

Model 323-201517

OVF 3-bander

2 active elements on 20m
3 active elements on 15m
3 active elements on 17m

Version 1.0

Preface

- This is a collection of documents for our own use, generated during an antenna building project. Participants in the project were Lasse OH1EVI, Elias OH1XFE and Pekka OH1TV. Everybody built his own antenna but also gave ideas and support to each other.
- We would like to present this as an example of a successful joint project rather than a construction guide. The documentation is not complete. But an experienced builder can solve the missing details...
- The antenna itself is not conventional. There are many ideas not often seen together, like
 - Two driven elements, Opposite Voltage Feed on all bands
 - Open sleeve feed on 15 and 17m to two elements
 - Band switching partly by relays, 15/17m
 - Band combination 20m 17m and 15m
 - Integral impedance matching unit

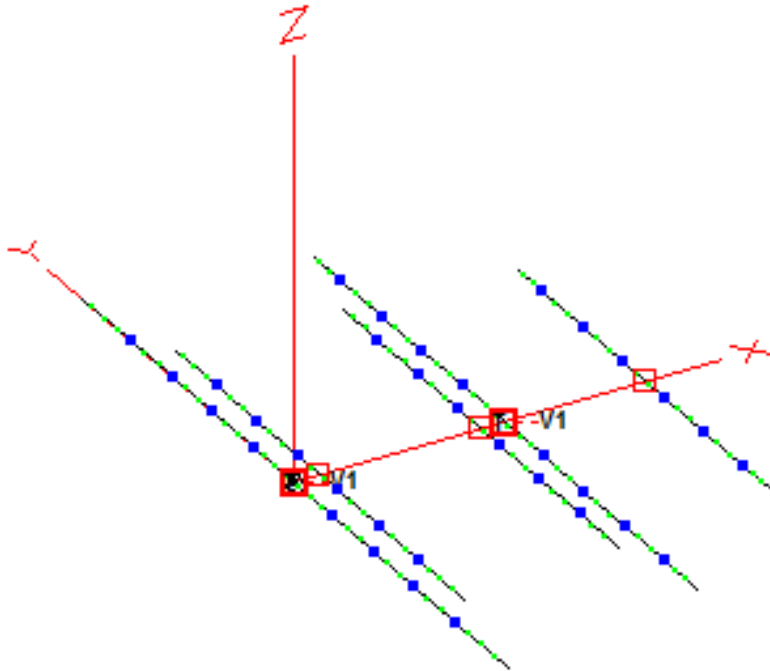


26.7.2017

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OVF 3-bander, Model 323



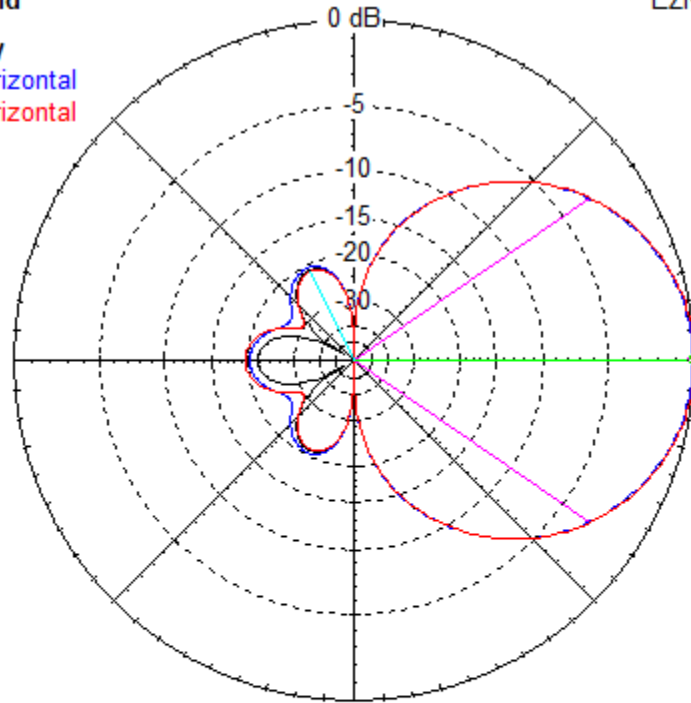
- Bands 20, 15 and 17m
 - 2 active elements on 20m, $G=6.5\text{dBi}$
 - 3 active elements on 15m, $G=8.0\text{dBi}$
 - 3 active elements on 17m, $G=7.4\text{dBi}$
 - F/B 20dB on all bands
 - $\text{SWR}<1.5$ on all bands
- Boom length 520cm
 - max spacing 500cm
- 2 fed elements, the 20m elements
 - 3 parasitic elements on 15m
 - On 17m the 15m elements are coil loaded to 17m.
- Switched L-match for each band
- Instant band change
 - Monoband performance

