

This column is a forum for sharing the vast range of practical experience accumulated by our membership and not just my favorite boat maintenance topics. It is intended to be the place where you, the reader, can ask technical questions and either obtain direct answers in this column or direction to appropriate reference material.

Since you have not asked for specifics since the last newsletter, I'll continue on course with the original list of topics. Just to refresh your memory the topics are: electrical wiring, alternators and regulators, batteries, grounding and bonding, radios and antennas, and instrumentation (depth, speed, GPS, LORAN, etc.). We have already covered wiring, alternators and regulators, batteries, bonding and grounding so let's look at the normal problems encountered with radios and antennas; poor performance or no performance. An interesting fact about these problems is that the radio and antenna are usually not at fault. The problems are usually associated with the quality of the original installation and/or how long they have been exposed to the marine environment.

Every topic we have covered so far supports the basic requirements needed to provide power to a radio or other electrical devices that you may have aboard. Radios have some special requirements that your starter motor or running lights could care less about. All of the other accessories onboard may be operating just fine but the radio, specifically the marine VHF, just doesn't seem to be working as well as it used to when it was new. What could be wrong?

Well, if you still have the operating manual that came with it, see if you can pry the pages apart and look at the specifications. Most VHF radios, fixed mount VHF radios and handhelds, come with a page of specifications that really don't mean very much unless you're an engineer. So most of us look at them when we pull the radio out of the box, look at the installation instructions, then proceed to install the unit where we want it, regardless of what the instructions say.

If you go back to the specifications you may discover that the hasty installation a few years ago set the stage for the problems you are experiencing now. Look at the specification table and find out how much current the radio needs to operate at its full power rating of 25 Watts. In most cases a fixed mount radio will draw 6 to 10 Amps and require between 11.5 to 15 Volts (at the fuse on the back of the radio) when it is operating correctly.

What size wire did you use to hook things up between the circuit breaker panel and the fuse? A few articles ago we looked at wire size and the amount of current a given size wire could conduct without a detrimental drop in voltage from one end to the other. If the wire size was marginal when the original installation was performed, or the power connector or any other connection between the power source and radio is corroded you are not providing enough power (remember Volts X Amps = Power (in Watts)) to the radio. Cleaning the connections (an easy task) or installing the correct size wire (a not so easy task) will allow the radio to operate the way it was designed.

An important thing to note here is that the total power required to operate the radio is HIGHER than the Radio Frequency (RF) power output from the radio. By law, marine VHF (Very High Frequency) radios are limited to a maximum of 25 Watts RF output. Due to the power lost internally, due to heating of components and other inefficiencies, you have to supply over twice the RF output power at the 12-Volt DC input. If you look at the typical specs in the last paragraph and multiply 6 Amps X 12 Volts you see that you have to provide 72 Watts at the input to get the rated power of 25 Watts RF at the output. Depending on your radio's specification this requirement could be much higher.

The other chief contributor to poor performance is the connection(s) between the radio's RF output connector and the antenna. Most Friendships have at least 50 feet of coaxial cable and two PL-59 connectors between the back of the VHF and its antenna. RF cable connections that are well sealed will normally last several years. The worst enemy to the connections and coaxial cables is moisture! Especially salt moisture! Obviously we get plenty of that on the ocean so our goal has to be to keep it away from the RF connections, especially the connection at the antenna.

Moisture that penetrates the plug causes two problems. First, it corrodes the connecting surfaces of the connector, which to a limited degree you can clean off; but the second problem doesn't have an easy fix. As the moisture builds up inside the connector it is carried down the braided outer conductor of the coaxial cable much like the wicking action in an oil lamp. Eventually the coaxial cable gets waterlogged. If corrosion doesn't ruin the cable where it joined the connector, the gradual saturation of the cable interior will either short circuit the inner and outer conductors or change the impedance to something other than the 50 Ohms called for by those specifications we mentioned earlier. If you have a leaky connector at the antenna you have set yourself up for gradual

deterioration of the transmission system that carries the RF signal from your radio to the antenna, then out to the world. The only remedy for a saturated cable is to replace it.

