

RFI Removal from Microphone Inputs

Many amateur radio stations today are experiencing terrific RFI (Radio Frequency Interference) that is impeding their audio signals and causing very garbled and distorted audio. Careful listening indicates that MANY SSB signals on the air today exhibit RFI – sometimes not enough for the other stations to notice (because they are listening on a 3? speaker in their transceiver), but careful listening in a wideband receiver with VERY high quality receiving equalizers and studio monitor speakers allows this slight interference to become VERY annoying. And, of course, there are also signals on the bands that have terrible problems with RF getting into their audio lines, causing all sorts of problems.

1. Shielding of the Mic Connector

We, here in the Heil Sound lab, have discovered a very interesting fact. Most of the major transceivers today do NOT ground their microphone shields! That's correct – the mic connector shields FLOAT! Now wasn't this one of the FIRST things we learned about building RF transmitters with speech audio sections? GROUND those shields!! So, we came up with a very simple fix that just about anyone can make to their rig. You don't have to get inside the radio, so you don't void any warranties. The fix is simple and effective.

This applies to the 4 and 8 pin Foster (that's the Japanese company that builds those dang little mic connectors!!) microphone connectors so common on today's rigs.

First, unplug your Heil (what – you don't have one yet??) microphone cable from the front panel of the transceiver. Do this first, because you don't want the mic plug connected to the sensitive circuitry inside the radio while you're soldering.

Remove the two small #4 Phillips head screws and the cable clamp they hold. Then remove the tiny Phillips head screw that holds the rest of the metal sleeve. Slide that back onto the mic cable. Now, cut off the end of a resistor, or get a piece of #20 solid, tinned wire about 3? long. Locate the mic pin that has the shield of the mic cable soldered to it.

With a small iron, carefully solder this solid wire to that shield and pin. Bring the sleeve back up the cable and attach to the connector with the small screw. This leaves the solid wire coming out the back of the connector. Replace the cable clamp, and (as you do that), tightly wrap that solid wire around one of the #4 Phillips head screws and tighten the clamp assembly very well.

What you have accomplished is grounded the shield to the transceivers chassis ground through the ring on the mic connector. (Make sure that ring is tight). This has been a big help to many stations with RFI problems and should help you clean up your signal.

2. Eliminating Common-Mode Current from Shields

Common-mode current can be a serious problem in amateur radio stations. This current, which can start flowing due to mutual coupling between an antenna and your coax, frequency-sensitive problems in your station ground, or a floating ground in your rig's power supply, can create any number of headaches, including RFI on your microphone line. In a nutshell, "ground" can "rise above ground" on some frequencies.

Several remedies are available.

A simple one is to wind a coil in your coaxial cable, about 8 or 10 turns of about 6? diameter, as close to the rig as possible. Hold the turns in place with black tape. This forms an RF choke like the one often used at the feed point of a dipole, Yagi, or Quad, and for the same reason. This choke can break up the current flow, and may have miraculous results (both in terms of effectiveness and simplicity!).

Another tactic is to slip snap-on ferrite cores onto the microphone line. On an AD-1 boom set adapter cable, snap one core onto the PTT line, another onto the microphone line, and another over the combined cable. If you are hearing RFI in

your headphones, slip one or more cores onto the headphone line.

Earlier, it was mentioned that your rig's power supply might be involved. Many power supplies, especially switching-mode types, use a floating ground. A number of Astron® power supplies, which are very popular because of their low cost and excellent performance, use a floating ground. This can cause an amateur transceiver to take off scanning when you transmit or set up common-mode current. The solution is to connect a short strap from the power supply's Black (negative) output terminal to the chassis of the power supply (often there is a convenient ground lug inside the cabinet). Then, connect 0.01 μF and 0.001 μF 50-volt disc ceramic capacitors from the red (+) to the black (-) output terminals; the capacitors will shunt any RF on the DC line to ground, which now really is ground. Please use caution when doing any work inside your power supply, and utilize the services of a qualified electrician if you have any doubts about your capabilities. Heil Sound, Ltd. specifically disclaims any responsibility for personal injury or damage to the equipment caused by improper modification work on station components.

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The majority of RFI problems evolve around grounding systems of the stations. Several of the transceiver manufacturers do NOT ground the microphone shield. Here's a simple fix you can try. It just may be the ticket to removing your RFI.

