents are low. Rather than take any chances it is often recommended to use a balun.

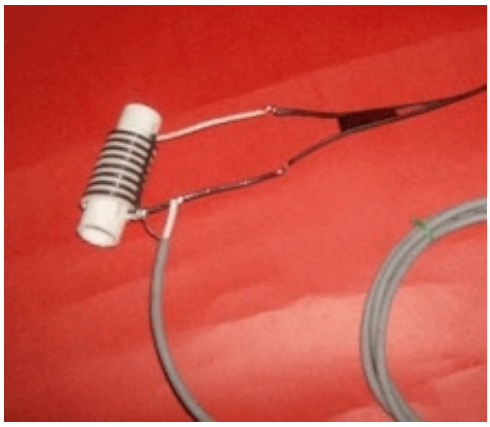
There are several different kinds of baluns. Some provide a 1:1 impedance ratio while others can provide 1:1.5, 1:4, or many other impedance ratios. A 1:4 ratio balun would come in handy if you were feeding a folded dipole (200 ohms) with 50 ohm coax.

A 1:1 ratio balun can be constructed using the feedline itself by simply winding about five turns of the feedline around a 2" diameter piece of PVC. In that case, the 1:1 balun could easily be moved from one antenna to another by simply unscrewing the coax.

If you have followed my previous discussions on antennas and dipoles, you will remember that a simple dipole will show an impedance of 200 ohms at the feedpoint. To feed this with a 50 ohm coax cable, do the math. If you divide 200 by 50, you end up with 4, thereby telling you that you would need a 4 to 1 ratio, or a 4:1 balun. Of course not all antenna impedances are 200 ohms, thereby telling us that whatever the proposed impedance is, we must construct a balun that will give us the impedance that we need.

CONSTRUCTION

By far, the simplest balun you can construct, and by far the cheapest, is a 4:1 design shown right:



Depending on how much power you plan to run, most of these baluns are made from #14 or #12 Romex. If you aren't familiar with Romex, it is the common house wiring used in your house. (I hope you have #12 in your house). It is fairly cheap, and can be purchased at any electrical supplier such as Home Depot, Lowes, etc… Or maybe you have a friend that does electrical work that would be happy to give you some scrap. I like to use Romex due to the simple fact that you have two colors (black and white).

This makes it easy so that construction is easier. Using #14, your balun can handle up to 400 watts. Using #12 puts you at 650 to 700 watts, and if you use #10, you can run the legal limit. I mentioned this balun first, for it can be used with your G5RV construction.

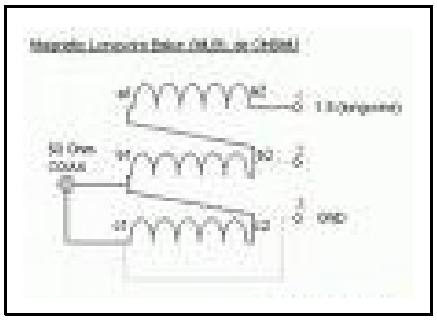
As you can see from the photo, connecting the ladder line to the balun allows you to run coax into the shack to your manual or auto-tuner. If you have a manual tuner, then just bring the ladder line directly to the tuner, because it has a balun built in.

Using your imagination, you can construct this type of balun inside a piece of PVC pipe, with two end caps, and it will look store-bought. Since these are so simple, I recommend that one be used with all dipole antennas, "Why take a chance..."

That will stop the dreaded, "... if I had only ..." later.

TRI-FILAR BALUN

For those RICH operators, this balun is a must. When you install that 5-element 80-meter mono-bander, or that stack four array of 5-element 20-meter yagi's, or any other BALANCED antenna, this is the one for you. It is shown below.



For best construction of this balun, use AWG #12 enameled wire. You will need enough wire to make seven turns three times on a 6" X ½" ferrite rod (which can be found in hobby shops).

Once again to keep from getting confused, I use some way to color code the three different wires. You can use tape, red, white, and blue, or I like to use heat shrink tubing because it bonds and won't come off.

The free ends of the windings are connected as shown. You will have two binding posts at the top, and a SO-239 at the bottom.

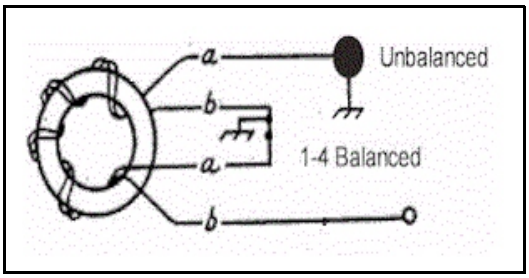
Once again using a 10" long piece of one and a half-inch schedule 40 PVC and the matching end caps, it is weather proofed, and looks factory made. If you don't like the idea of PVC construction, then there is an alternate balun using a device known as a toroid.

TOROID BALUN

If you could take the ferrite rod that we just mentioned, and bend it in a circle, you would pretty much have a toroid. However, since I don't know how to do this, then we will use one that is manufactured by someone that does.

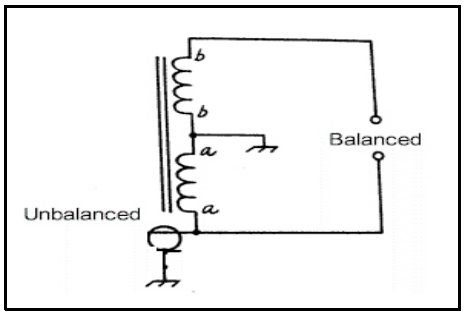
Toroids come in many sizes and shapes, and are used not only in antenna work, but in just about all the radio equipment manufactured today.

Basically, a toroid allows use to create a large inductance, while at the same time, remaining physically small for easy use in an antenna.



For example, if I were making a coil to use on 40-meters in a tank circuit, for less than 10 watts, I would need a 1" coil made with 20½ turns of #20 enamel wire.

The same can be accomplished with a toroid about the size of a Cheerio with 10 or 12 turns of #28 wire. Look at the construction of a balun formed on a toroid below:



Many modern HF transceivers come fully equipped with built-in tuners. While these tuners are great for changing bands, the manufacturers left out a very important accessory: the 4 to 1 balun.

Without a balun the transceiver can only feed an antenna which uses coaxial cable. While this may be satisfactory for some operators, this is a real

problem for those of us who prefer the super low loss ladder line.

The only other alternative is to buy an external tuner with a built-in balun which is really absurd after spending the additional money to have one built into the radio. Fortunately, a 4 to 1 balun can be easily home brewed as illustrated. The list below shows how you can choose the wattage rating, and what you need for the construction:

TOROID	NUMBER OF TURNS	POWER RATING
T80-2	25	60 watts
T106-2	16	100 watts
T130-2	18	150 watts
T157-2	16	250 watts
T200-2	17	400 watts
T200A-2	13	400 watts
T400-2	14	1000 watts

The exact number of turns is not critical but the numbers listed in the preceding table should yield optimum results. It is possible to exceed the power ratings listed above but the performance of the balun may be degraded during high SWR causing heating of the core.

Toroids of this type are available from a number of dealers, but for the quality and price, I would use Allied Electronics, or DigiKey. The baluns should be housed in a suitable weather-proof housing. You can use plastic weather-proof boxes from electrical suppliers for construction, or use PVC as mentioned previously.

Well, now that I have bored you again, I will close this session, and begin working on the next. Until then, remember, " May your QSO's be long, and your coax short ".
Jim