I4SBX's EH-Antennas

These are my home made EH-Antennas.
From left side to right:

#2- 20 m. band, pipe diameter 5 cm. (2"), Ratio 3.14, LL network (Stefano IK5IIR); L1=7.5t. 4.6 cm. long; L2= 9.5t. 4.3 cm long ; C1=C2=32 pF; L3=L4=2t. near radiators

#4- 40 m. band, pipe diameter 10 cm.(4"), Ratio 1.5, LL network (Stefano IK5IIR); L1=9.5t. 5 cm. long; L2= 12.5t. 6.3 cm long ;C1=C2=31 pF; L3=L4=1t. near radiators.

#3- 20 m. band, pipe diameter 3.2cm.(1.25"), Radiators 17.5 cm. long; LT network (like Ted W5QJR project described in 20_Meter_Bacpaker.pdf file.) L1=20 t. enameled 1mm dia. (AWG 18); L2=4t.; C1=225 pF; C2=298 pF

#1- is out of picture (it is working on the balcony)
it is like at #2 one except for a different adjustment C1=50, C2=32 pF

You can see the field strength meter hanged to the ceiling, it is used to have a fist look of RF radiation.

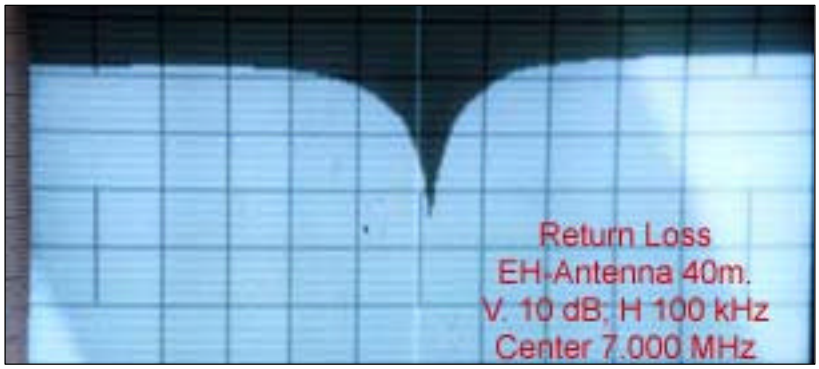
EH-Antenna tuning by Tracking Spectrum Analyzer and Return Loss Bridge

To tune the antennas I have used a spectrum analyzer with tracking and a home made Return Loss Bridge.
Tuning the antenna spreading the turns of coils. I can acquire a spectrum like this:

Horizontal scale = 100 kHz division
Vertical scale = 10 dB division
Center frequency = 7.000 MHz

EH-Antenna #4's Return Loss at –9.5dB (SWR=2:1) the Bandwidth is 100 kHz

Note: it is possible vary the bandwidth modeling L1 & L2. More will be the difference value between L1 & L2 wider will be the bandwidth.



