The Radio Hotel –Antenna Bandwidth & SWR Rick – W5RH

Over the past 4 submissions of The Radio Hotel I have talked about SWR. What generates it, what it is and how it is measured. In all of these discussions I have stated that the SWR is an indicator of the differential of impedances at the junction of the TL - transmission line and the Load – the antenna (commonly known as the feed point). Since the TL is always of a predetermined surge impedance (i.e. 50, 75, 300, 450, 600 ohms), the antenna feed impedance (Z) is the most significant side of that equation. Our desire is to have the antenna have the same Z as the TL. Fine, but Ham's have bands of HF frequencies to work on and not just a single frequency. Because of this, a dipole being "resonant and a close match" in the middle of the band, will not be resonant or matched at the ends of the band.

Just what is the range of the feed Z of a dipole over a typical band of frequencies? And how does this "change in feed Z" influence the SWR? Let's take a look.

Using EZNEC, I modeled a full length dipole -- ½ wavelength off the ground and resonant at the middle of the band. I charted the feed Z and SWR at that center frequency and also at both ends of the band. The chart below shows the values for 160, 80, 40, 20 and 10 meters. (the other bands 30,17,15,12 are quite narrow and vary very little). The dipole is modeled with #12 solid wire, stretched horizontally above the Earth.

Band	Center MHz	Feed Z ohms	SWR	Low MHz	Z	SWR	High MHz	Z	SWR
160	1.90	71	1.4	1.8	65 –j93	4.53	2.0	77+j103	4.72
80	3.75	71	1.4	3.5	65 –j109	5.63	4.0	80 +j123	5.87
40	7.15	72	1.45	7.0	69 –j27	1.75	7.3	74 +j40	2.14

20	14.20	72	1.45	14.0	70 –j12	1.49	14.35	74 +j24	1.74
10	28.50	73	1.51	28.0	70 –j13	1.5	29.1	75 +j35	1.99

You can see, as the frequency bands go higher, the narrower the bands and the less frequency change from band edge to band edge. The SWR "swing" has a diminishing width. 160 and 80 (with the most bandwidth change of any band) are the tough bands to match with a single resonant point system. Their SWR swing from the lowest frequency to the highest frequency is quite wide -- i.e. 5:1 thru 1.4:1 at mid-band and then back up to 5:1 again. To cover the whole 160 or 80 meter bands, some hams use open wire TL's and an ATU, while others use wider bandwidth antennas like cage dipoles or multiple wires in parallel, each cut for different portions of the band.

The higher frequency bands, 20 meters and up, stay under 2:1 SWR for the whole band and are, therefore, easily matched with 50 ohm coax across the whole band. For these bands, you can just use an "in shack" tuner to trim the matching so the transmitter puts out the full tilt wattage for which it is built. Unmatched line loss remains fairly low at these low SWR ratios. Thank goodness.

The above cursory study is what happens with resonant wires on the band of design choice and use. But what happens on a single dipole that is used on other bands? The SWR goes wild at times, especially on the even harmonics. Matching networks/ATU's are implemented. What happens in those matching networks and what happens on the transmission lines? That will have to wait until next month.

Next Time: Matching, reflections and the magic of wave mechanics.

*The purpose of **The Radio Hotel** is to give you a practical kickstart into exploring the workings of antenna systems. It is a series, so go back and read the previous columns to get the whole picture, as one month relies on the previous month's information . Google the buzz words and find out what they mean. Read up on antenna system theory to see how it all works together. You will be glad you did.*

Repeater Etiquette

By Robert Polinski KD5YVQ

As trustee of the 146.940 repeater in Houston, a short reminder of appropriate etiquette when using the repeater. Although most users use the repeater with no problems occasionally someone steps over the line. Please, if you think it is being misused or someone is not abiding by the following rules, let me know. If you are in a conversation and you feel one of the parties is stepping over the line, do not argue with him or her, just politely SIGN OFF.

1. Do not bash, or disrespect other Hams or their views. You may disagree, but always remain polite.

2. Criticize off-air

Remember that there is almost always someone listening to the repeater. Sometimes it's a fellow ham, sometimes it's a prospective ham listening to a scanner. If for any reason you feel that you have something to say to someone that you might not want someone to say to you over the air, don't say it on the radio. Instead, find a private communications channel (telephone, email, meeting in person) and work things out that way.

3 The 94 has a 1.1/2 minute timer. The timer only resets when the repeater completely drops (some reset when the input drops) Please try to avoid the repeater time out.

4. Remember to ID when you sign off and every 10 min.

5. Pause during long QSL to allow others to sign in or out.

6. If you do not like someone, or do not want to talk to that person, just sign off, be polite but just sign off. There are many other repeaters to talk on and if you cannot be polite and follow the rules, go somewhere else.