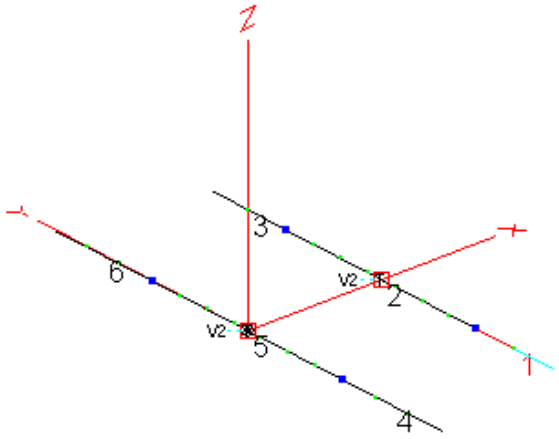


Opposite Voltages Fed Array for 50MHz

Pekka Ketonen

Background

I have developed a new kind of phasing system for two element arrays. The system is best suit for lower bands like 160-30m where 2-element antennas are more common.

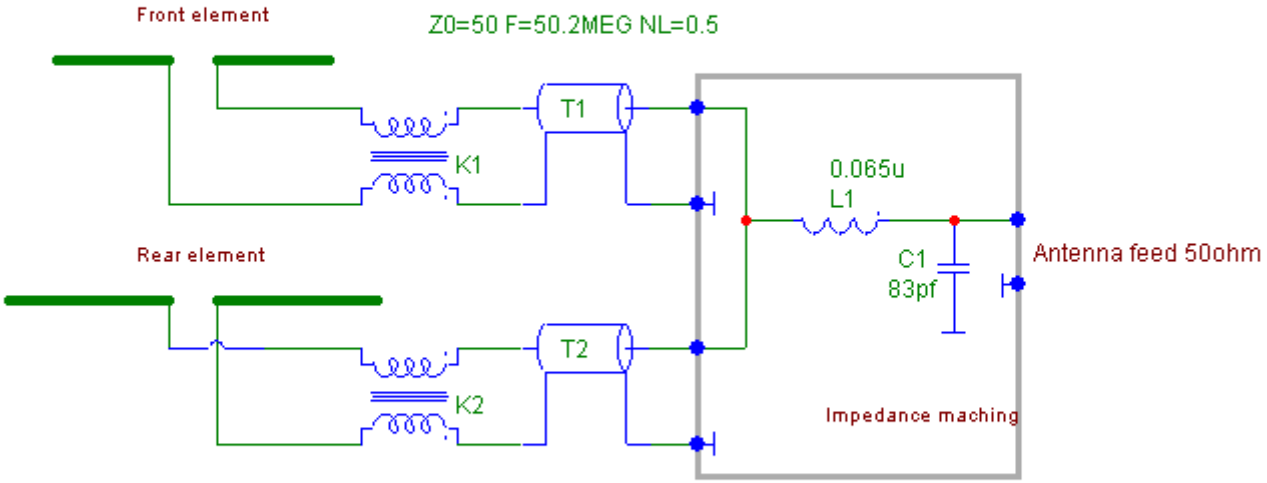
Motivation for this antenna project was to proof the concept. Construction for 6 meters was easy and served the purpose well. Earlier a two-element phased vertical array for 80m had been built and is in use at OH1NM.

In this antenna reactances generated by element length are used for phasing. Also lumped reactances in form of coils and capacitors can be used. They can situate in either end of the half lamda feed cables.

The advantage of this feed system is that it is broad band. Radiation pattern changes only little as function of frequency. Also input impedance is wideband.

