ELECRAFT Application Note

Improving the Immunity of the Rear-Panel RS232 and Audio Connectors to RF

Background

Some K3 owners have noted RF pickup problems in lines connected to the K3 rear-panel MIC, PHONES, PC IN/OUT and RS-232 rear-panel connectors. This Application Note describes how to improve the RF grounds on those connectors by bypassing RF chokes in the ground return lines.

When encountering RF pickup, noise radiation or other problems associated with cables connected to the K3, be certain you are using cables with effective RF shielding. The shielding used on audio cables is seldom useful at RF. You may eliminate the problem simply by using small-diameter coaxial cable designed for RF applications, such as RG-174U. In any case, poorly shielded cable may cause trouble even after completing this modification.

Most issues with RF pickup through the rear panel cables are traced to the MIC input where bypassing the RF choke has made a significant improvement. Later K3s are modified at the factory to bypass this choke (see *Was the Change Incorporated in my K3 at the Factory?* below). The audio PC IN/OUT circuits use isolation transformers and are not a likely point for RF intrusion. However, there may be a benefit bypassing these chokes in some cases when they are connected to unbalanced circuits, such as the audio input and output on a typical computer. Similarly, bypassing the RF choke in the RS232 ground return may help in some cases.

Was the Change Incorporated in My K3 at the Factory?

If you are not concerned with bypassing the chokes in the other circuits, you can check your to see if your K3's microphone connector has been modified without opening the K3. Use a DMM to measure the resistance between the ground ring (visible just inside the lip of the connector) and chassis ground. **Do not use the metal shell of the ACC or RS232 DB-9 connectors for chassis ground. They are normally isolated from the chassis**. Good ground points include the GROUND screw, the metal ring on the PADDLE or KEY connectors, or the metal rings on the ANT1 or ANT2 connectors.

The resistance should be less than 1 ohm. If the resistance is >3 ohms, the modification has not been done on your K3. Note that many DMMs show a resistance of > 1 ohm when the leads are touched together. First touch the leads together and note the reading, then subtract that value from the reading you get when making the measurement.

Tools and Test Equipment Required

You will need a Phillips screwdriver for removing the case screws, diagonal cutters, long nose pliers and a temperature controlled ESD-safe soldering iron with rosin core small diameter solder. A grounded wrist strap and ESD dissipating mat are recommended whenever you work inside your K3.

Procedure

The RF chokes are located on the Remote I/O and Audio I/O modules just inside the rear panel. They are accessed easily by removing only the top cover and one small panel on the back of the K3.

☐ Remove the K3 top cover as shown in Figure 1.

⚠ **Whenever you remove screws from a panel, if one screw seems too tight to loosen without damaging it, first loosen the other screws then try again. Sometimes one screw binds in its hole when the other screws are tightened.**
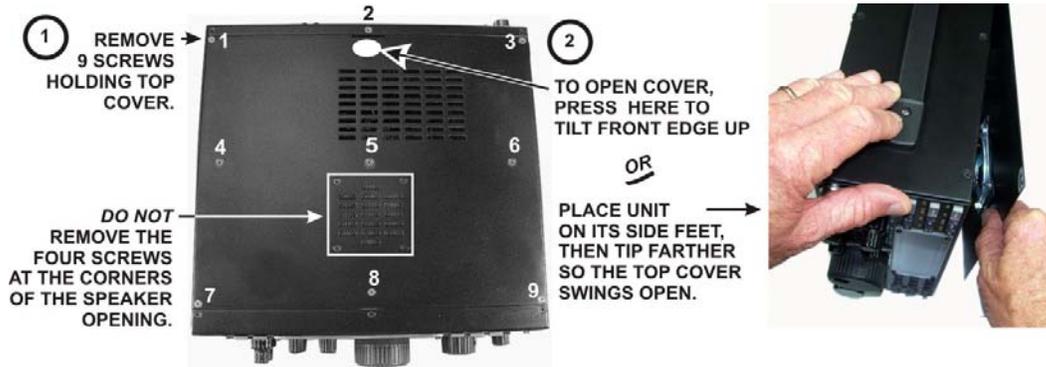
Figure 1. Removing the Top Cover.

☐ Remove the Remote and Audio I/O modules as shown in Figure 2.

