

A really 'Hen' double band 2m-70cm wire antenna.

Recently I started to operate in the VHF band with all the limitations due to the urban life-style, as the lack of free access to the roof... the enemy number one of ourselves OM!

So after the promising performances noticed with some experiments in this band I led with both an home-brewed small magnetic loop and a rigid dipole, I've discovered on the web some designs of a seldom used, at least in the Europe, antenna called hentenna.

It has its origin in Japan, when JE1DEU, JH1FCZ and JH1YST invented and realized this particular aerial for the 6m band in the late 1970's.

A lot of papers are available on the web, especially in japanese language, so I will not provide for the n-time the entire design, but I'll provide the web source where the reader could find all the information necessary to simply realize its own hentenna in order to became immediately operative!

Follow a list of links, sorted by quality of the content and innovation, second my personal opinion:

- (1) The DK7ZB-Reflector-Hentenna: <http://www.mydarc.de/dk7zb/Quadlong/Hentenna.htm>
- (2) The 4 Element Hentenna Beam for 2 Meters, by N5NNS: <http://www.hamuniverse.com/n5nns4elhentenna.html>
- (3) Introduction of Hentenna, by JR1LZK: <http://www.ve3sqb.com/hamaerials/jr1lzk/>
- (4) Cebik W4RLN paper: <http://w4rml.net46.net/gloop.html>
- (5) Una strana antenna, by Daniele Cappa (Italian language only...): <http://www.iw1axr.eu/articoliEF/Hentenna.pdf>
- (6) Hentenna 144MHz, by IW3HZX (Italian language only...): <http://iw3hzx.altervista.org/Antenne/HENTENNA/Hentenna.htm>
- (7) Hentenna VHF, by IZ0HCC (Italian language only...): <http://www.iz0hcc.it/hen.html>

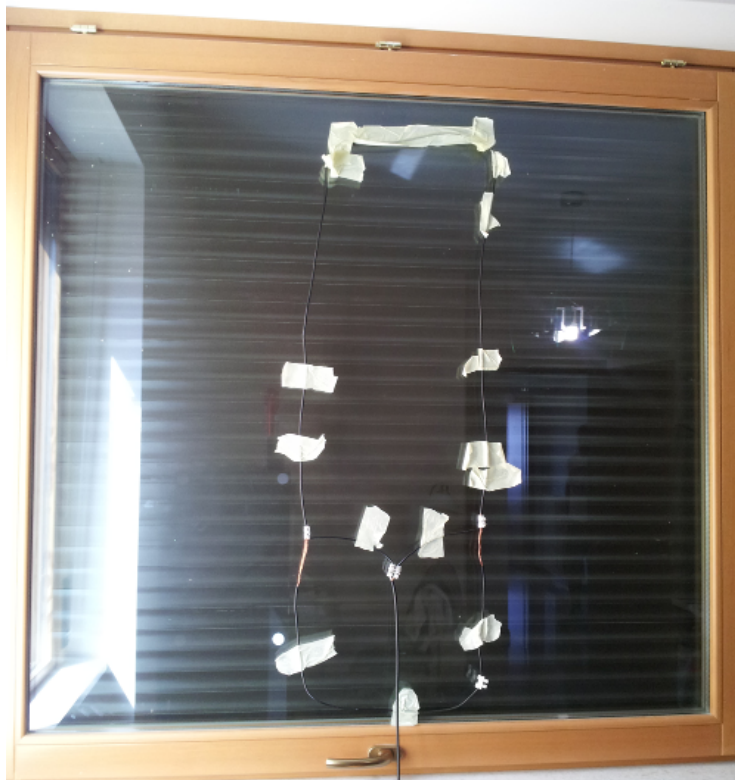
I'll report my particular experience with this antenna and I'll provide some simulation results, a real QSO log, and all the data I've collected about an unexplained (for the moment) dual band behaviour: **the exemplar I've built perfectly resonate also on the third armonic, working as a double band VHF/UHF antenna!**

All the test reports and measurements that follow will be referred to my wired prototype (AWG13 or 2.5mm²), based on the design by IW3HZX (6).

You can see it together with the details of the installation in the *picture 1*.

This is a very ugly setup, I should call it "first aid hentenna" due to the adhesive tape that looks like to some bandages, but this poor-man antenna has astonished me not only for the good performances but also for the third armonic resonance that I have mentioned earlier.

So, in the boundary conditions you can see in the *picture 1* connected to my rig by moreless 5m of RG58/U coax cable and at approximately 110cm above the floor level, this poor windowed hentenna showed an SWR between 1.7:1 at 143.000MHz and 1.8:1 at 146.000MHz (I used a cross-needles ZG Mod. 430 SWR and power meter to perform the measures, see *picture 2*).



