



Grounded Groundplane antenna construction details by R.O.M 106,5 FM

This is the detailed construction tutorial for a grounded groundplane antenna 1/4 wavelength.

The antenna will be built out of stainless steel with a central body made out of Delrin. This aerial, where the radiator and the radials will be connected together at one point and earthed, uses a gamma-match as feeder to the radiator.

Here are the theoretical calculations based on our transmission frequency of 106.45MHz:

Shortening-factor for a standard 1/2 wave dipole : 0.96
So this will give us the following: $\lambda = c/f = 2.816\text{m}$

λ_v ($v = \text{shortened}$) = $2.816 * 0.96 = 2.703$
For a 1/4 λ Radiator, this will give us a total radiator length of 676mm

The slimfactor (s) of this antenna (built with 8mm tubes) $s = \lambda_v/d = 676/8 = 84.5$

The real shortening-factor will then be: $sr = s/(1+s) = 0.988$

Now we can calculate the physical wavelength of the radiators:
 $\lambda_p = 0.96 * 0.988 * \lambda = 2.671\text{m}$
which will give us a radiator length of 668mm for a 1/4 radiator.

But I checked up with Karl Rothammel's antennabook, and out of a table I could read a real shortening factor of 0.93 with respect to the calculated slimfactor. Driving the calculations with this factor will give us a radiator length of 653mm. A difference of 15mm according to my calculations. ...what now?

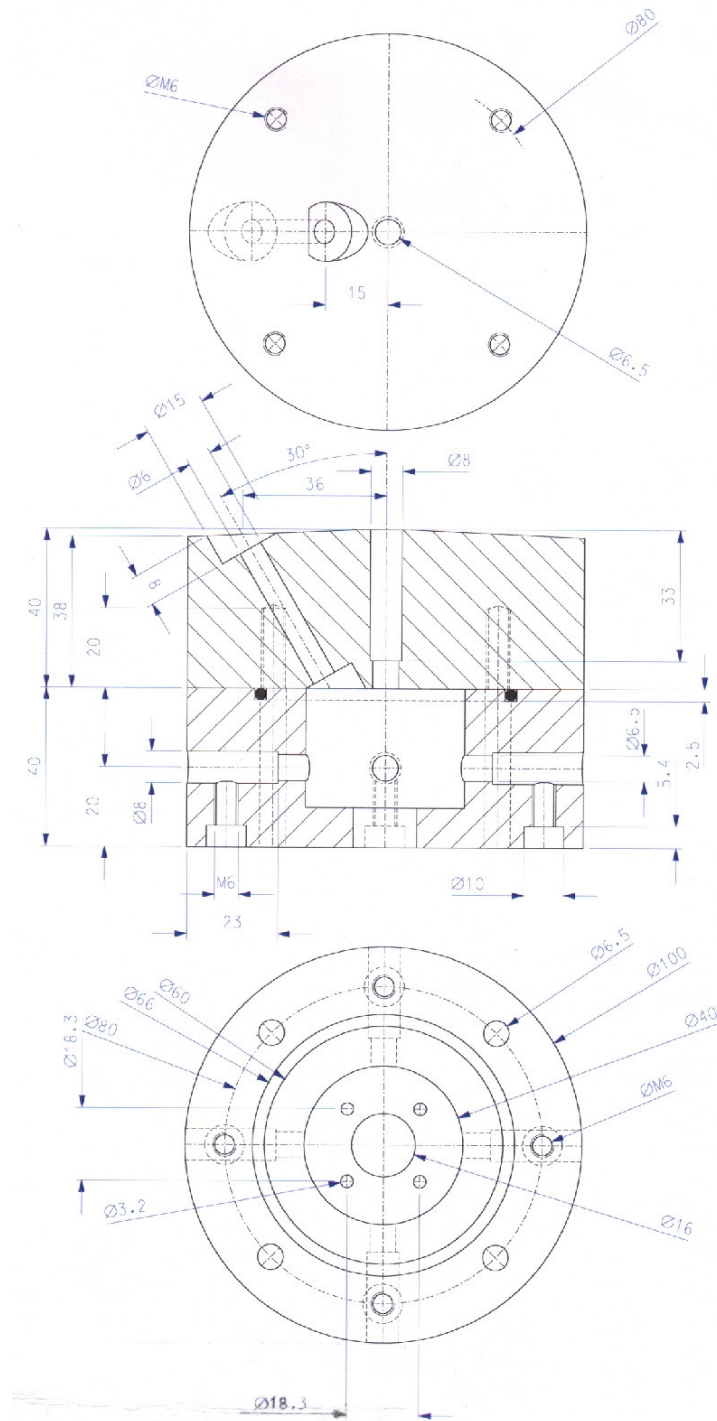
Let's do the following: We'll use the 653mm, the shortest length and cut a 1/4" thread at the end of the radiator and radials. By means of a 1/4" screw about 1" long, we can adjust the resonant length of the radiators.

So 27mm offset from the middle of the antenna connector to the beginning of the tube for the radials minus the head of the screw and the fixing nut at the other extremity of the radials will give us a length of the tube for the radial of about 614mm. Same calculation for the radiator and off we go. The dipmeter will show which calculations will be right.

Here is the drawing for the Delrin body. OK, OK, for the experts, the hidden lines of the 3,2mm holes for the antenna connector are missing on the sectional drawing... Nobody's perfect...



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We'll start with cutting the threads into the radials for the "match" screws
Cutting threads into stainless steel with a HSS thread cutter is not that easy...

