ELECRAFT® K3

HIGH-PERFORMANCE

160 – 6 METER TRANSCEIVER

KBPF3 GENERAL COVERAGE RECEIVE OPTION
100-400 kHz MODIFICATION KIT INSTRUCTIONS

Rev A2, June 29, 2015

Contents

⚠ Elecraft manuals with color images may be downloaded from
www.elecraft.com.

Introduction

This kit modifies a KBPF3 General Coverage Receive option board to optimize receiver sensitivity outside of the Ham bands from 100 KHz to 30 MHz and from 48 MHz through 54 MHz. If you have a KRX3 or KRX3A sub receiver equipped with a KBPF3, it must be modified as well to obtain the same performance below 500 kHz. If the modified KBPF3 option is installed in a K3 (not K3S) a small modification must be made to the K3 RF board to obtain optimum sensitivity on the lower frequency tuning range. .

A kit of the parts required are available from Elecraft. Order the KBPF3MDKT. This kit includes the parts modify a K3 RF board and associated KBPF3 board. If you are modifying both the main K3 receiver and a sub receiver you will need two kits.

Installation of this modification requires soldering small SMD parts (see Figure 14 on page 15).

> ⚠ **In order to take advantage of the extended low frequency tuning range, your K3 transceiver must be equipped with KSYN3A synthesizers. The KSYN3A synthesizer is standard on the K3s and newer K3 transceivers. Refer to the KSYN3A Installation manual on the Elecraft web site to determine whether your K3 is equipped with the KSYN3A synthesizer.**

Customer Service and Support

Technical Assistance
You can send e-mail to k3support@elecraft.com and we will respond quickly - typically the same day Monday through Friday. Telephone assistance is available from 9 A.M. to 5 P.M. Pacific time (weekdays only) at 831-662-8345. Please use e-mail rather than calling when possible since this gives us a written record of the details of your problem and allows us to handle a larger number of requests each day.

Repair / Alignment Service *(We want to make sure everyone succeeds!)*
If necessary, you may return your Elecraft product to us for repair or alignment. (Note: We offer unlimited email and phone support to get your kit running, so please try that route first as we can usually help you find the problem quickly.)

IMPORTANT: You must contact Elecraft before mailing your product to obtain authorization for the return, what address to ship it to and current information on repair fees and turn around times. (Frequently we can determine the cause of your problem and save you the trouble of shipping it back to us.) Our repair location is different from our factory location in Aptos. We will give you the address to ship your kit to at the time of repair authorization. *Packages shipped to Aptos without authorization will incur an additional shipping charge for reshipment from Aptos to our repair depot.*

Preventing Electrostatic Discharge Damage

Sensitive components may be damaged by Electrostatic Discharge (ESD) simply by touching them or a circuit board containing them unless you take specific steps to prevent such damage. Damage may occur with static discharges far too little for you to notice.

A damaged component may not fail completely at first. Instead, the damage may result in below-normal performance for an extended period of time before you experience a total failure.

Parts which are especially ESD-sensitive are identified in the parts list and in the assembly procedures.

We strongly recommend you take the following anti-static precautions (listed in order of importance) to ensure there is no voltage difference between the components and any object that touches them:

- Leave ESD-sensitive parts in their anti-static packaging until you install them. The packaging may be a special plastic bag that allow static charges to flow harmlessly over their surface, or a component's leads may be inserted in conductive foam that keep them at the same potential.

- Wear a conductive wrist strap with a series 1-megohm resistor that will constantly drain off any static charge that accumulates on your body. If you do not have a wrist strap, touch a ground briefly before touching any sensitive parts to discharge your body. Do this frequently while you are working. You can collect a destructive static charge on your body just sitting at the work bench.

⚠ *WARNING*

DO NOT attach a ground directly to yourself without a current-limiting resistor as this poses a serious shock hazard. A wrist strap must include a 1-megohm resistor to limit the current flow. If you choose to touch an unpainted, metal ground to discharge yourself, do it only when you are not touching live circuits with any part of your body.

- Use a grounded anti-static mat on your work bench (see below).
- If you pick up a pc board that was not placed on an anti-static mat or in an anti-static package, touch first a ground plane connection on the board such as a connector shell or mounting point.
- If you use a soldering iron to work on a circuit board, be sure your iron has an ESD-safe grounded tip tied to the same common ground used by your mat and wrist strap.

Choosing an Anti-Static Mat

An anti-static mat must bleed off any charge that comes in contact with it at a rate slow enough to avoid a shock or short circuit hazard but fast enough to ensure dangerous charges cannot accumulate. Typically, a mat will have a resistance of up to 1 Gigaohm (10^9 ohms). Testing a mat requires specialized equipment, so we recommend that you choose an anti-static mat that comes with published resistance specifications and clean it as recommended by the manufacturer. Testing has shown that many inexpensive mats that do not specify their resistance have resistance values much too high to provide adequate protection, even after they were cleaned and treated with special anti-static mat solutions.

Suitable anti-static table mats are available from many sources including:

- U-line (Model 12743 specified at 10^7 ohms)
- Desco (Model 66164, specified at 10^6 to 10^8 ohms)
- 3M™ Portable Service Kit (Model 8505 or 8507, specified at 10^6 to 10^9 ohms)

Preparing for Installation

Tools Required

1. #0 and #1 size Phillips screwdrivers. To avoid damaging screws and nuts, a power screwdriver is *not* recommended. Use the screwdriver that best fits the screw in each step.
2. Small needle-nose pliers or tweezers to position small parts.
3. Flush-cutting diagonal cutter.
4. Soldering iron with a fine tip (0.06" / 1.5mm or smaller recommended)
5. 63/37 or 60/40 rosin-core solder, 0.015" to 0.025" diameter
6. Soft cloth or clean, soft static dissipating pad to lay cabinet panels on to avoid scratching.

The following tools are strongly recommended:

1. ESD wrist strap.
2. Static dissipating work pad.

Parts Included

Check to be sure you received the following parts with your kit. If any parts are damaged or missing, contact Elecraft for replacements (see *Customer Service and Support*, page 3). If you are using your own parts to make the modification, use a solid polymer capacitor as specified. Ordinary electrolytic capacitors are not as effective.

ILLUSTRATION	DESCRIPTION	QTY.	ELECRAFT PART NO.
	220 µF Solid Polymer Electrolytic Capacitor. ⚠ **The capacitor is coated with a thin clear insulation. Do not scrape or cut the insulation. It is required to prevent sort circuits when installed.**	1	E530625
	0.1 µF SMD Capacitor (extra capacitors are included in case you lose one)	3 on strip	E530306

Installation Procedure

Removing the Top Cover and Chassis Stiffener

☐ Disconnect power and all cables from your K3.

☐ Remove the nine screws to free the top cover as shown in Figure 1. After the cover is open, lift it gently to reach the speaker wire connector. Unplug the speaker then set the top cover aside in a safe place.