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Early ICOM (everything before PRO series)

Early ICOM - that's every ICOM before the great PRO series - had very low-level microphone preamplifiers. Traditionally they are 20 dB down in gain from the standards set by Collins, Kenwood, Yaesu, etc. years ago. ICOM came to America in the early 70's with their "zero" models (720, 730 and 740) all which had NO mic preamps built in. The microphone preamplifiers were in the microphone! How stupid. This did not allow you to use any other microphone but THAT mating microphone since half of the audio circuits were in the mic. A very cost effective method to bringing those ole 'zero' transceivers to life is to use a small Behringer UB 502 mixer or W2IHY two band EQ plugged into the mic input. NOW you can use a Heil GM-5, HM-10, PR 20 or any of our dynamic microphones and have 2 band EQ besides.

With enough outrage and complaints, ICOM finally moved the preamp section into the radio starting with the 735, 745, 751, etc.; however, those "new" front ends were still 15 dB down in gain from everyone else, still making it difficult to use anything but the ICOM SM-6, SM-8, etc. preamplifier microphones - mics with WAY too much sensitivity that picked up everything. Cardioid pattern dynamic mics are the only thing to use in an amateur radio shack, as they will reject from the rear and only pick up your voice. Talk no more than 2' away from the element.

Our dynamic elements will work with some of those early ICOM models (not the "zero" models) by using the compression - all the time- at a low level. A compressor at low levels actually acts as a low-level preamplifier. Adjust the mic gain to about 3/4 open and set the compression about 4 to 6 dB and those great little 735, 751, etc. usually will work with our dynamic elements such as the HC-4 and HC-5. Of course, using the outboard mixer or EQ will provide ample input gain and is really the way to solve the low gain ICOM problem.

ICOM AMERICA knew of this problem and a few years ago invited Heil Sound to help solve the problem and solve it we did by developing our high-performance Heil "iC" condenser. Not the usual 15-cent import electret but a very high-quality condenser electret as used in many studio microphones. The electret, by its design, has LOTS of output and will drive the early ICOM rigs (not the "zero" models) to full output, and it sounds terrific. Your 775, 781, 761, 751, 745, etc. NEVER, and we do mean NEVER, sounded better than when using the Heil iC product. This also applies to the iC910 and the great little iC718

All of the Heil "iC" products work well with the great little IC-706. You need the AD-1 iCM modular adapter and one of the new high-performance Heil "iC" products such as the "iCM," Traveler, etc. This will make a new transceiver out of the little jewel. The IC-706 (before the MkIIIG) will NOT work well with our HC or GM elements, as the 706 is short on mic preamp gain, so you need to solve the low audio problem with one of the new Heil "iC" products or use an outboard mixer or EQ. Be sure to adjust the carrier balance control (Q4 or Q6) for the desired transmit tone. This is VERY important.

So, the bottom line for those wonderful old 735, 745, 761, 765, 756, 781, 775, 751, etc., is to use any of our products using our new high-performance Heil IC electret elements: the HM-iC, PRO-SET iC, PRO-SET PLUS iC, BM-10 iC, or the wonderful "iCM" microphone. These are the products that should all be called the "ICOM FIX!"

The original 746 (Not the 746 PRO or 7400) was in-between the very low-level inputs of the early models and the higher input levels of the great PRO series. The IC-746 works well with our dynamic microphones - BUT you have to adjust the 746 correctly. Set the Mic gain at 3/4 open, Compression at 50% (back panel control), and TCN (tone control network) at + 12dB for the GM and +6dB for the HC-5. The "iCM" has plenty of drive for the 746, and it sounds beautiful also.

ICOM finally got it right with their fabulous PRO and 7800 series. These have righteous microphone preamplifiers that will support any of our low-level high-performance dynamic microphones. The best combination in amateur audio today is the Heil PR 781, PR 40, the Classic, the GM microphone, the PRO-Set, or PRO-SET PLUS headsets into one of the PRO or 7800 models. It just doesn't get any better. Properly adjusted, spoken into at the right distance, this combination is THE overall winner. Use the CC-1-i microphone connecting cable or the AD-1-i headphone adapter for iCOM. Any of the "iC" products also will work with the PRO or 7800 series; just be careful to adjust the mic gain for proper ALC action, as the Heil "iC" products have lots of output.

Always keep in mind that the ONLY way to adjust the Microphone Gain control is by watching the ALC meter. Only your voice peaks will send it to the red. You watch the ALC meter to adjust the microphone input gain.