BALANCED FEEDERS

This is a good subject, but one I can't go into great detail because I don't know enough about it. However, I think a few things should be cleared up where balanced transmission lines are concerned.

The feed impedance of a half wave dipole on its operating frequency is in the region of 50 ohms, an ideal match for 50 ohm coax. This is a great one-band aerial. But, if we use the same aerial and coax on another band, the feed impedance might be in the region of 1000 ohms. There'll be a huge mismatch to the coax. OK, so you use an ATU and tune out the SWR and it works... Sort of. The losses in the coax will be immense and, overall, the system will be pretty naff.

We've been brought up with the idea that running an aerial system with a high SWR is verging on a criminal offence. The reason is that a length of coax with a high SWR is hugely lossy, the power being dissipated as heat in the feedline. But this is not the case when using balanced feeders. 300 and 450 ohm balanced feedlines are practically lossless on the HF bands, even when the SWR is high.

RG-58 coax has an attenuation (loss) of 2db per 100 feet at 21 MHz and a loss of about 2.6db per 100 feet at 30 MHz. RG8, the fatter stuff, has a loss of 1db per 100 feet at 30 MHz. 300 ohm feeder has a loss of about . 4db per 100 feet at 30 MHz and 450 ohm ladder line has a loss of about .16db per 100 feet at 30 MHz.

A 1db loss may not seem significant but, if you stuff 100 watts into a system with a 1db loss, about 80 watts will come out. A 2db loss with 100 watts in means that about 63 watts are will dribble out. Remember that this loss is only true in a matched system where the antenna feedpoint impedance, the feedline impedance and the transmitter output impedance are all the same. These losses may seem small, but do remember that they increase dramatically as the SWR increases.

OK, so we have a half wave dipole resonant on the 40 metre band. The feed impedance is around 50 ohms, ideal for coax. If we feed this dipole with 450 ohm balanced transmission line, there's going to be a massive mismatch at the feed point. What does this mean? Big mismatch = high SWR. A high SWR on coax is a bad thing as the coax will become extremely lossy. However, a balanced feeder can withstand a very high SWR with negligible loss.

TUNED AND FLAT LINES:

A transmission line is either NONRESONANT or RESONANT. A nonresonant line is one having no standing waves of current and voltage. A resonant line has standing waves of current and voltage.

Nonresonant Lines

A nonresonant line is one which is terminated in its characteristic impedance - i.e. a 50 ohm line and an aerial with a feed impedance of 50 ohms. Since no reflections occur, all the energy traveling down the line is absorbed by the aerial. Since no standing waves are present, this type of line is sometimes spoken of as a FLAT line.

Resonant Lines

A resonant line is not terminated in its characteristic impedance. In other words, the line may be 300 ohm ribbon looking at a 50 ohm aerial feed impedance. This means that a high SWR will occur. An ATU is used to eliminate the reactance and to bring about maximum power transfer from the source to the line. Therefore, a resonant line is sometimes called a TUNED line.

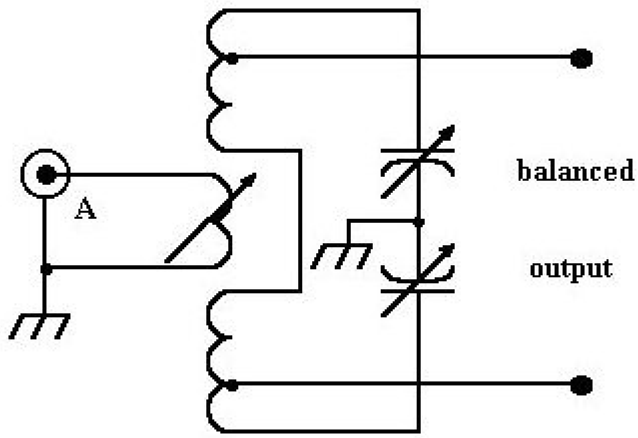
On one band, the feed impedance of our aerial might be 450 ohms, great for our balanced feeder. On another band, the impedance might be 1000 ohms or 50 ohms. It doesn't matter whether the SWR is high or not as the losses are small. What does matter is that you have a good ATU which can handle very high currents and voltages.

