



SETI League Technical Manual -- Receivers

Additional SETI Modifications for the ICOM 7000 Series Receiver

by Graham Wiseman, VK5EU

I note in the Seti literature that the Icom R7000 is used by many Seti searchers, and that very narrow derived bandwidths are used, so I thought that the information below might be of assistance to members that also use this receiver.

Users that search through noise all of the time probably will not know if their receiver is deficient in the performance characteristics necessary for this sort of search. The easiest way to check is to listen to the 'Note' of a stable signal in the SSB mode (an Amateur beacon, a crystal oscillator harmonic etc.). A clear 'sweet' tone indicates good performance, but a noisy/raucous tone indicates poor performance.

The narrow band performance of my R7000 has been progressively worsening over the years, and I have been in contact repeatedly with the local agent over those years in an attempt to get a fix for the problem. The receiver has been in to the local agent twice, but with little improvement. I have also checked on a range of internet sites, and tried the modifications relevant to poor narrow-band performance, but again found little improvement.

The modifications detailed below caused a dramatic improvement to the usability and performance of the receiver, particularly in narrow band modes.

I have also fitted an external heat sink on the power supply rectifier to move the excess heat generated outside of the case.

ICOM ICR7000 Poor audio quality and intelligibility on SSB

My R7000 performed well on SSB initially, but progressively worsened over the months and years until SSB became almost unintelligible, particularly on the higher frequency VCO.

VCO PHASE NOISE

Investigation of this fault revealed that the problem was caused by very high phase noise on the PLL sub-assembly VCOs. The bandwidth of the noise on the lower frequency VCO was 5KHz, and on the higher frequency VCO was 8KHz.

I found very high noise levels on the supply rails feeding the VCOs. The voltage out of the regulator IC1 was clean, but the switching transistors Q8 and Q14 had excessive voltage drop across them, allowing noise modulation of the supply voltages to the VCOs and other stages on the PLL board. The voltage drop across Q8 was 300mV, and across Q14 was over 400mV.

CAUTION, The modifications listed below involve the replacement of small and fragile components. Do not attempt these modifications unless you have experience working with this type of componentry and have the correct tools and a temperature controlled soldering iron.

I replaced the 2.2K switching transistor bias resistors R37 and R57 with 1K resistors. This reduced the voltage drop across the switching transistors to well under 200mV, and achieved a significant reduction in VCO phase noise. As an added bonus I also noted an improvement in general receiver performance.

To further reduce the noise on the VCO supply voltages, I made the following modifications:

1. Replace the electrolytic capacitors C6 and C17 in the VCO enclosure with 220uF 10V capacitors

(This part of the modification has been published by others).

2. Replace C178 and C179 to the rear of the VCO enclosure with 470uF 10V capacitors.
3. Install 33ohm resistors in the wire leads carrying the VCO supply voltages from the switching transistors to the VCO filter. (From L73 to Q8, and from L56 to Q14).

The result of this modification is a dramatic improvement in SSB intelligibility and quality. The CW note changes from wideband noise that sounds a bit like a tone, to a tone with some residual low frequency noise modulation, again a dramatic improvement.



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