So how do you prevent moisture intrusion? Proper assembly techniques and quality materials will keep water out. Some of the basics are:

- Purchase good quality material. Equipment made for the marine environment is far superior to, in the long run cheaper than, home electronics or automotive products.
- Follow the manufacturer's instructions when assembling the connectors. (Personally, I prefer soldered connectors, but if you don't have good soldering skills have someone else install them; or use the new PL-259-CP solder-less connectors.)
- Never connect the connector to the antenna without lubricating the threads. The lubrication keeps moisture from "crawling" down the threads. Be careful not to get the lubrication on the center pin or base of the connector as this could act as an insulator and prevent a good electrical connection.
- Always tape or heat-shrink the whole assembly after the connections have been completed. An outer layer of self-vulcanizing tape, followed by a layer of vinyl electrical tape provides a good weather-resistant seal. Wind the outer layer of vinyl tape from the lowest point on the coaxial cable up to and over the connector body and finish off by locking the last turn of tape in place with a small black tie-wrap. (Winding from the bottom up gives the tape an overlap like the shingles on your house and the black tie-wrap is more weather resistant than a white one and will prevent the tape from unwinding as the adhesive ages.) Another good finishing touch is to coat the tape with liquid electrical tape or a product called Scotch Coat.

West Marine, Boat US, Defender, and other marine supply outfitters are good sources of material. The West Marine Catalog is an excellent reference book even if you don't buy anything. The West Advisor pages, included in each product section, provide accurate, informative articles on product selection and performance differences. Their prices may not be the lowest but the catalog is certainly the most informative.

Now before you go buying new wire, coaxial cable or connectors there are some easy tests you can perform to see if things are really as bad as you think or at least as expensive. Here are some tests you can perform and an interpretation of the results.

1. Turn off all power to the radio.
2. Perform a visual inspection of the 12-Volt wiring and antenna connections. If corrosion is evident, clean it.
3. Temporarily reconnect the antenna and 12-Volt power to the radio.
4. Turn the VHF on and tune in to one of the NOAA weather frequencies.
 - If you can hear the signal clearly, or at least as well as a nearby boat with an antenna as high as yours, the receive side of the system is probably working correctly.
5. Turn off all power to the radio.
6. Disconnect the antenna cable from the back of the radio. With an Ohmmeter, measure the DC continuity of the antenna cable and antenna. Ideally the meter reading should be about 1.5 W (Ohms) or less.
 - Yes this is correct! VHF antennas are designed to be short circuits to DC currents in order to provide a measure of lightning protection. This low reading indicates that the antenna and cable have good connections, and there are no open circuit conditions in the antenna, cable, or connectors. Additionally, the previous test of the receiver system eliminated the probability that the antenna or cable is short-circuited. If it was you would not have heard the weather broadcast.
 - But if the meter indicated a much higher resistance, which is what we were really testing for, the cable, a connector, or the antenna is either corroded or an open circuit and needs to be repaired. And yes, the receiver can still pick up the weather broadcast and other signals even though the outer conductor of the coaxial cable is not connected to anything.
7. If the Ohmmeter read more than 1.5 W but less than 5 W the antenna and cable may have a poor connection or the DC resistance of the antenna may be slightly higher than the average antenna, but odds are that the radio will work. (Note that different manufacturers have different resistance specifications for their antennas so there will be a small range of readings from antenna to antenna even though the systems seem to be equal. Differences in coaxial cable lengths also contribute to a slight difference in the measured resistance.)
8. If the previous test results are good you should be able to hook everything up and successfully use the radio. If it still does not work correctly there is another test that will show you much more than the simple Ohmmeter

tests are capable of showing. The instrument used for this test is a RF Watt meter that measures the radio frequency power actually traveling from the radio up to and out of the antenna. More importantly it can also measure the power that cannot be radiated by the antenna due to some problem with the cable, connectors, or antenna. The correct name for this instrument is VSWR Meter, which stands for Voltage Standing Wave Ratio meter. If you have never used one or don't have one to perform this test you should have a qualified technician do this test.

- The test will show you if there are any kinks, distortion, moisture or other problems in the transmission path that may not be visible during a visual inspection.

If you would like me to check out your VHF radio and the antenna system while we are in Rockland let me know. I'll have some of the basic tools and test equipment with me and will be happy to assist as long as you allow **Gaivota** to finish the races ahead of your boat. And please, if you do, don't be so obvious as to lower your sails before crossing the finish line.