The concept

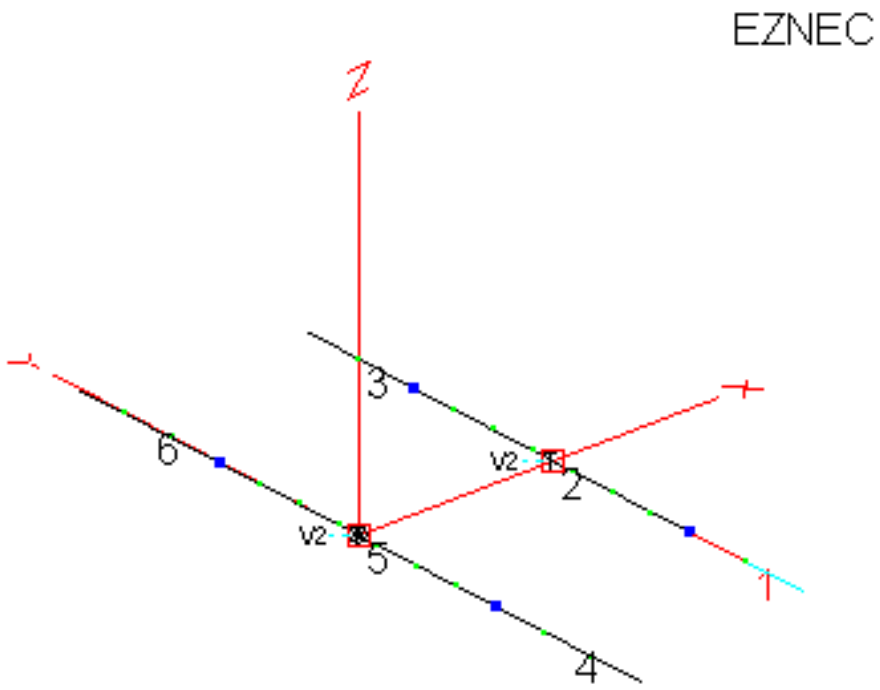
Opposite voltages fed array for 50MHz band
2TV50



K1, K2 are current baluns

13.4.2010
OH1TV

The shape



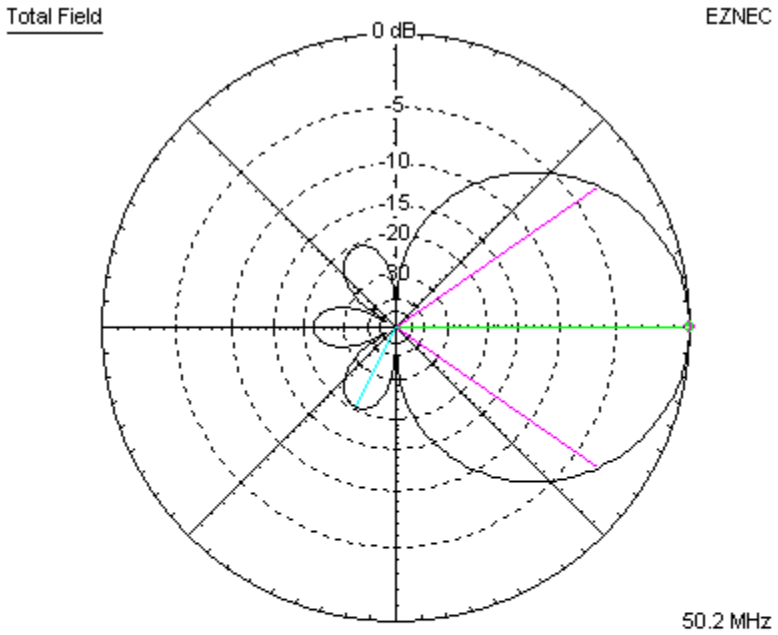
2-element phased array by OH1TV

I call this antenna Opposite Voltages Fed Array because equal amplitude but opposite polarity voltages are brought to the feedpoints of the two elements. The phasing itself is made by adjusting element self reactance (element length).