⚠ **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.**
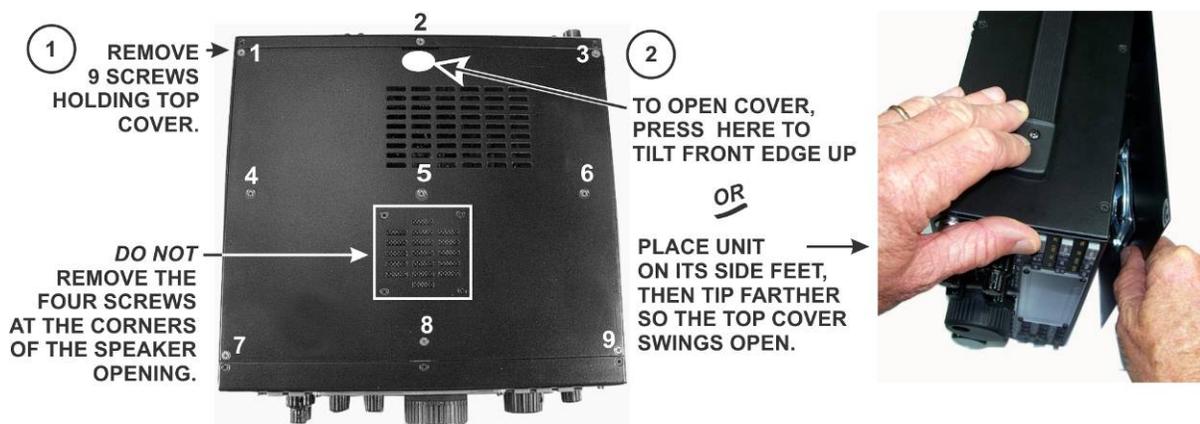

Figure 1. Removing K3 Top Cover.

⚠ **CAUTION: Touch an unpainted metal ground or wear a grounded wrist strap before touching components or circuit boards inside the K3. See *Preventing Electrostatic Discharge Damage* on page 4 for more information.**

☐ Remove the stiffener bar that runs from side to side across the top of the chassis. This is the bar the three screws across the center of the top cover thread into. The bar is held in place by a single screw at each side. If the KPA3A or KPA3 100 watt amplifier option is installed the stiffener is attached to the shield around the amplifier by two screws. Some older KPA3 shields have PEM nuts permanently attached to the shield for the screws. Others use ordinary nuts that must be removed with the screws and lock washers.

① **REMOVE 4-40 BLACK FLAT HEAD SCREWS ATTACHING THE STIFFENER TO THE SIDE PANELS**

② **IF THE KPA100 100-WATT OPTION IS INSTALLED, REMOVE 4-40 1/4" (6.4 mm) ZINC PAN HEAD SCREWS ATTACHING THE STIFFENER TO THE SHIELD**
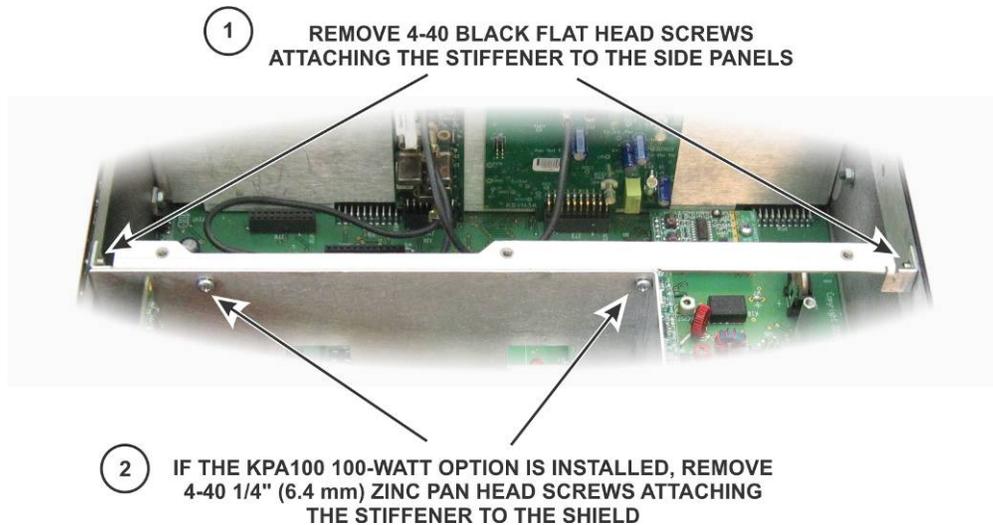
Figure 2. Chassis Stiffener Bar.

☐ If you do not have the K144XV 2-meter option installed, skip the next section and go to *Removing the KRX3 or KRX3A Sub Receiver Module* on page 8 if you have the sub receiver installed. If no sub receiver is installed, go to *Modifying the Main Receiver* on page 13.

Removing the K144XV 2-Meter Module

☐ The K144XV module is mounted on the left side panel of the K3. Remove the five screws shown in Figure 3 and lift the top cover off of the module. Note: Some units may have a sixth screw in the hole near the Elecraft name on the top cover that must be removed.

Figure 3. Removing the K144XV 2 Meter Module.

☐   Unplug the coaxial cables and the power connector attached to the K144XV module. Pull on the metal part of the TMP coaxial connectors (see Figure 4) . Do not pull on the cables.

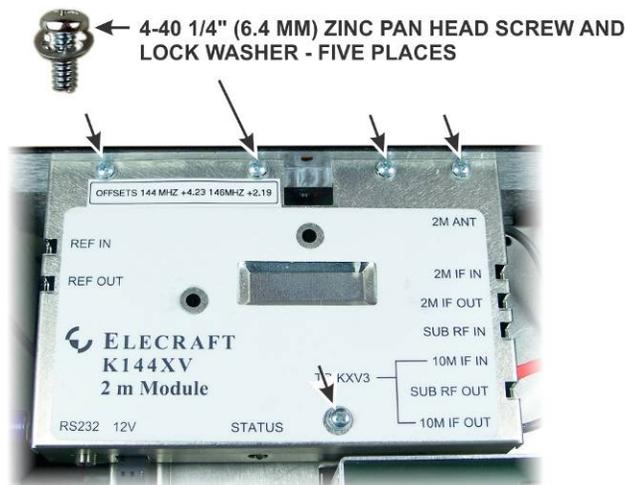☐   Remove the three 6-32 screws that secure the K144XV module to the side panel. Hold the module to keep it from falling if the KRX3 sub receiver is not installed. Lift the module out, set the top cover on it to protect it, and set it aside in a safe place.

☐ If your K3 is not equipped with the optional KRX3 or KRX3A sub receiver, skip the following section and go directly to *Modifying the Main Receiver* on page 13

Removing the KRX3 or KRX3A Sub Receiver Module

The sub receiver module is the "L" shaped metal enclosure (see Figure 5). Remove the sub receiver module as follows:

☐ Remove the KRX3 RF module as follows. The circled numbers refer to Figure 5 on page 9.

 ─   Remove the two long screws ① that attach the sub receiver enclosure to the K3 main board.

 ─   Grip the knurled nuts ② and lift the enclosure up and out of the K3. The enclosure will unplug from two interface boards ③, one near the front and the other at the back. Also there will be two coaxial cables attached to the forward edge and usually one cable attached at the back of the enclosure. Carefully unplug these cables holding onto the metal finger grip, not the black coax (see Figure 4). The connectors are held by friction and slide apart. They do not unscrew.

Figure 4. TMP Coaxial Connectors

☐   Remove the two small interface boards ③ that plug into the board on the bottom of the K3 and the sub receiver enclosure. The boards may still be attached to the K3 main board or may be attached to the connectors on the sub receiver module. Set them aside in an ESD-safe place.

☐ Place the sub receiver RF enclosure on your work table.

.

