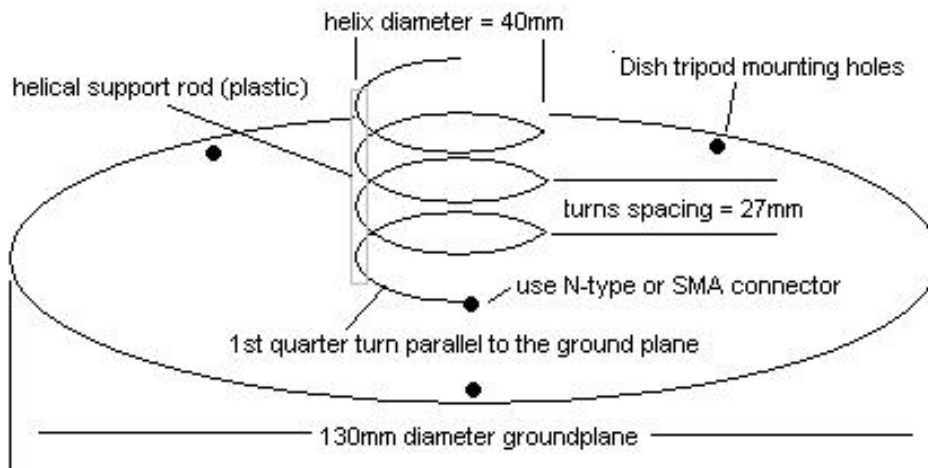


S-Band Helical Omni Antenna

Matthias, DD1US, January 24th 2019, Rev. 3

For some time, I wanted to build a short helical antenna to use it as a RHCP omni antenna to monitor LEO satellites in the S-band. I wanted to cover the frequency range 2200-2450 MHz. Fortunately, I now found the time to build it. I used the following construction details from www.uhf-satcom.com as a guideline and optimized it further.

uhf-satcom.com S-band antenna **2250MHz LHCP helical**



As I wanted to use this antenna as an omni antenna, I decided to use only 2 turns for the helix. The gain of such a short helical antenna is expected to be slightly higher than 7 dBi and the half power beam approximately 77 degrees. The first nulls in the radiation pattern should be at about 170 degrees which means that this antenna will cover most of the sky and enable reception of LEO satellites well, once they are above approximately 20 degrees elevation. The practical results will show in the future how well it actually works.

Looking for a suitable radome, I found a 3dBi Industrial Spire Omni Antenna for 1 Euro on eBay. This antenna is intended to be used indoors and outdoors.

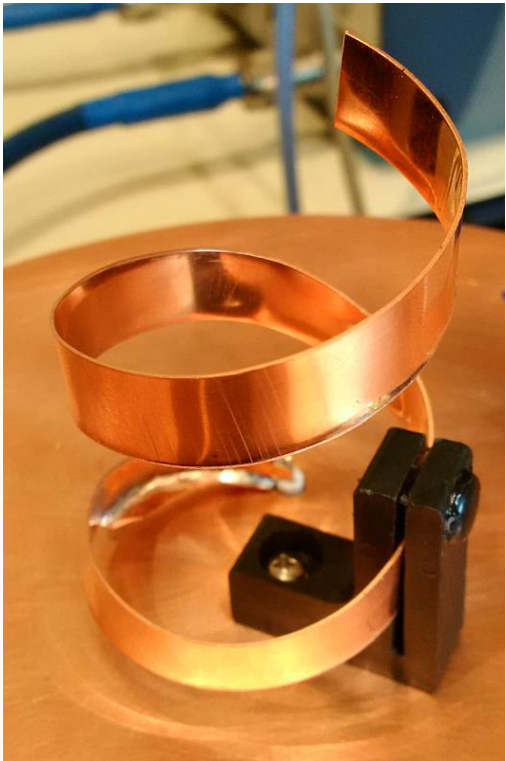
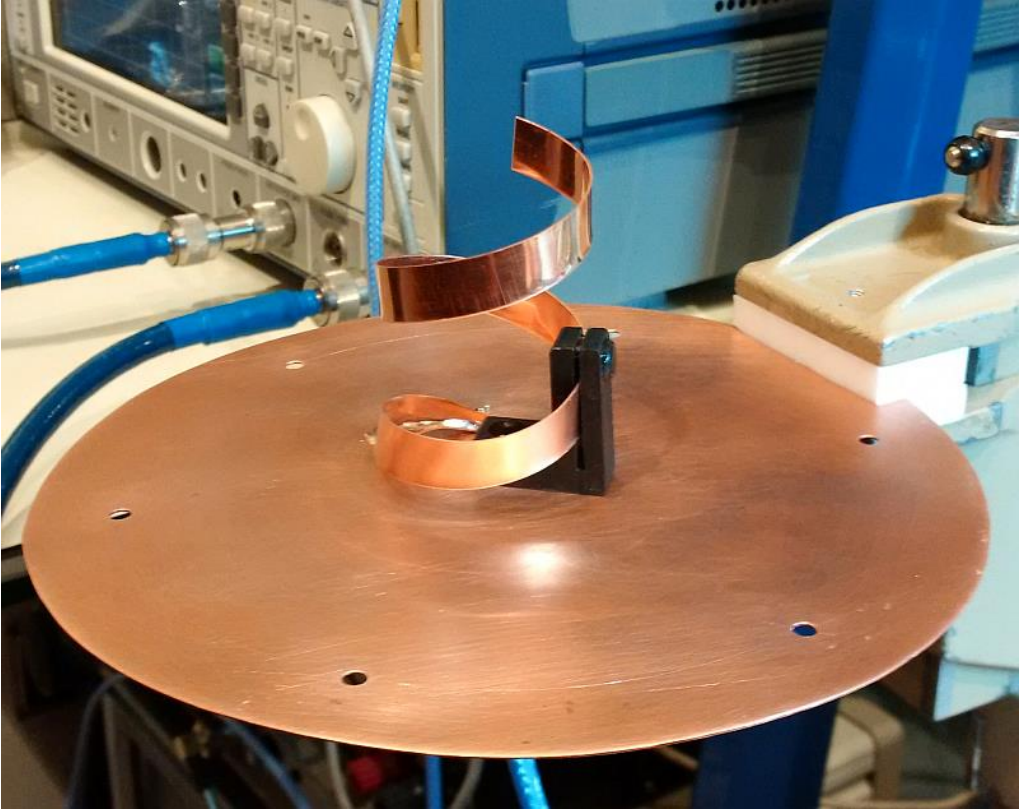


