Simple dummy load and power indicator.
By Lou Destefano, VK3AQZ 16/12/2010

At a recent swap meet, I was fortunate enough to purchase a UHF 50 watt, 50 ohm, dummy load, ex commercial gear, all for $10.

It came with a short coaxial lead screwed into the side of the mounting block, which is used for sampling the RF levels. The cable centre conductor is not electrically connected to the load and samples the RF level by capacitive coupling only.

I generally like to take a sniff of RF whenever I use a dummy load just to make sure everything is connected and I am getting the expected levels. I don't normally worry too much about the absolute power values – as long as I get a fair idea of what it is.

Unfortunately the amount of pickup from the cable was too low at low VHF power levels.

So I removed the cable and fitted a small homemade circuit board containing the sampling circuit.

A small screw is used to make contact with the hot end of the load resistor. The sampled RF is buffered by an smd resistor pad and rectified by a 1N5711 hot carrier diode purchased from Mini Kits in Adelaide.

The resulting DC is then fed to a small ex CB radio S meter (730 ohm resistance) via a 100k linear pot.

The pot has a 0 to 10 scale used to set the full scale sensitivity at different power levels.

In order to cover a wide range without multiple switching, I use the pot to set the full scale sensitivity, then use the meter scale to obtain an estimate of the load power.

This technique is common with SWR meters doubling as in-line power meters.
It's not a super accurate power meter reading but it is good enough for quick tests.

Photo 1 is of the front panel and shows a small table which indicates how much power will give full scale deflection for various settings of the pot knob. A pot setting of 5.3 gives full scale deflection with 100 W, whilst a pot setting of 9 gives full scale deflection with 1 W, at 30MHz.

Even though the dummy load is specified as 50 W, I found it would take 100 W for short durations. During these high power tests I placed a digital thermometer on the load to ensure it did not get too hot. I found I could feed 100 W into the load for 10 seconds at less than 40 degrees C.

I did not push my luck passed the 10 second mark. Unlike the surface mount power resistors now readily available, the carbon rod type is more forgiving. I found the SMD type RF power resistors fail quickly at elevated temperatures. There are no second chances with these unless you take extra measures to ensure they remain cool.

The sampling circuit is quite simple. I used small SMD resistors as a pad and the ones I used seem to survive the 100 W level.

I conducted some SWR tests on the load using a VK5JST UHF homebrew antenna analyzer.
This analyzer, built as per the VK5JST article, was checked to 500MHz using a precision test load

and was found to give an imperceptibly low swr reading.

Using this analyzer at 432 MHz, the load gave an SWR of 1.2:1 without the sampling screw touching the load resistor and 1.5:1 with it in contact. I think this could be improved by incorporating the 4k7 smd resistor (or several higher value ones in parallel) into the end of the screw probe.

At 144MHz, the SWR was undetectable with or without the screw in contact with the load.

The power calibrations were performed at 30MHz as I don't have a 100 W transmitter at 144MHz.

With the unit calibrated at 30 MHz, I found that power readings at 144MHz were approximately 71% of those at 30MHz and 62% at 432MHz. This is due to various losses and falling diode efficiency at VHF and UHF. To get the same reading as 1W at 30MHz, it took 1.4W at 144MHz and 1.6W at 432MHz. I think a small variable C across the 4k7 resistor could be used to flatten the response.

However that is not a problem for me as I also have other power meters which work at VHF and UHF, which I can use to obtain more accurate readings.

This load is used mainly for tuning up circuits and quick checks to ensure the rigs are outputting around the right amount of power.

At $10 for the load, a diode, and a couple of bits from the junk box that's pretty good!

The die cast box housing the meter, is ex one of my early noise bridge kit designs.

The circuit for the load is shown in Fig.1.

