ICOM ID RP-4000V D-Star Repeater Power Control

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The Mount Climie ICOM D-Star installation consists of an ID-RP-2000V - 145.425 MHz, an ID-RP-4000V - 438.600 MHz repeater and the ID-RP2 Controller.

Branch 63 NZART ZL2VH received reports that the D-Star 438.600 MHz Repeater was not consistent in signal strength. Reception was always good into the RP-4000 so a stepped attenuator was added to a monitor station receiver.

Over a period of two weeks the received signal was seen to go up and down depending on ambient air temperature and how long the RP-4000 was on air.

A 10dB change was recorded. The repeater was removed and an analogue FM 25W repeater was installed in its place. This FM repeater is a replacement used for maintenance purposes. Any antenna or QRM issues are easily detected using an analogue repeater. 860 FM analogue was found to be working perfectly and consistent in every way.

The RP-4000 was returned to my workshop for investigation.
Using the ICOM supplied service software I was able to key up the TX with a 25W Bird 43 watt meter connected. The fault was evident and followed the exact characteristics seen while on site at Mt Climie.

When first keyed up the TX started at either 6W or 10W and then dropped to 4W after 2 minutes. Once reaching this low point the power output was seen to rise again over a 15 minute period rising to 22W.

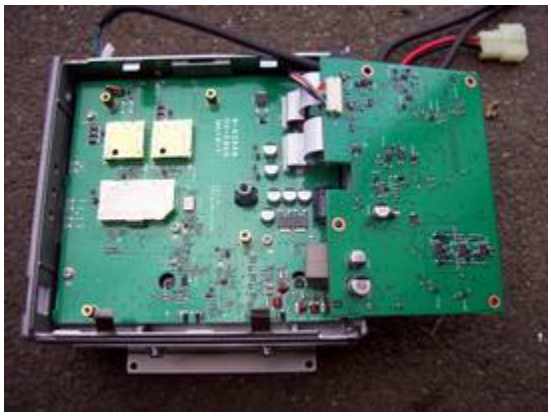
The RP-4000 had been seen to produce 25W when checked during a maintenance visit 4 months earlier. Repeater Trustee Simon ZL2BRG, who originally set up the repeater, had observed 17W and 22W previously. This was of concern but due to time constraints the repeater was installed to get the system running as a trial.

Continued testing on the workbench showed that at times, after the RP-4000 was on stand-by, the TX output power sometimes would start at 10W and continue to rise to 22W. While at 10W I removed the top cover of the TX and the power jumped up to 22W. A tap with a small nylon head hammer caused the power output to jump about. There was a bad connection or bad ground problem.
I also noticed from the ICOM service software readout that the TX temperature reached high temperatures around 60 degrees after 30 minutes of TX.

There was obviously a cooling problem. I opened the TX unit and removed all the boards. I found that ICOM have used “fast” type screws with course thread and

not machine screws with fine tread. These screws were not torqued down tight and in my opinion this was the cause of the bad ground.
The power block and N connector was also of concern.
Swarf was found inside the connector and the center pin connection to the PCB was only 1mm to 2mm from the PCB ground. The connector was also not in line with the RF PCB connection and only bridged with a solder blob.

The following photos show the disassembly of the boards and connector Swarf.

The power block heat sink surface is not milled flat and has a rough surface. Excess heat grease was used and has melted and pooled into hard lumps.

I had to remove all the grease due to not being able to smooth any of it out. The power block is a 30W unit part number RA30H4047M.

I have applied an even surface of Dow Corning 341 blue heat transfer paste as seen in the following photos.

N connector earth and center pin use solder bridges. Center pin almost touches earth pad under the protection device. Sold wire links are now fitted. Center pin was cut on an angle so that the left side, as seen in this photo, was clear of the earth.

