Drake TR-3 Crystal Filter Replacement

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The Drake TR-3 and some TR-4s employ 9 MHz crystal filters in so called “soup cans”. These filters are located in a copper shell behind the front panel sideband switch. I purchased a TR-3 for a hundred bucks and started to restore it, first with power supply rework and then much more. Unfortunately, the crystal filter did not work in either sideband.

Circuit Description:

For illustration purposes, Figure 1 shows the filter in a simplified schematic form. Here, one of the two filters is shown. Note that the filter has 2 inputs and 2 outputs plus a ground and is called a “balanced” filter. A front panel Sideband switch alternates between LSB/USB filters. Signals travel through the filter in opposite directions for transmit or receive.

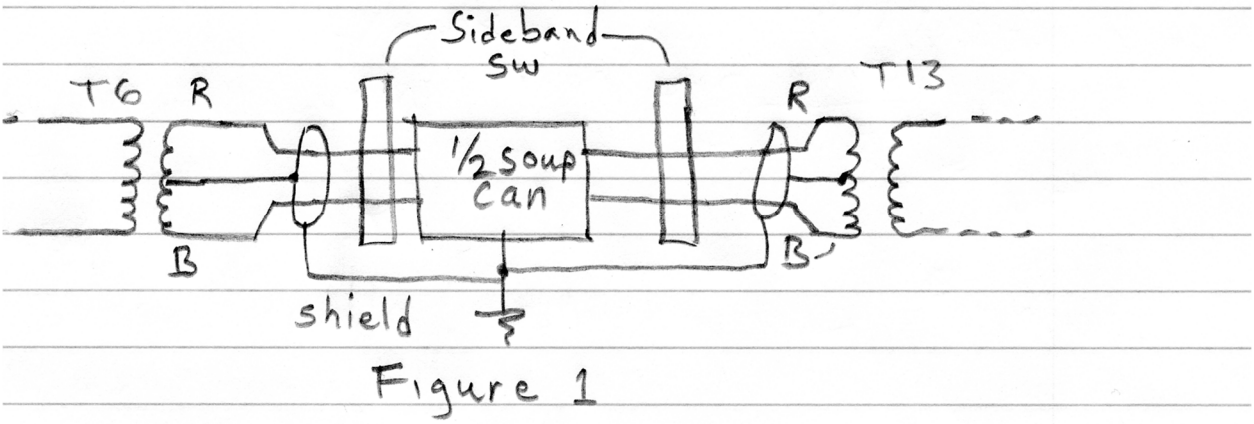

Figure 1

Although it may be possible to locate and replace a failed crystal, the process is complex. First, at writing of this article only one manufacturer, Bomar Crystal, can supply the same package size as originally used, at a cost of $50 each. One should replace a filter only with same power rating; the maximum voltage in this circuit is 5 volts p-p. Second, to locate a failed crystal and test the repaired filter, a spectrum analyzer with tracking generator is recommended, not common for most hams. The crystals are series resonant when specified; no capacitance value provided, HC-33/U or eqv. Further, the motional parameters of a replacement crystal may not match original stock.

An alternate approach is to replace both filters. For some time Inrad was supplying such but is no longer. I was fortunate to find surplus KVG filters via Israeli surplus. These are no longer on eBay. One other manufacturer, Krystaly in the Czech Republic offers 9 MHz filters. However, both KVG and Krystaly use tiny crystals which are not rated for the voltage levels in the Drakes. Nevertheless, I have used the KVG filters for 2 years with no failures; however, they were a bit

wide for crowded bands. Figure 2 shows one of the KVG filters. Most commercial filters are single ended, so a circuit change is necessary.

To perform the filter replacement, first note that the "IF can" windings of T6 and T13 (see original schematic) that connect to the filters have a red, black, and ground connection. Mark the chassis with an R and B label at each transformer. To convert its balanced output to single ended, disconnect the ground on the center tap and leave it open. Disconnect the black wire and tie the transformer B mark to the nearest chassis ground. Use RG 174 coax from the R mark on the transformers for connection to the same location on the Sideband switch as the red wire on the original cable, then remove original wire. It will be necessary to follow the signal path through the Sideband switch for connection to the new filter. It is only necessary to switch the R lead, coax center, on the Sideband switch; the coax grounds just tie to ground.

