

## Cushcraft R5 $\frac{1}{2}$ $\lambda$ Vertical Maintenance and Repair

### CUSHCRAFT R5 (10/12/15/17/20 m)

Cushcraft have made many vertical antennas; R4, R5, R6, R6000, R7, R7000, R8 etc. All are  $\frac{1}{2}$  wave radiators with 4 or shorter base-load rods. Those "radials" are in fact a top hat capacitance. The quality of the R6 successors decreased, see Product Reviews on [www.eham.com](http://www.eham.com).

The 17ft half wave vertical is covering the 10, 12, 15, 17, and 20m amateur bands. The antenna does not require traditional ground radials, so no need for unsightly radials and is so light a normal scaffold pole would be ideal to mount the antenna.

### POWER

The manual states that this shortened half wave radiator is suited for 1.8 kW pep power and that is remarkable for this type of 5 m-tall antenna. The vertical passed a test with a borrowed 1.5 kW amplifier with no-ill effect. There were no signs of failure on the traps or matching unit.



R5 on top of a 12 m mast.

### PRACTICAL TESTS

The R5 is mounted on a 12 m mast. My 2 el. Yagi only outperforms this antenna if the beam is pointed to the station. The difference is very noticeable in SSB/CW DX pile-ups, but if I can hear them I can work them. It provides useful DX performance. I did comparisons with my open wire fed inverted V W3DZZ and on 20 m: R5 = W3DZZ at 1500 km. On all bands beyond 1500 km the signal strength is about 1 S unit better than the W3DZZ.



This antenna is very usable and, being asymmetrically fed, with no radials and only  $4 \times 1.24$  m stainless steel whips («fig) is attractive for apartment dwellers. All hardware is aluminium or stainless steel. The aluminium durability is good but not as good as Fritzel's tubing. It has withstood many heavy windstorms without a problem and currently is bent over at about a 10 – 15 degree angle. It is rugged and not too tall mounting without guy ropes. This antenna is sensitive to metal objects in near field. Prevent installation over a metal roof or near out other antennas because they will detune the R5 considerably.

### INSULATOR

The fibreglass base insulator (fig a) is a polyester-coated tube. The polyester surface has the tendency to "evaporate" and the bare glass fibres then are like a sponge attracting

absorbing dirt and moisture.



"Bumper" spray

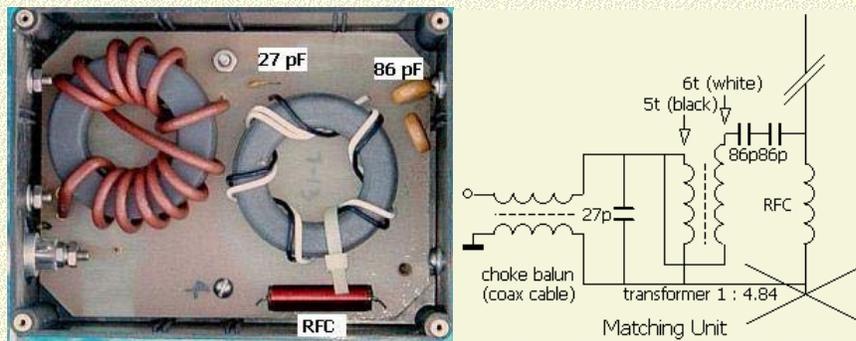
weather beaten i

insulator

The insulator was "painted" with layers of 2 component polyester resin and sprayed (fig») with "bumper spray", a black car paint for polyester prevents the deterioration.

Insulator covered and protected with black spray.

## MATCHING UNIT



L to R: choke balun (brown colour wire) and 1 : 4.84 auto transformer (black and white colour wire).

On several homepages the transformer is called a 1 : 4 balun. That is contrary to the print design. On the auto transformer are 5 black turns and 6 white turns through the toroid. So the transformer step up ratio is 5 : (5 + 6) and that is an  $5^2 : 11^2 = 1 : 4.84$  impedance ratio. All matching units' shows equally designed print boards.

I replaced the two 86 pF caps in series with a single transmitting high current 47 pF doorknob type.



This happens if one use the antenna with an ATU and a lot of power on more than the specified 5 bands!

## MAINTENANCE

The traps should be carefully loosened and the contact area and all other aluminium hardware should be cleaned with Brillo pads (steel wool impregnated with soap).



## COIL



Water got inside a trap due to cracked heath shrink tubing.



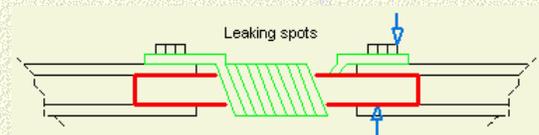
Cleaned and repaired coil

I have been using my 2ndhand R5 for more than two years and then some problems arose. The SWR was varying and increased on some bands. I took the antenna down and it turns out that water got inside a trap because cracked heath shrink tubing and a split in the joint between the coil former (force-fit?) into the aluminium tube. The heath shrink tubing was carefully removed and the coil, covered with "transparent contact adhesive", was cleaned with thinner.