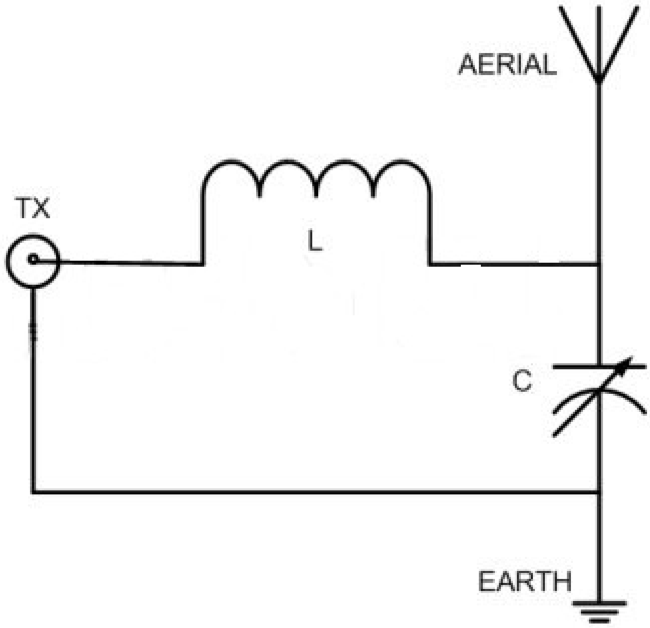
Why are the losses small? With tuned lines, we completely ignore the sometimes huge mismatch at the antenna end, and compensate for the mismatch with the tuner at the shack end of the line. The SWR may run as high as 10 or even 20 to 1, but the power reflected from the mismatch is re-reflected back to the antenna by the tuner. Tuning for maximum line current simply adjusts the phase of the reflected wave to re-reflect down the line in phase with the forward wave, again reaching the antenna. Thus the reflection loss from the mismatch is cancelled by the reflection gain of the tuner. And that is the secret of the so-called doublet aerial.

Manufactured feeder comes in several different impedances. There's 300 ohms, 450 ohms and 600 ohms.

Which one do we use and why? What's the difference? To feed a doublet, which is basically a dipole, the majority of people use 450 ohm line. This is because the input impedance of the aerial might be 600, 700 or 800 ohms on one band and perhaps 100, 200 or 300 ohms on another. Obviously, 450 ohm feeder is half way between 300 and 600, giving a pretty good compromise.

With any balanced aerial system, you must use a proper ATU. By proper, I mean balanced. By balanced, I don't mean the "balanced" ATUs available from manufactures at extortionate prices. The majority of ATUs on the market today incorporate a 4:1 balun. They are NOT balanced ATUs. In fact, they are very often a simple L match.





The ATU on the left is balanced. The one on the right is NOT.

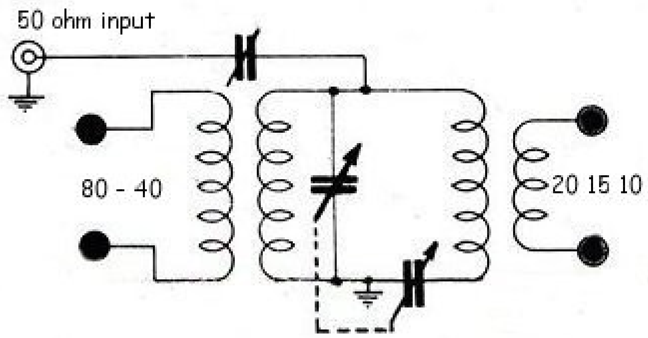
With balanced feeder, it is important to keep the line clear of metal objects etc. However, I've just erected an 66 foot doublet fed with 300 ohm 'window' line and, contrary to popular belief, it seems that nothing affects it. Even coiling the feeder on the shack floor doesn't seem to make any difference. I've clutched it in my grubby hand, stood on it, pi**ed on it... And the damned stuff doesn't flinch an eyelid.