Picture 1: my "first aid" dual band 2m-70cm hentenna



Picture 2: measurement setup

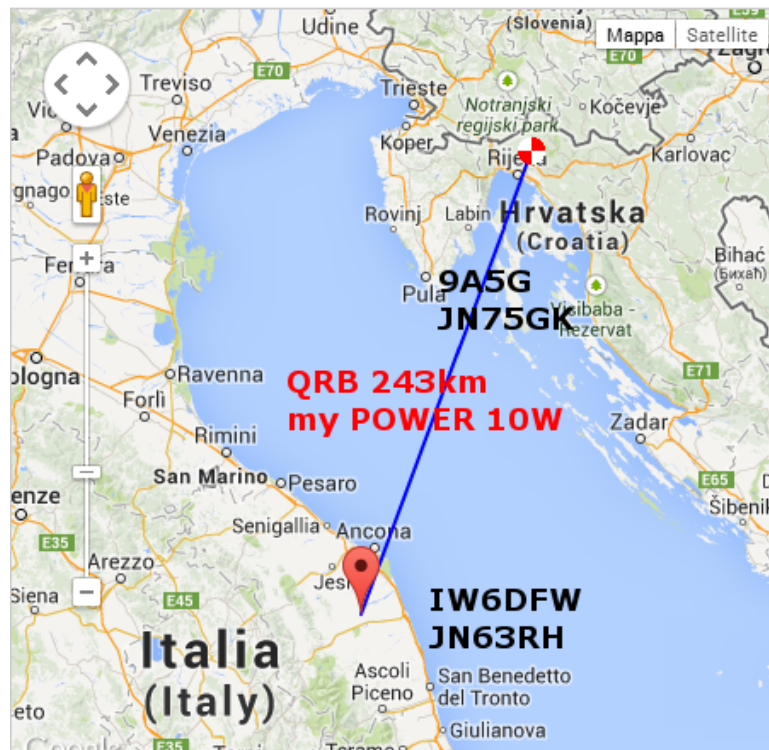
Operating with a power between 2 and 50W (the factory output of my Icom IC-7000), and taking advantage of the contest organized during the summer, when the propagation is good on these upper bands, I was able to perform some QSO in order to characterize my antenna system.

Follow an extract of the 2m band log:

Date UTC time	Power [W] MY - HIS	Mode / f [Hz]	Remote station's call	QTH	RST SENT	RST RX
2013-08-04 09:30:00	10-10	SSB / 144.252	9A5G	CROATIA	51	59
2013-08-04 08:58:00	10-10	SSB / 144.290	S59DEM	SLOVENIA	50	59
2013-08-04 08:26:00	10-10	SSB / 144.211	S53DKR	SLOVENIA	50	59
2013-07-28 18:30:00	100-12 <i>17 el. Yagi</i>	SSB / 144.290	I3EHK	ITALY	50	51
2013-07-20 21:30:00	50-25 <i>19 el. loop Yagi</i>	SSB / 144.250	IV3RKD	ITALY	59	59+10

Using the google maps based service provided by qrz.com and the QTH locator distance calculator on-line service <http://no.nonsense.ee/qth/map.html>, I've extracted some picture of the straight line connecting my QTH with some other stations, reporting also the QRB [km] and the power I have used.

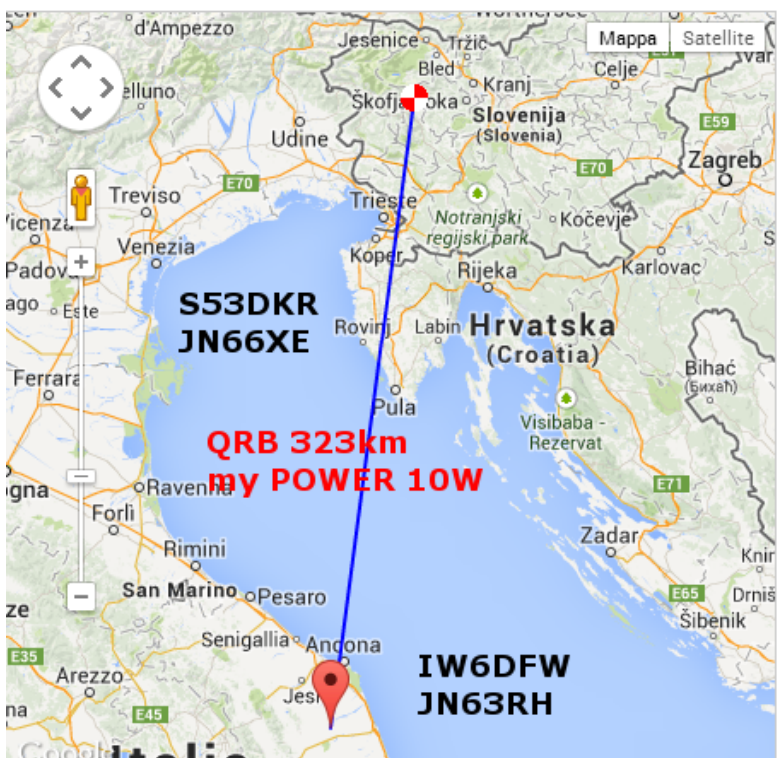
Follow some pictures:



