Application Note: K1 Upgrade

W. Burdick, August 1, 2002

APPLICABILITY

This note applies to K1s with RF board revision D or earlier. The revision E RF board already has the changes in place. This new board has been shipping with K1 kits since approximately March, 2002.

BACKGROUND

The K1 PC board was recently upgraded to revision E. Most of the changes were not modifications--just changes to the layout to accommodate parts that had always been included in the kit, but had to be attached on the bottom of the board.

A few of the changes did affect operation or alignment. These modifications, which can be made to older K1s, are covered in this application note. You can make any or all of the changes, which are completely independent.

PARTS NEEDED

A kit of parts for use in making the changes can be ordered as the "**K1 Upgrade Kit**".

MODIFICATIONS

1. VFO linearization

This change improves the linearity of the VFO tuning potentiometer by adding a 100-k resistor from the wiper to the top end. This compensates in part for the nonlinearities inherent in the varactor diodes used to tune the oscillator.

A. Do a "before" test of VFO nonlinearity, nothing how many kHz the frequency changes for each revolution of the VFO knob, starting with the knob fully counter-clockwise. If you don't find the nonlinearity objectionable, you can skip this change.
B. Remove the four screws holding the Front Panel assembly to the K1.
C. Unplug the Front Panel assembly.
D. On the back side of the board, locate the "1" and "2" pads of R1 (VFO pot). Solder the resistor between the two lugs of the VFO pot that are connected to these pads (see Figure 1).
E. Add this resistor, R19, to the Front Panel board schematic (Appendix B).
F. Reinstall the Front Panel assembly.
G. Do an "after" test of the VFO nonlinearity (see step A). You may wish to experiment with smaller-value resistors--as small as 50 k--to improve linearity further. However, this is probably not necessary since the LCD shows the frequency accurately regardless of any tuning nonlinearities.

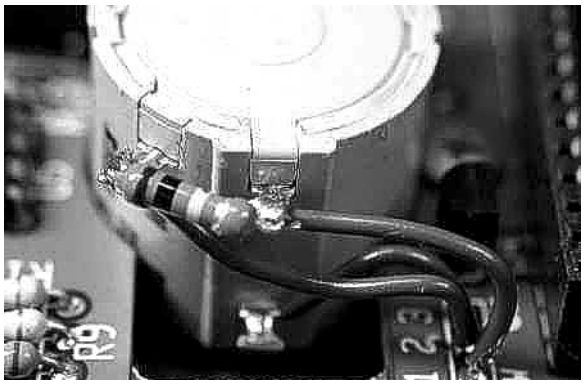

Figure 1

2. Eliminating Attenuator OFF "Pop"

This change eliminates an occasional loud "pop" sound that may occur when the attenuator is turned OFF.

A. Remove the K1's bottom cover.
B. Solder the 15 µH RF choke on the bottom of the RF board, between pins 3 and 8 of K1 (see Figure 2 & 3).
C. Add this choke, RFC9, to the schematic in your K1 manual (Appendix B, RF board, sheet 1).
D. Re-install the bottom cover (unless you plan to make the remaining modifications--see below).
E. Test the modification by turning the attenuator on/off using the ATTN switch. There should be no loud audio artifacts when turning it either on or off.