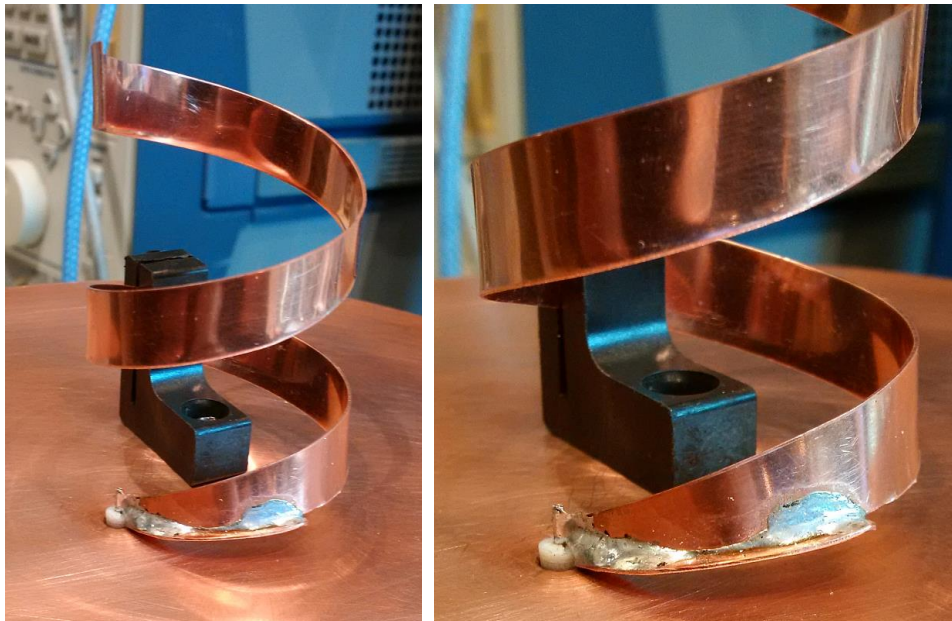
This antenna is housed in a plastic radome and has already a bracket attached to it. Inside the radome was a quarter wave ground plane antenna.



