

The Radio Hotel – The Fun of Troubleshooting

by Rick Hiller – W5RH

Hams, over time, develop a fair amount of skills like building electronics and working CW or keeping their shack computers current with the necessary IT tasks, etc. One other skill that is necessary, but sometimes ignored, is the skill of troubleshooting. Troubleshooting is the process of diagnosing the source of a problem. The basic theory of troubleshooting is that you start with the most general (and often most obvious) possible solutions to the problems, and then with a knowledge of how the system works, narrow it down to more specific issues

Troubleshooting involves both the art and skill of solving a problem by 1) knowing, fairly intimately, the workings of the system on which you are troubleshooting, or 2) by eliminating those parts of the system that don't have an influence on the problem, or 3) by substituting parts of the system, one by one, to see what changes. IMHO, knowing how the system works and what function the parts perform is the most important. On any system, this involves either a long term study into the operation of each part or attendance at the "school of hard knocks" -- years of experience working with or fixing the system. However, another method of troubleshooting is to "Shot Gun" or just flat out replacing everything or a large number of the parts involved. When time is money, as in the business world, changing out a few parts at a time with known good parts might get you back in operation more quickly.

In electronics (radio, etc.) we troubleshoot by having access to only the stimulus and the result. Minimal visual clues exist, unless it's cut antenna wires, burned connections or melted coax. We cannot see gears or belts going around (or not going around), or hearing the squeaking produced by some out of whack pulley or bushing. What we get is no RF out or in. This could be caused by high SWR, or operator error such as the RF Power control turned down or the wrong mode selected (a non-carrier mode like SSB) or one or more of many other things that could have gone awry. But knowing how things should all work and interact is a significant step toward fixing the problem.

Some troubleshooting examples -- Our antennas are a system, consisting of the antenna – the load, the transmission line, the ATU (antenna tuner) and the source – the transmitter power output. These parts all have their operational characteristics and they all interact affecting each other's operation. When there is synchronicity in our antenna system there is calm. But then one thing goes out of whack and all parts are influenced. i.e. When the antenna wire breaks, it causes a shift in feed Z which causes an increase in SWR which causes a decrease in output power from the transmitter. You have done nothing. It all happens due to your friendly neighborhood squirrel eating your antenna wire. So, when troubleshooting this problem you can look at it from an RF standpoint or a visual standpoint. One quick use of your handy dandy antenna analyzer will show you the SWR or Feed Z and you can see what has changed. Not "why", but just that it has. You'll see that the fault is in the antenna system from the coax out to the load. Then it is outside to look at the antenna and coax to see anything obvious. Sure enough, easy analysis is the downed, chewed wire. The fix might not be easy, depending on your installation, but at least you'll know what is causing the issue.

Another situation that can cover up some marginal failures in an antenna system is in the use of an antenna matching network, especially an automatic one. For example, if a PL-259 connection becomes open to water influx, water will start to rot the coax and the connector, causing higher resistance. This happens over a long period of time and you might not notice it because the ATU adjusts for the slight change. At the shack end all looks good. Then one day it becomes too much for the ATU to match and you start troubleshooting to see why your SWR is not 1:1. Bad connectors and coax are difficult to find as they are out of sight. So an almost complete dismantle of all coax connections and testing of each piece of coax or placing a dummy load in-place of your antenna and measuring Z, etc. will place you on the path to good troubleshooting and success in finding the issue.

Enjoy your hobby. 73—Rick W5RH