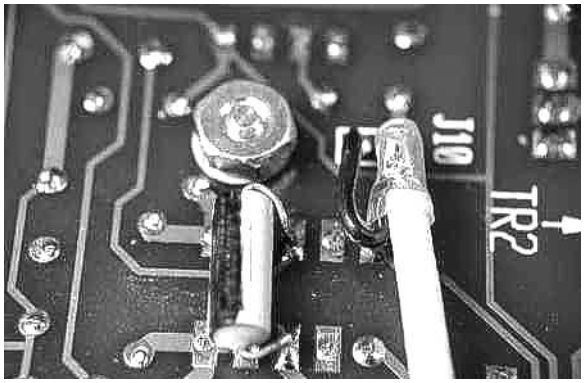

Figure 2

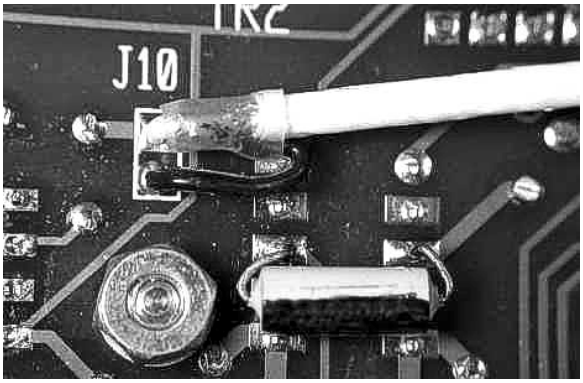

Figure 3

3. RF Detector Source Slide Switch

This change adds a switch to select the source for the RF detector voltage. One position selects the SWR bridge on the KAT1, the other selects the detector on the RF board. This eliminates the need to desolder and resolder one end of resistor R36 when removing the KAT1 antenna tuner to align a new band module.

If you don't have a KAT1, or if you don't anticipate building and aligning additional band module boards, you may not wish to make this modification. It may be simpler to continue desoldering and resoldering R36 when necessary. Most K1 users rarely need to realign a band module.

A partial schematic showing the location of the new switch, S3, is shown below. On the actual revision E K1 RF board, a 3-pin header (P3) and 2-pin jumper were used, not a switch. However, due to the difficulty of retrofitting a 3-pin header onto the revision D RF board, the upgrade kit provides a small slide switch instead. This switch will be referred to as "S3" in the instructions that follow. An SPDT switch could have been used, but we supply a DPDT switch in the upgrade kit because we stock of switch of this type.