Once clean, the split should be filled with epoxy glue (2-part polyurethane adhesive), the coil buttered with transparent contact adhesive and reassembled with heath shrink tubing. The process with the transparent

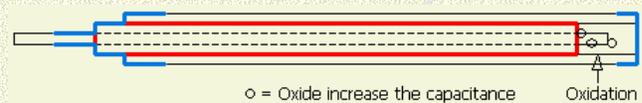
adhesive is for preventing that water gets inside the trap.

Leaking spots are the heath shrinks tubing over the bolt onto the connection of the coil former with the tube.



## CAPACITOR

The capacitors paralleling the sealed coils are coaxial types with a rod, a tube and a dielectric tubing in between. One end is sealed with heath shrink tubing and the other end is protected with a cap.



One capacitor failed because of a burst cap and water get into the coaxial system. This changed the dielectric constant of the capacitor, thus moving the resonant frequency, and the SWR increased dramatically. Flash-overs when running high power shorted the wet capacitor out and evaporated a part of the insulating tubing.

This was replaced with a short piece of PTFE tubing and all of the components were dried, cleaned and reassembled with contact cement and heath shrink tubing.



All caps are replaced with rugged caps.



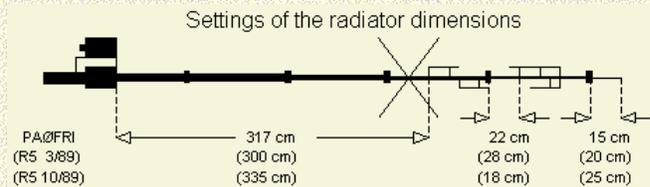
All R5 parts of the 1989 model.

Measuring the traps is only possible by comparison with another R5. Make sure that you do not touch any part of the antenna and vary the frequency of a (grid)dipper meter until a strong dip is seen. Move the meter away while retuning until a very shallow dip is seen. Take note of the trap frequency. Repeat this process with the repaired R5.

### RADIATOR DIMENSIONS

The assembly and installation manuals of 3/1989 and 10/1989 show different dimensions for the radiator.

With the antenna on a 2 m mast I measured the SWR, on each band with a half wave (or multiple) 50 Ω cable for that band between the feeder point and an analyser. I found the dimensions in the schematic by varying the sections to match the specifications for SWR ~ 1



Back on a 12 m mast the R5 performs by 1/2 – 1 S unit better (75% of the QSO's) than the inverted V W3DZZ.

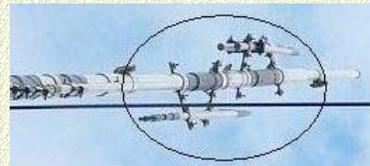
With a 12.5 m 50 Ω coax cable feeder line the SWR was:

MHz	14.200	18.100	21.400	24.950	29.500
SWR	1	1	1.3	1	1.1

### NOTE: 2 TYPES OF TRAPS FOR 15 m and 17 m



Combined 15/17 m trap March 1989



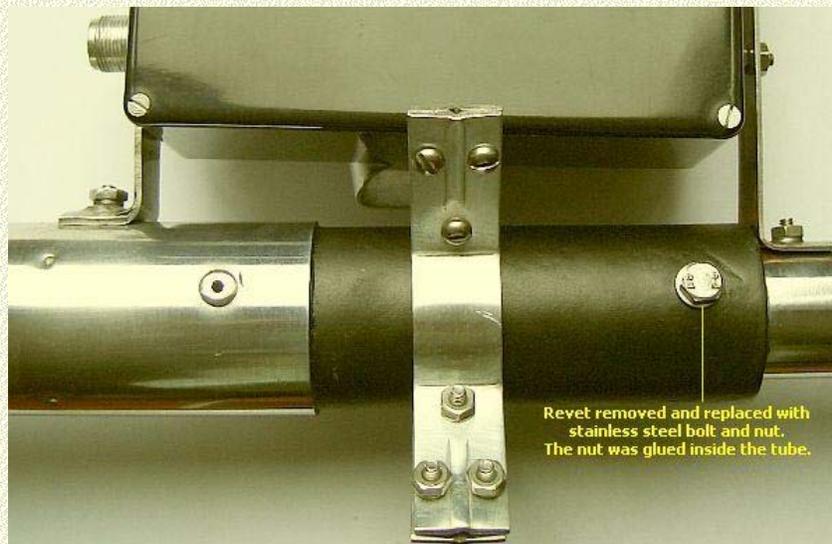
15 + 17 m traps October 1989

### WOBBLED ANTENNA



The antenna wobbled due to the gap caused by evaporation of the polyester. The tube was removed, the inside of the insulator applied with layers of 2 component polyester resin until a minimum variation of fit of the tube. Then I sanded the insulator for a perfect cylindrically curved shape and applied the last layer and placed the antenna back in the insulator. In fact the insulator was restructured to its original diameter.

I used a polyester repair set (for automobile) and applied the 2 component polyester resin with a brush. Eventually fill holes with fibreglass. The 2 component polyester resin can be used in combination with fibreglass mat and fibreglass thin film to fill holes in surfaces of steel, aluminium, wood, concrete and polyester. Polyester resin is elastic and resistant to chemicals and weather influences and is, after hardening only sand smooth mechanically.



Due to the gap the antenna wobbled and one of the straps was broken.



I replaced a shortcut 27 pF cap with 4 × ceramic tube caps in series/parallel.



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