At the Repair Bench – Icom IC-746 PRO – January 2025

Recently, I wrote about the repair of an Icom IC-756 PRO, wherein I replaced the VFO encoder. I had no sooner returned that radio to its owner when that individual presented me with another radio for repair. This time, it was an Icom IC-746 PRO (Figure 1), and the failure was in the realm of a lack of output signal from the radio as a whole.

Figure 1 - Icom IC-746 PRO

The IC-746 PRO is a 160m to 6m plus 2m all-mode transceiver. When tested for output, it was found that the transmit power was nil on all bands and in all modes. The internet is full of stories about such or similar failures on this family of Icom transceivers. There are some similarities among these web reports, with the most common cause being related to the failure of a component identified by Icom as *IC151* and referenced in the Service Manual as the wide-band *YGR Amplifier.* The conventional wisdom holds that this IC, which is an MMIC device, typically fails due to excessive heat being experienced by the IC. Investigation of this unit showed that the failures in this case went beyond the YGR amplifier, and affected the pre-driver transistor and both driver transistors.

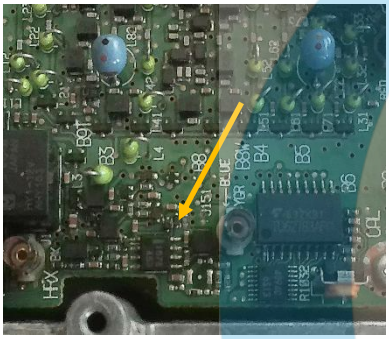

Figure 2 - IC151 location

The YGR amplifier, as already mentioned, is a surface-mount MMIC device carrying a part number of µPC1678G (Figure 2). The pre-driver is a silicon NPN power transistor in a TO-220 case. This transistor, a type 2SC1971, is obsolete and is *extremely* difficult to find. Fortunately, there is a suitable replacement still available, though in very limited quantities. The NTE-342 transistor is a good match and will serve nicely in place of the original 2SC1971 transistor. One of the factors that makes for difficulty in finding a suitable replacement for the 2SC1971 is not the operating voltages of the device; instead, it is the fact that this device has an unusual physical arrangement in that the center pin and tab are emitter-connected rather than the much more common collector-connected tab arrangement.

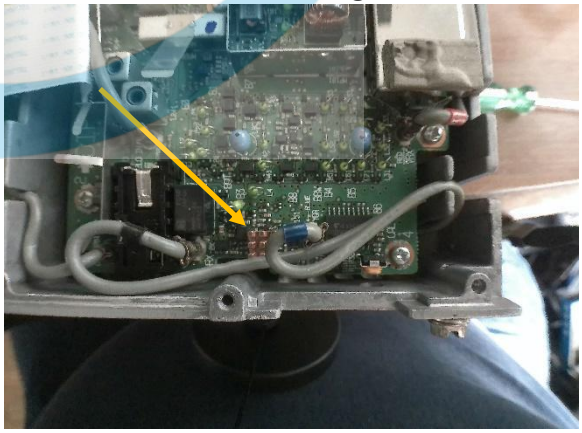

Figure 3 - Heatsink on YGR amplifier IC

The driver transistors are a pair of 2SK2975 surface-mount N-channel enhancement-mode power MOSFET's. These transistors are mounted to a small daughter board that is equipped with a large heat-sinking metal base, directly to which the *source* connection is

made through holes in the daughter board. The *gate* and *drain* connections are made to SMT pads on the top side of this board. We will discuss replacement of these transistors a bit more later on.

Replacement of the YGR amplifier IC is best done with the board on which it is installed having been removed from the chassis. This is the board identified by Icom as the *RF Unit*, and the IC is installed in the vicinity of the mounting hole identified as Hole 4, near one corner of the board.