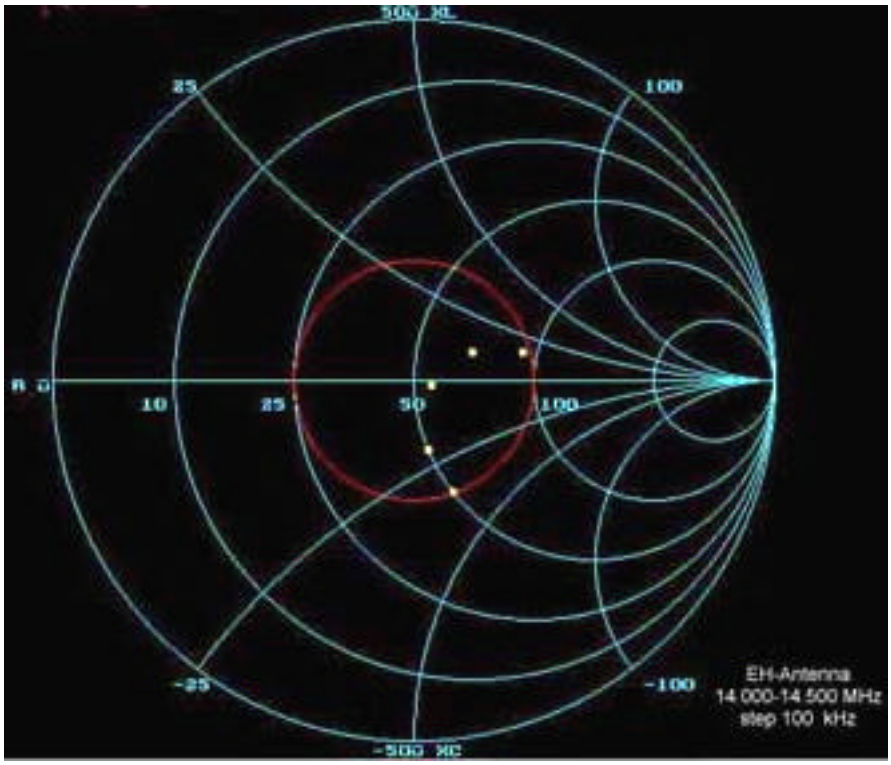
Input Impedance of RH-Antenna

To measure, correctly the value of impedance, the EH-Antenna is feed with lambda/2 of cable to avoid variations of impedance due to the cable, when the antenna is not perfectly matched.
I am using, from 33 years, the Boonton Rx 250A Rx Bridge (the grandfather of MFJ269!!). With this device I have measured the antenna impedance and all their components like capacitors and coils.

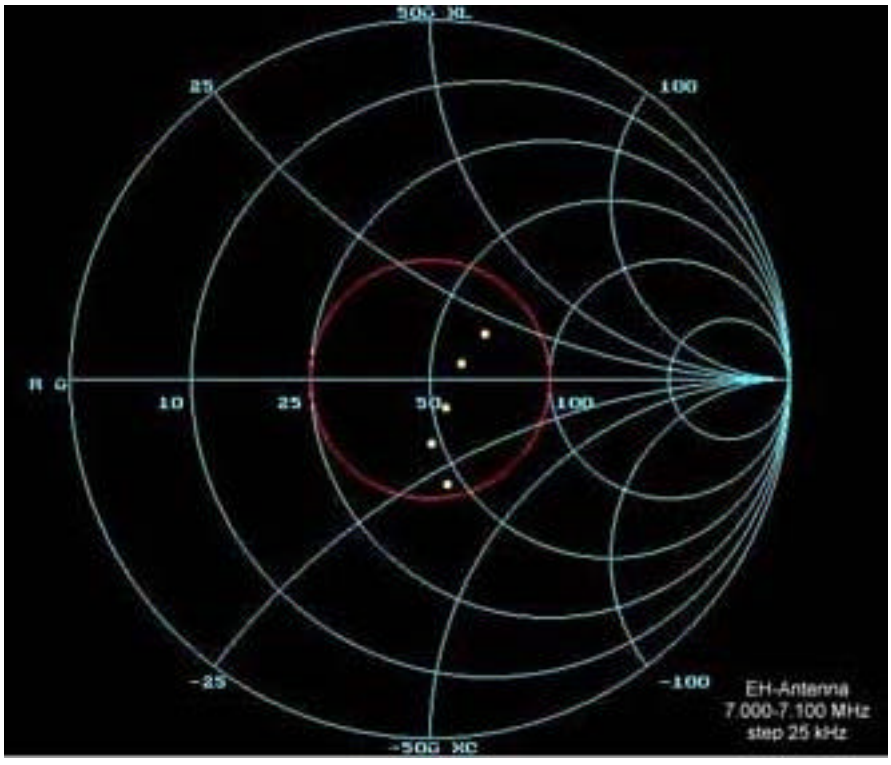
Following You can see Smith Chart plot of antenna #2 (14 MHz) and Antenna #4 (7 MHz) .

Input impedance of RH-ANT.#2
Red circle SWR=2:1
BW= 400 kHz @ SWR 2:1

Note: modeling C1 & C2 value it is possible move input impedance.
In this case may be enhance the matching moving right the points. C1 & C2 values lower.



