At the Repair Bench – Icom IC-746 PRO – May 2026

Figure 1 - Icom IC-746 PRO transceiver

A while ago, one of my regular customers who is now a GCARC member brought to me his Icom IC-746 PRO with a complaint of lower-than-normal RF output. This is a common HF plus 6-meters plus 144 MHz desktop transceiver, a very popular radio type that has had its share of known problems and issues. However, the only thing amiss in his unit was the apparent loss of some output power. Unfortunately, it is unknown what the baseline power outputs had been, as no old records of any testing of the radio exist. This left us with the position of needing to test the radio's RF outputs and make a decision what to do based on the test results.

With the radio on the bench in the shop, I set up the trusty Bird 43 and a dummy load, and proceeded to test the radio in its various modes. What I found was a maximum output of about 75 watts ±5 watts across all of the nominal 100-watt modes. While this was clearly less than rated power, it was by no means a dead unit. The next testing to be done was to measure voltages at key points and to trace the RF signal through the unit.

The Icom IC-746 PRO uses an MMIC identified as IC151, a µPC1678G amplifier known as the *YGR amplifier* to prepare the RF signal for handling by the PA board. On the PA board, the YGR RF signal passes through a 2SK2973 N-channel enhancement-mode MOSFET pre-driver and then though a 2SC1971 pre-driver before going into the push-pull combination of two 2SK2975 MOSFETS that serve as the output driver. After that, the RF signal path splits, depending upon the frequency selected. The HF and 50MHz path goes through one push-pull pair of 2SC2694 transistors, while the 144MHz signal path is passed through a second push-pull pair of 2SC2694 devices. Thus, there are actually four "final" transistors in this unit. For each "final" pair, bias control is handled by a separate 2SD1585 transistor. All of this can be seen in the block diagram excerpt in Figure 2.

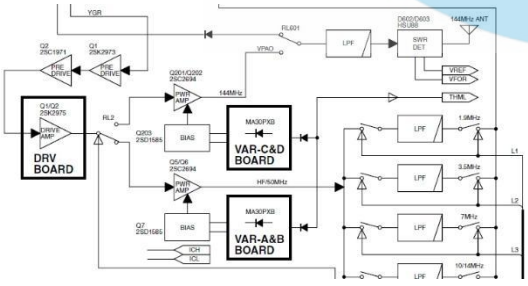

Figure 2 - IC-746 PRO block diagram excerpt

The RF signal into the power amplifier (PA) section was normal, so there was no problem with signal genesis. That left the PA as a possible problem location. Moving on to voltage tests throughout the PA section, I found that all of the transistor operating voltages were within normal limits, though both of the bias voltage values were a bit low. Tracing of the RF signal through the PA showed respectable gain at every stage.

At this point, I called the owner and discussed my findings with him. I explained that although every transistor was working and gain was present at every stage, it was not quite up to snuff. In my opinion, the gain was not quite what it should have been. I further explained that although I could spend his money and replace the transistors that were not exhibiting as much gain as I would have liked, there was also no guarantee that brand new transistors would produce significantly more gain. In other words, there would most likely be very little improvement for the amount of money that it would cost to replace the driver and PA transistors. We decided to align the transceiver, adjusting the bias voltages as a part of that process, and to see what that would get us in terms of improvement. The owner also asked me to install a common IC-746 modification that I promote, which involves the installation of heat sinks to certain high failure rate devices in the amplifier chain. We will discuss this more later.