The TX cooling fan has a 5 degree differential and was set to start at 42 degrees. I have altered the start temperature to 30 degrees and it stops at 25 degrees. This gives a pre-chill to the heat sink it didn't have before.
The heat sink outside now feels hotter than before with the new heat transfer paste working as it should.

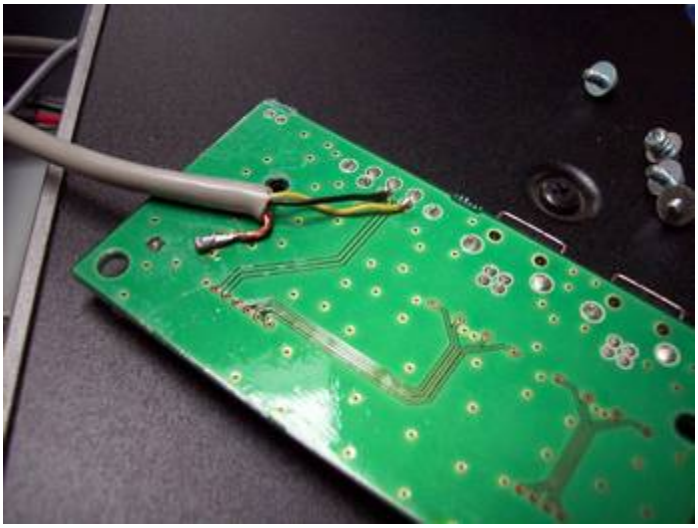
After a continuous TX period of 40 minutes the temperature reaches 58 degrees and stayed there for a further 40 minutes. Previously the temperature continued to climb. Note: The case cooling fan must be running and top and bottom air vents clear of dust or obstructions.

The N connector on the back has metal swarf as seen in the above photo. Clearing this out and also trimmed the center pin back away from the earth under the diode could have been causing an SWR fold back to occur.

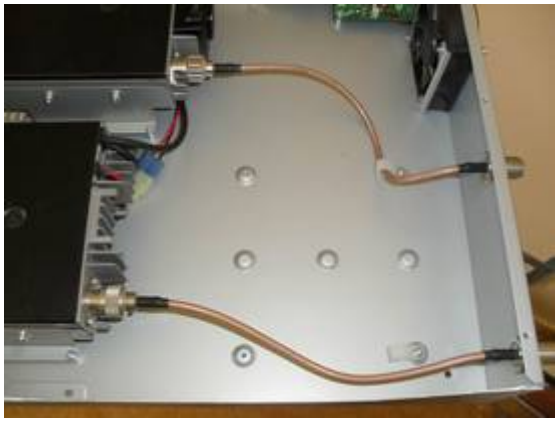
Low power is set at 2.5W and High is 25W.
At an ambient air temperature of 22 degrees power drops to 23W at 55 degrees transmitter temperature. The TX never rises above this and cools quickly as soon as the TX is keyed off. This is the behavior I would expect.

A plug socket arrangement has been fitted and wired across the H/L front panel power switch. This reduces the RP-4000 to 2.5W during power outages. There is an output on the Innovative SR-250C PSU that closes a contact during power blackouts to save on battery capacity. Remote power control reduces the current from 6.0A to 2.5A. This allows the D-Star system to run for longer during long power outages. The stand-by current is 0.5A.

The following pictures show the PCB connection and rear panel socket. Screened two core cable is used. A ground is soldered on the PCB end only.



While the RP-4000 was opened up the opportunity was taken to replace the internal RG-58 coax cables originally fitted by ICOM.
RG-142 cable is used as replacements. Cross talk causing desense is eliminated using the higher quality screened RG-142 cables. I was not able to measure the difference as I did not have appropriate test equipment but others around the world have and posted this alert on the internet. Having built duplexers I know that RG-58 is a lossy cable used on UHF and the braid is not woven tight enough to prevent cross coupling. The following pictures show the before (black cable) and after (fawn colour cable)

The following are pictures of the completed modified RP-4000 and the MT Climie D-Star rack installation.