Specifications

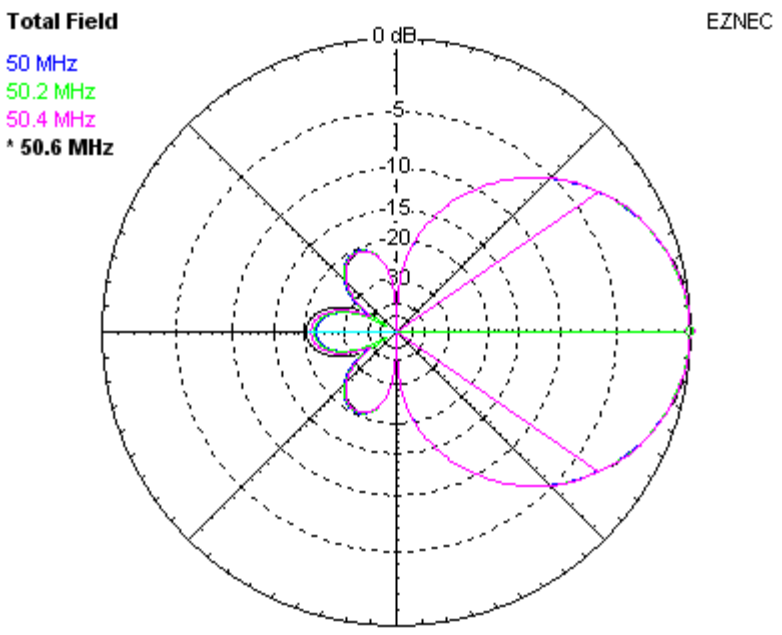
- Frequency range 50.0 – 50.5 MHz
- Power gain 6.2 - 6.4 dBi
- Impedance 50 ohm
- SWR <1.2
- Front to back > 20 dB
- Dimensions 3056 mm x 90 cm horizontal plane
- Advantages
  - Gain pattern and input impedance are wide band
  - Good front-to-back-ratio

Radiation pattern



Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	0.0 deg.	Gain	6.37 dBi
Outer Ring	6.37 dBi		0.0 dBmax

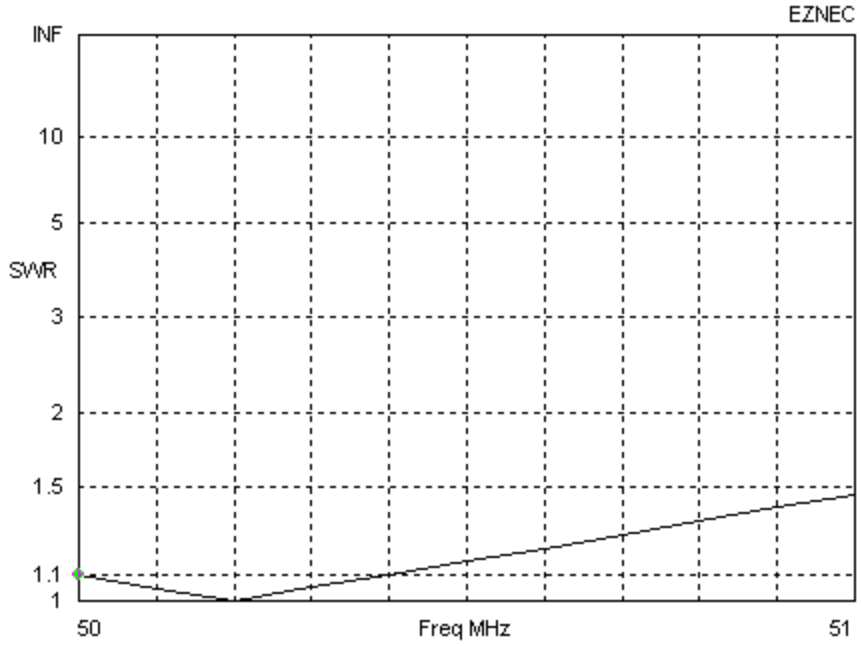
Slice Max Gain	6.37 dBi @ Az Angle = 0.0 deg.
Front/Back	21.86 dB
Beamwidth	69.6 deg.; -3dB @ 325.2, 34.8 deg.
Sidelobe Gain	-14.03 dBi @ Az Angle = 243.0 deg.
Front/Sidelobe	20.4 dB



Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	0.0 deg.	Gain	6.41 dBi
Outer Ring	6.41 dBi		0.0 dBmax

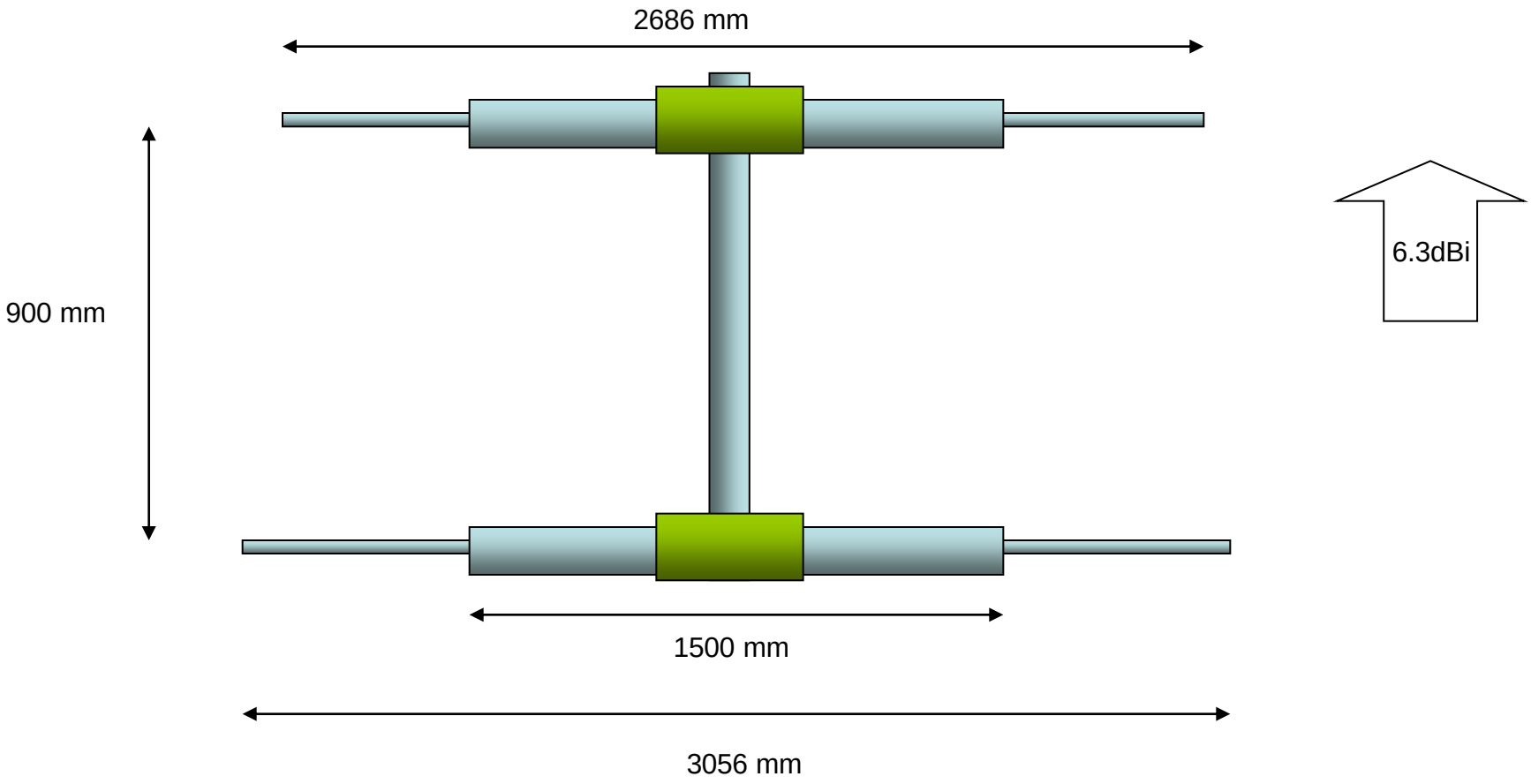
Slice Max Gain	6.41 dBi @ Az Angle = 0.0 deg.
Front/Back	20.22 dB
Beamwidth	69.4 deg.; -3dB @ 325.3, 34.7 deg.
Sidelobe Gain	-13.81 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	20.22 dB