20m, free space

Total Field

* Primary
 14000 horizontal
 14350 horizontal

EZNEC Pro/4

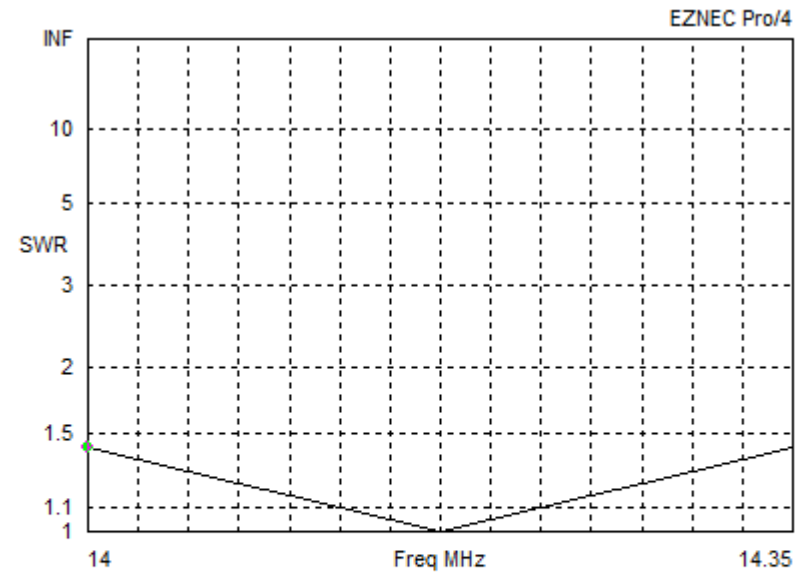


14.2 MHz

Azimuth Plot
 Elevation Angle 0.0 deg.
 Outer Ring 6.52 dBi

Cursor Az 0.0 deg.
 Gain 6.49 dBi
 0.0 dBmax

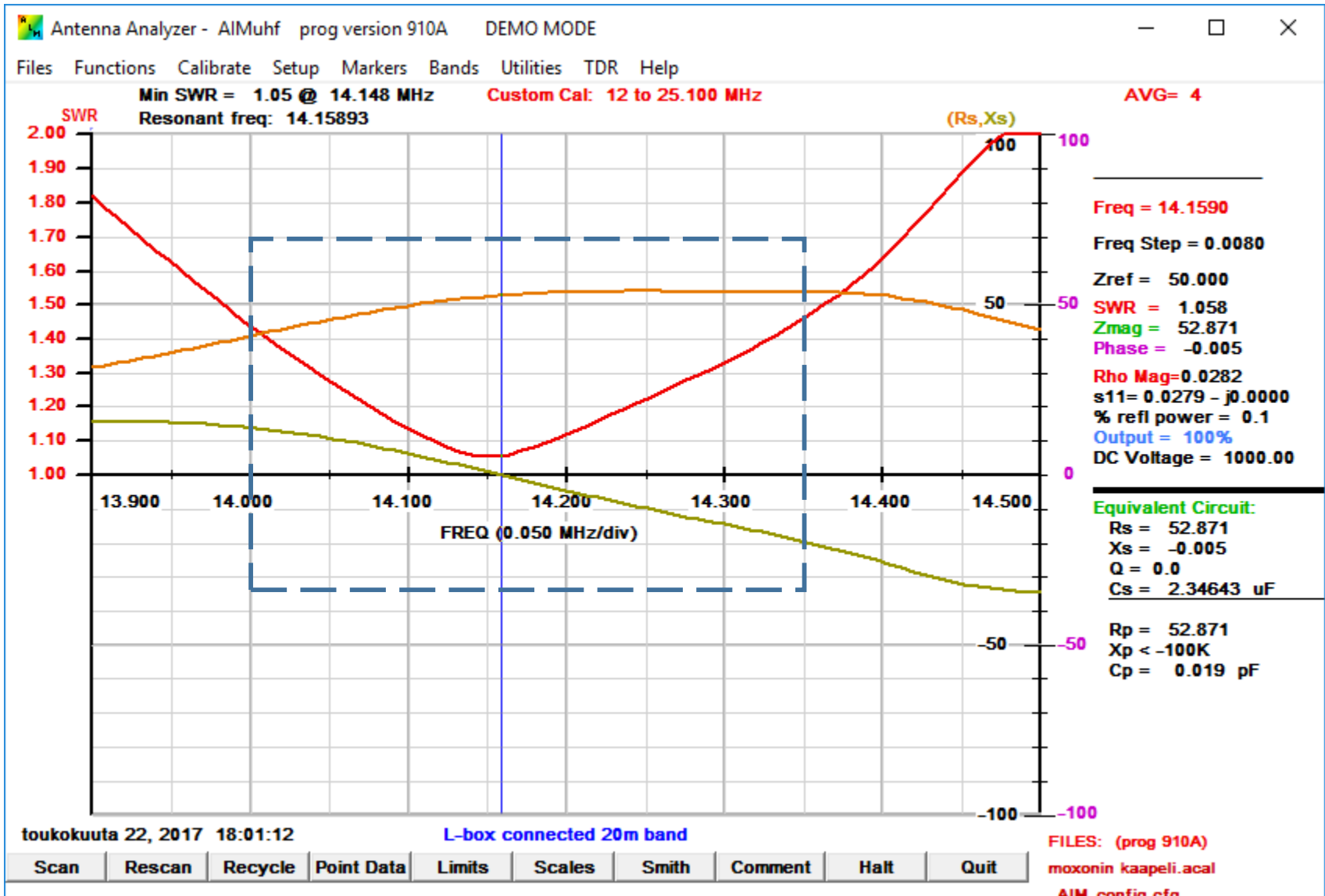
Slice Max Gain 6.49 dBi @ Az Angle = 0.0 deg.
 Front/Back 21.68 dB
 Beamwidth 69.2 deg.; -3dB @ 325.4, 34.6 deg.
 Sidelobe Gain -14.45 dBi @ Az Angle = 116.0 deg.
 Front/Sidelobe 20.94 dB



Freq 14 MHz
 SWR 1.41
 Z 39.6 at 14.16 deg.
 = 38.4 + j9.686 ohms
 Refl Coeff 0.17 at 133.89 deg.
 = -0.1179 + j0.1225
 Ret Loss 15.4 dB