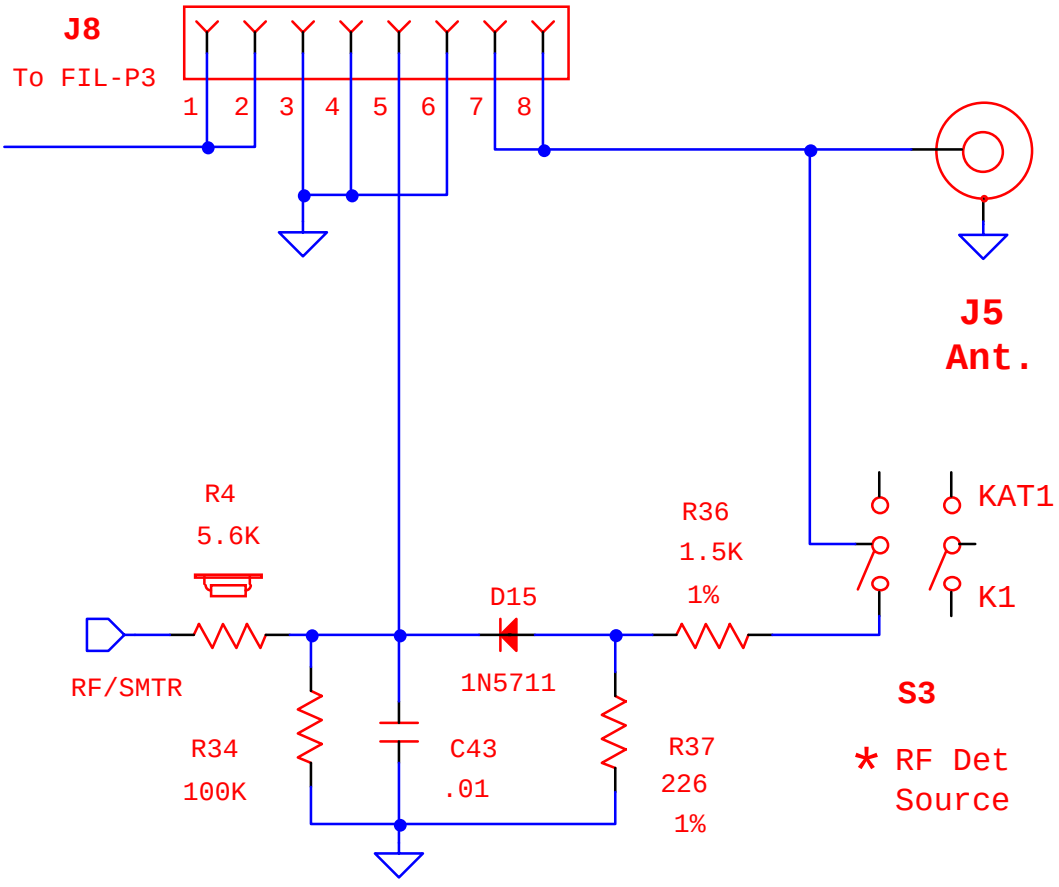

Figure 4

A. Remove the K1's top and bottom covers.
B. Remove the KBT1 and KAT1 options, if present (battery and ATU).
C. Remove the Filter board.
D. Remove the hardware holding the PA transistor in place.
E. Remove the right side panel.
F. With your soldering iron, heat the lead of R36 nearest the edge of the PC board and carefully lift this lead from its hole. Lift the end of the resistor only enough to allow the resistor lead to clear the hole. You DO NOT need to clean out the hole.
G. In a similar manner, remove the other end of R36 from the PC board.
H. Locate one of the miniature DPDT slide switches. Holding the switch with the pins facing you, hold one of the two BOTTOM pins with a pair of pliers and bend the lead back and forth, so it bends right at the body of the switch, until the metal work hardens and the lead comes off. Repeat for the bottom lead on the other side. See Figure 5.
I. The switch must be seated flat against the PC board, and no metal part of the switch (other than the required leads) should be touching any adjacent pads or leads. (If the switch is not seated flat against the PC board, it may extend more than 0.25" (6 mm) above the PC board, preventing installation of the bottom cover.)
J. Holding the switch in the same position, bend the TOP LEFT lead inward and flush against the bottom of the switch. The tip of this lead should just touch the TOP RIGHT lead. See Figure 5.
K. In a similar manner, bend the MIDDLE RIGHT lead flush against the bottom of the switch.
L. Using pliers, bend the two remaining leads away from the body of the switch. Make your bends such that the bend is even with the bottom of the switch and the tip of the lead bent toward it, so you can solder the two leads together in the next step.
M. Solder the leads which were bent against the bottom of the switch to their adjacent leads. Figure 5.

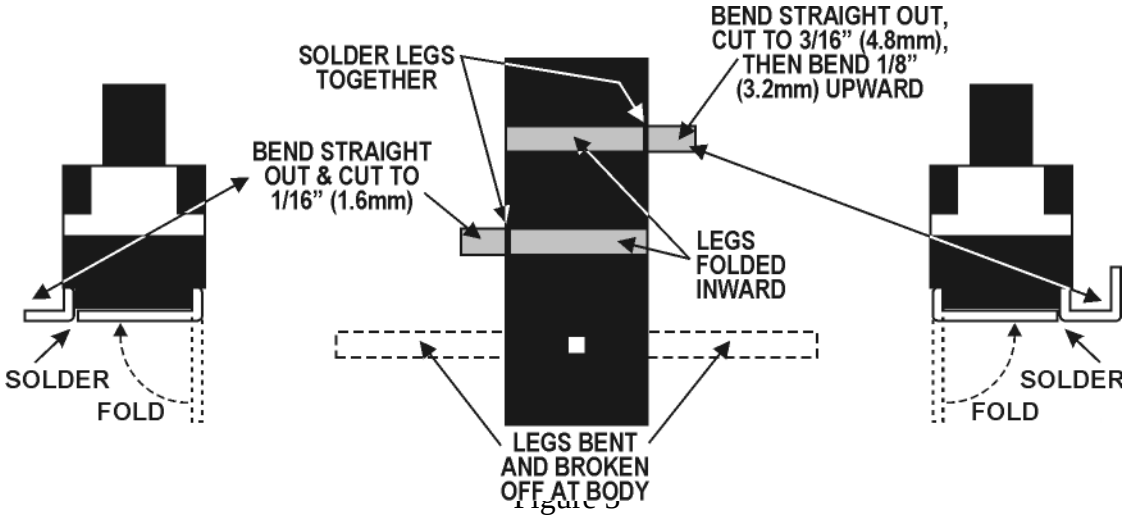

Figure 5

N. Cut the bent-out center lead to a length of 3/16" (1.6 mm) and then bend the outer 1/8" (3.2 mm) straight up.
O. Refer to Figure 6, next page. Lay the switch against the PC board so its CENTER pin overlays the empty hole on the land labeled "ANT" where one end of R36 once was. Position the TOP LEFT pin just above the top of the land labeled "RFD". Be sure the switch is straight and solder the center pin to the "ANT" land.
P. **Note:** If the leads of R36 have become fragile due to repeated soldering and unsoldering, use the new 1.50 k 1% resistor supplied with the upgrade kit. Tack-solder one end of R36 to the BOTTOM pad of the land labeled "RFD", and solder the other lead to the top left lead from the switch.
Q. Set the new RF detector voltage selector switch to the position in which the K1 RF board is the source (R36 in circuit, i.e. switch closed). **Note:** Label this position "K1".