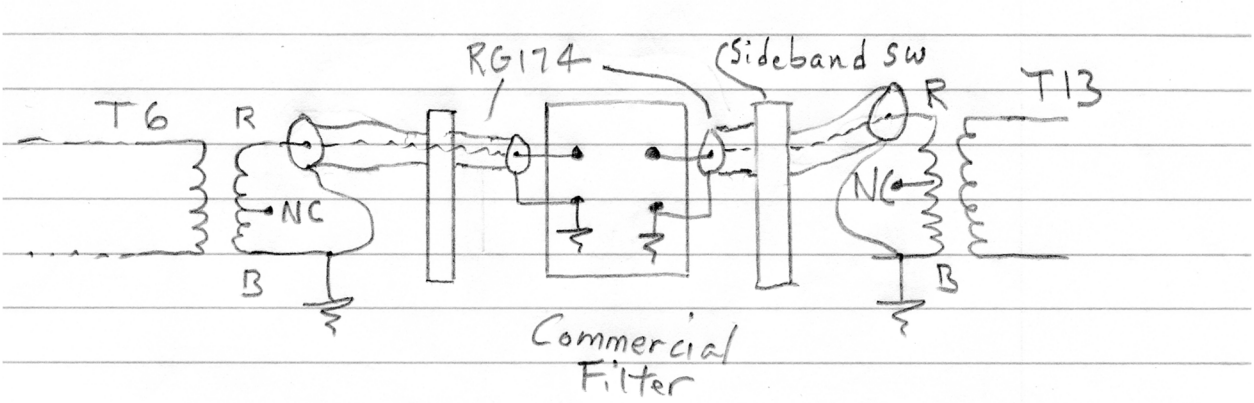

Figure 2

Having become dissatisfied with the KVG filters (XF-9 S43 and 44), I managed to locate a 9 MHz crystal filter out of a Galaxy GT-550. This was however a single frequency filter and would require 2 different carrier oscillators for LSB/USB, where the Drake original design uses 2 filters and one 9 MHz carrier oscillator. Figure 3 shows the Galaxy filter with a relay slaved from the Sideband switch. The Galaxy filter required carrier frequencies of 8.99875 and 9.00125 MHz, so the existing oscillator was detuned for 8.99875 and the second crystal was set to 9.00125 MHz when selected. Both T6 and T13 must be re peaked with any filter change.

Previously, we installed 2 F9 Silent fans under the top frame over the PTO to nearly eliminate drift, with power supplied per Figure 3 for both the fan and the carrier switch relay. Without fan load the series resistor may need to increase in value so the DC voltage across the relay is 12 V when selected (Note that the relay chosen is polarity sensitive.). Since there is only one filter it does not need to go via the Sideband switch. It can be direct wired in single ended configuration, using RG 174 coax, and mounted where convenient. An alternative single

frequency filter is a ladder type (found on eBay from Spectrum Communications, G4CFY, GB for $35, not evaluated) or other source or homebrew.