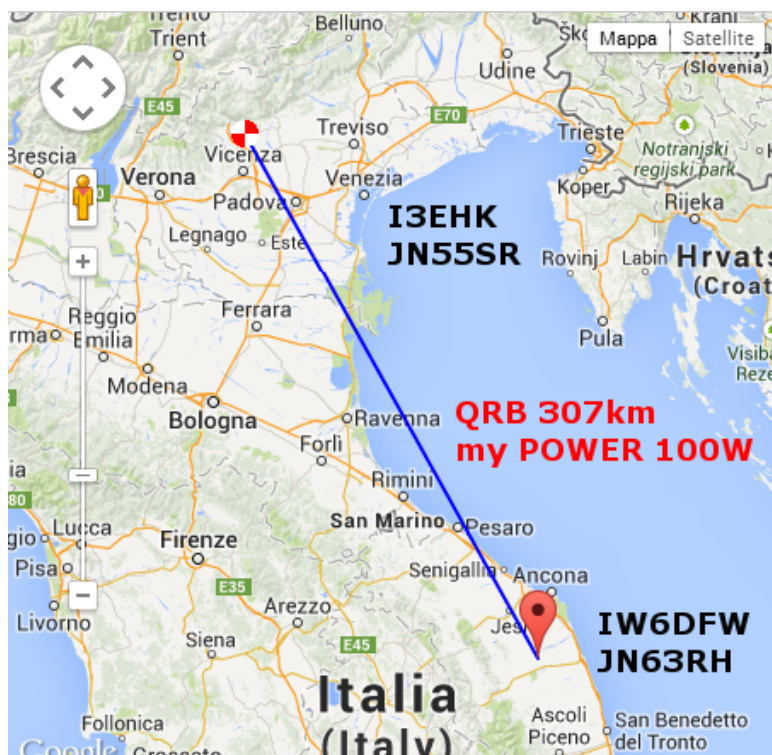
Picture 3: QSO with 9A5G station



Picture 4: QSO with S59DEM station



Picture 5: QSO with S53DKR station



Picture 6: QSO with I3EHK station



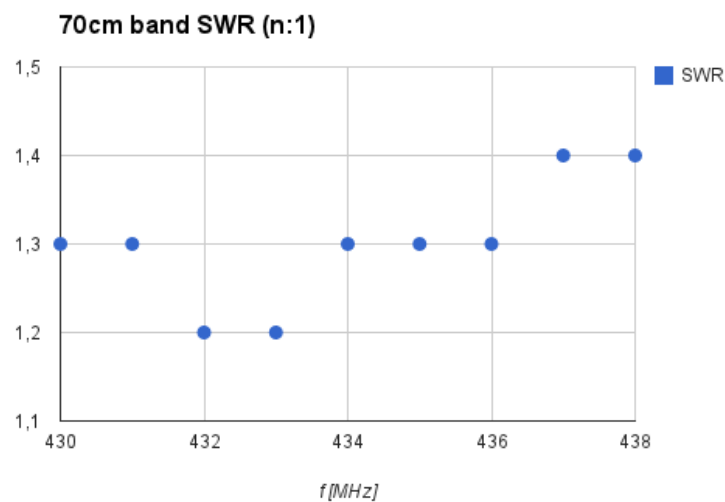
Picture 7: QSO with IV3RKD station

As you can see the propagation takes advantage of the Adriatic sea. The waves cross it reaching the north-east of Italy, the Croatia and the Slovenia, from the center Italy (QTH locator JN63RH).

Not bad for a little antenna attached to the window at 1m above the floor level, considering that my QTH elevation is moreless 290m ASL (computed by the <http://www.zonums.com/gmaps/maptool.php> elevation tool)!

And now comes the fun! Accidentally the tuning knob of my rig tuned the 70cm band... and my ears started to listen strong signals... very strange I thought... it was time to check the SWR.

Magically the SWR in this upper band was better than in the 2m band: between 1.2:1 and 1.4:1 inside the segment 430.000MHz and 438.000MHz with a center band frequency of 433.000MHz, as visible in the following picture:



Picture 8: SWR trend in the 70cm band

Follow the immediate consequence:

Date UTC time	Power [W] MY - HIS	Mode / f [Hz]	Remote station's call	QTH	RST SENT	RST RX
2013-07-20 22:00:00	25-50 27el. Yagi 18dBd	SSB / 432.210	IV3RKD	ITALY	50	52
2013-07-30 07:27:00	10-15 vertical omni	SSB / 432.300	IK6SIO	ITALY	50	50