And I've discovered another marvel... My doublet is bloody marvelous! As yet, I've only tried it on 40 metres and the 5mHz frequencies. But the results have been amazing. I'm picking up far less QRM, electrical noises, buzzing, gurgling, farts, etc. In fact, when I first used the new aerial, I wondered why 5Mhz was so quiet. Used to a pretty high noise level, I thought that something must be wrong. Until I hard a station in Yorkshire come romping in at 30 over 9.

Changes to my doublet

As always, I can't leave things alone. My 66 foot doublet works very well, but I've been reading about 88 foot doublets. It seems that this length will work very well from 80 through to 20 metres. I've lengthened my doublet and found this to be correct. On eighty, the aerial is only slightly down on a half wave dipole for that band. Great stuff. But, more than this, 88 feet is resonant in the centre of the UK five meg frequencies. This is an added bonus for me because I love five megs. I'm looking forward to thoroughly testing my 88 foot doublet. Watch this space for my findings...

Just out of interest, below is the basic circuit of the KW E-ZEE match and KW 107 Supermatch ATUs.



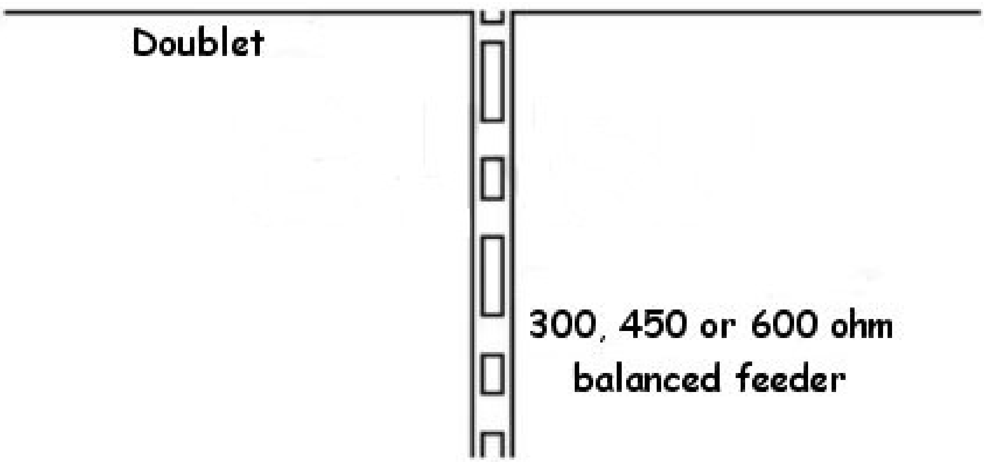
THE DOUBLET AERIAL

What is a doublet? What should the aerial below be called? Basically, it's in the form of a dipole fed with balanced feeder. This is what I've gleaned from scouring the internet...

A DOUBLET IS:

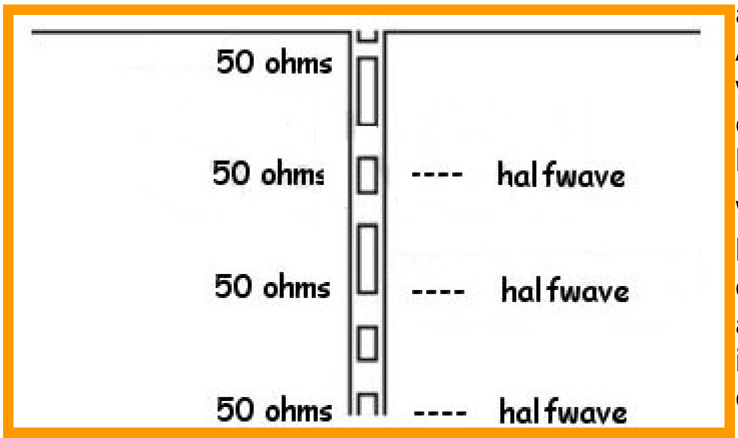
1) A centre fed aerial which is too short on the operating frequency.
2) Any aerial fed in the centre with balanced line.
3) An aerial where the balanced line is exactly the same length as one leg of the dipole.
4) Doublet, dipole... There's no difference.
5) Any centre fed aerial working away from it's resonant frequency.
6) An article of clothing.