SWR



Freq	50 MHz	Source #	1
SWR	**1.095**	Z0	50 ohms
Z	45.84 at 1.48 deg.		
	= 45.82 + j 1.182 ohms		
Refl Coeff	0.04528 at 163.49 deg.		
	= -0.04341 + j 0.01287		
Ret Loss	26.9 dB		

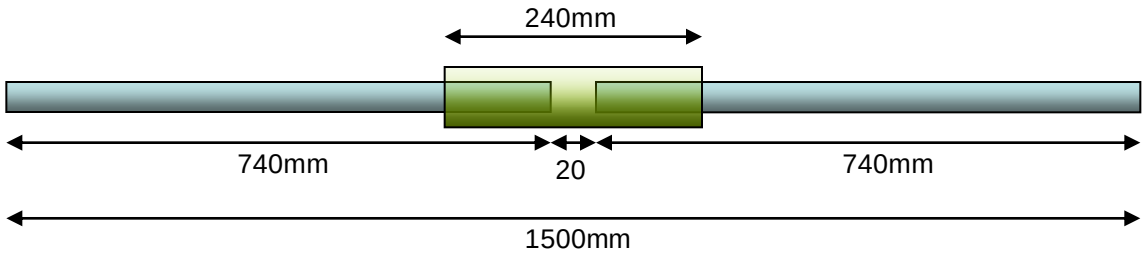
OH1TV antenna for 50 MHz



Parts, element center sections

Both elements, center section
tube outer diameter 16mm, wall thickness 1.5mm

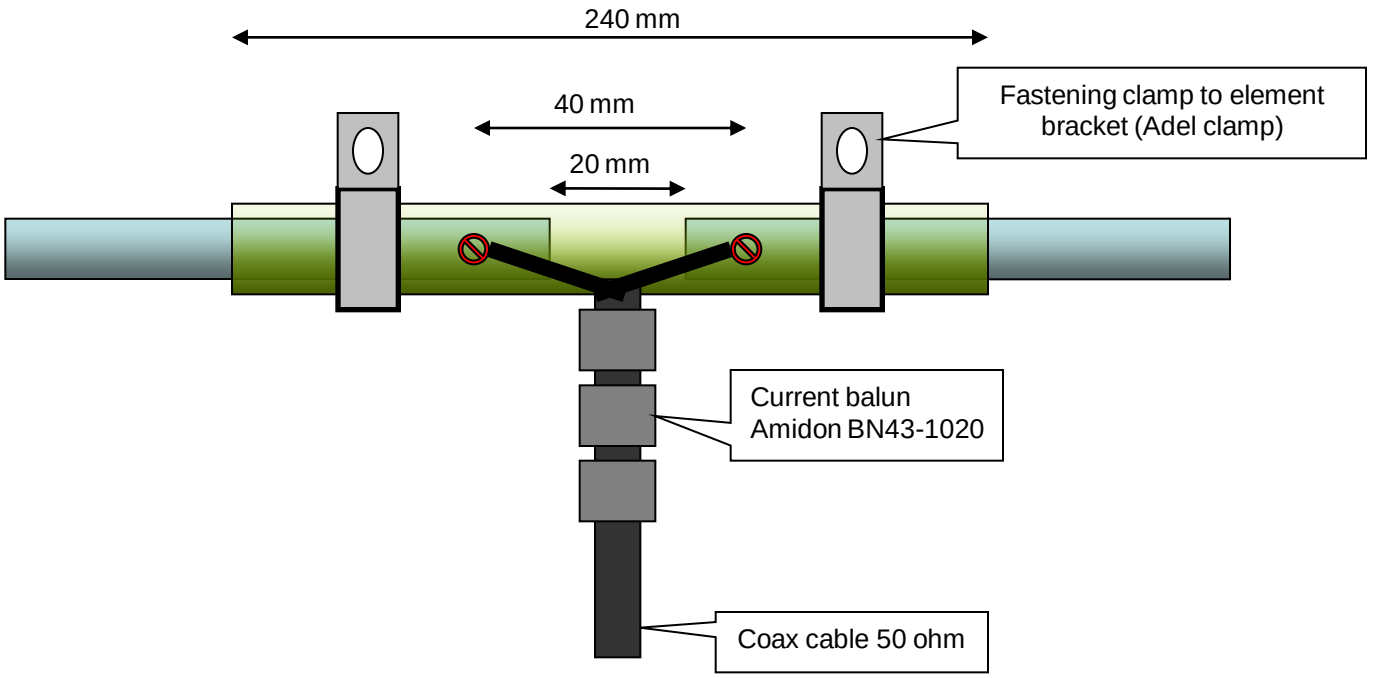
Glass fiber isolator inner diameter 17mm, outer diameter 20mmm
Glued with Araldit (epoxy)