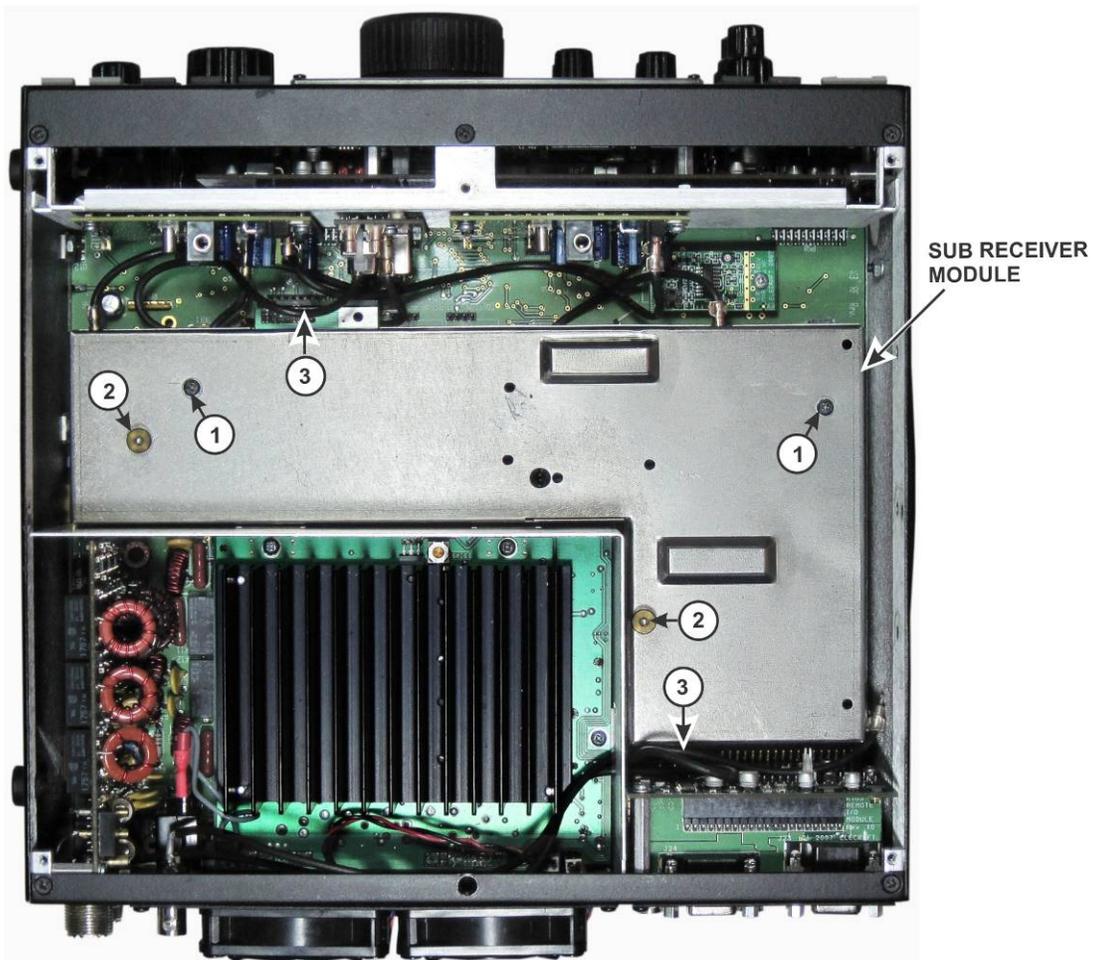
Figure 5. Removing the KRX3 or KRX3A Module.

☐ Directly under the front of the sub receiver module is a battery with a clear plastic cover (see Figure 6). Slide the cover off so it does not become lost. You will need to replace it later.
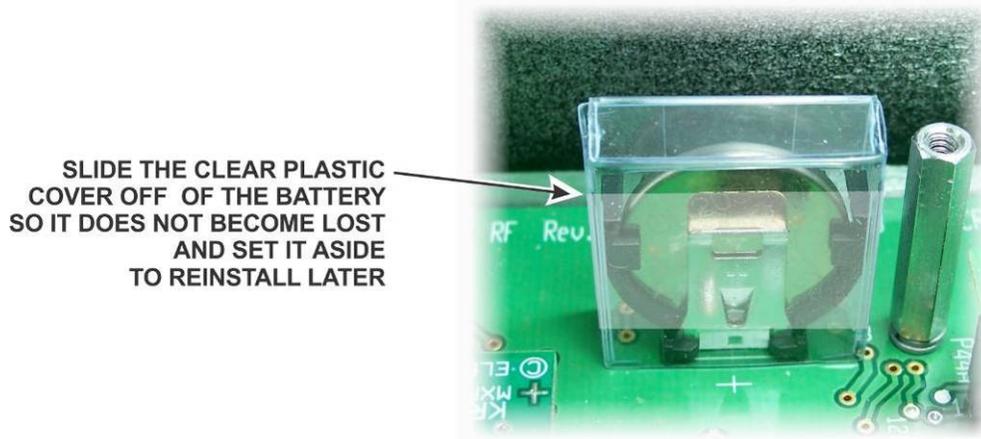
Figure 6. Removing the Battery Cover.

☐ If you are <u>not</u> modifying the sub receiver go directly to *Modifying the Main Receiver* on page on page 13.

Modifying the Sub Receiver

☐   Remove the two knurled nuts (Figure 7) and lift the top half of the sub receiver RF enclosure off of the lower half. As you lift the KRX3 module, it will unplug from two small interface circuit boards. One is at the front and the other is at the rear. These small boards may come out with the module or they may remain attached to the K3 main RF board.

Figure 7. Removing the Top of the Sub Receiver Enclosure.

☐ Remove the main pc board from the lower half of the enclosure as follows (see Figure 8):

— Remove the two sleeves ① from the long screws.

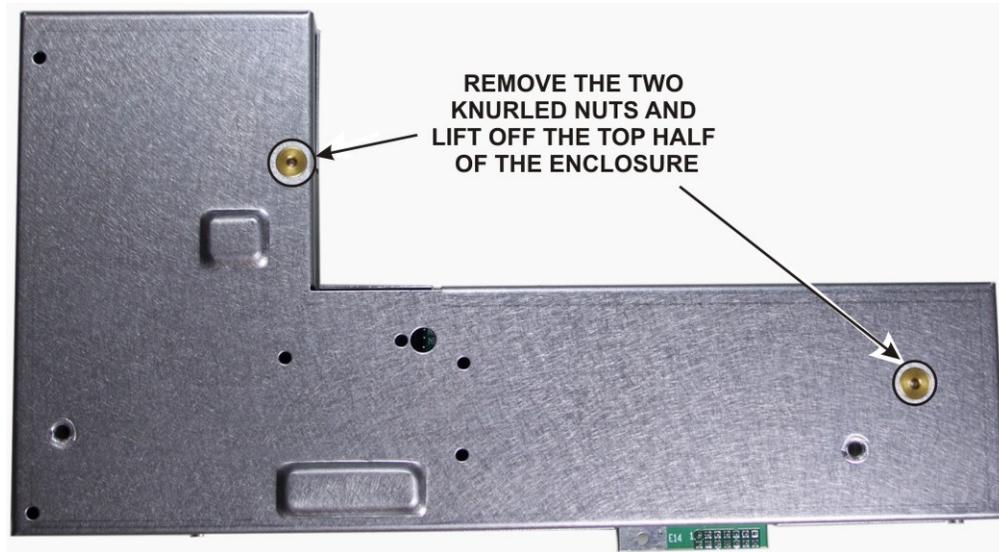— Remove the two screws and lock washers holding the KBPF3 board and the screw and lock washer holding the KNB3 board ② and unplug them from the main sub receiver board.