⚠ *CAUTION:* **The boards are ESD sensitive. Wear an ESD wrist strap or touch an unpainted, metal ground frequently while working.**
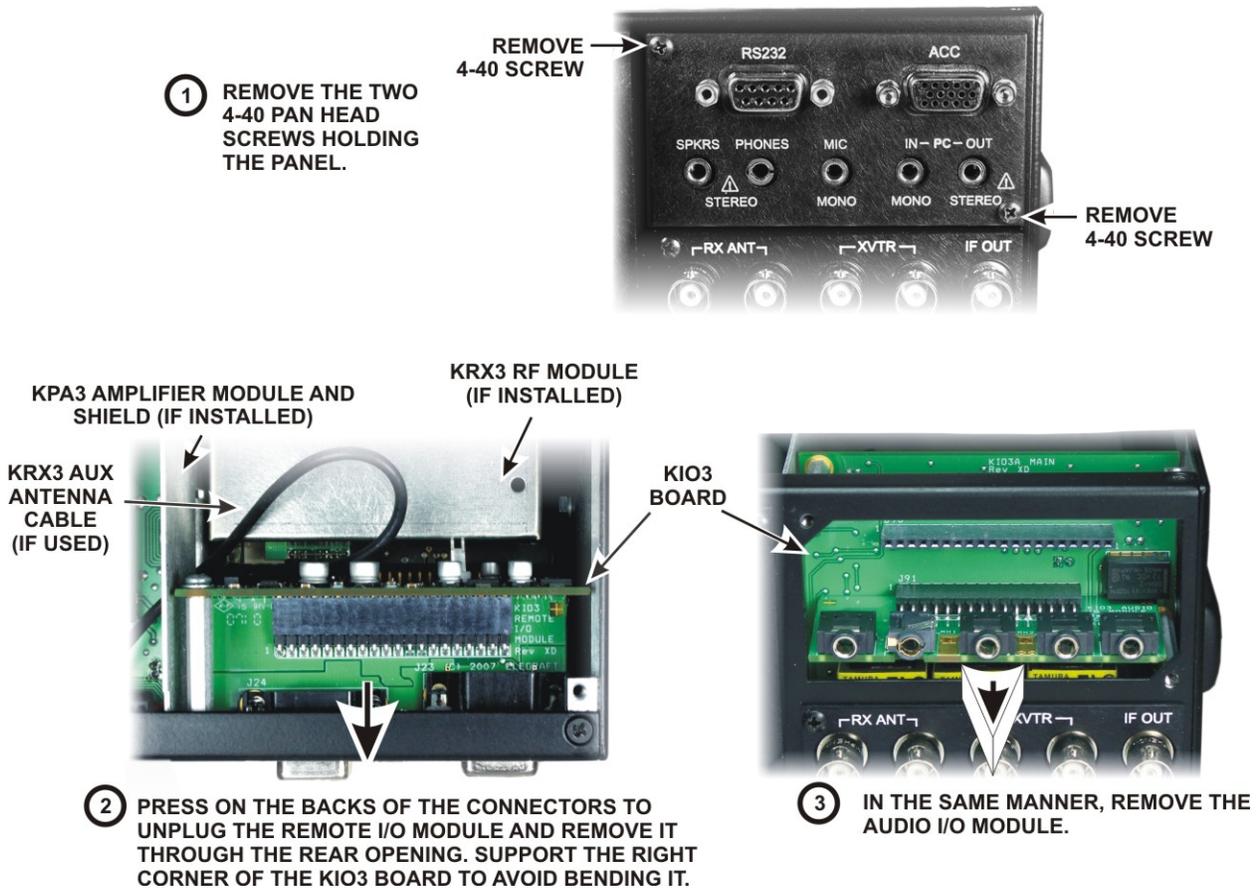
Figure 2. Removing the Remote and Audio I/O Modules.

☐ If you have a revision XD Audio I/O module, ensure the long jumper shown in Figure 3 is installed. The revision is printed on the top side of the board. Install the jumper if it is missing.