Feedpoint construction

Both elements, center section
tube outer diameter 16mm, wall thickness 1.5mm

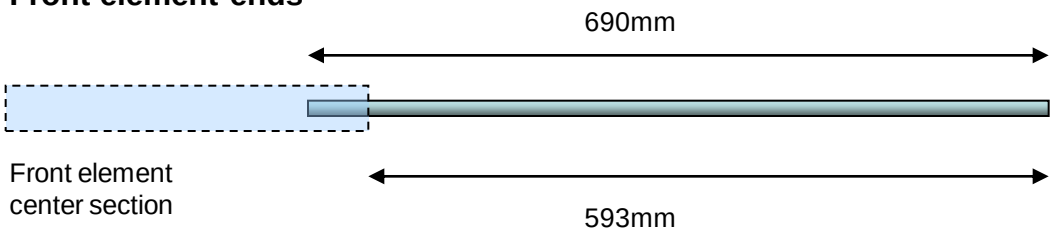
Glass fiber isolator inner diameter 17mm, outer diameter 20mmm
Glued with Araldit (epoxy)



Parts, element end sections

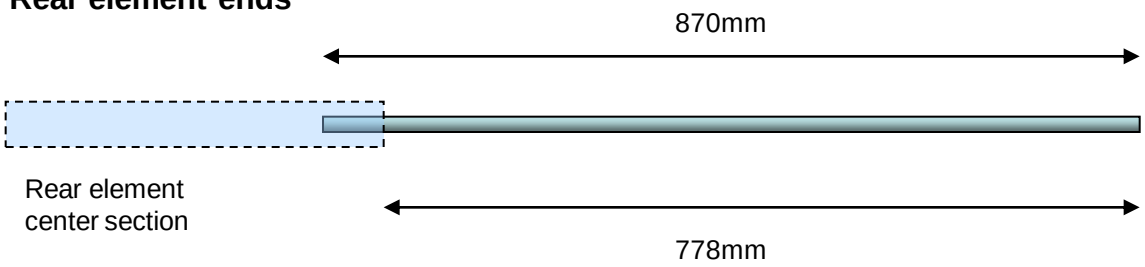
Aluminium tube outer diameter 12mm, 1mm wall