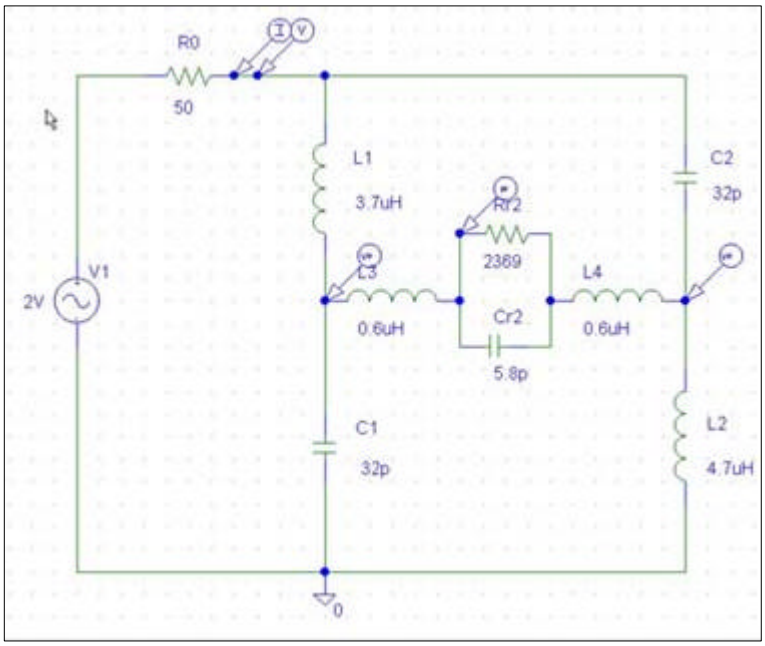
Input impedance of RH-ANT.#4
Red circle SWR=2:1
BW= 100 kHz @ SWR 2:1



EH-Antenna PSpice Simulation

LL Networks:

The values of components were measured after the Antenna tuning. So the schematich diagram are strictly equals of working antennas.



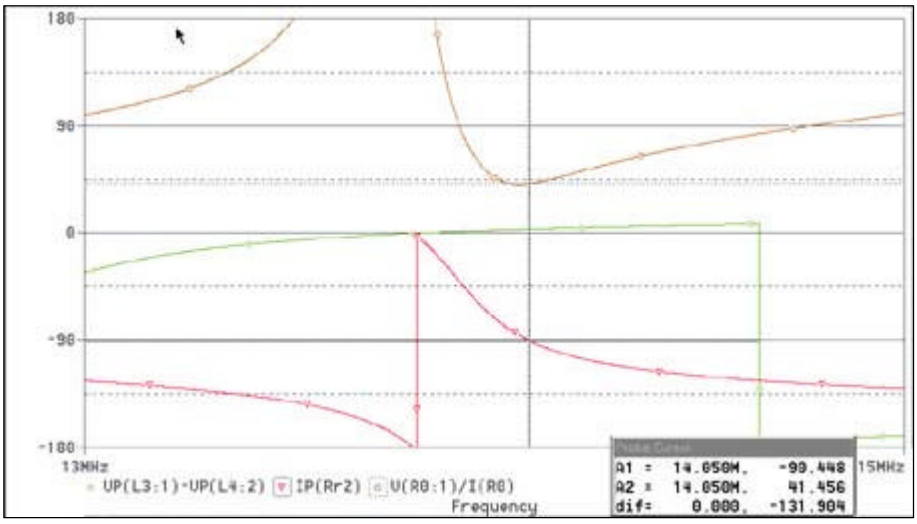
This is the diagram equivalent of #2 EH-Antenna.
Rr is the value given from Stefano IK5IIR and I verified right
The others components are measured.
L3 & **L4** are the equivalent of 2 turns put near the radiators.
Branch **L1 C1** is tuned at 14.627 MHz
Branch **L2 C2** is tuned at 12.978 MHz
The difference of tuning betwin the two branches permit current flowing on the radiator.
Note: for simulator Rr is always present, but is not so, on Antenna, only when the phasing circuits is correctly tuned, the fat short dipole acts like a radiator and show is right impedance.
In practice Simulator works at all frequency, but when you are tuning the EH-Antenna it show low SWR and radiates **only** it match the right phase

This result of PSpice simulator

The brown line is the input impedance; the green line is the voltage phase on dipole , and the red line is the phase current on radiator.

At f0 = 14.050 MHz Phase current is crossing –90° line and this, and only this, permits at the fat short dipole to become an EH-Antenna.

At f0 Zin is 42.45 ohm and this confirms the value read by the Rx Bridge and plotted on Smith Chart.