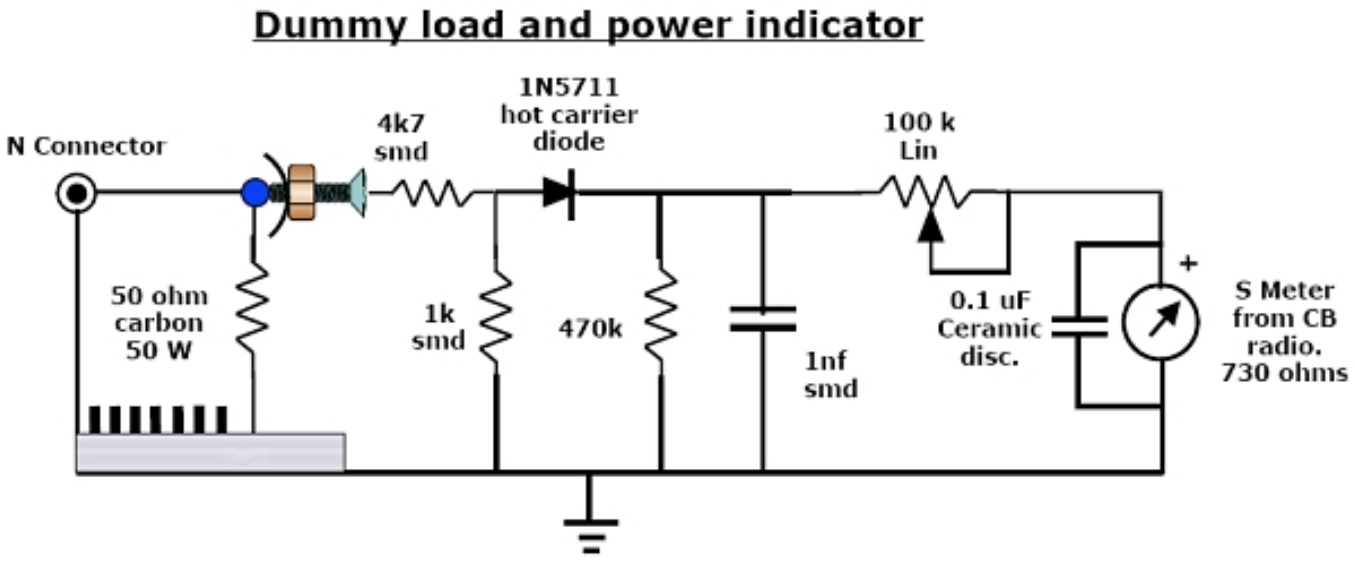


Fig. 1 Circuit diagram of dummy load and power indicator.

Photo 1: Front of unit showing the CB S meter, sensitivity pot and power chart.