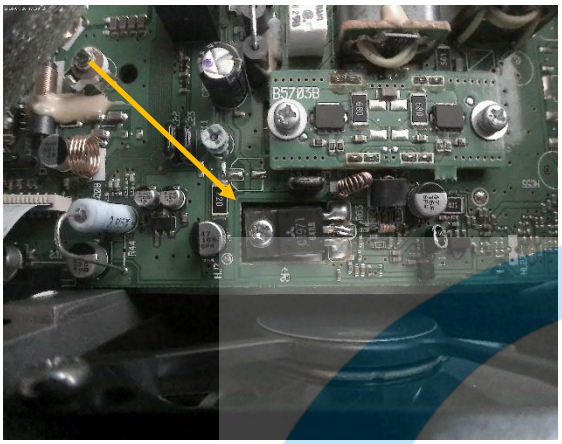

Figure 4 - Pre-driver transistor location

Removal of this IC is most easily done simply by first cutting two three-eighths-inch-long pieces of bare 22 AWG wire. Lay each of these wire lengths across the IC leads on each side of the device, and solder them freely to the leads. Then, apply the heat of the soldering iron to the wire lengths, one at a time, and heat the wire until the solder all along the wire has melted. At that point, gently lift that side of the IC using the tip of a pick or a fine tweezer. Lift it carefully, and just enough to keep it free of the solder puddle. Repeat the heat-and-lift operation on the opposite side of the IC, and the part will be free. Clean up the pads with some solder wick and then with some 99.9% isopropyl alcohol (IPA). After the clean-up is done, tin the pads lightly with some fresh solder, in preparation for the placement of the new IC. This removal method is a useful trick for removing many multi-pin devices from a PCB, and can be used with a wide variety of device types.

After installation of the new IC, a solid copper machined heatsink was attached to the IC (Figure 3) to protect it against heat during future operation of the radio.

Next to be replaced was the pre-driver transistor (Figure 4). This was a straight-forward component replacement, except that in this installation, the transistor leads are not passed through the PCB, but instead are clipped short and are soldered to pads on the PCB top surface. The mounting tab of this transistor is secured directly to the radio chassis through a hole in the PCB, a design feature intended to remove heat from the transistor. However, as the chassis is beneath the transistor and heat naturally moves upward, the cooling efficiency is not as great as it could be. To that end, a heatsink identical to the one installed to the YGR amplifier IC was installed to the body of the pre-driver transistor (Figure 5) after the new transistor was installed.

Figure 5 - Heatsink on pre-driver transistor

Replacement of the driver transistors on their daughter board (Figure 6) required removal of the board from the chassis. This was a simple matter of desoldering four sets of four pins and removing two screws. While the transistors were the only items needing replacement on this board, it was actually easier to clear the board of all components and to start with a clean board. This board holds a total of twelve surface-mount passive devices. These included (2) 100Ω 0805 resistors, (4) 1Ω 0805 resistors, (1) 150Ω 0805 resistor, (2) 68Ω 2512 resistors, (2) 0.1µF 0805 capacitors, and (1) 22pF 0805 capacitor. The reason that it was best to wipe the board clean was because of the high heat developed in the heatsink first in removing and then in installing the driver transistors. The heat of removal was sufficient to "float" the nearby components.

Figure 6 - Driver daughterboard

Once the board was stripped and cleaned, paste solder and liquid flux were applied to the board and heatsink, after which the driver transistors, one at a time, were installed, soldering them in place via the application of focused hot air. Then, it was a simple matter to replace the passives, using the hot tweezers to install each of those devices.

With all of the failed parts replaced, it was time for the post-repair testing of the radio, followed by an alignment and tweaking job to ensure maximum performance. On delivery back to its owner, the radio performed flawlessly, making for a very satisfied customer.

Repairs of this nature can be time-consuming, but what really took the most time on this one was locating the correct replacement parts. Many of the components used in radios of this period are now obsolete and are quite difficult to source. I was very lucky, and as such, I brought in sufficient quantities to permit repair of several more radios of this type.

Take the time to research the parts carefully, and then only buy when you are sure that you are buying the right items. Then check those parts carefully against their datasheets to ensure that you have received what you expected to get. For example, I actually received and returned a set of bogus 2SC1971 transistors that had their pin assignments different from what the real 2SC1971 should have been.

Persistence and perseverance will carry the day. See you next month.

