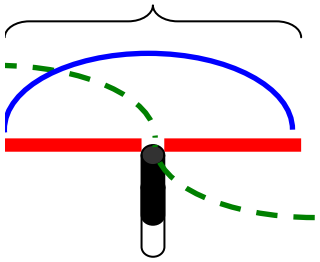
Di-pole and Quarter Wave Ground Plane Antenna Myths
by
Aaron VK4VOX

Remember when you got your first CB radio and set up a quarter wave ground plane antenna on the gutter of the house or roof of the car? I would like to revisit those good old days along with some of the mis-conceptions about antennas beginning here with the half wave centre fed dipole as seen in the schematic image below.

Half Wave
centre fed dipole consists of two
quarter wave elements

Voltage distribution is
shown in **GREEN**
Current is
shown in **BLUE**
The Balun is
shown in **BLACK**



Arguably the basic of our hobby that is least understood is that of the half wave centre fed dipole. In fact nothing will start an argument faster then the truth about the Vswr of a centre fed dipole. Walk with me a moment and let me explain.

With the surge in Amateur Radio numbers these days from the ranks of CB - I was one myself - we have a lot of mis-information coming into our hobby that needs to be corrected. One topic that stands out from the crowd is the di-pole and topic of "swur" or as it is more correctly referenced "Vswr" which stands for voltage standing wave ratio.

Vswr is a fancy name that engineers give to swur to impress everyone about how smart they are, whereas it is actually a very simple math equation or the sum of one number divided by another - but more on that later.

Coming back to the di-pole, most new amateurs - and a majority of old amateurs as well - believe their di-pole works best when it has a Vswr of 1:1.

Believe it or not this is WRONG. Let me explain.

The ARRL Antenna Hand Book tells us the centre point impedance of a one half wave centre fed di-pole is 72.5 ohms – let's round it up for simplicity and call it 75 ohms. If we take a half wave centre fed di-pole and connect it to un-balanced coaxial feed line with a 1:1 balun and 50 ohm coax we have a 75 ohm antenna matched or electrically connected to a 50 ohm feed line or coax.

To work out the Vswr there is a very simple equation that we can use on a pocket calculator that I have simplified below - remember in maths we can take really REALLY complex numbers and reduce them to their lowest common denominators - and still get the right answer. So if we simplify and reduce the complex Vswr equation it comes down to this simplified sum below - all we do is divide 75 by 50 - and what do we get ???

$$\text{Vswr} = 75 \div 50$$
$$= 1.5$$

This means if you have done your sums and measured and cut your dipole and configured it exactly as per the centre fed dipole image above then the Vswr - give or take a bit either way for the meter error or calibration – will be 1.5:1. I will say that again – A centre fed dipole Vswr at resonance is 1.5:1.

WHAT ? A centre fed dipole at resonance has a Vswr of 1.5:1 - NOT 1:1 – All True.

About this point in time the bad old habits we learnt from CB days kick in and we yell "hell no" and commence to cut and trim the ends of the di-pole until the Vswr drops to 1:1. "Ahhh" we say with a comforted contented sigh.

Unfortunately what we do when we start to cut and trim like this is we take a perfectly good antenna that is resonant on the desired frequency and we change it to a less effective NON resonant antenna with a Vswr of 1:1 - thereby defeating all our hard work and effort because in our mixed up heads we have learned over the years that 1:1 is the best.

This starts more arguments then any other subject I know because of misconceptions, wrong information and bad habits that we have picked up over the years.

While on this subject the same goes for a quarter wave ground plane antenna. If a half wave centre fed di-pole has an impedance of 75 ohms what do you think a quarter wave ground plane antenna feed point impedance will be ??? It is not rocket science - half of 75 is 37.

So if we do the sum above for 37 ohms and 50 ohms we get,

Vswr = 50 ÷ 37
= 1.35

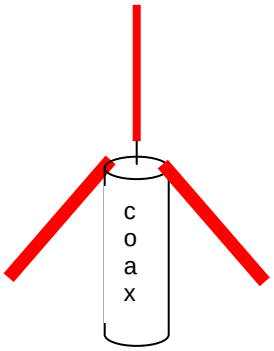
You might notice that I put the equation around backwards - it is not important to understand the engineering maths and which number goes first only that it is the ratio of two numbers.

The main thing is if you have a resonant quarter wave antenna the Vswr should be 1.35:1 and don't let anyone tell you otherwise and never start cutting and trimming till it gets to 1:1.

The Guru once said that there was only one antenna that had a 50 ohm feed point impedance and that is the quarter wave droopy. See below.

Quarter Wave Droopy

The Quarter Wave Droopy schematic consists of three equal quarter wave elements. One is connected vertically to the centre conductor of the coax the other two elements hang down at 45 degrees and are connected to the outer braid of the coax. This gives a feed point impedance of 50 ohms.



I believe the Guru about the droopy and to this day thank him for sharing his knowledge and hope that this explodes some of the myths about dipoles and quarter wave antennas for you.

Until next time 7 - 3 form Aaron VK4VOX.