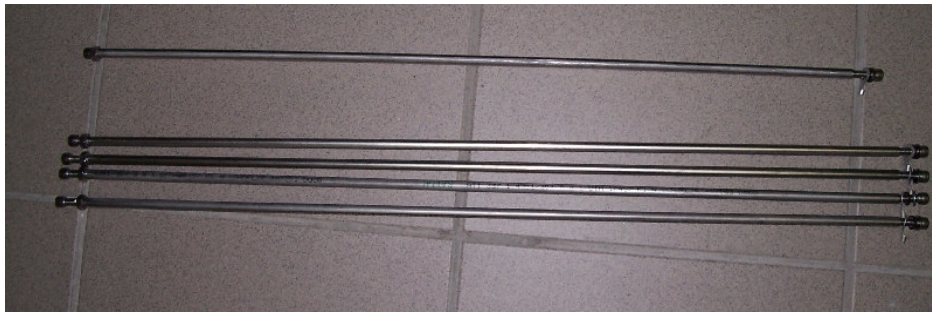
This is what the Nylon body now looks like. Many, many thanks to my friend and co-worker Toni who spend a lot of time for me on his turning-lathe.

As I got conflicting results from Rothammel and my own calculations, I searched the web a bit on related informations about ground plane antennas.

I finally found a site where they state that the radials should be about 5% longer than the radiator itself. So I decided to cut the radials to 640mm and the radiator to 600mm keeping in mind that everything that's too short can be extended... 😊

A longer adjustment screw will do it then.

Here's a picture of the radiator and the radials:



All the threads in the nylon body are finished except the hole for the match.
This is what the inner of the delrin body looks like:





And here the assembled body:



The N-connector is in place and here we see a hole where a radial will be mounted later. Ah yes, I filled up the radial tubes on the body side with silicone compound. The radiator on both sides. All we want to avoid later is getting moisture into the body.

so first I had to bend the radials to 50 Degree. This is what it looks like:





Here we see the bottom assembly with the worm locking screws for the radials.



And the mounted Radials. Looks like Sputnik.. 🤪





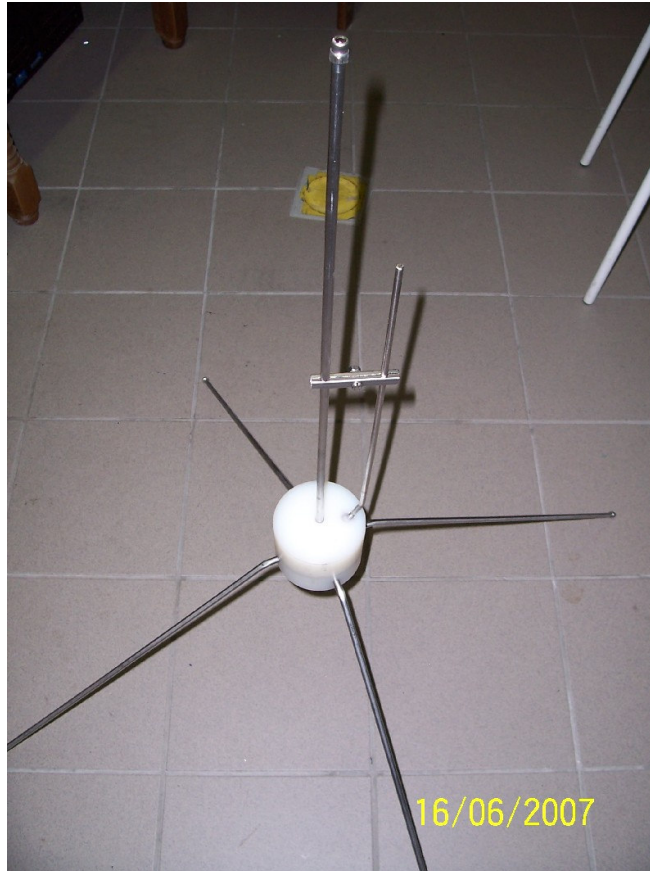
The top assembly without the Gamma-match



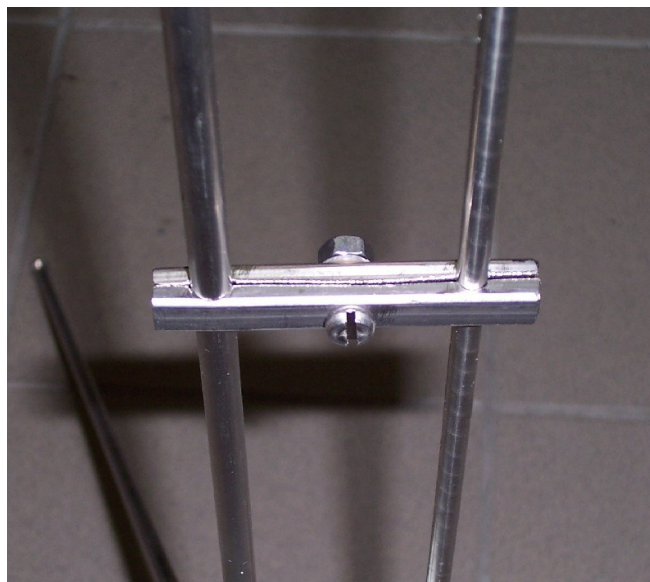


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And here an overview of the complete antenna. So I still have to do the wiring inside and tune it of course.



And finally a detail of the Gamma-Match:





The antenna is assembled and this is what the inner „circuit“ looks like.



and the finally assembled antenna with quite some silicone grease around the gasket to make it watertight.



So the first test gave me a SWR of 1:1,4
Not bad if I consider that this test was conducted inhouse.