Source # 1
 Z0 50 ohms

20m, measured at L-box input, height 16m

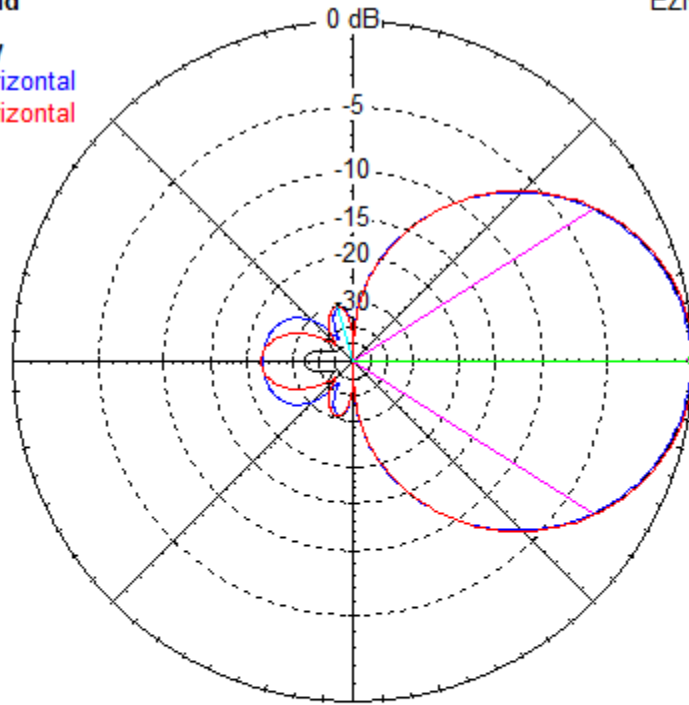


15m, free space

Total Field

* Primary
 21000 horizontal
 21450 horizontal

EZNEC Pro/4

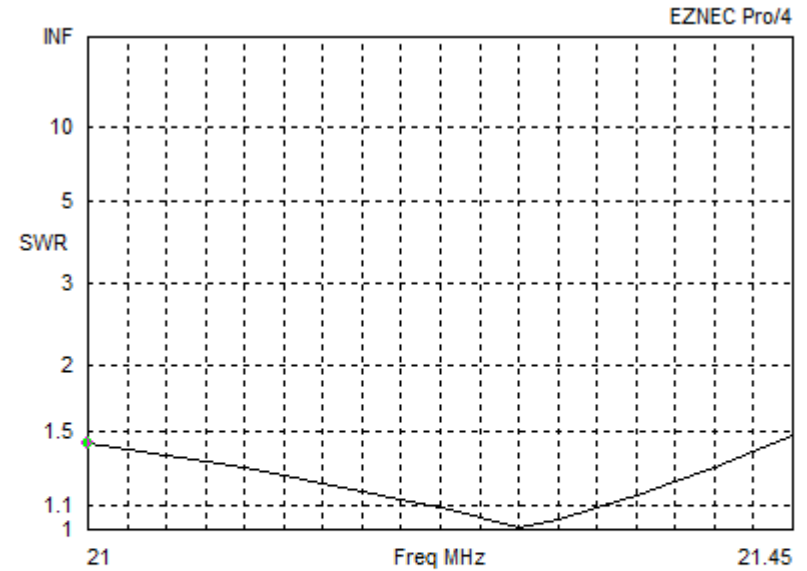


21.3 MHz

Azimuth Plot
 Elevation Angle 0.0 deg.