Front element ends



Front element tip-to-tip length 2686mm

Rear element ends



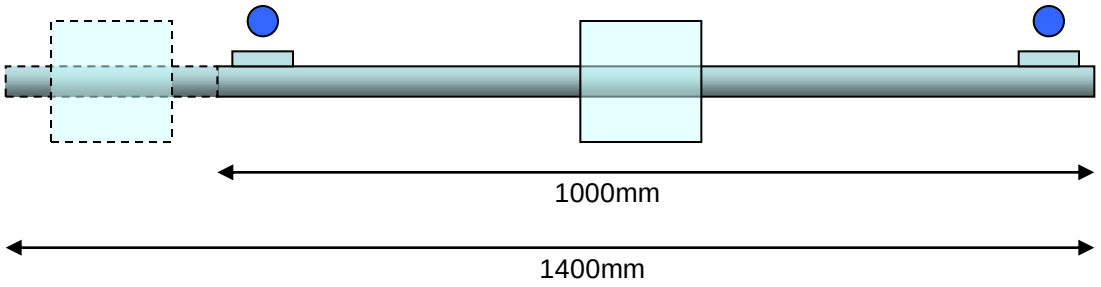
Rear element tip-to-tip length 3056mm

Parts, boom

Boom material aluminium tube, outer diameter 25mm

For normal mast mounting boom lenght 1000mm

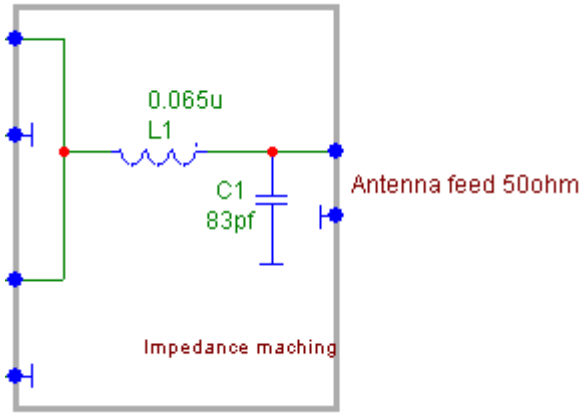
For side mounting tube length 1400mm, mast bracket behind the rear element



Parts, element feed cables

- Both elements are fed with λ/2 long 50ohm coax cables.
  - I used foam dielectric cable, which had velocity factor 0.77
  - With λ= 600cm, cable length becomes 231cm. I cut 232cm because 3cm long V-opening in element end shortens the cable a little.
  - Cables (element ends) are protected with self vulcanizing tape
  - The other end is with UHF (PL 259) plug

Connection box



The box connects the two element feed lines parallel and provides impedance matching

- C1 is 82pF / 500V silver Mica (was 85.2pF)
- L1 is 65nH air coil made from dia 1.5mm copper wire. 2-3 turns, dia 12mm
- All connectors UHF female (SO 239)
- Housing is diacast siluminium box