— Remove the two screws ③ securing the KRX3 main board to the bottom half of the enclosure. These screws thread into bushings attached to the enclosure with screws. If a screw seems to turn without loosening, hold the corresponding screw on the bottom of the enclosure so it cannot turn.

— Lift the main board out of the enclosure. It is a tight fit. There may be small bumps along the sides of the board that snap into holes in the sides of the enclosure. Start by lifting carefully at the two extensions where the board extends outside of the shield while pressing down on the edge of the shield to free it then work the board up and off of the long screws.
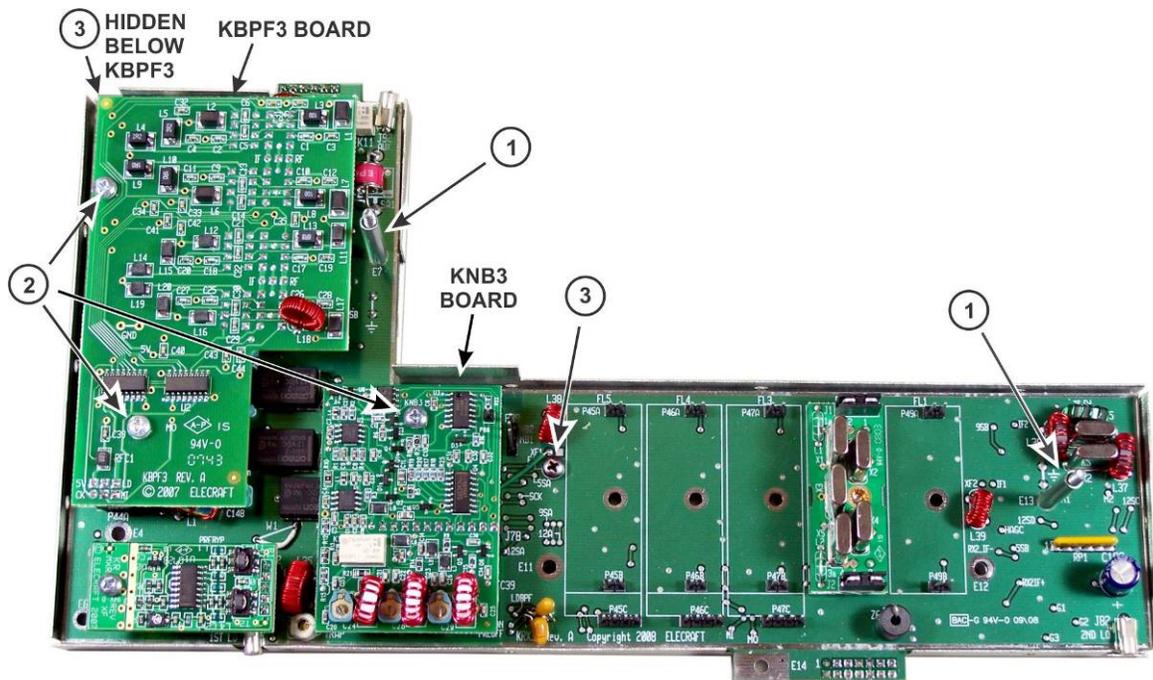
Figure 8. Removing the Main Board from the Enclosure.

☐   Install the poly capacitor on the sub receiver main board as shown in Figure 9. Bend the leads so the capacitor lays against the pc board next to J78 as shown so it will fit under the KNB3 module. Recommend you solder from the bottom side of the board. Clip the leads flush after soldering.

⚠ **Observe polarity when installing the capacitor. Unlike older electrolytic capacitors, the negative lead on the solid polymer electrolytic capacitor is marked with red instead of black.**

Figure 9. Mounting the Poly Capacitor on the Sub Receiver Main Board.

☐   If you are only modifying the sub receiver and not the main K3 receiver, go directly to *Modifying the KBPF3 Module* on page 14, otherwise continue with *Modifying the Main Receiver* below.

Modifying the Main Receiver

☐ Remove the KNB3 and KBPF3 modules from the K3 (see Figure 10). Remove the screws shown, lock washers, and unplug both modules.
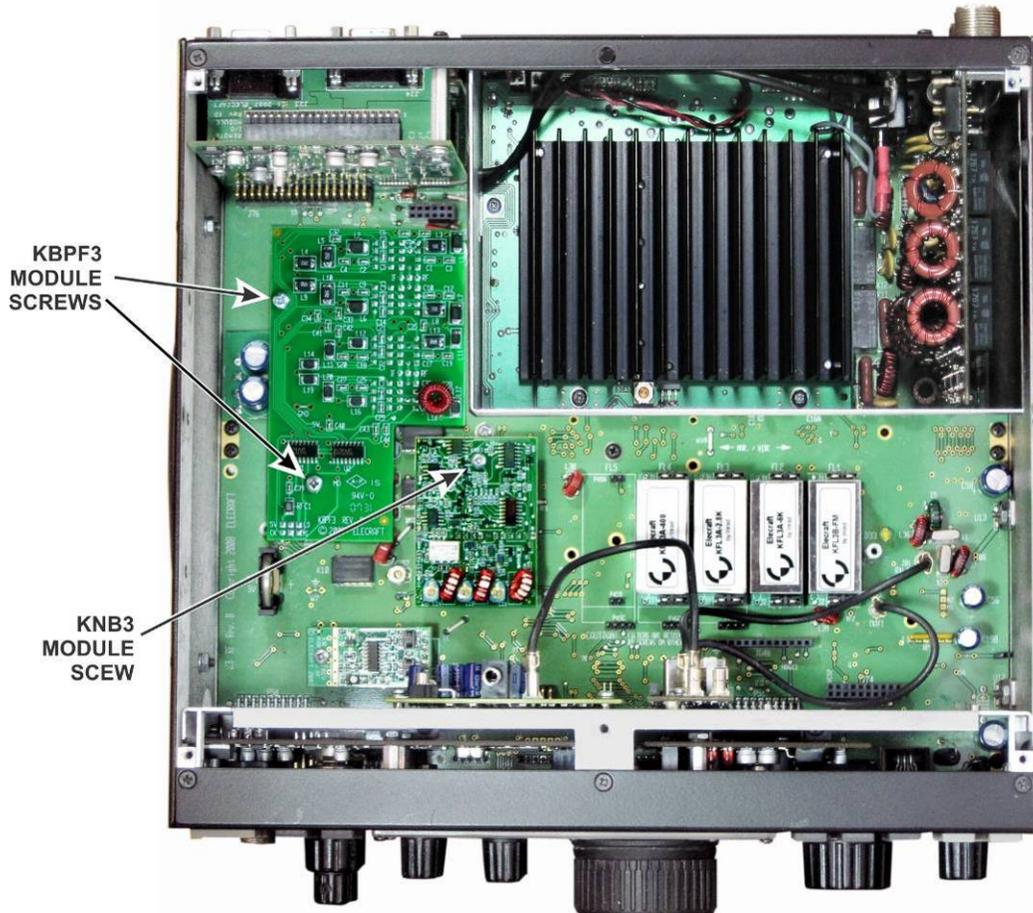

Figure 10. KBPF3 and KNB3 Modules on K3 RF Board

☐ Turn the K3 over and remove the front section of the K3 bottom cover as shown in Figure 11.

Figure 11. Removing Bottom Cover Front Section.

☐ Turn the K3 right side up again and install the poly capacitor on the main board as shown in Figure 12. Bend the leads so the capacitor lays against the pc board next to J77 as shown so it will fit under the KNB3 module. Recommend you solder from the bottom side of the board. Clip the leads flush after soldering.