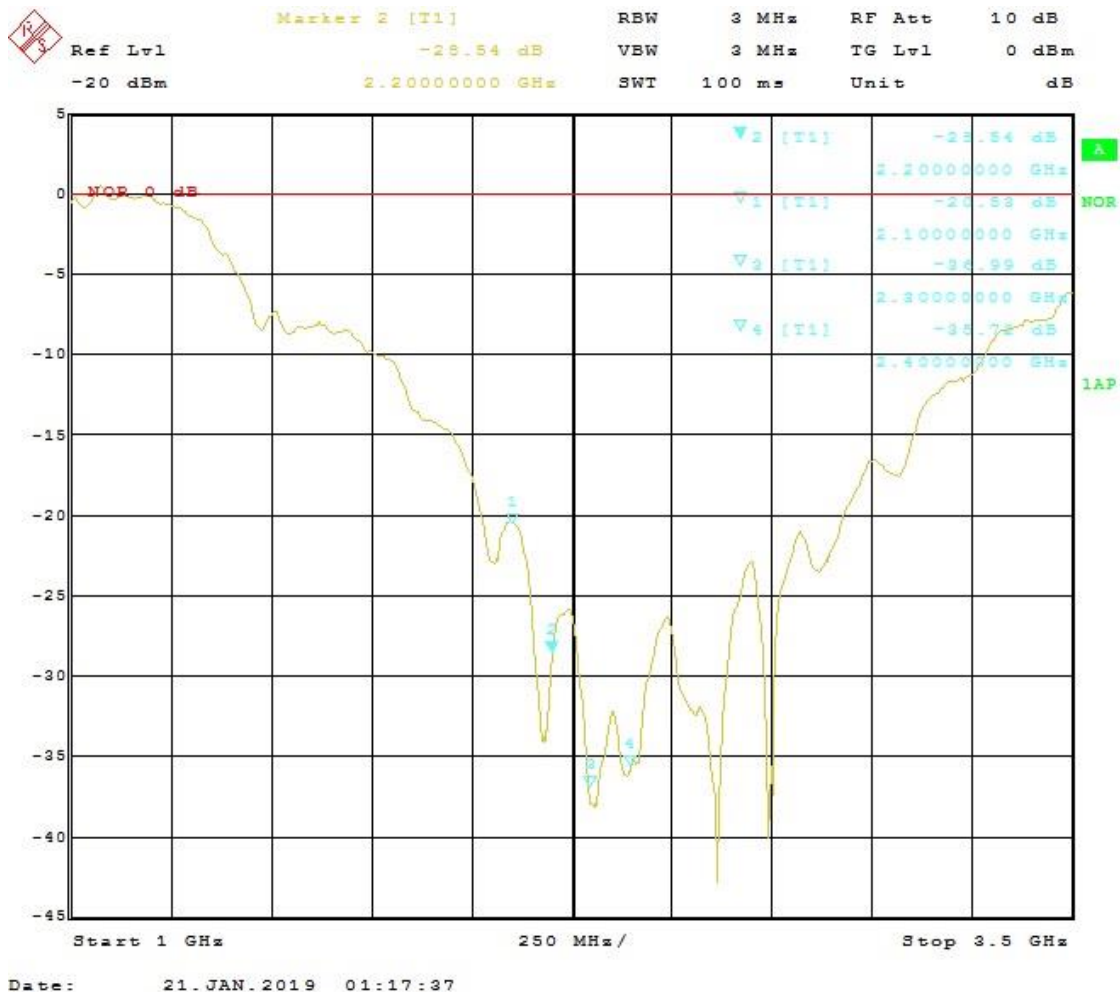
The antenna seemed to be unused and I was surprised, that the radome had a small hole drilled into the top. It looked like this was done by the manufacturer intentionally. If anyone has a clue why then please let me know. I removed the antenna with the RG58 cable and the TNC connector as I intended to mount a N-jack in the baseplate. The bracket is made of steel with minimum protection against oxidation. As I also wanted to seal the hole in the top and the cable feedthrough at the rim of the radome I decided to paint the radome and the bracket in order to provide optimum protection for the intended outdoor application.

I built the reflector plate and the helix of the antenna from some 0.6mm thick copper sheets which found in my workshop. The I decided to use a copper strip instead of a wire and soldered a small tapered copper strip under the helix in order to provide a proper matching to 50 Ohms. The helix is directly soldered to the inner conductor of an N-type jack, which is soldered to the reflector plate from its backside. The helix is mechanically supported by a L-shaped plastic bracket. Here are some pictures of the antenna before mounting coating it with a thin layer of Urethane spray and mounting it into the encasing.





Tuning of the antenna for optimum 50 Ohms match was actually more difficult than I had expected. Usually helix antennas are said to be very unproblematic. I had to tune the distance and the angle of the tapered copper strip and the reflector plate under the helix several times until I was happy with the results. Return loss is better than 25 dB in the frequency range 2150 – 2700 MHz. Maximum return loss is at 2300 MHz with more than 35 dB.