Other parts

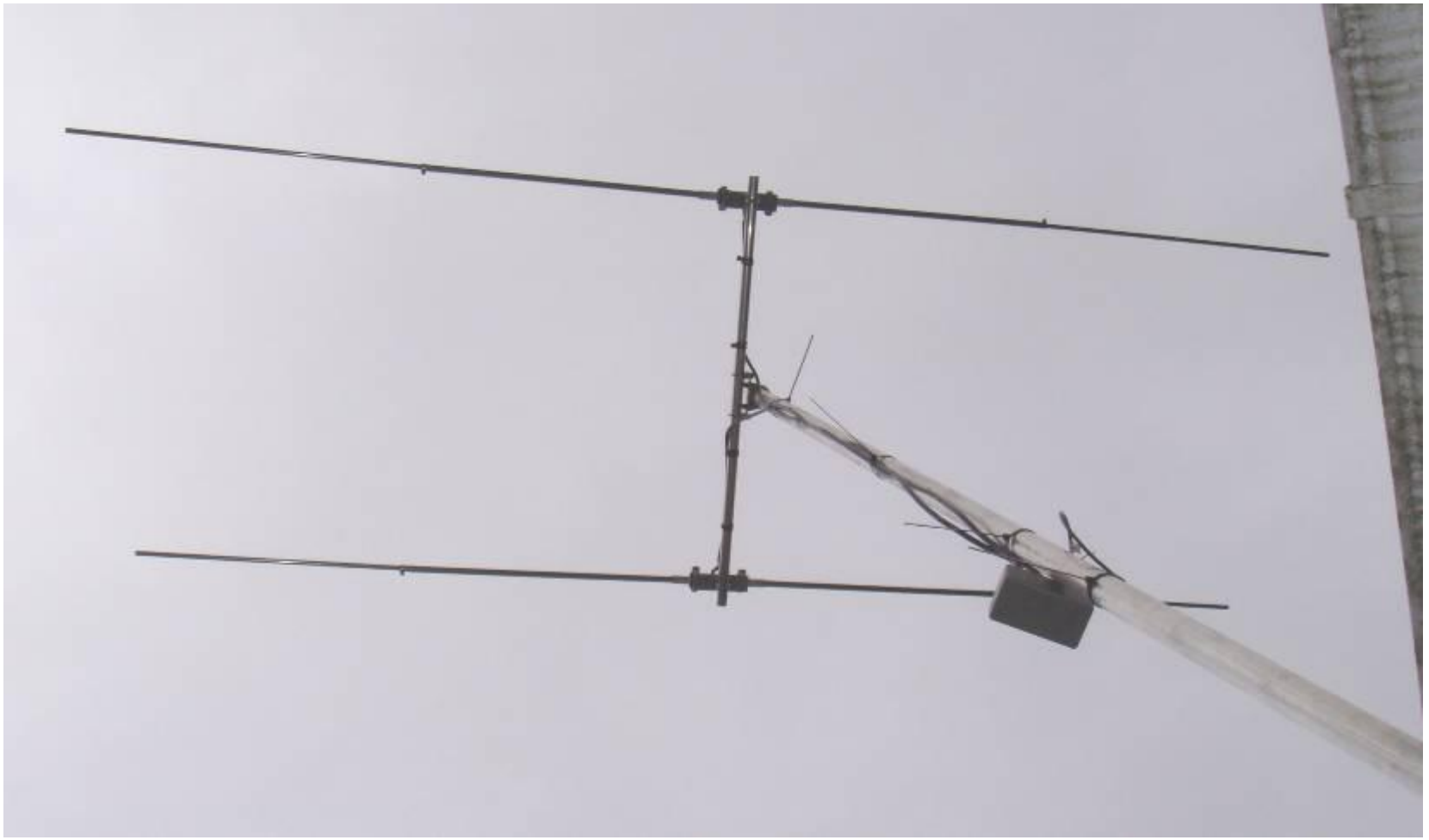
- Element to boom bracket
  - Both elements (2 pcs)
    - Mounting plate:: 130 x 40 x 3 mm aluminium
    - Element to mounting plate: Adel clamps 20mm, screws
    - Mounting plate to boom: 25mm exhaust pipe clamp
  - 25mm exhaust pipe clamp (2 pcs)

- Boom to mast bracket
    - Mounting plate 120 x 120 x 5 mm aluminium
    - 25mm exhaust pipe clamps, 2 pcs
    - xx mm exhaust pipe clamps, 2 pcs, size depends on your mast
- Center section to end section joints
    - 4 pcs 16mm hose clamps, 4 pcsM4 screws with nylock nuts for locking

- Current baluns for both elements
    - 3 Amidon tubular ferrites BN43 -1020 on each coax near feed point

- Glue, Araldit or similar epoxy

The antenna



Element center and feed

..Element center and feed

Boom to mast

Connection box