⚠ **Observe polarity when installing the capacitor. Unlike older electrolytic capacitors, the negative lead on the solid polymer electrolytic capacitor is marked with red instead of black.**
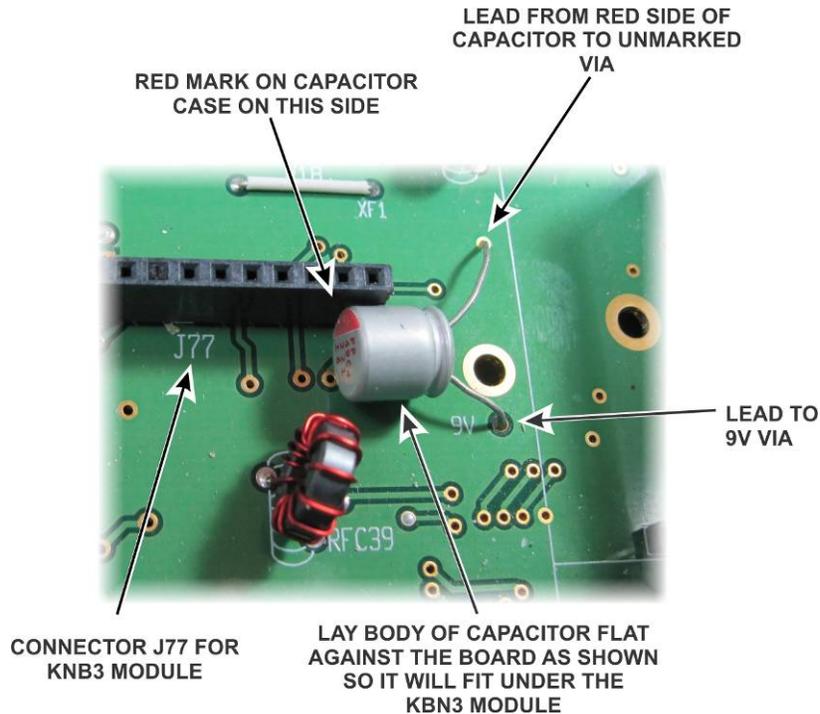

Figure 12. Mounting the Poly Capacitor on the K3 RF Board.

Modifying the KBPF3 Module

☐ Modify the KBPF3 module as shown in Figure 13.

- L1 and L2 are easily removed with flush cutters.

- Mount the SMD caps on top the SMDs already on the board using your favorite technique for handling SMDs. A suggested method is shown in Figure 14. If you have the experience and tools, you may remove the existing SMD capacitors from the board first. There is no difference in performance between leaving the existing capacitors in place and "piggybacking" the new caps as shown, or in removing the original capacitors first.
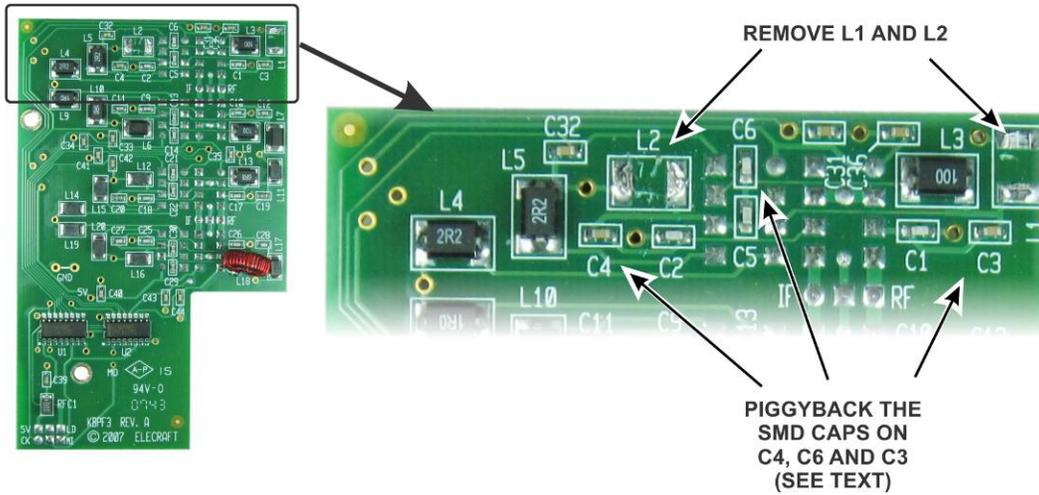
Figure 13. KBPF3 Module Modifications.
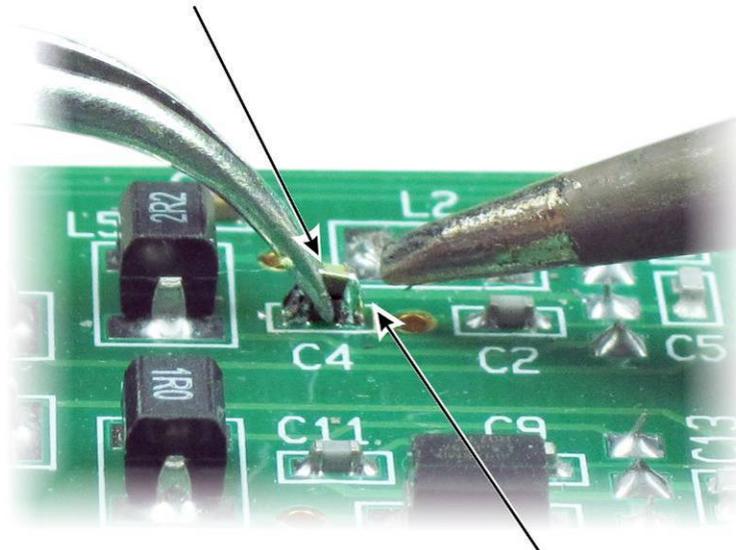

Figure 14. One Technique for Mounting the SMD Capacitors.

☐ If available, us a fine tip marker to write the letter "A" near the KBPF3 lettering on the pc board to indicate that it has been upgraded to the same level as the KBPF3A boards.

Reassemble the K3

⚠ **As you reassemble your K3, be sure all the screws are in place and secure, but do not over tighten them. Failure to tighten all screws may result in poor shielding of sensitive components, resulting in possible noise or birdies in the receiver as well as other difficult-to-trace problems.**

Reinstall the KBPF3 and KNB3 on the K3 RF Board

If you did not modify your K3 main receiver, go directly to Reassembling the *KRX3/KRX3A Sub Receiver* below,

☐ Replace the bottom cover (see Figure 11 on page 13) using the black 4-40 3/16" (4.8 mm) pan head screws you removed earlier. Do not place lock washers under these screws.

☐ Replace the modified KBPF3 on the K3 RF board (see Figure 10 on page 13). Be sure the three connectors are properly engaged. When they are engaged, the screw holes should line up with the threaded standoffs below. Secure the board with the two 4-40 3/16" (4.8 mm) zinc pan head screws with split lock washers you removed earlier.

☐ Replace the KNB3 board. It should fit over the poly capacitor you installed earlier (see Figure 10 on page 13). Secure it with the 4-40 3/16" (4.8 mm) pan head screw you removed earlier.

☐ If your K3 is equipped with the sub receiver but you did not modify it, go directly to *Reinstalling the KRX3/KRX3A Sub Receiver* on page 17 . If your K3 is not equipped with the optional sub receiver, go directly to Reinstalling the K144XV 2-Meter Module (page 21) if you have the K144XV 2-meter option installed. If you do not have a K144XV installed, go directly to *Final Steps* on page 21 .