☐ Install the MIC ground choke bypass jumper on the Audio I/O module as shown in Figure 3 using a short piece of wire such as a discarded component lead.
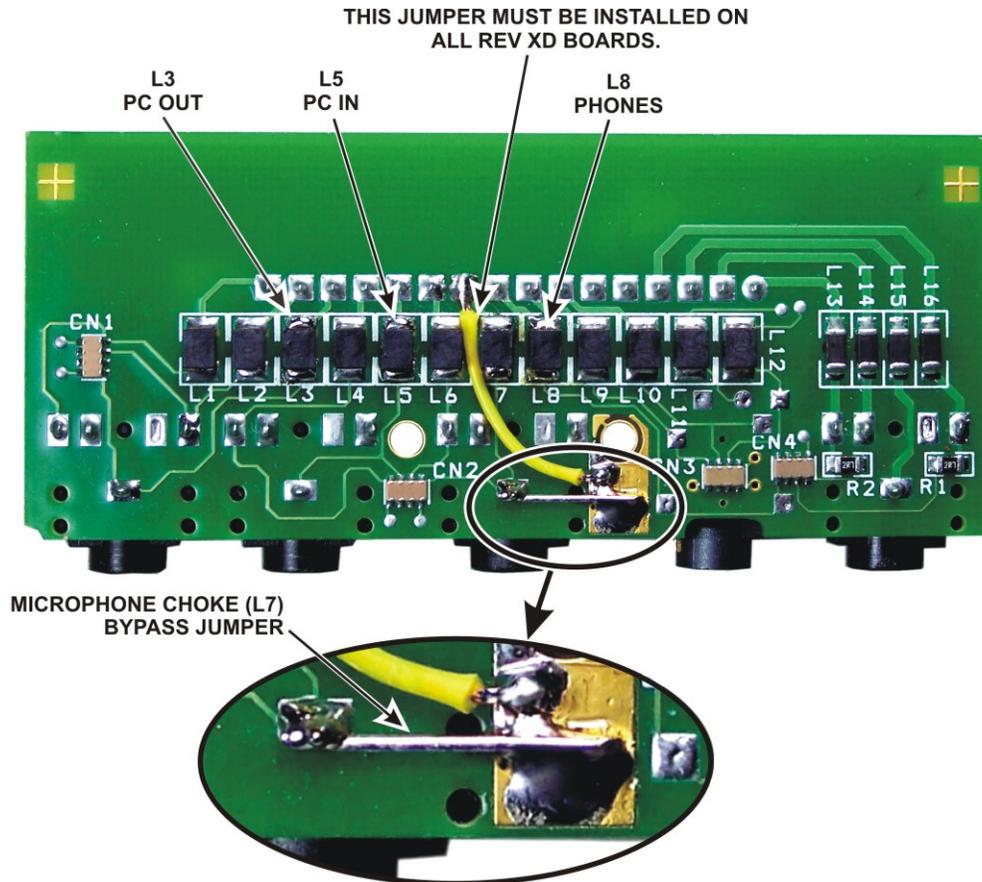

Figure 3. Audio I/O Module Choke Locations.

☐ If you wish to bypass the ground chokes for the PC OUT, PC IN and PHONES jacks (L3, L5 and L8 on the Audio I/O Module shown above), you can remove the chokes and replace them with short jumpers across the solder pads or you can fashion a wire jumper that goes over the existing choke as shown in Figure 4.The chokes are glued to the board as well as soldered. If you do not have proper tools to remove them safely without damaging the traces on the board, we recommend you use the wire jumpers shown. They are as effective as removing the choke. Be sure the loop passing over the choke does not stand more than 3/16" (4.7 mm) above the board. If it is higher it may strike the transformers on the main KIO3 board.
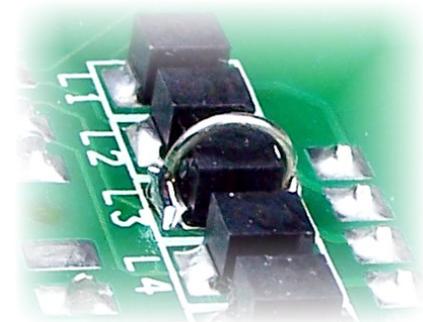

Figure 4. Typical Jumper (See Text).

☐ If you wish to bypass the ground choke for the RS232 connector, jumper L1 on the Remote I/O Module (see Figure 5).
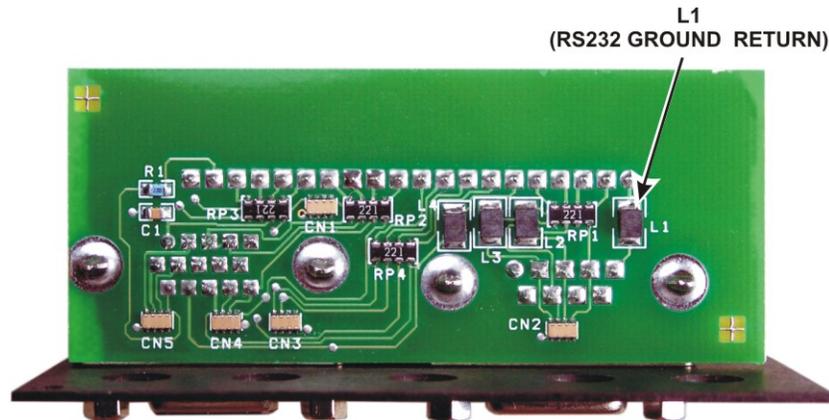

Figure 5. RS232 Ground Choke on the Remote I/O Module.

☐ Replace the Audio and Remote I/O modules by reversing the procedure shown in Figure 2. Support the KIO3 main board while mating the connectors to avoid bending it. Be sure the connectors are fully mated and that the connectors on the Audio I/O module line up with the holes in the rear panel.

☐ Hold the top cover above the K3, route the speaker wire under the stiffener bar and plug it into P25 on the KIO3 board at the left rear of the K3 as shown in Figure 6.

Figure 6. Connecting the Speaker Cable.

☐ Replace the nine top cover screws shown in Figure 1. Replace and tighten all the screws. Loose or missing screws may result in birdies or other hard-to-locate problems with your K3.

This completes your grounding modification for the rear-panel audio and RS232 connectors.