R. Turn on the K1. Connect a dummy load, and make sure the K1 is transmitting normally and that the power can be set using the OUT menu entry.
S. If you have a KAT1 ATU, turn off the K1 and install it at this time. Set the RF detector voltage selector switch to its open position (R36 out of circuit), which allows the KAT1's SWR bridge to supply the detector voltage. **Note:** Label this position "KAT1". Then turn on the K1 and make sure it and the KAT1 are functioning normally.
T. Add the switch as S3 to the RF board schematic (sheet 2). See Figure 4.

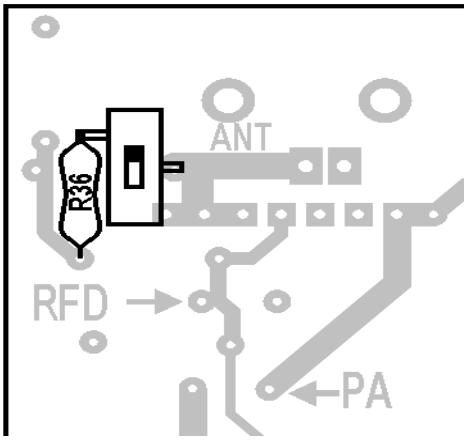

Figure 6

Though it is not difficult to remove the K1's bottom cover in order to access this switch, it has been suggested that you might want to consider drilling a 3/16" to 1/4" (5-6 mm) hole in the bottom cover, centered on the switch, to facilitate access for switch actuation.

4. Transmit Oscillator Offset Test Switch

This change simplifies setting of the transmit offset. It adds a switch (S2) that can be used to turn on the transmit mixer when the transceiver is in receive mode, allowing you to hear the transmit offset, i.e. the difference in pitch between the transmitter and receiver. This can then be easily matched to the sidetone pitch.

You may not wish to make this change if you have already aligned your K1, since that is the only time the switch would normally be used. The only other time you might use it is in the event that you change the sidetone pitch (using the STP menu entry).

The location of the switch (electrically) is shown in the partial schematic below. An SPDT switch could have been used. We provide a DPDT switch in the upgrade kit because we stock a switch of this type.

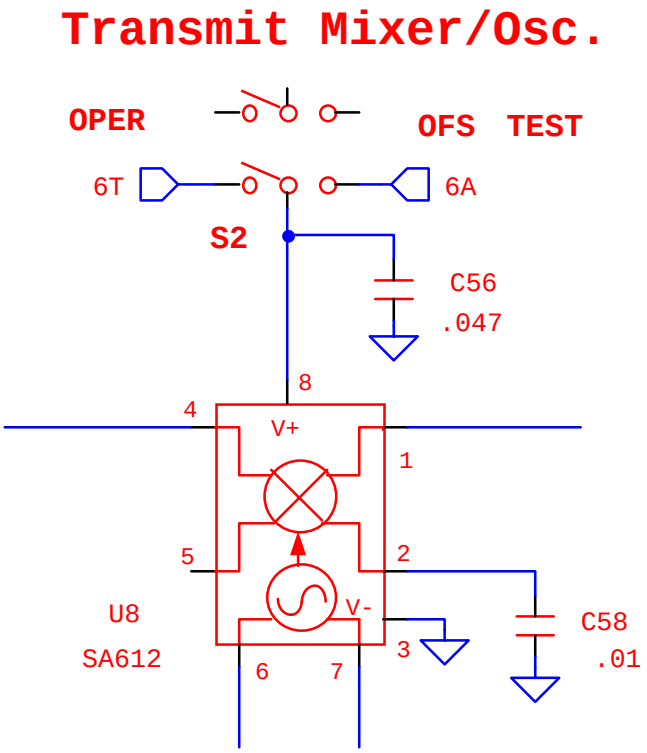

Figure 7

A. Remove the K1's bottom cover.
B. On the bottom of the RF board, locate the label "MIX". The label includes an arrow which points to pin 4 of U8. Locate pin 8 of U8, which is diagonally opposite from pin 4. (See Figure 9.)
C. **Important** - Flush-trim all of the leads of U8 and the capacitor that connects to U8 pin 8 (C56).
D. Refer to Figure 9 and cut the long trace that goes to pin 8 of U8. Make sure that the trace is cut completely.
E. Locate a miniature DPDT slide switch. Prepare its pins as illustrated in Figure 8. Carefully tin all five of the switch leads.