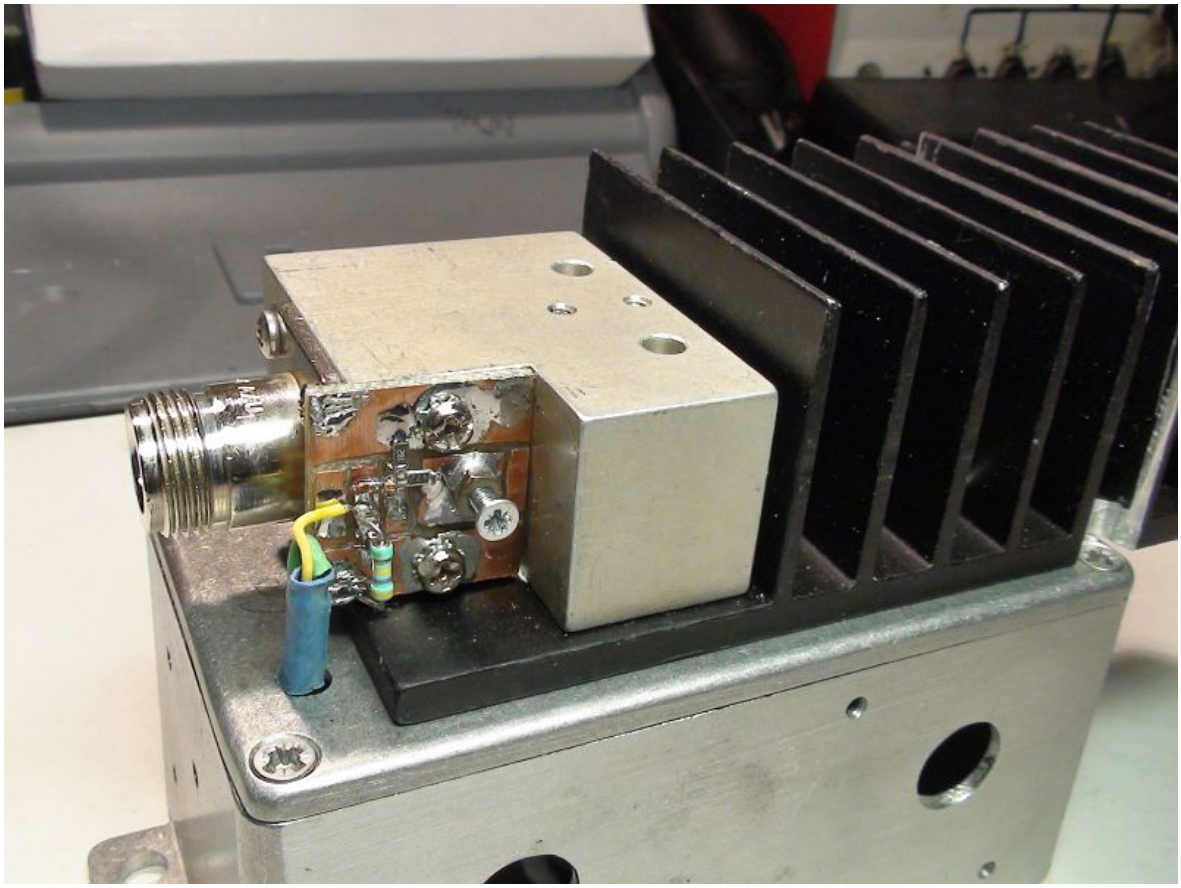


Photo 2: Sampling PCB attached to the load resistor mounting block.

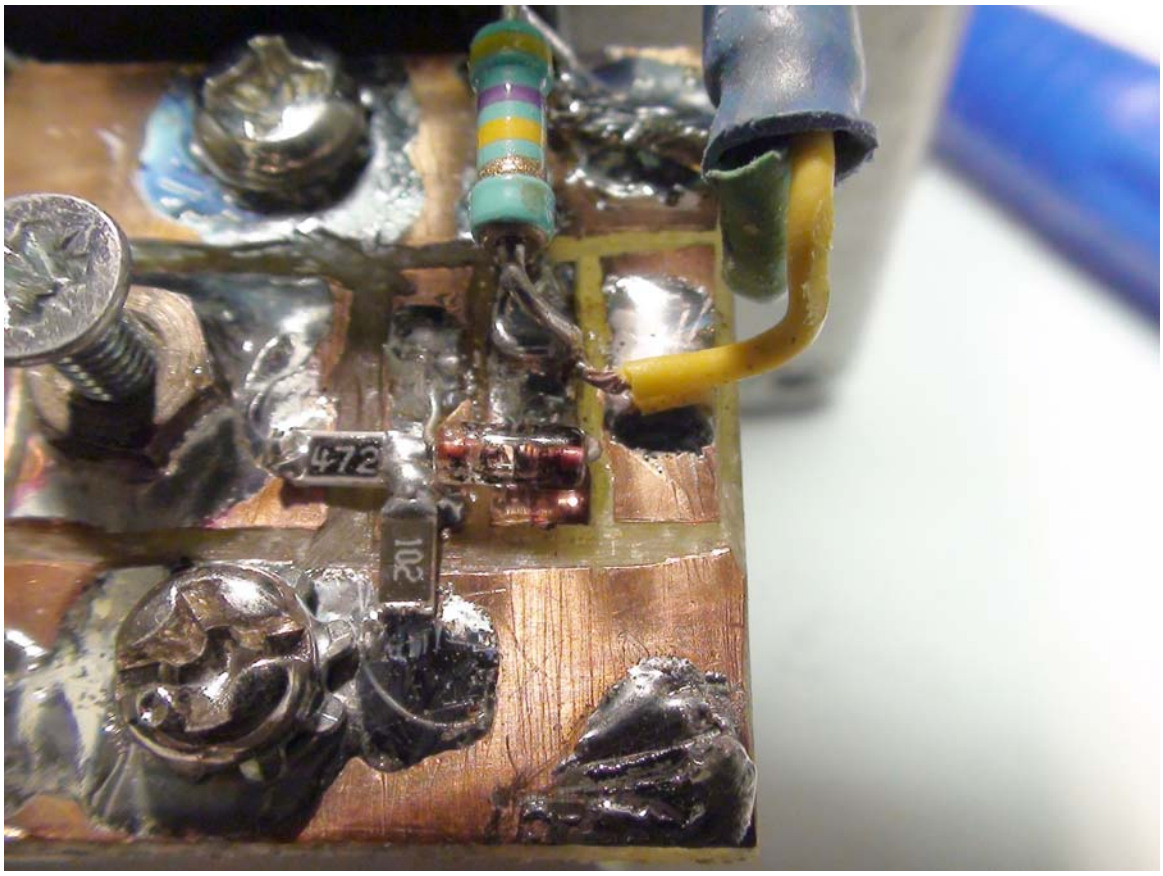


Photo 3: Sampling PCB showing the smd resistors and diode. Tracks were cut with a Dremel disc.