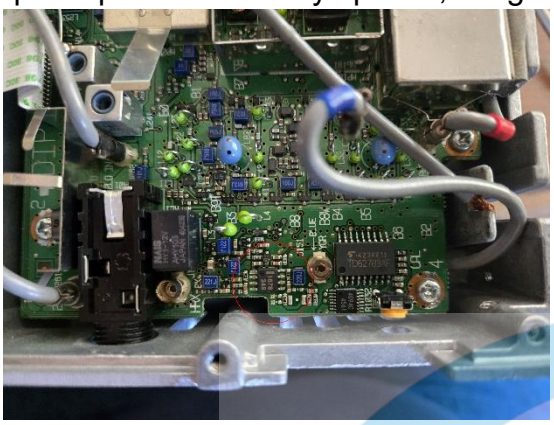

Figure 3 - IC151 location on RF UNIT board

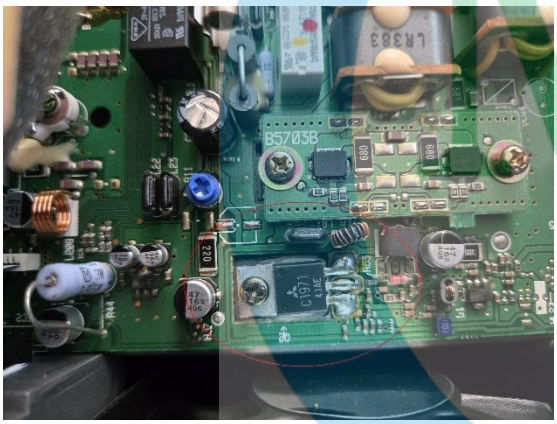

Figure 4 - Q2 location on PA board

I performed a full alignment of the set, including adjustment of the bias voltages. This produced some improvement in the output performance, with the maximum RF level across all modes now being between 85 and 89 watts, depending on the output frequency. I considered this to be an acceptable outcome for the age of the radio and the minimal investment involved.

I spent a few minutes doing some cleaning of the various controls and switches, using DeoxIT® Gold (G100L) as the cleaning agent. An immediate improvement in the audio quality was noted, in that there had been a bit of scratchy crackling and static in the audio as the audio gain control was advanced. While this had not been mentioned by the owner, I noticed it during testing, which is what led me to do the cleaning in the first place.

That brings us to the modifications, comprised of adding heat sinks to two very susceptible devices. These devices are the YGR amplifier MMIC, the µPC1678G device labeled as IC151 on the RF UNIT board, and the 2SC1971 pre-driver transistor Q2 on the PA board. Historically, there is a high failure rate for these two devices in normal use of the IC-746 PRO transceivers.

In the case of the YGR amplifier (Figure 3), it is a case of the amplifier being on the underside of the radio so to speak, as the RF UNIT board is located at the bottom rear of the radio. The puts the MMIC in such a position that the considerable heat generated in

it as the RF signal passes through has nowhere to go except through the IC and up into the chassis above it, but there is no cooling provision made for this IC.

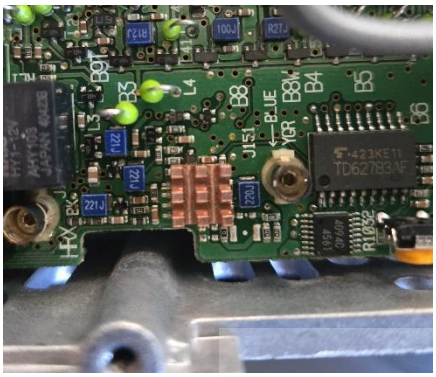

Figure 5 - IC151 with heatsink applied

In the case of the pre-driver transistor (Figure 4), its heat is forced to move in an unnatural downward direction into the chassis through the transistor mounting tab. This device is mounted near the upper portion of the radio, on the PA board which is in the top front portion of the chassis. Apart from its securement to the chassis underneath the device, no additional cooling provision is made.

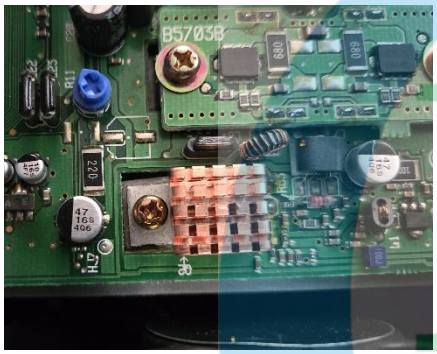

Figure 6 - Q2 with heatsink applied

With both of these devices, I modify the radio by adding a machined copper heatsink to the semiconductor device substrate, using a thermally-conductive mounting tape from 3M. The µPC1678G gets a 6mm square heatsink, while the 2SC1971 gets one that is slightly larger at 9mm square. While this is not a perfect cure, as it still does not correct the direction of heat flow as related to the IC151 MMIC, it is surely better than the way the factory left these devices. To date, I have not had a repeat failure of these devices in any radio to which I have applied these modifications.

This repair was made at the lowest possible cost, and while the radio still did not reach its full advertised output power, it would have cost more than the owner wanted to spend on it to make any significant changes to the output power. It would have meant replacement of the 2SK2975 driver MOSFETS in addition to probably replacing the four 2SC2694 power amplifier transistors. None of these devices showed the full gain advertised in their datasheets, though they all had considerable gain.

Sometimes, a decision has to be made as to how much is worth spending on an older unit to get acceptable performance out of it. If money is no object, then the sky is the limit. But… who can really say that money is no object, and truly mean it?

See you next month…