And so it goes on and on... What's in a name?



One mystery which needs dealing with is the length of the feedline on this type of aerial. It does NOT have to be cut to any particular length. All you do is cut it to the length you need. However, you might find that on one or two bands you can't get a 1:1 SWR. This doesn't mean to say that something is wrong. All that is happening is that your ATU is looking at an impedance at the shack end of the line that it can't handle. The answer is to shorten or lengthen the line by a few feet.

The reason some articles give a feed line length is because a certain length of balanced line for a certain aerial will give an overall acceptable impedance at the ATU on all bands. By acceptable, I mean an impedance which the ATU can cope with. A decent ATU will be able to cope with all impedances at the shack end of the feed line. But, not all ATUs are decent. Far from it, in fact.



Why doesn't the aerial load on one or two bands? An all-band doublet shows a different feedpoint impedance at different operating frequencies. The exact length of the antenna relative to the frequency will determine that impedance. The feedline will transform that impedance continuously along its length, repeating values every half wavelength of line. By adjusting the length of the line, you are changing the impedance the ATU sees on all bands. Some juggling of the feeder length may be necessary to ensure that your ATU can handle the impedance it sees on each of the bands. Take a look at the diagram on the left. We'll assume that the dipole is cut to the frequency we're working on. So, the feed impedance of the aerial is 50 ohms. OK, so that doesn't match the 300 ohm feeder but that doesn't matter.

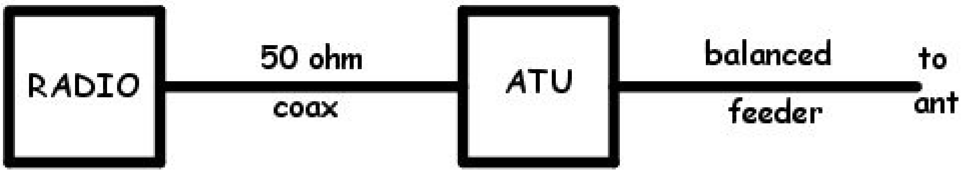
By looking at the diagram, you'll see that the impedance repeats itself at every halfwave length down the line. As I've said, the line transforms the impedance continuously along its length. If the line is cut to a certain length, the impedance at the shack end of the feeder will be 50 ohms. Obviously, this is a good match for 50 ohm coax. But, between each 50 ohm point, the impedance might be 600 ohms or more. Forget the coax!

If your balanced ATU can handle this impedance, then all well and good. If it can't, then lengthening or shortening the feedline will change the impedance at the ATU. Have you grasped that? I know that it is sometimes difficult, especially with my explanation!

THE G5RV

This has to be one of the most popular aerials around. Basically, it's the balanced-fed dipole above but with a length of coax connecting the end of the feeder to an unbalanced ATU. If the length of the dipole and the feeder are about right, then the impedance at the shack end of the feedline might be somewhere near to 50 ohms on all bands. Hence the coax between the feeder and virtually any old ATU. Presumably, the advantages are that coax comes into the shack rather than balanced line and there's no need for a balanced ATU.

Quite a few people cut the coax off and use a balanced ATU, ending up with the aerial in the diagram above. In my view, this is the thing to do. Using a properly balanced ATU, the set up in the diagram below shows the correct way to use coax and balanced line.



STICKING UP AN AERIAL

When considering which type of aerial to put up, remember to take into account such things as gain, directivity and noise. A low dipole will tend to fire the signal straight up (NVIS) where it will bounce off the ionosphere and come straight back down again. This might be good for inter-G working on forty metres, but not for DX. An end fed wire, far too long for the band you're on, can be very noisy, picking up all sorts of junk from various directions. A vertical should be pretty good for DX with its low angle of radiation, but poor for inter-G working.

I heard a chap on 5mHz the other day. His top band doublet raised the noise level on 5mHz by three S points. It was great on TX, but pretty naff on RX. His loop aerial was generally down on the doublet, on TX and RX, but far better for working the weaker stations. Food for thought?