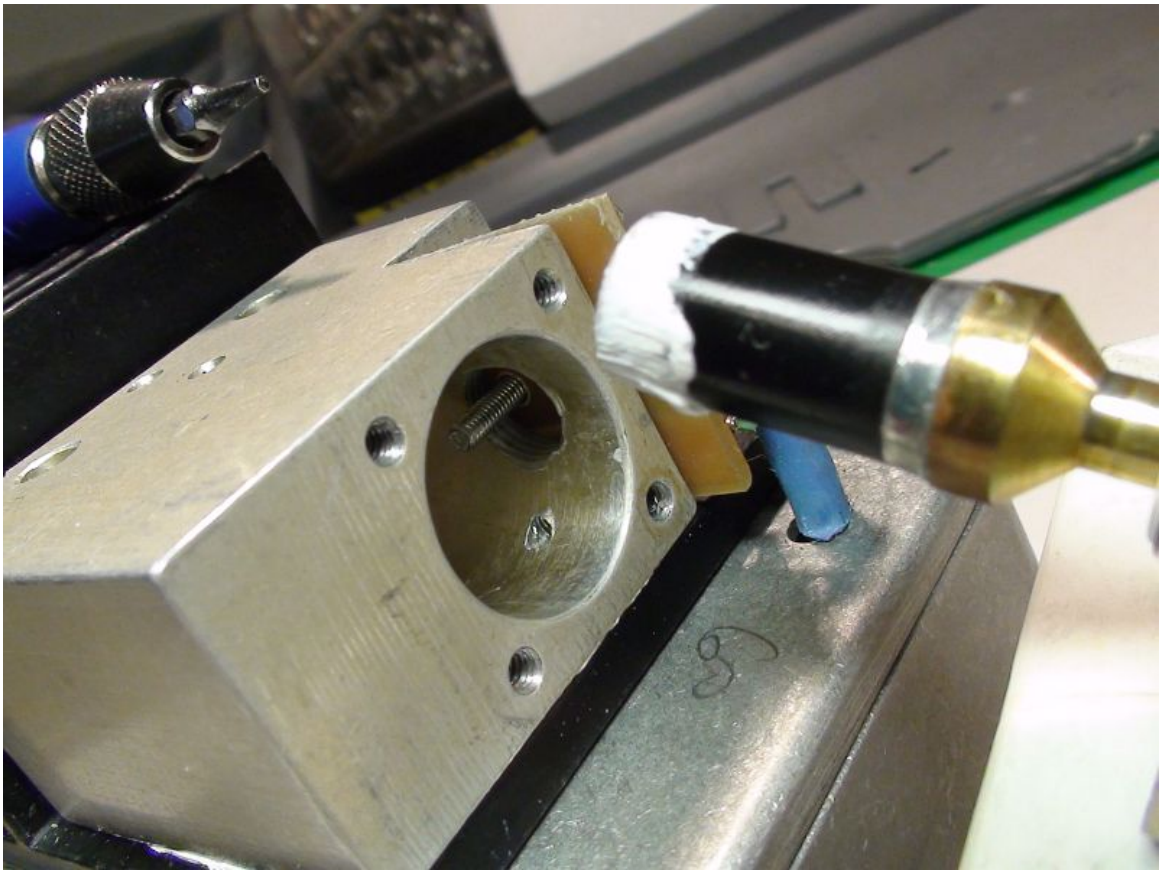
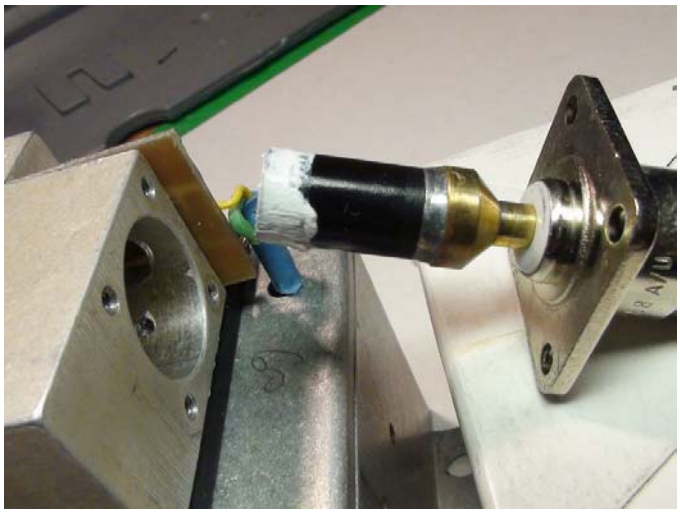


Photo 4: Load resistor. Note the sampling screw visible through the side hole. This could have been placed more centrally.



