Cheap 'N Dirty Signal Tracing in the K1

by: Tom Hammond NØSS rev.2 04/08/2002

The following article was originally written to specifically address signal tracing needs for Elecraft K2 owners, but it has been adapted (herein) to address the needs of K1 owners as well

About a year and a half ago, someone on the reflector reported that he'd reached the test point in the assembly of the RF board for his K2 where he was supposed to be hearing signals of 40 meters, but he heard very little. He knew the band was open because he heard signals on his 'big rig', but few sounds managed to make it thru his K2.

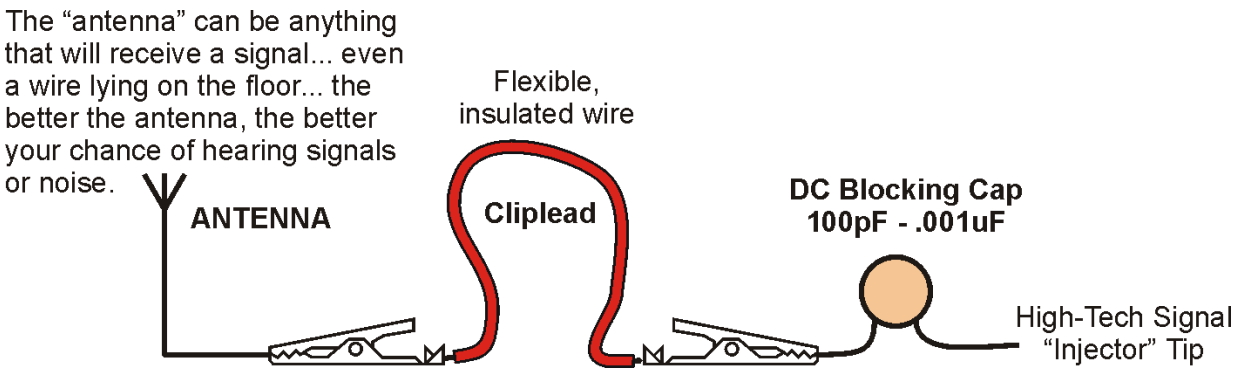
My first suggestion to him was to beg, borrow, or steal a signal generator from another 'local' and to start doing some signal tracing, using the signal generator to inject a signal at appropriate points along the receive signal path on the K2, to see where the signal disappeared.

It turned out that this fellow lived in a small town and was (at least to his knowledge) the only ham in the area. Therefore, no availability of a signal generator. Something else had to be found as this builder had virtually no test equipment, other than a digital voltmeter.

The K1 was specifically designed to be a single-conversion receiver. This means that the incoming signal is mixed only once in order to convert it to a common IF (intermediate frequency). The signal path from the antenna up to the one and only IF mixer can be readily signal-traced if you can provide a signal somewhere within the band in question. If you first inject a signal AT the input to the IF mixer (see test point #1 on the included K1 RF PC board layout), AND you can HEAR that signal at the output of the K1 (speaker or phones), you have a pretty good indication that all the oscillators, mixers, and audio stages are functioning properly. This probably won't save the day, BUT it will at least give you an idea of where to begin to continue your testing efforts.

However, we still needed to obtain an in-band signal source… and it had been in front of us all the time… it's an ANTENNA, a cliplead, and a small value capacitor!

Here's a pictorial of the Cheap 'N Dirty Signal Injector:



Granted, there's almost nothing to it... and that's the idea… virtually ANY builder can make one of these devices to assist in signal tracing efforts of a 'deaf' K1.

If you have success at injecting a signal at test point #1, move on to point #2, and so on, until you have located the point in the circuit where the signal either disappears or drops significantly in level. This tells you that the problem lies somewhere between the last SUCCESSFUL test point and the test point at which you failed to hear the injected signal.

Here's a list of the various starting "test points", along with a brief description of where they are in the circuit itself. I have also annotated them on the parts layout diagram at the end of this document.