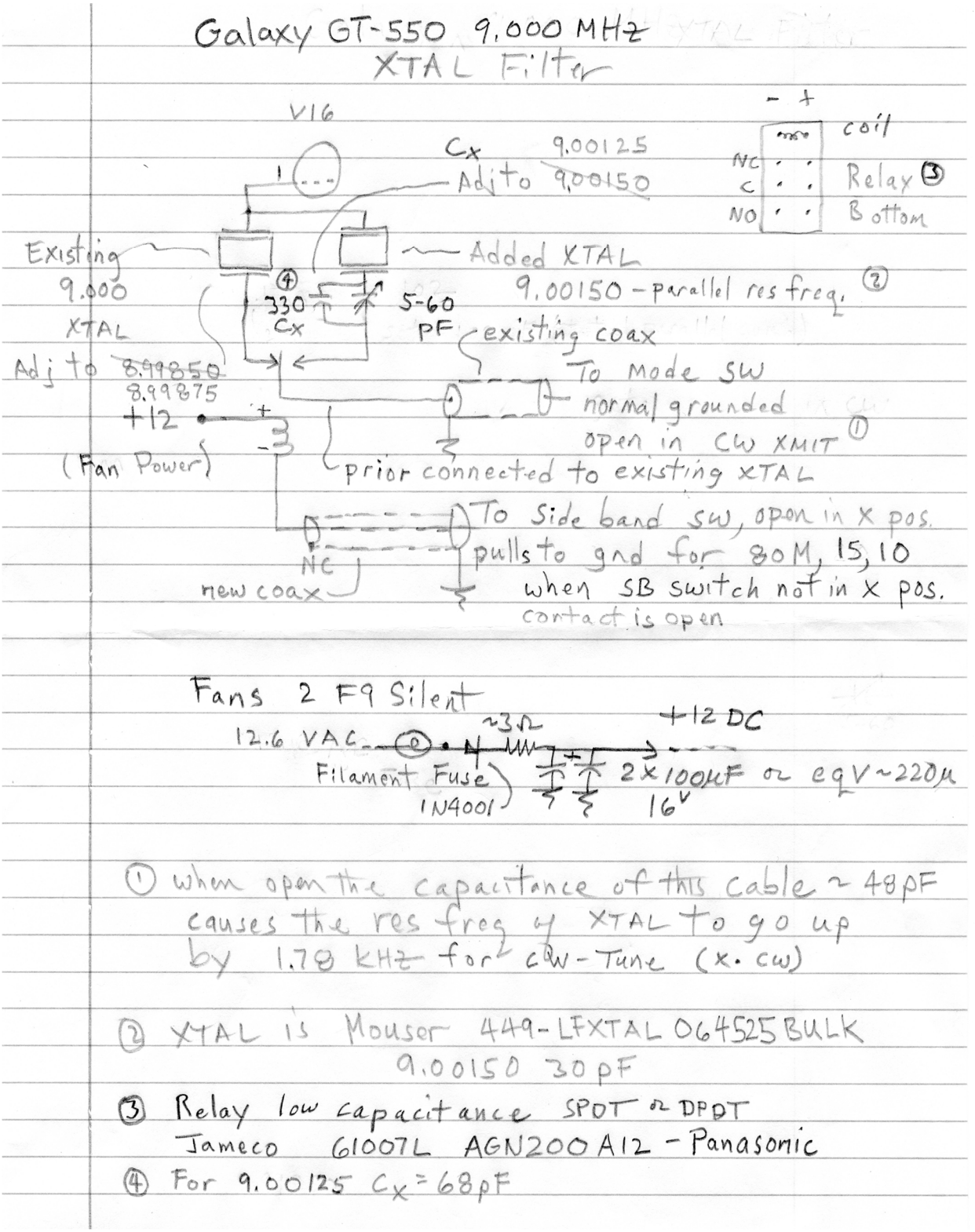

Figure 3

Construction Photos:

Figure 4 shows the disconnected KVG filters mounted behind the Sideband switch. Also shown is the coax center conductor from the crystal selection relay connected to the near upper left terminal (orange circle) of the Sideband switch, used with Galaxy single crystal filter.