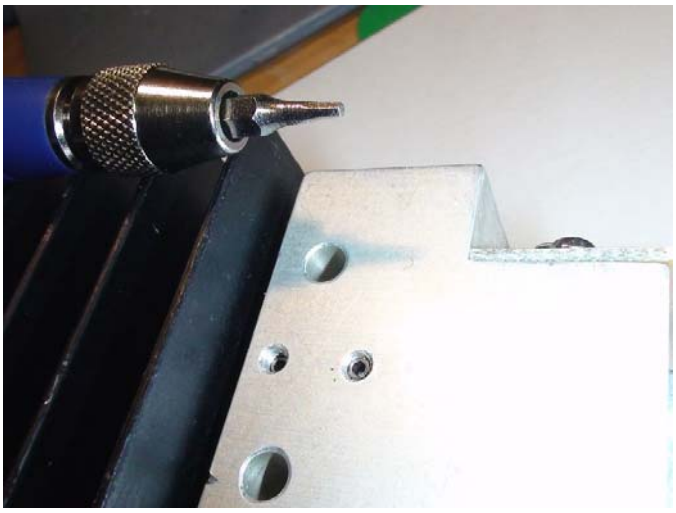


Photo 4 & 5: The earth end of the load resistor is held in place by a small grub screw (1.3mm hex key). A second grub screw holds a small bullet which is inserted up against the load resistor end. The white grease is heat conducting compound.

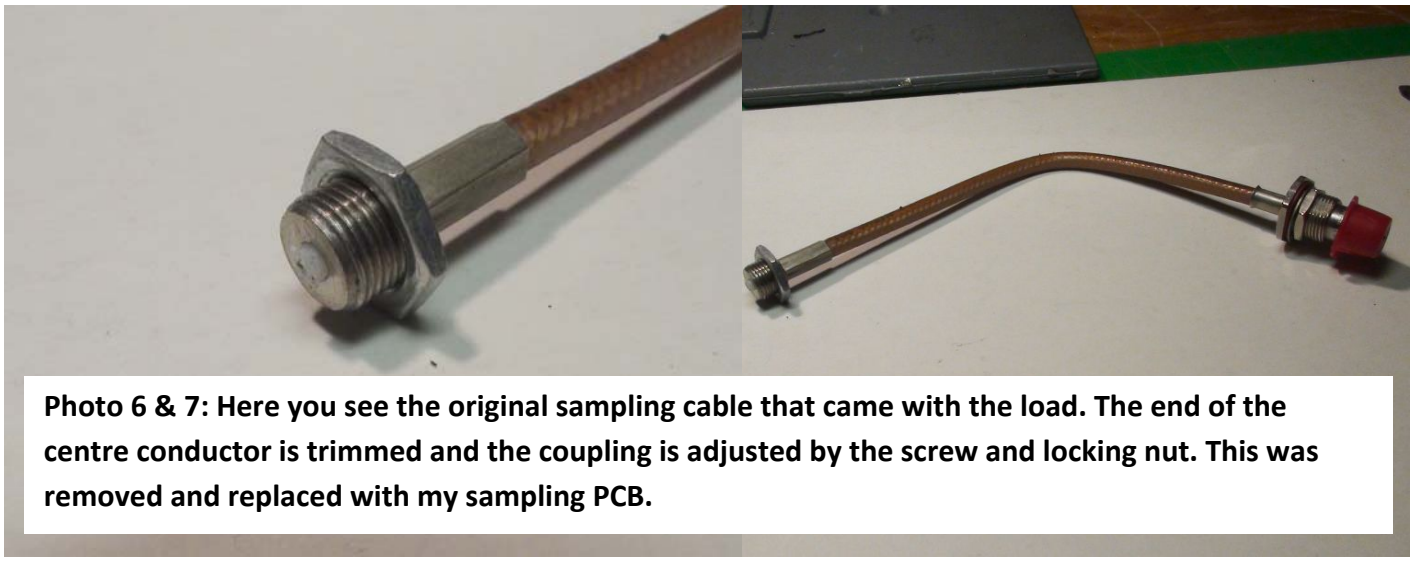


Photo 6 & 7: Here you see the original sampling cable that came with the load. The end of the centre conductor is trimmed and the coupling is adjusted by the screw and locking nut. This was removed and replaced with my sampling PCB.