Mounting the antenna into the radome and characterizing the impedance showed no noticeable difference than the measurements done with the bare antenna. The antenna is water-tight by the original rubber gasket placed between the radome and the copper plate and Spinner Plast 2000 © sealant between the copper plate and the L-shaped bracket. Also, the N-Jack is protected by a layer of Spinner Plast 2000 ©.

Here are some pictures of the final antenna including an aluminium clamp attached to the bracket.





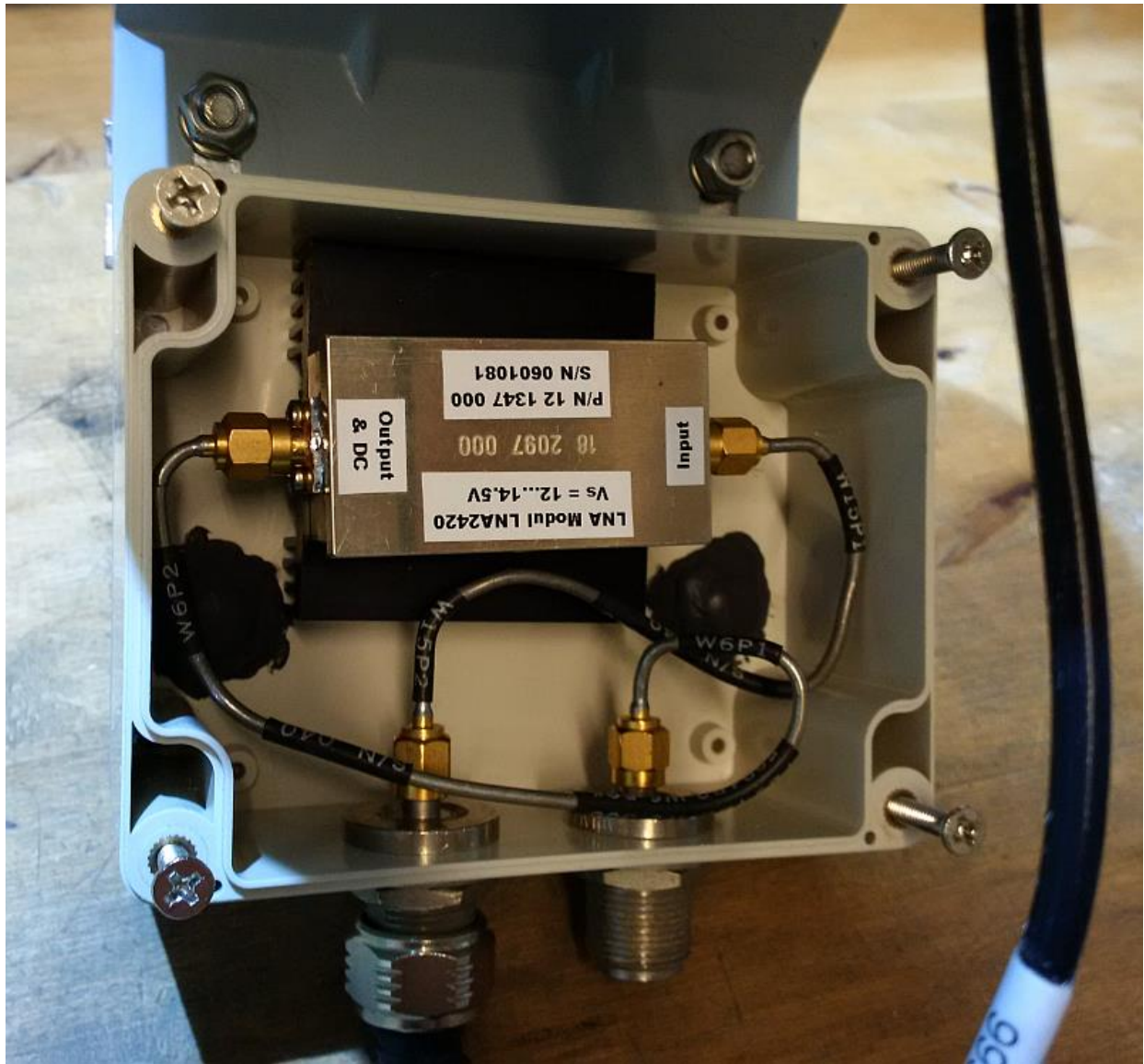


Finally, I added a low noise preamplifier to the setup. I am using the LNA2420 from Tandberg which I described in a separate document on my website. In the frequency range from 2150 ... 2700 MHz the gain is more than 25dB and the noise figure between 0.6 .. 0.7 dB. Here are some pictures of the final setup including the LNA.









I always appreciate feedback and will be happy to answer questions. Please direct them to my Email address given below.

Best regards

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