 Outer Ring 8.14 dBi

Cursor Az 0.0 deg.
 Gain 8.07 dBi
 0.0 dBmax

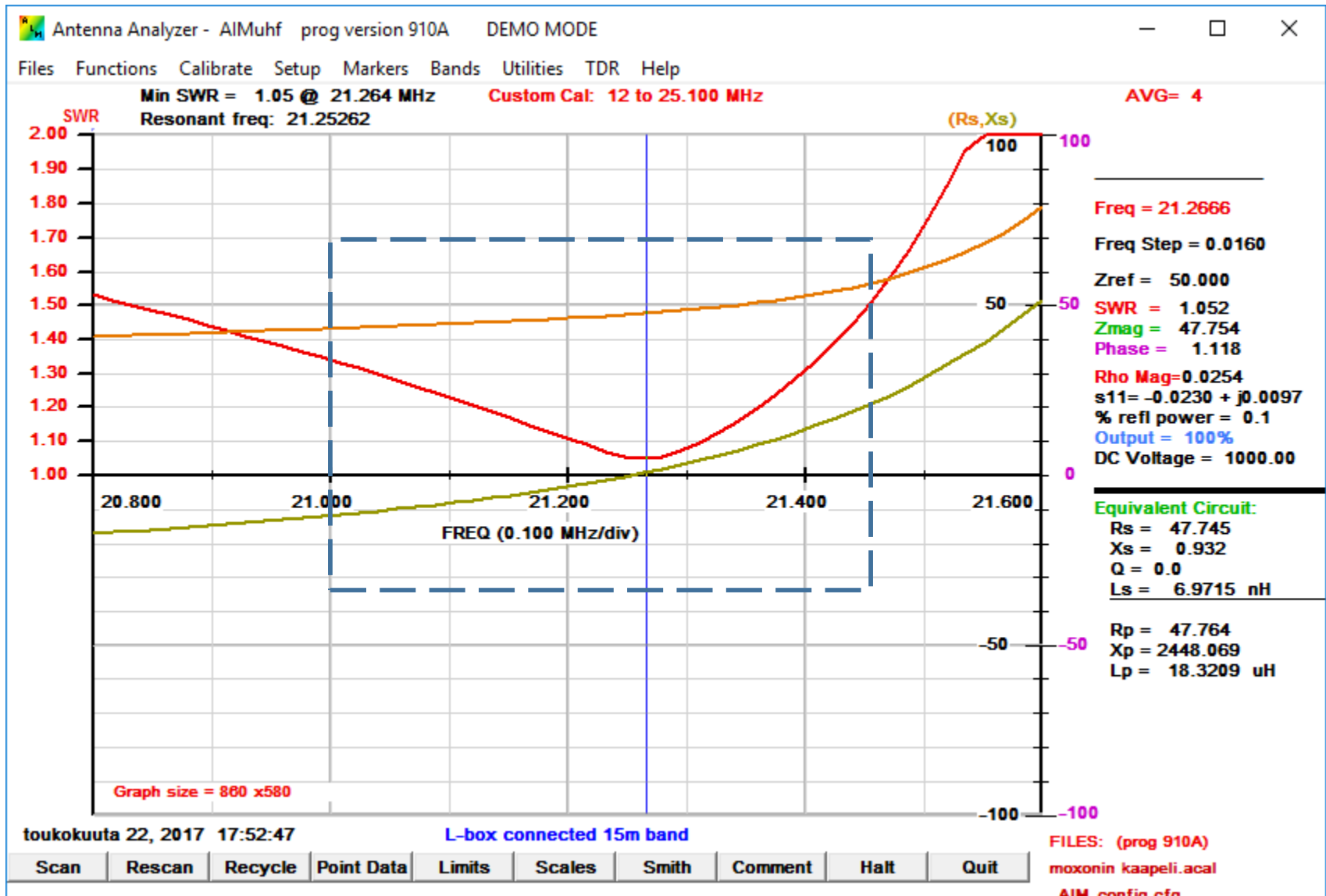
Slice Max Gain 8.07 dBi @ Az Angle = 0.0 deg.
 Front/Back 33.17 dB
 Beamwidth 64.8 deg.; -3dB @ 327.6, 32.4 deg.
 Sidelobe Gain -22.37 dBi @ Az Angle = 107.0 deg.
 Front/Sidelobe 30.44 dB