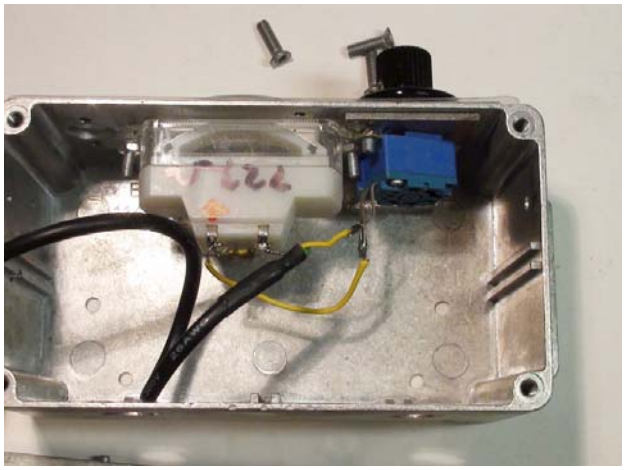


Photo 8: What's inside the die cast box?
Not much – just the meter and pot.
Maybe room for a precision log amp chip or similar.

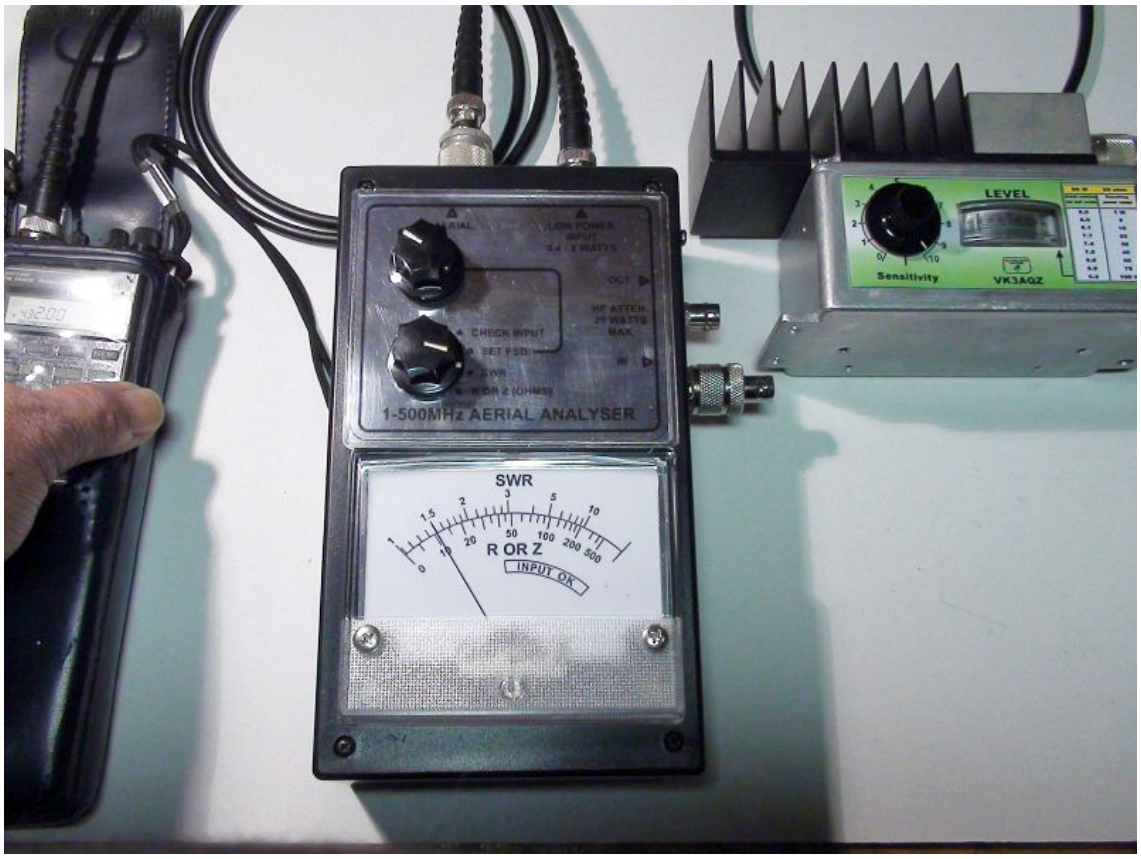


Photo 8 & 9: The VK5JST analyzer used to check the load at 432MHz with the sampling screw in contact with the load resistor (SWR 1.5:1), and then not in contact with the load resistor (SWR around 1.2:1).