

RFI (Radio Frequency Interference) And How To Stop It From Crashing Your Digital Ham Radio

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“RF in the shack” in years past meant you might get “bit” by the mic if it touched your face – but in the digital age, it can mean USB ports lock up, computers freeze, digital signals from your trusty ham radio come to a screeching halt. After the issue of simply getting your Signalink or other interface device properly wired up to your radio, conquering RFI is probably the most thorny problem that new digital hams face. When you hit the TX button and everything freezes....that's a clue!

Whenever RF energy is *flowing through*, or *radiating from* the grounds, cases, shields, and braids of your ham shack wiring or coax cables, you are possibly going to have enough of a voltage difference between “ground” potential of one device (Signalink) and the next device (USB port) that semiconductor junctions get inappropriately activated....leading to crashes.

It is devilishly difficult to understand, because at HF or VHF frequencies, every wire, every loop, every surface can have an inductive or capacitive reactance – ground wires aren't merely wires any more, they are transmission lines!

Here are some suggestions based on what has worked for me, in operating four digital stations:

1. **BALANCE.** Fully balanced antenna systems, while not required, will be easier to deal with. Coax (at RF frequencies) has **not just two, but actually THREE conductors:** inner conductor, inner SURFACE (skin effect) of the braid, and OUTER SURFACE of the braid (skin effect again!). The current on the first two will likely be equal and opposite (no radiation) – but that third conductor, the outer surface of the coax cable, can support an unbalanced current that turns your transmission line into yet another antenna, which goes all the way back to, and even includes the case of your transceiver. A “balun” device may add sufficient impedance into this third conductor system that it damps down that current/radiation so that your RFI problems disappear. Try a full dipole (two quarter wave wires with coax connecting the middle). Then put a balun in the coax line either at the center of the antenna or as close to the antenna as reasonable. I've used inherently-unbalanced off-center-fed “Windom” antennas successfully with digital systems – but definitely using a balun! Without the balun you are almost certainly going to have some radiation from your transmission with inherently unbalanced antennas. Use the balun to stop that from making it all the way back to your station. (I never ever used a balun until I started digital.) At HF, toroidal products abound for purchase. For VHF/UHF, several turns of coax in a nice pattern on a PVC form add the required impedance (more effective than “scramble wound” without a form).

<http://www.hamuniverse.com/w7lpnvertdipole.html>



2. **Shielded USB cable.** The single most important thing I learned the hard way was to use a SHIELDED USB computer cable between a Signalink and a laptop computer. Very sneaky crashes were eliminated by replacing a cheaper cord with a \$5 shielded USB cable. The one I used was:

https://www.amazon.com/gp/product/B001MSU1HG/ref=oh_aui_detailpage_o05_s00?ie=UTF8&psc=1

3. **RF ISOLATOR** For HF, an inexpensive RF ISOLATOR on the coax transmission line seems to help. These may be the bifilar wound toroid, or a bead based product. They aren't expensive. I've used this one but there are many others on the market:

<http://www.mfjenterprises.com/Product.php?productid=MFJ-2912>

4. **Snap-on ferrite cores** should be used liberally on all digital lines and anywhere else you can think of. If you buy ones with larger thru-holes, you can even make a couple or 3 turns of the cable like a toroid inductor. Here's an inexpensive set to consider:

https://www.amazon.com/gp/product/B01E5E5IY4/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1



5. **LOOPS** Even simple loops (“scramble-wound”) of signal or coax cables, held in shape with zip ties, can help.



6. **CAPACITORS** I had a PACTOR modem that would crash....until I put a small bypass capacitor (0.01 microfarads, short leads) right at the power input to the modem. Now I put filter capacitors on any 12 volt line going to any fancy modem.
7. I had a TNC-X that would hang (in transmit) at times when connected to a lowly Baofeng via a professionally made TNC cable....until I put a 28K resistor from base to ground on the open collector output transistor of the TNC-X. The CMOS output from the 8-bit microcontroller still keys the PTT transistor perfectly, but *something*--- leakage or RF or whatever-- no longer keeps the transistor conducting enough to key the transceiver when the microcontroller wants to go to RECEIVE mode. Can't prove it, but the problem got better.

Hope these ideas help!