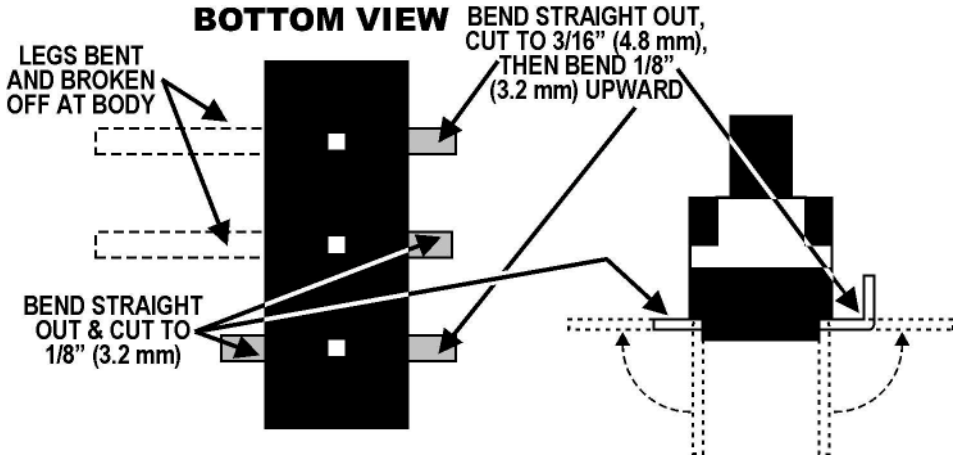

Figure 8

F. Refer to Figure 9 and place the switch on the PC board such that the center of the switch's three pins touches pin 8 of U8 and the end pin on the other side of the switch touches U8 pin 4. The bottom of the switch must be laid flush against the PC board, and no metal part of the switch should touch any adjacent pads or leads. (If the switch is not flat against the PC board, it may extend more than 0.25" (6 mm) above the PC board, preventing proper installation of the bottom cover.)