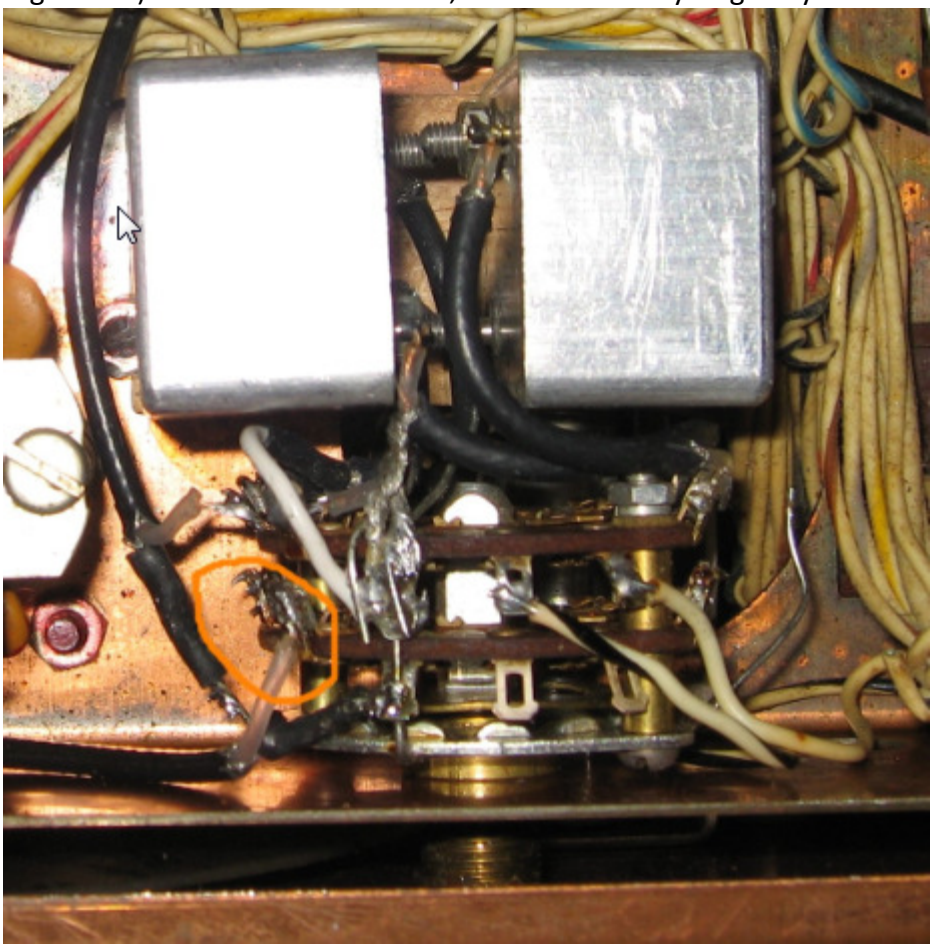

Figure 4

Figure 5 shows the 12 VDC rectifier pcb, upper left, next to fuse. The blue xtal filter (upper right) and tiny second carrier oscillator pcb, lower left (orange circle). The pcb has a buss wire loop that is soldered to the existing terminal strip ground terminal.

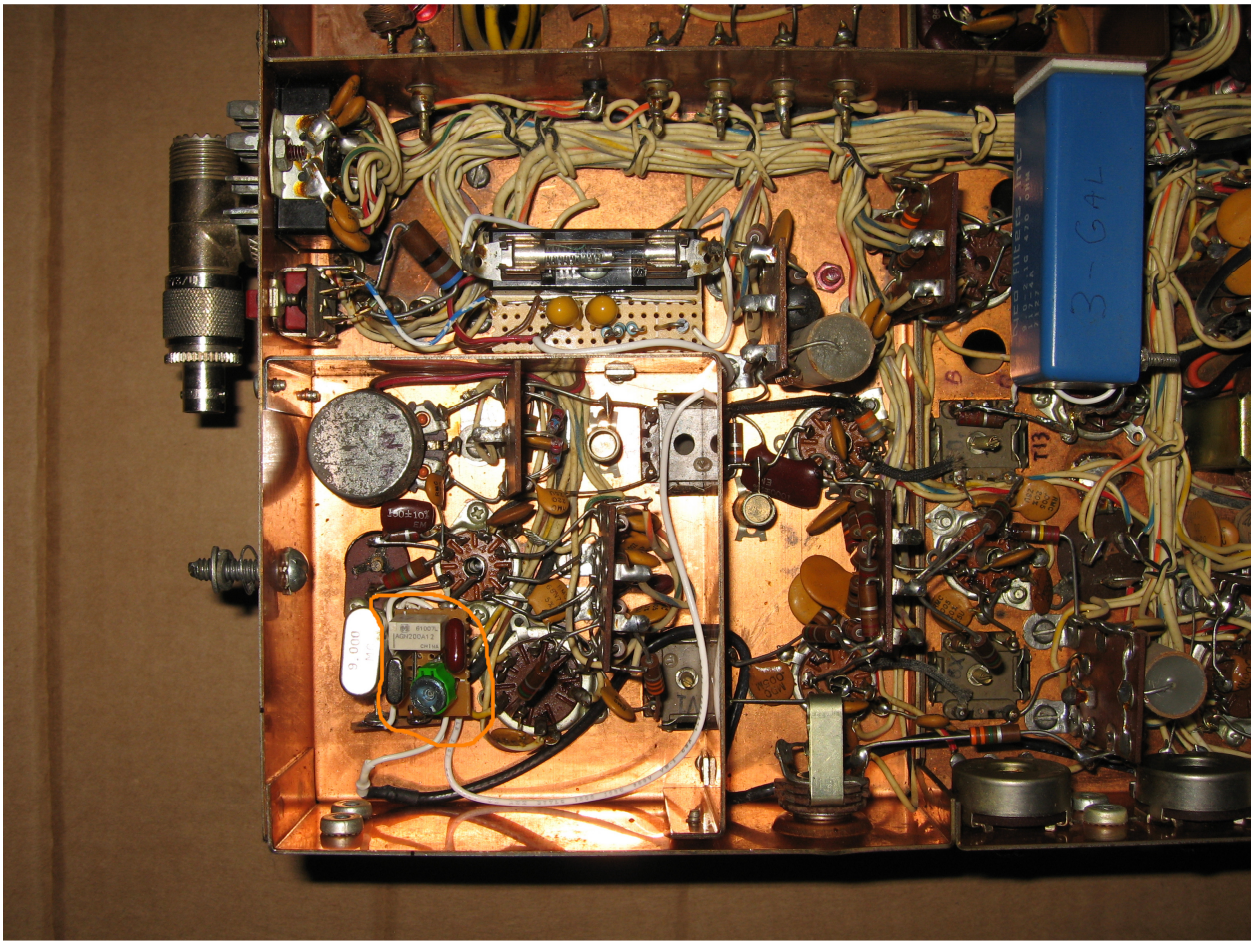

Figure 5

Figure 6 shows 2 F9 Silent fans attached to the upper frame with a loop of black binding wire snaked through vent holes then through the upper fan mounting holes and twisted snug tight. The wires are barely noticeable from the top side. Also shown is a Berg style male connector for power that plugs into a female jack mounted to chassis.