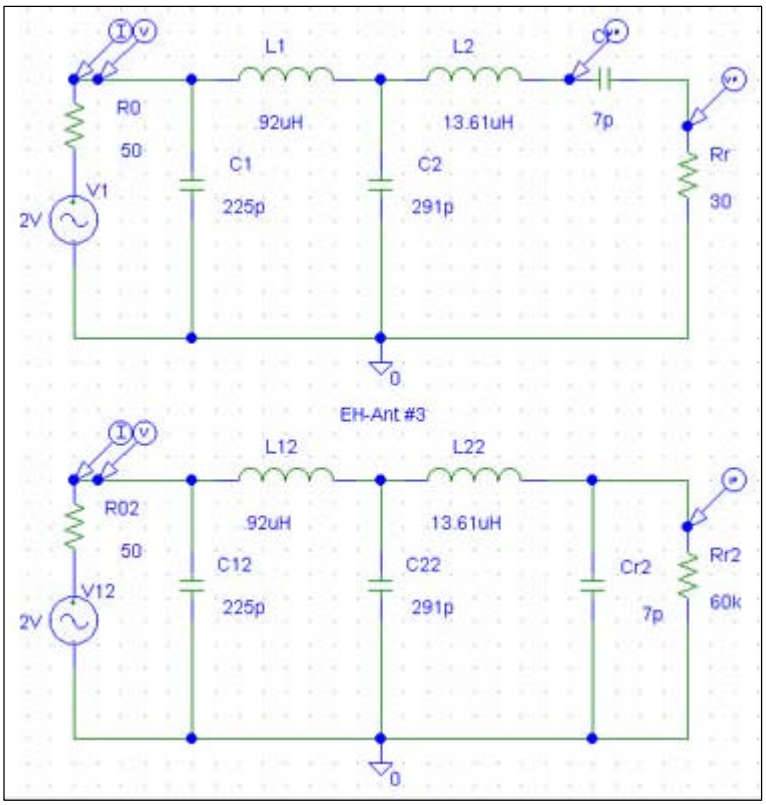
Note: the Phase current –90° is equivalent at 90°. It was plot in negative area to not confusing with others lines.

Basically is the some for the #4 40 m. LL Network EH-Antenna.

EH-Antenna PSpice Simulation

LT Networks simulation:

Ted's W5QJR in his 20_Meter_Backpaker.pdf file give the component values to build a EH-Antenna. Fist I tray to use these data to simulate the antenna.
Ted W5QJR and also Jack W0KPH gives the radiator impedance = 30 ohm in series.
I suppose that the LT circuit see the dipole with Cr in series with Rr. Otherwise the computing does not work.
So the relative circuit diagram must be as follow:



The two circuits are exactly the same, and they produce the same plot.
Change only the way to see the circuit from computing method.

In this case Q of the phasing circuit is near 44.7.

Rp = (Q^2 + 1) * Rs

So:

Rp = (44.7^2 + 1) * 30 = 60k

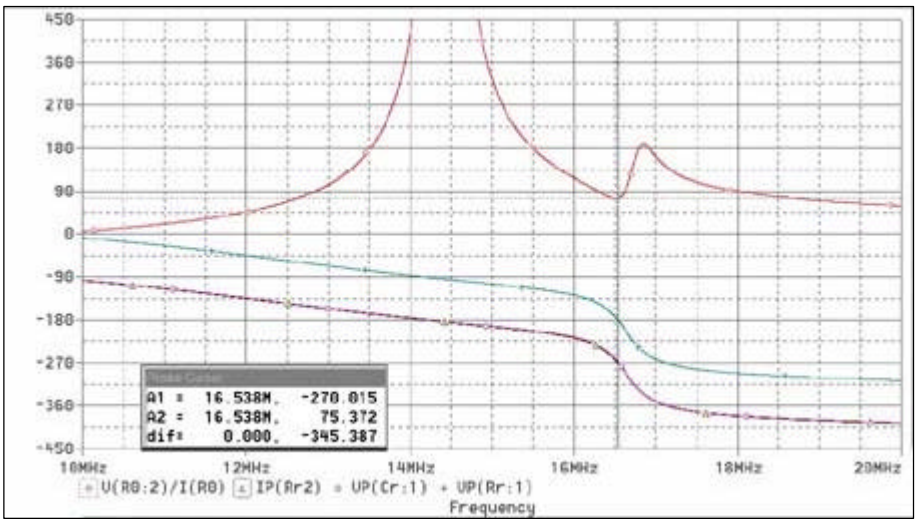
Xp = (1 + Q^2) * Xs) / Q^2 ~ Xs

Next time, if somebody is interesting, I can simulate the real LT-Network EH-Antenna

With this circuit PSpice give the following result:

The brown line is the input impedance, and the red line is the phase current on radiator.

At f0 the circuit present a current phase near –180° and a Zin too high.
But at 16.538 all the condition for EH-Antenna are reached
Current Phase = -270° (+90°)
Zin = 75 ohm (SWR 1.5:1)



I4sbx, 14/gen/03