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Made Simple for Cruisers

RF Isolator Placement

The question of where to install an RF Isolator on a Marine HF SSB radio has come up many times when people are installing a new IC M802. We live in a world surrounded by Radio Frequencies. As a result, it is very common for electronic products to include a ferrite core on the line cord to isolate it from RF coming from or to the power source. The antenna system is no different.

What is an RF ISOLATOR?

An RF Isolator is a short piece of coax, surrounded by approximately 5 Ferrite cores, with an SO239 connector at each end. The Isolator is packaged in a PVC tube to seal it against the elements. The RF Isolator is frequently used by Ham operators at the back of the transceiver to eliminate getting shocked on the case of their radio when transmitting. When transmitting the RF field can couple into the coaxial (and other) cables and come back into the transceiver ground creating a shocking experience for the operator.

Background

When I purchased my boat, Sunnyside, it had a Sea 222 HF SSB radio installed with its SEA HF tuner. The radio worked fine but was a very old analog circuits design and would not support a Pactor modem. It was also a very large unit taking up valuable space on the boat.

When I purchased my Icom IC M802, the vendor supplied three snap on ferrite cores with instructions to place two at the transceiver and one at the tuner. After installing the radio and doing some basic testing, the radio seemed to work. I did not have my power/SWR meter on board, but was not that concerned as I was simply replacing a radio in a configuration that worked before.

That fall, I did a presentation with the Icom Marine Product Manager and he emphasized the importance of the RF Isolator being installed, but it was not clear where it was to be installed. He simply explained it was to protect the radio from RF. The following are some important quotes from that Icom presentation that may be useful to installers:

- The automatic tuner should go as far away from the radio as possible in order to minimize RF feedback.
- HF Antenna Coax feed can be any almost any length to feed tuner.
- Avoid adding extra “jumpers”(multiply by .5 db the number of cable junctions)
- Solder on PL-259 Connectors preferred
- Higher quality cable provides less loss. We generally recommend at least RG 8/U
- You need an RF Isolator between your tuner and your transceiver to make sure the transmitter is not reducing its power because of reflected power.

Over the next year I questioned the product manager and one of the technical representatives at Icom USA. I also reviewed the web sites of the manufactures of the RF Isolators. They indicated the basic function of an RF Isolator was to be installed at the back of a radio transmitter to protect the operator from getting shocked as a result of the RF being coupled back into the coaxial cable from the antenna radiation.

Common Practice on Boats

After assisting over 250 boats owned by other cruisers here in Mexico, it appears that the majority of installations do not include an RF Isolator. Many installations do not have snap on ferrite cores on the coaxial or control cable. The boats that were reviewed include Ham rigs, IC M700 Pro, IC M710, and the IC M802.

Approximately 20% (36 out of 178 installs) of the IC M802 installations tested had a single RF Isolator, typically connected at the tuner end of the coaxial cable between the IC M802 and the AT 140 tuner. In approximately 30% of the IC M802 installations, one or two snap on cores were installed at the back of the transceiver and at the tuner. Very few installations have snap on cores in the tuner control cable.

22 March 2014

Does the radio work with or without a RF Isolation?

In the majority of cases the IC M802 works fine with no ferrite cores or RF Isolators installed. There does not appear to be a need for RF Isolation for many installations. However all of the units that had high reflected power impacting the operation of the radio were M802s with either no RF Isolation or in some cases with an RF Isolator at the tuner end of the cable.

While it is common to find no cores at the transceiver end, my first indication of a potential reflected power issue has been receiving a shocks while holding the watt meter case while transmitting at 100% modulation.

Boats that typically have reflected power issues even with RF Isolators installed at the tuner:

1. The transceiver is installed to close to the antenna tuner
2. A short stay is used as an antenna such that the transmission is much more horizontal to the boat that it would be on a typical backstay.

In the above cases, moving the RF Isolator to the back of the transceiver allowed for proper operation of the radio.

The reason some boats have issues and others do not may be because of wire/coaxial cable routing, the grounding system, or other physical aspects of the boat design. I frequently see boats that were installed months or even years before, so it is possible that other un-known factors come to play such as additional corrosion from the atmosphere.

Frequently it appears the installer never tested the installation. As result of the user's lack of experience with HF SSB, they assumed it was their lack of knowledge and not the installation. After paying a few thousand dollars to have a radio installed, it is true it should work, but frequently not the case. I typically find much better installations that were completed by the boat owners. Most boat owners take their time and install things with loving care and are not working against the clock so they can move on to the next installation.

Specific Boat Issues

In 11 cases I found that without RF protection of the IC M802 directly at the back of the transceiver, the radio had a high SWR indication when transmitting and reduced power. In those cases I also received a shock from the case of the SWR/power meter. In these cases the general installation was good and showed no corrosion. Nine of the installations were relatively new installations. By moving the RF Isolator to the back of the transceiver or in a few cases by installing 5 snap on ferrite cores at the back of the transceiver, the high SWR condition and shocking condition was eliminated.

Not having RF Isolation at the tuner end of the coaxial cable typically results in more radiation in your boat from the coaxial cables and usually into a cable run. So neither end of the Coax should be ignored for an Icom IC M802.

Discussion

The IC M802 seems to be more sensitive to reflected RF than other units tested for both Ham and marine radios installed on cruising boats. It could be as a result of the IC M802 having multiple central processors and as a result needs much better protection from RF.

The majority of IC M802s work fine without RF Isolation. However, if someone is installing a new radio, the additional cost to add RF Isolation is minimal and makes sense to not skip RF Isolation. When Cruisers are in a marina or even at an anchorage, the RF can bounce around and result in a SWR indication so RF can come back into the radio. Again, adding protection at installation makes good sense.

Many cruisers have tried to find RF Isolators and snap on ferrite cores here in Mexico. They have not been successful. As a result, installing the protection in the US or Canada will provide the best solution.

RF Isolators vs snap on Ferrite Cores

I have two issues with RF Isolators. An RF Isolator adds an additional connection and an un-known piece of coaxial cable inside the PVC tube to the transmitter output. Basically, these are probably not a major issue, but over time connections corrode.

Snap on Ferrite Core have the issue of un-snapping if not tie-wrapped in place, but they are my preferred method.

22 March 2014

Recommendation

Ferrite Cores are relatively in-expensive and add no additional connections. Adding the following cores will result in a 99% probability of a good operating system.

1. Use RG 213 or RG 8 (if 213 not available) Coaxial cable.
2. Install the transceiver close to the battery.
3. Install the tuner close to the antenna.
4. I recommend at least 5 snap on ferrite cores at the back of the radio to protect the radio from all RF.
5. I recommend three to five snap on ferrite cores at the tuner end of the cable.
6. Use the same ferrite cores on the tuner control cable, but loop the cable through the core twice.
7. Add Ferrite cores to all cables coming in or out of the IC M802

Boats with this configuration never have an SWR indication on the Icom IC M802.