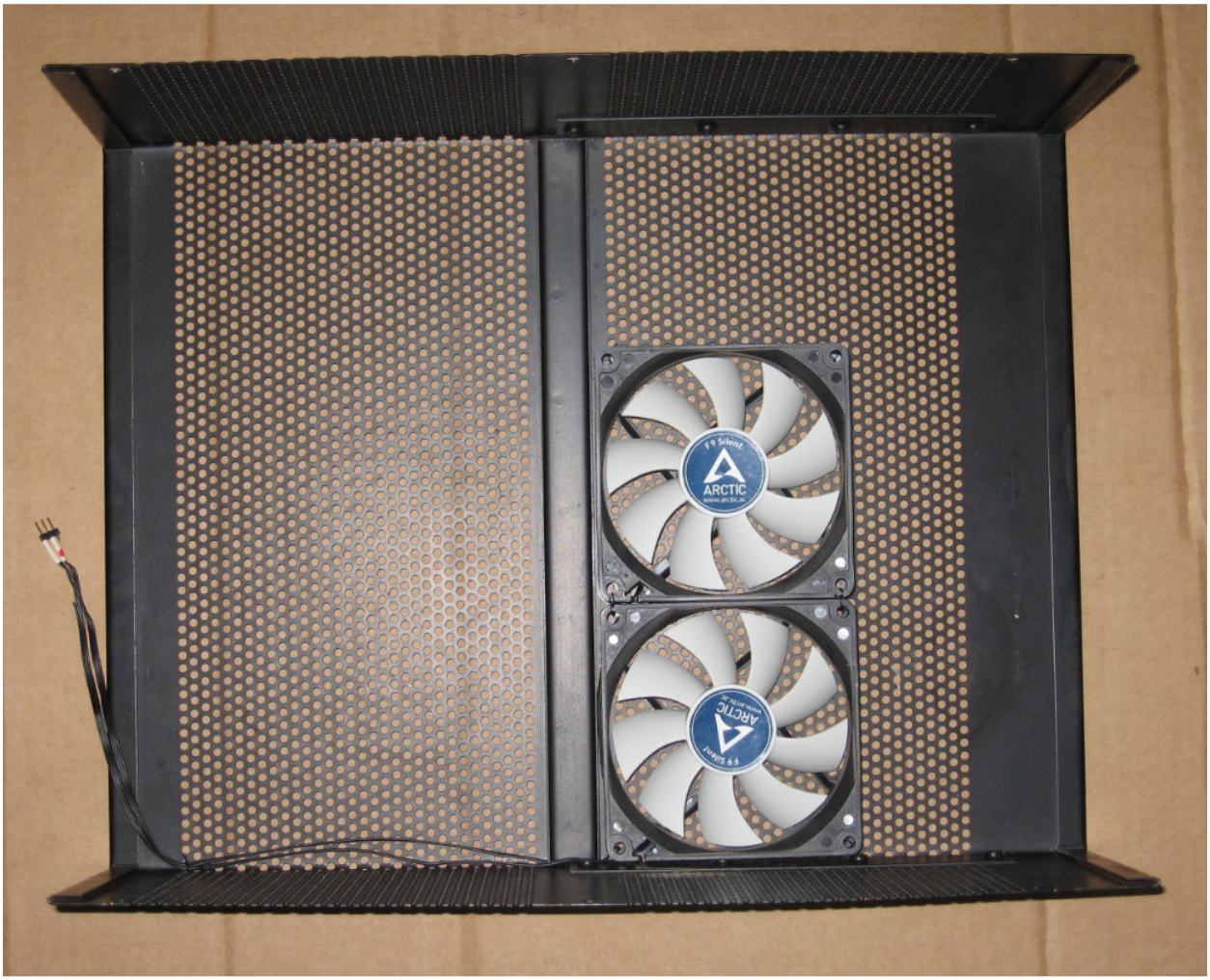

Figure 6