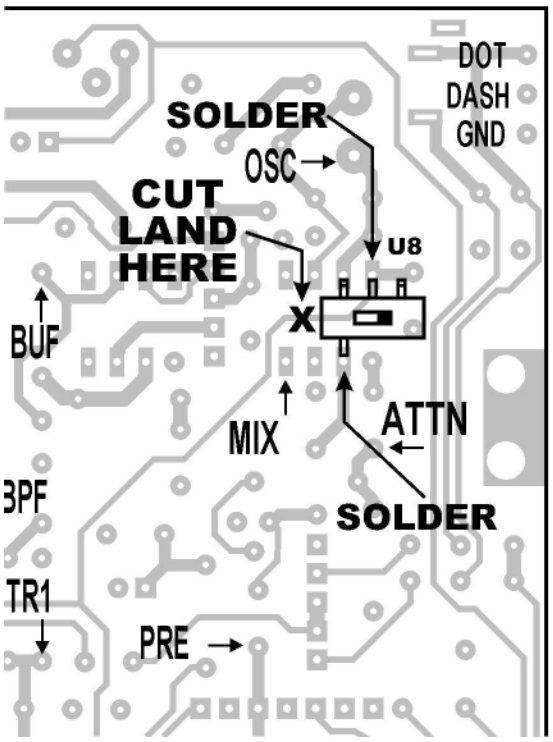

Figure 9

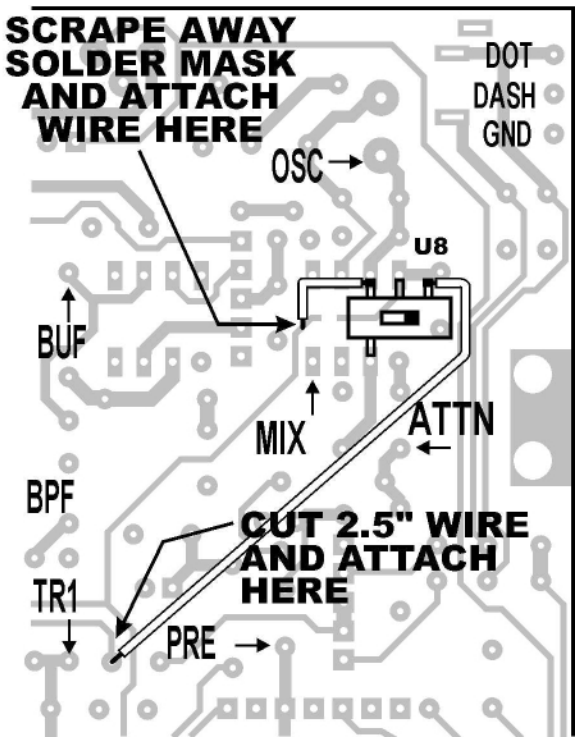

Figure 10

G. Solder the center pin of the switch to U8 pin 8. Trim off any excess lead length.
H. Solder the end pin on the other side of the switch to U8 pin 4. Trim off any excess lead length.
I. Refer to Figure 10. With a sharp knife blade or a single-edged razor blade, scrape away about 1/8 inch (3 mm) of the green solder mask from the PC board land which was just cut and which runs diagonally down and to the left. This is the land which is no longer attached to U8-8.
J. Cut two lengths of small gauge (c. #24) insulated hookup wire, one 3/4 inch (19 mm) and the other 2-1/2 inches (63 mm). Trim about 1/8" (3 mm) of insulation off each end of both wires. Tin the ends of each wire, and on one end of each wire, bend a very small "J" hook.
K. As shown in Figure 10, loop the hooked end of the shortest of the two wires around the switch lead closest to the cut land and solder into place. Then, solder the free end of the jumper wire to the land which you cleaned in step I, above. See Figure 10.

NOTE: In the next step, if you find the length of the wire to be too long, trim the length as required, then strip and re-tin the lead before soldering.

L. In a similar manner, attach the longer of the two jumper wires to the switch pin closest to the outer edge of the PC board, and the other end to the via (plated through hole) near the "TR1" label. Set the switch to the "OPER" position, i.e. toward C56. This places the "6T" voltage at pin 8 of U8 for normal operation.
M. Turn on the K1. Set the switch to the "TEST" position. This places the "6A" voltage at pin 8, turning on the only transmit mixer in receive mode. You should hear the transmit offset pitch. Set the switch back to the "OPER" position.
N. Add the revised **Transmit Offset Adjustment Instructions**, below, to your manual. You may wish to go through the procedure one time to make sure that the switch is installed correctly and that you know how to use it. If you do *not* perform the Transmit Offset Adjustment at this point, reinstall the K1's bottom cover now.
O. Add the new switch, S2, to the schematic (RF Board, sheet 2). See the partial schematic, Figure 7.

Transmit Offset Adjustment Instructions

A. Locate the offset test switch (S2) on the bottom of the RF board. Place it in the TEST position. You should hear a tone in the headphones; its pitch is equal to the transmit offset. If you don't hear a tone, try rotating C13 (back left corner, near the key jack).
B. Locate the offset test switch (S2) on the bottom of the RF board. Place it in the TEST position. You should hear a tone in the headphones; its pitch is equal to the transmit offset. If you don't hear a tone, try rotating C13 (back left corner, near the key jack).
C. Using the menu, locate **STP** (sidetone pitch), and go into edit mode to turn on the sidetone. You should now hear two tones: the sidetone and the transmit offset tone. If the sidetone is very weak or very strong compared to the transmit offset tone, use the **STL** menu entry to adjust the sidetone volume. Note: The receiver is muted in **STL** edit mode, so you'll have to return to **STP** after making any change to the sidetone setting.
D. Adjust C13 so that the transmit offset pitch is as close as possible to your selected sidetone pitch. The two will seem to "merge" when the pitches are matched.
E. Exit the menu, and set S2 back to the OPER position.
F. If necessary, use the CAL menu entry to calibrate the operating frequency on transmit (see procedure below).
G. Reinstall the K1's bottom cover.