Test Points for the K1

NOTE: Though this instruction set was originally written for use with the KLF1-2 filter (and specifically the Band 1 components), its general direction should be readily translated to Band 2 of the KKFL1-2 board, AND to any of the four individual bands on the KFL1-4 Filter board as well. Obviously, you will want to select the appropriate set of band-components to go with the band you are having problems with. If this is a generalized problem, then use 40M by default.

Test Point	Description
1	RF Board (1 of 2), T1-1, input winding of the transformer feeding the mixer. *Must* use pin 1.
2	RF Board (2 of 2), D5, last T-R diode in the signal path before the mixer.
3	Filt Board, P2-1 (Plug P2, Pin 1), RF board connection to the output of the RF Band Pass Filter (RF BPF).
4	Filt Board, junction C11/C12, output of Band 1 RF BPF.
5	Filt Board, C13, inter-stage coupling RF BPF.
6	Filt Board, junction C14/C15, input to Band1 RF BPF.
7	Filt Board, P2-8, input from RF board to RF BPF.
8	RF Board (2 of 2), D10, part of T-R switch.
9	RF Board (2 of 2), D11, part of T-R switch.
10	RF Board (2 of 2), D12 (**on the BOTTOM of RF board**), part of T-R switch.
11	Filt Board, P3-1&2, output of Low-Pass Filter (LPF).
12	Filt Board, junction of C21 & L9, output of Band1 LPF. **NOTE**: One side of C21 is grounded. No signal should be found on the grounded pad.
13	Filt Board, C22, part of Band1 LPF. **NOTE**: One side of C21 is grounded.
14	Filt Board, C23, input to Band1 LPF. **NOTE**: One side of C21 is grounded.
15	J2-10, input to LPF. This point should be jumpered to J2-2.
16	J2-2, input to LPF.
17	J8-7&8, point of connection of Filt Board to RF input from RF board (ANT).

Notes:

Some of the test points on the RF Board will be covered by the Filter Board. In this case, you will have to access them from the BOTTOM of the PC board. USE CARE in locating the specific test point.

Although D12 is drawn (in the accompanying illustration only) as if it were located on the top of the RF board, it is actually located on the bottom of the RF board. The illustration only attempts to indicate the relative position of this device on the bottom of the board.

P2 and P3 are both physically located on the bottom of the Filter board. However, short stubs of their soldered pins are accessible from the top of the Filter board.

BE CAREFUL to not short a PC board pad to ground (or to an adjacent pad). Some pads may have DC voltage on them!!

DO NOT omit the DC blocking capacitor in the signal injector. Your antenna may be at DC ground, and some of the PC board pads may have DC on them.

Be sure that you are testing on an 'open' band, where signals really are present.

Real live signals are best, but a noisy band can be of some use as well. If you can't find an open (or noisy) band, and if you have a broadband noise source, it can often be substituted as a signal source.

If you find a test point which fails, test it several times, the point you are touching may have a thin covering of rosin (or lead oxidation), left over from soldering, and you may have to break through that (insulating) covering in order to achieve a good connection.

FOLLOW your testing on the schematic, so you will have a better 'feel' for exactly where you are during your efforts. If you find a point of failure, use the schematic (and the pictorial) to help identify other possibly points for signal injection as you work deeper into a section of the radio.

When checking capacitors which are ***in series*** with the signal path, be sure to check on BOTH sides of the capacitor, if the signal fails on one side, but not the other, the capacitor may be open.

When testing at test points 2, 8, 9, and 10 (all diode switches), if your tracing fails here, it may not be due to a bad diode, but the lack of switching voltage (6R) used to turn these diodes on. Check for the presence of around 6VDC on the ANODES (non-bar end) of these diodes before you assume they're bad.

Cheap ‘N Dirty K1 RF Signal Tracing

K1 Filter & RF Boards