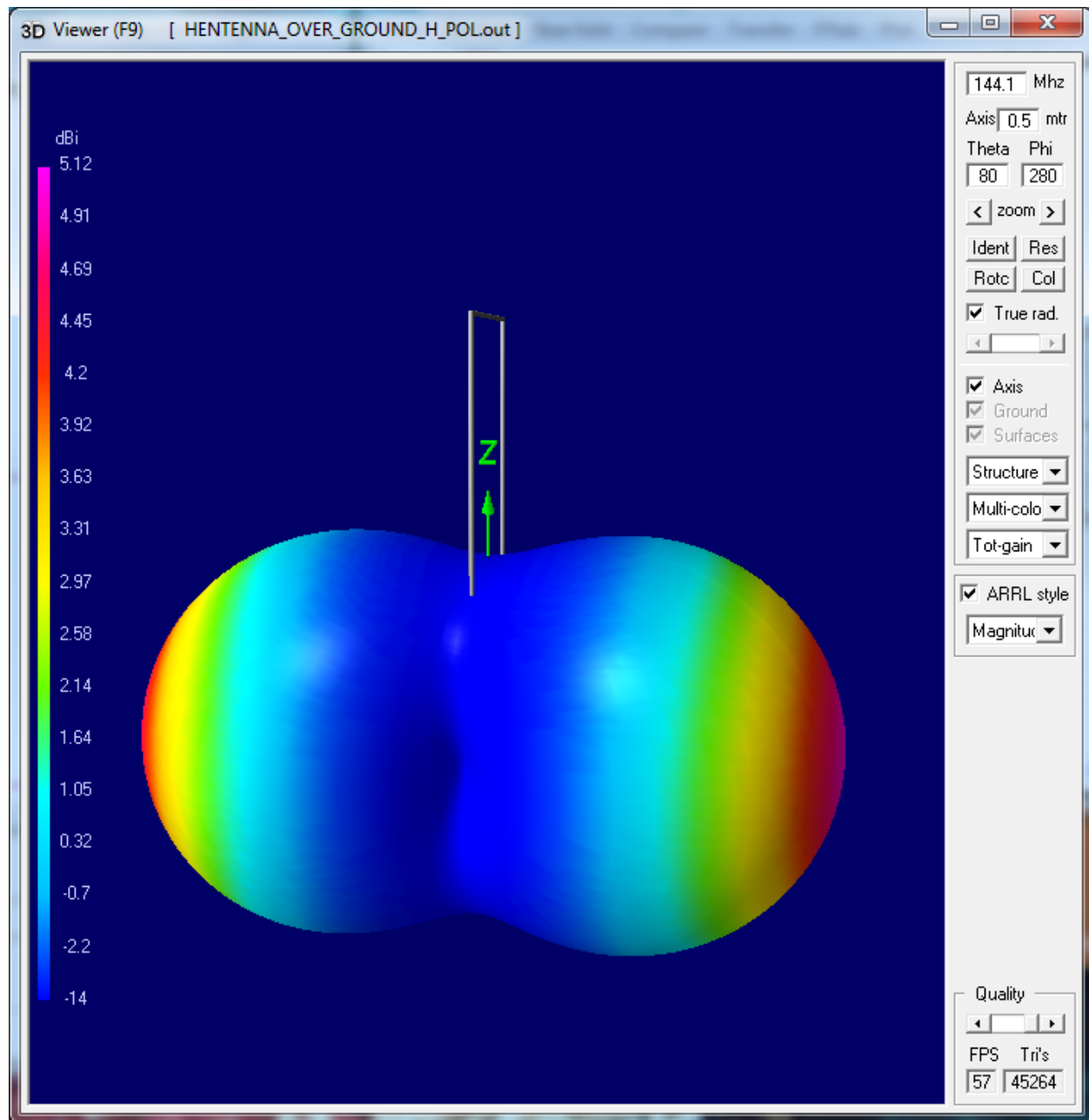
P.S. Many thanks to everybody whom permit me to try my strange antenna system in the 70cm band!

Very proud of the result, I started investigating the cause, according to which, my hentenna was resonating also in third armonic.