Reassembling the KRX3/KRX3A Sub Receiver

☐ Place the sub receiver main circuit board in the bottom shield so that the 1-1/2" screws extend through holes E7 and E13 in the board. The two standoffs should line up with holes E1 and E10 in the board. Press the main circuit board down against the standoffs. The board will "snap" into position as the small bumps along the edges of the board slip into the holes in the sides of the shield.

☐ Secure the sub receiver main circuit board to the standoffs at E1 and E10 with the 4-40 3/16" (4.8 mm) black pan head screws and #4 split lock washers your removed earlier.

☐ Replace the modified KBPF3 on the sub receiver RF board (see Figure 10 on page 13). Be sure the three connectors are properly engaged. When they are engaged, the screw holes should line up with the threaded standoffs below. Secure the board with the two 4-40 3/16" (4.8 mm) zinc pan head screws with split lock washers you removed earlier.

☐ Replace the KNB3 board on the RF board. It should fitvover the poly capacitor you installed earlier (see Figure 10 on page 13). Secure it with the 4-40 3/16" (4.8 mm) pan head screw you removed earlier.

☐ Replace the sub receiver enclosure top cover. Be sure to replace the two sleeves over the long screws as shown in Figure 15. The long screws will pass through holes in the top cover. Adjust the position of the cover so the edge of the top fits inside the bottom cover and rests against the sub receiver main board on all sides. Secure the top with knurled nuts tightened only enough to hold the cover in place so it isn't loose.
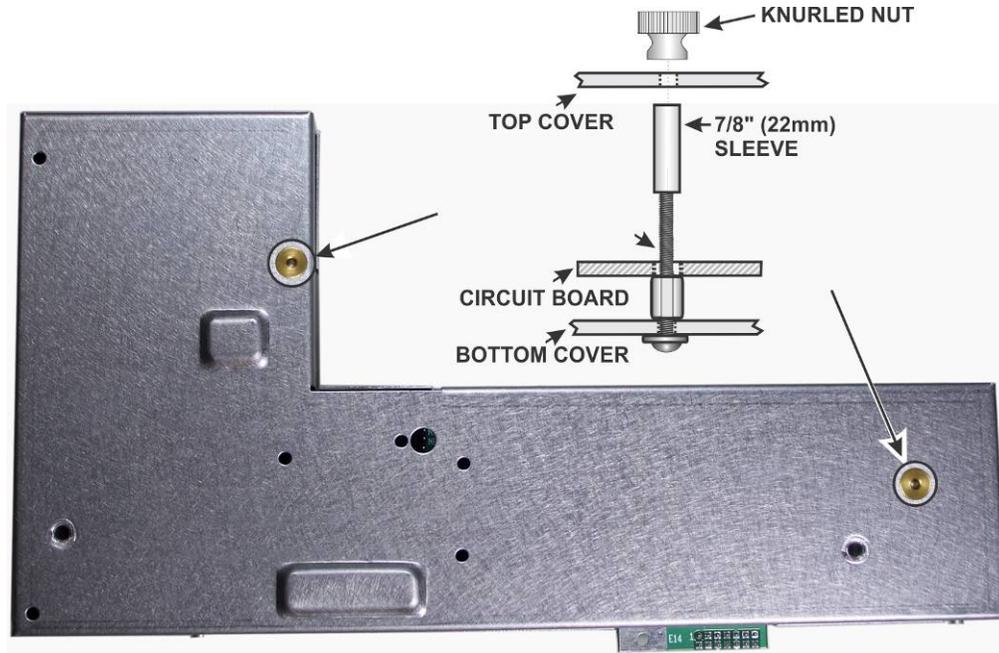
Figure 15. Replacing the Sub Receiver Top Cover.

Reinstalling the KRX3/KRX3A Sub Receiver

☐ Replace the battery cover. Be sure the cover fits all the way down against the RF board as shown in Figure 16.
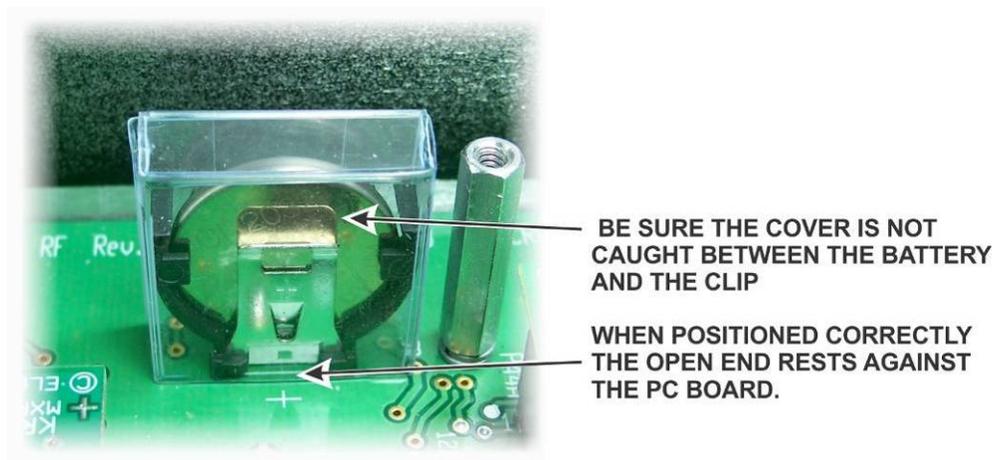

Figure 16. Battery Cover.

☐ Locate the two small interface boards you removed earlier with the sub receiver module. One is marked SUBIN and the other SUBOUT. Plug the SUBIN interface board into J64A on the K3 RF board as shown in Figure 17. J64A is directly in front of the KIO3 board in the rear left corner of the K3. Be certain the connector on the SUBIN board is aligned with J64A so all pins are engaged.

Figure 17. Replacing the SUBIN Board.

☐ Plug the SUBOUT interface board in J64B on the K3 RF board as shown in Figure 18. J64B is between the K3 crystal roofing filters and the front panel. **Be certain the SUBOUT board is aligned so all pins of P1 are engaged with J64B.**
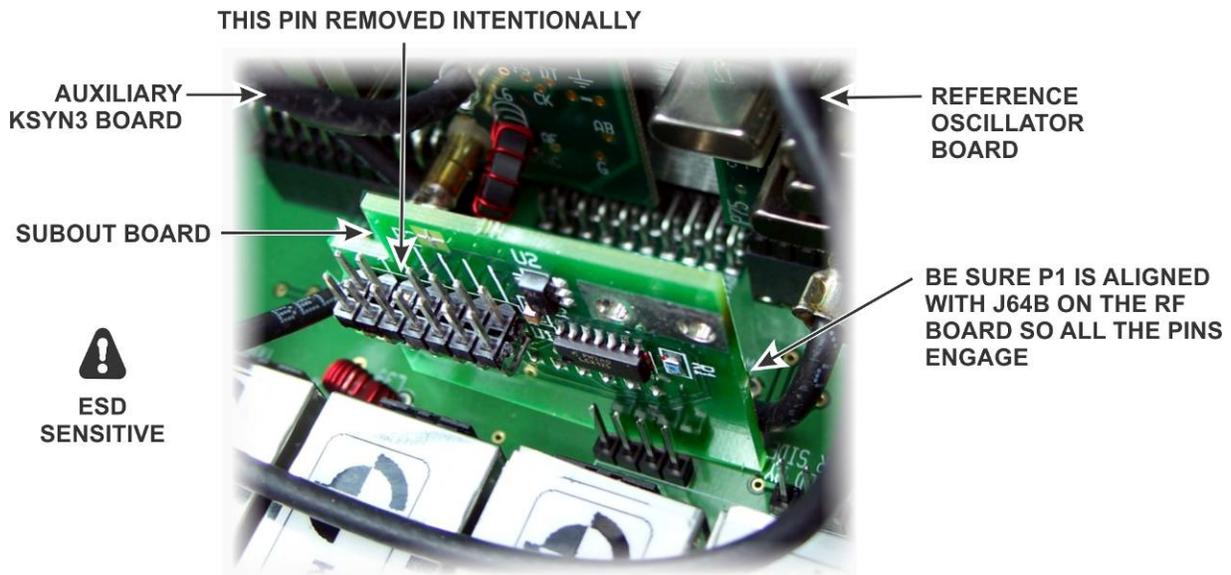

Figure 18. Replacing the SUBOUT Board.

☐ Position the three TMP cables near the SUBOUT board as shown in Figure 18 so they will not interfere with installing sub receiver enclosure. Avoid kinking the cables.

☐ If you have the K144XV 2-meter option with the K3EXREF phase lock option installed, be sure the 6" (15 cm) cable to J4 on the Main KSYN3A board has not pulled loose. (see Figure 19). The other end will be connected to the K144XV module when you reinstall it later.

☐ Be sure the 10" (25 cm) TMP cable you connected to J4 on the Auxiliary KSYN3A earlier is connected to J2 on the main KSYN3A board (see Figure 19).

☐ Hold the sub receiver module directly over the K3 and attach the TMP cables to J82 and J85 on the module as shown in Figure 19).
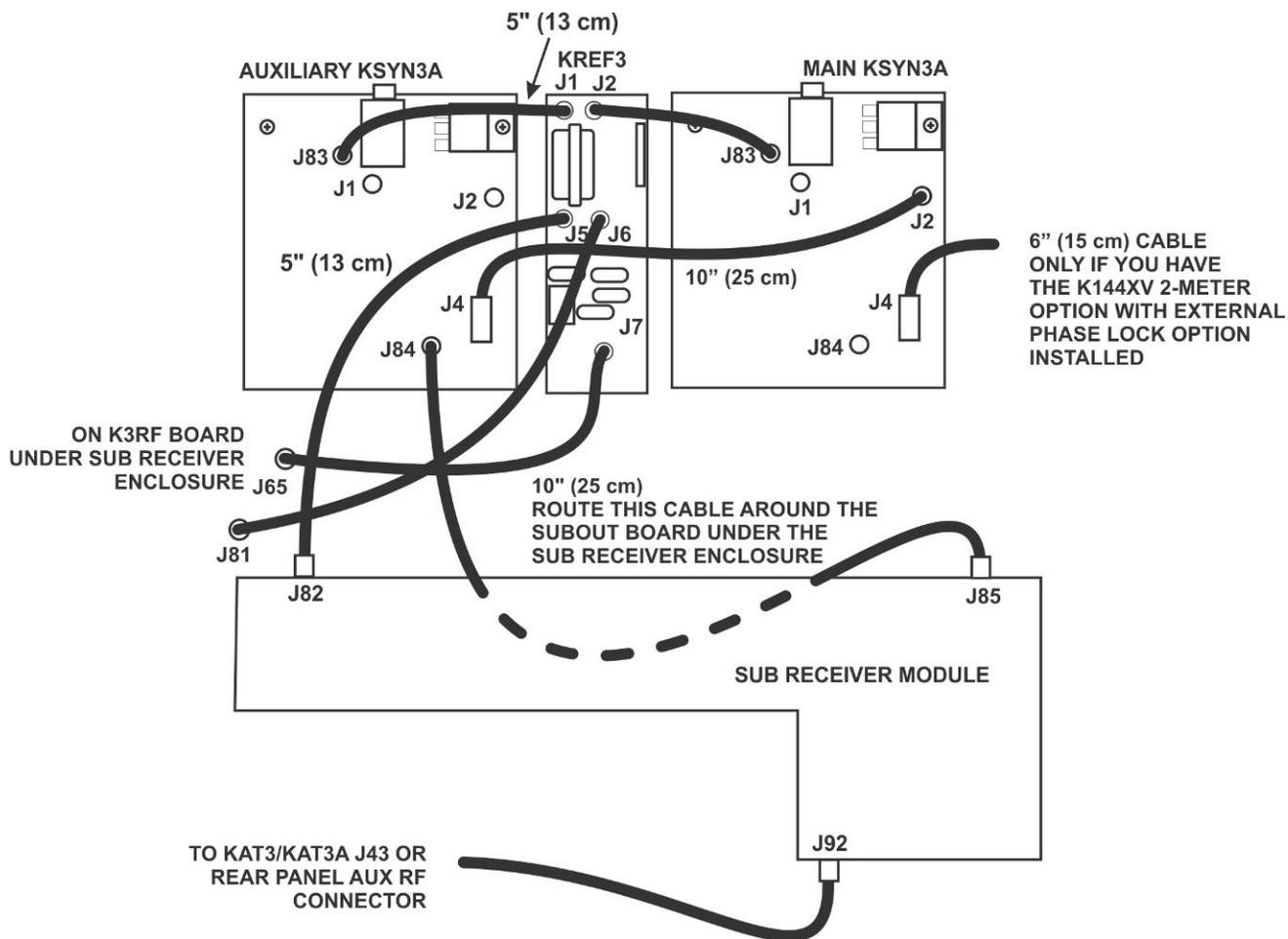

Figure 19. TMP Cable Routing.

☐ If installed, attach the antenna cable connected to either the KAT3/KAT3A or to the AUX RF BNC jack on the rear panel to J92 at the end of the sub receiver module as shown. This connector is angled upwards to provide clearance between the connector and the KIO3/KIO3A board when the unit is installed. Be certain the TMP connector is fully inserted in J92. When the sub receiver module is installed the clearance is very small.