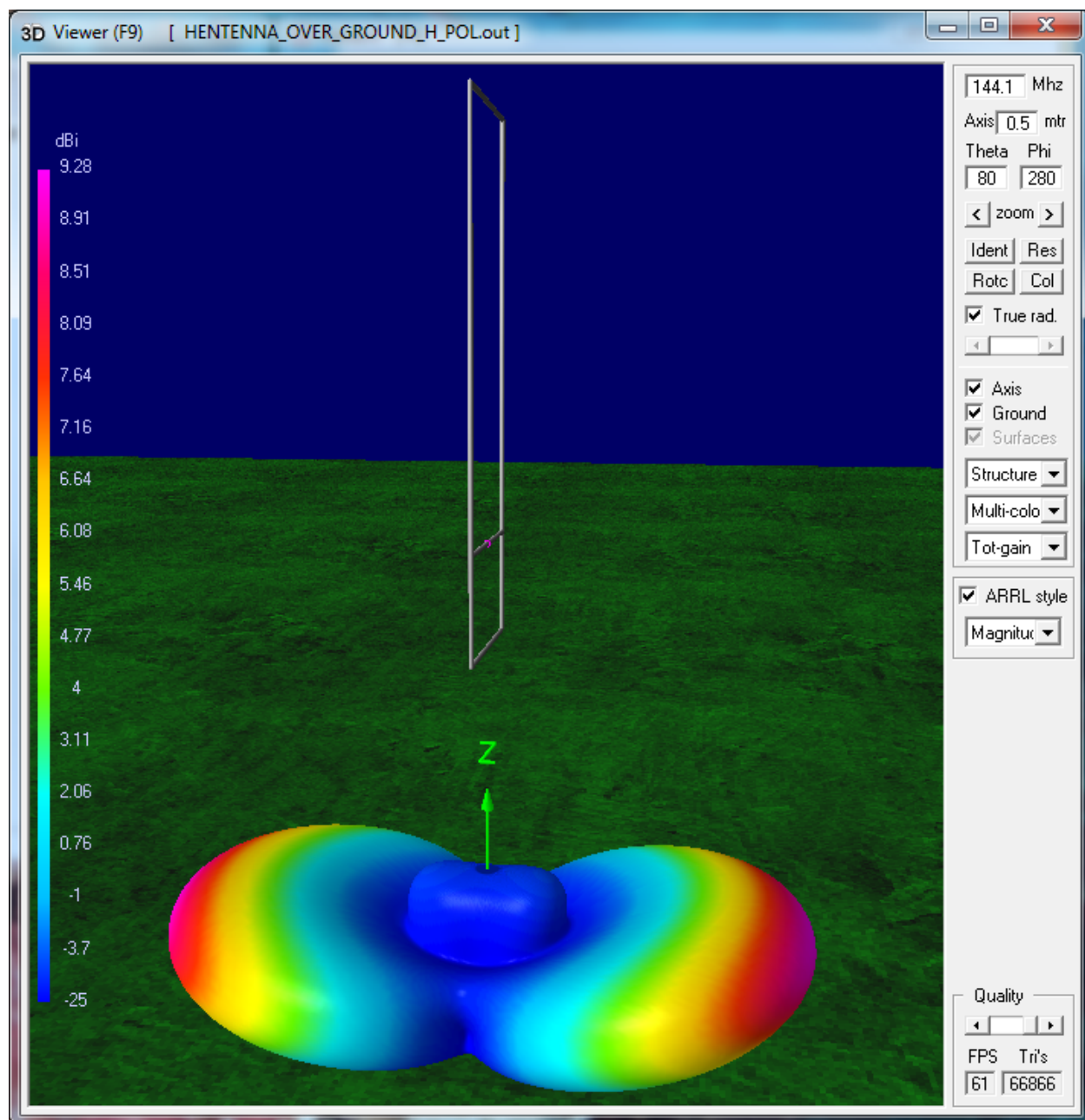
The first approach has been based on the simulation.

Using the great 4NEC2 V5.8.11 by Arie Voors (thank you very much indeed Arie for the precious support you gave me!) I've simulated the antenna behaviour both in the free space and above the real ground at different height, making also some frequency sweep in order to estimate the impedance and hence the SWR both on the 2m and on the 70cm band.

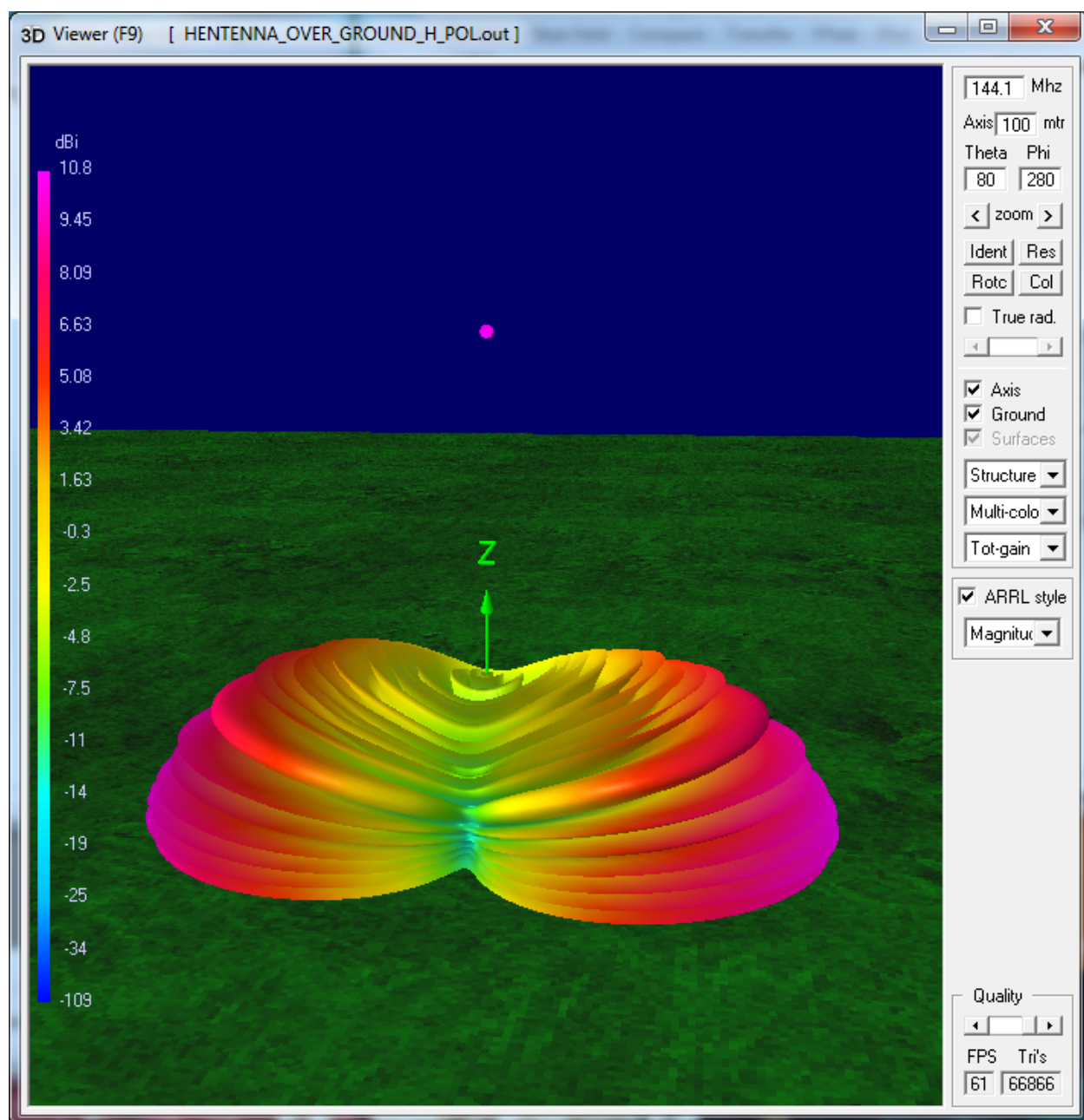
Follow some antenna 3D pattern obtained with this great and totally free antenna simulator:



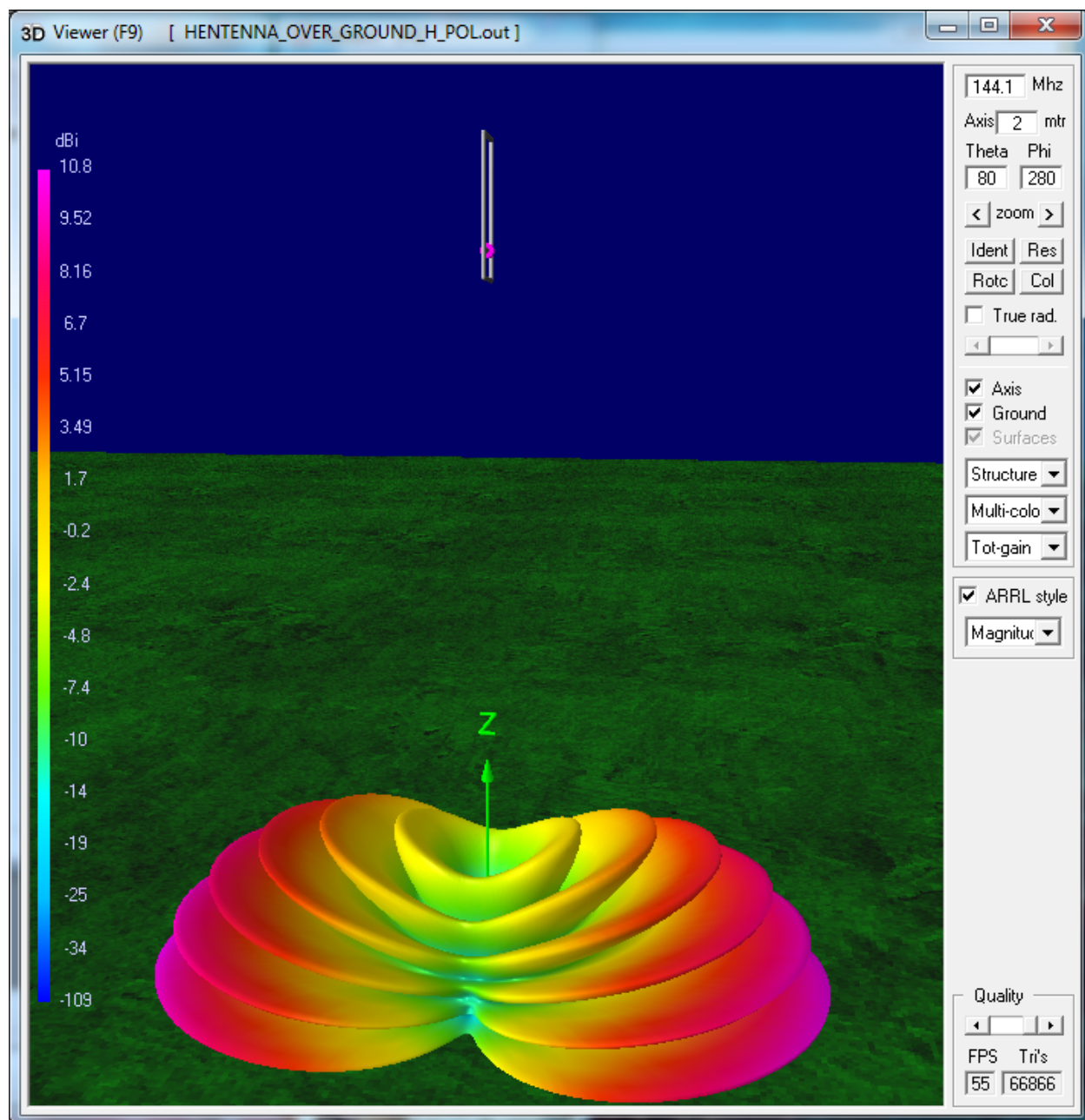
Picture 9: Hentenna far field pattern 2m band in free space