☐ Lower the KRX3A module into the K3 so that the connectors on the sub receiver module mate with the connectors on the SUBIN and SUBOUT interface boards (see Figure 20). The knurled nuts are provided as handles to make holding the assembly easier. You may need to adjust the cables near the SUBOUT board so they don't interfere with mating the connectors. If the connection between J92 and the KAT3/KAT3A is used, form the excess cable into a loop in front of the KIO3 board.
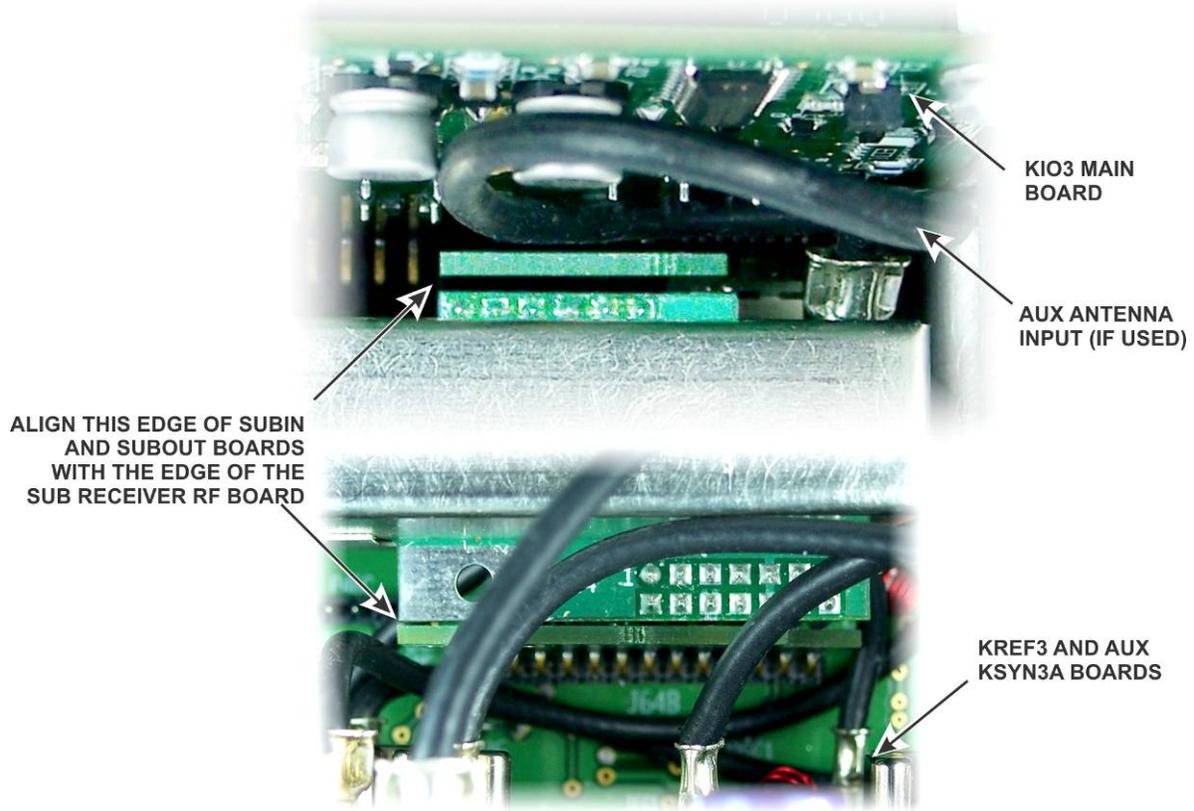

Figure 20. Aligning the Sub Receiver Module Connectors with the SUBIN and SUBOUT Interface Boards.

☐ Replace the two long screws that attach the sub receiver enclosure to the K3 RF board
(See Figure 5 ① on page 9).

☐ If you do not have the K144XV module installed go directly to Final Steps on page 22.

Reinstalling the K144XV 2-Meter Module

☐ Mount the K144XV module on the K3 side panel with the three 6-32 flat head screws you removed earlier (see Figure 3). The top cover should still be loose from when you removed it.

☐ Lift the top cover off of the K144XV module and connect the cables as follows:

⚠ *CAUTION*

DO NOT touch the small red coils on the K144XV pc board. Doing so will disturb the alignment and compromise the performance of your K144XV.

– Connect the cable from the rear panel ANT3 connector to 2M ANT.

– Connect the marked cable from the KXV3A module to the IF IN connector on the K144XV board.

– Connect the remaining cable from the KXV3A to the IF OUT connector on the K144XV board.

– If you have the K144XV Reference Oscillator Phase Lock option installed connect the cable from J4 on the main synthesizer (see Figure 19) to either REF IN or REF OUT (the connectors are in parallel).

– Reconnect the power cable to the 12V connector on the K144XV module.

☐ Replace the top cover on the K144XV module and secure it with the screws and lock washers.

Final Steps

⚠ REPLACE ALL THE SCREWS!

The chassis has excellent rigidity despite its light weight. The screws that hold the top cover in place are an important part of the structural design. Be sure to replace all the screws and verify they are tight whenever you replace the cover or other panels

☐ If you removed the chassis stiffener replace it as shown in Figure 21. Some stiffener bars do not have permanently-attached PEM nuts for the screws attaching them to the amplifier shield. If not, you found 4-40 nuts when the bar was removed. Place the lock washers under the nuts instead of under the screw heads.
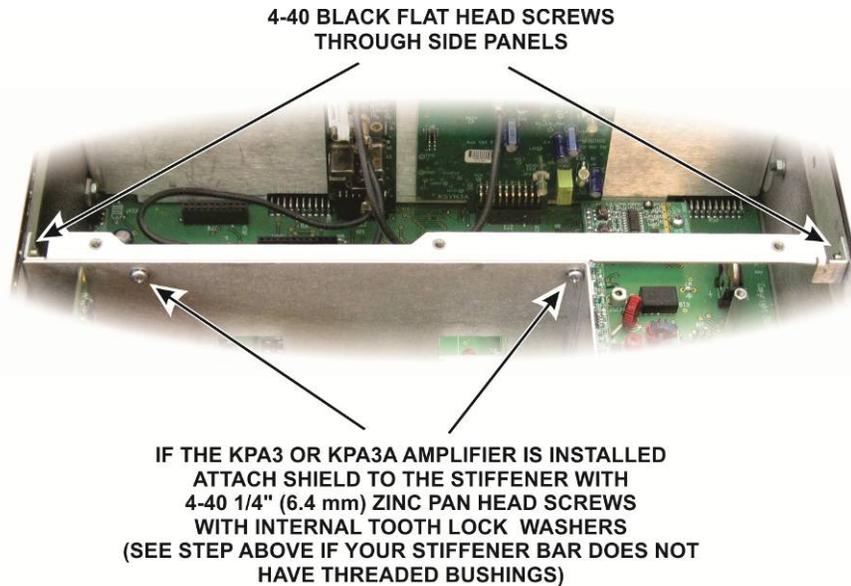

Figure 21. Installing the Chassis Stiffener.

☐ Hold the top cover above the K3, route the speaker wire under the stiffener bar and plug it into P25 on the KIO3 or KIO3B board at the left rear of the chassis as shown in Figure 22. If the K144XV module is installed pass the cable under the stiffener at the depression in the top of the K144XV.
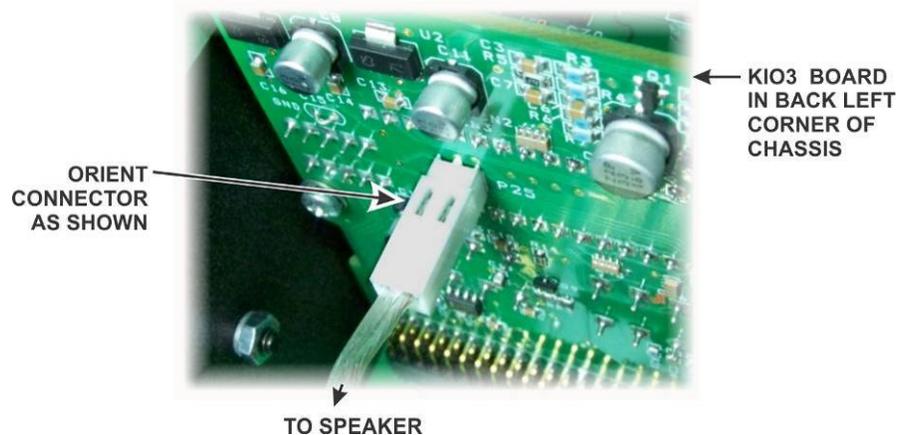

Figure 22. Connecting Speaker Cable.

☐ Position the top cover on the K3. Note that the tab on the back center goes under the rear lip of the rear panel. Secure the top cover with the nine 4-40 3/16" (4.8 mm) black flat head screws you removed earlier.