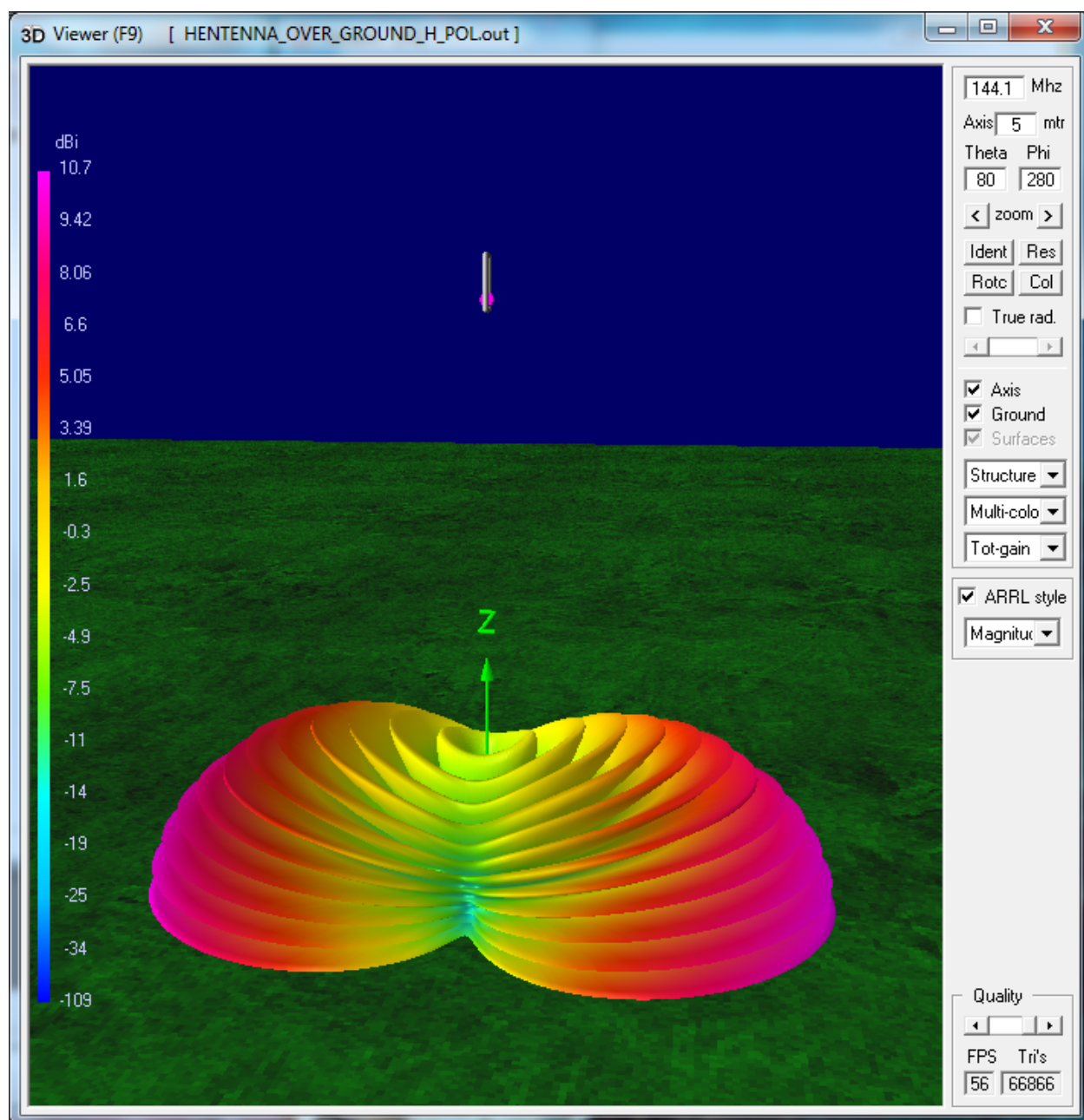
Picture 10: Hentenna far field pattern 2m band 1m ($0.5 \cdot \lambda$) above real ground



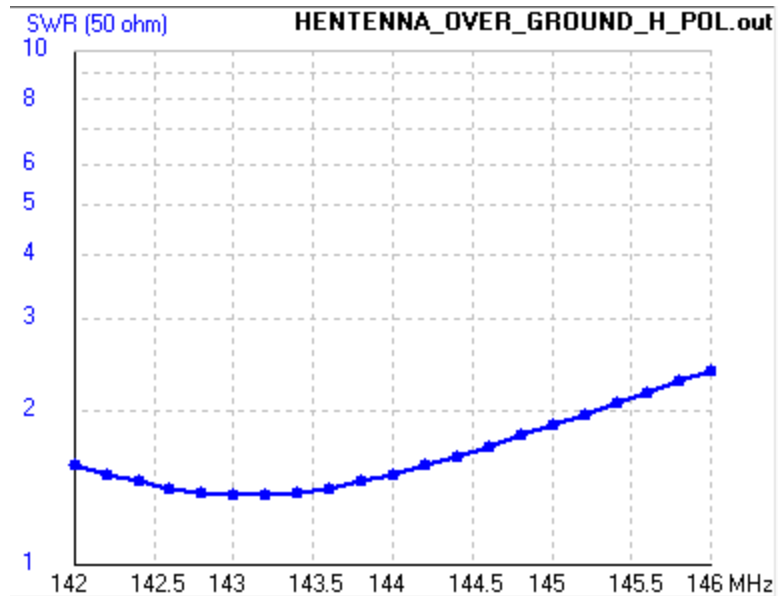
Picture 11: Hentenna far field pattern 2m band 6m ($3 \cdot \lambda$) above real ground



Picture 12: Hentenna far field pattern 2m band 12m ($6 \cdot \lambda$) above real ground



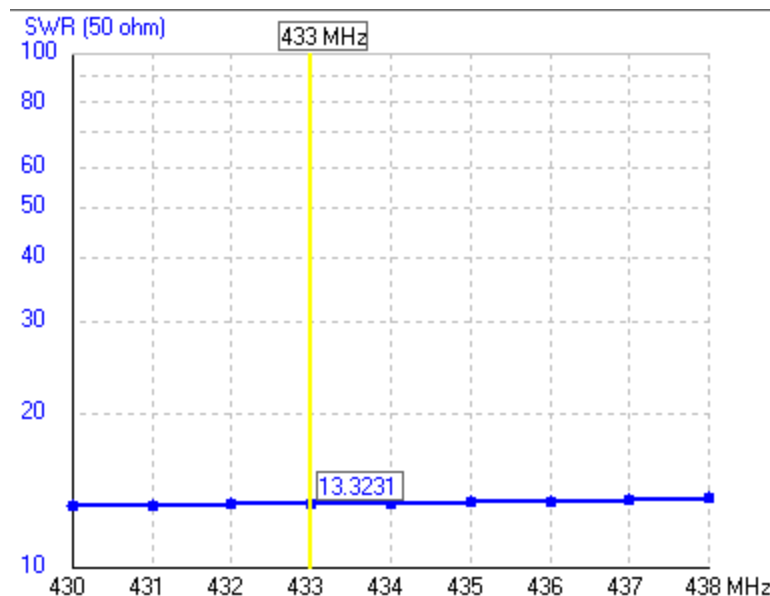
Picture 13: Hentenna far field pattern 2m band 20m ($10 \times \lambda$) above real ground



Picture 14: Hentenna simulated SWR in the 2m band 1m above real ground

Interested readers can contact me at "iw6dfw AT gmail.com" and I'll send them the .nec simulation file.

As visible from *picture 14*, the simulated SWR show a typical trend for a well installed antenna. In the reality the SWR is almost constant and equal to 1.7:1 at 143.0MHz and rises to 1.8:1 at 146.0MHz. The increase happens according to the simulation result but with different levels.



Picture 15: Hentenna simulated SWR in the 70cm band 1m above real ground

Simulated frequency sweep in the 70cm band shows a pessimistic result, see *picture 15*. The reality is quite different: the SWR is much better than in the 2m band!

Also great distortion at the far field pattern manifests.

But what was happening?

Suddenly some esoteric theory filled my brain... perhaps the boundary conditions are modifying the expected behaviour of the antenna?

The simulating approach came to my aid again. I tried to insert the metal frame of the window and let the simulator perform the calculus but... nothing to do... the theory said that this windowed antenna doesn't resonate on the third harmonic!

The last thing to do was to remove the antenna from the window, put it far away from metal object and perform some measures.

SURPRISE: Also in this almost insulated conditions the antenna still resonates in a dual band mode!

Dear friend, I'm sorry, at this point I need your suggestion in order to understand this strange phenomena. Please contact me if you have some idea and don't forget to realize your own antenna prototype at least to compare your results with mine!

Thank you very much for the attention and I wait for your contribution!

Maurizio Malaspina, IW6DFW