Freq 21 MHz
 SWR 1.43
 Z 46.83 at -19.64 deg.
 = 44.11 - j 15.74 ohms
 Refl Coeff 0.1761 at -101.03 deg.
 = -0.0337 - j 0.1729
 Ret Loss 15.1 dB

Source # 1
 Z0 50 ohms

15m, measured at L-box input, height 16m

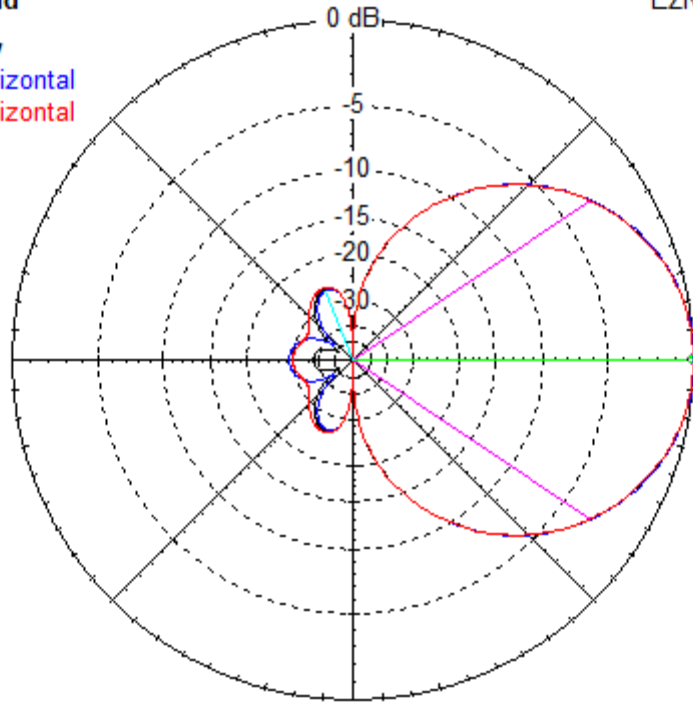


17m, free space

Total Field

* Primary
 18060 horizontal
 18170 horizontal

EZNEC Pro/4

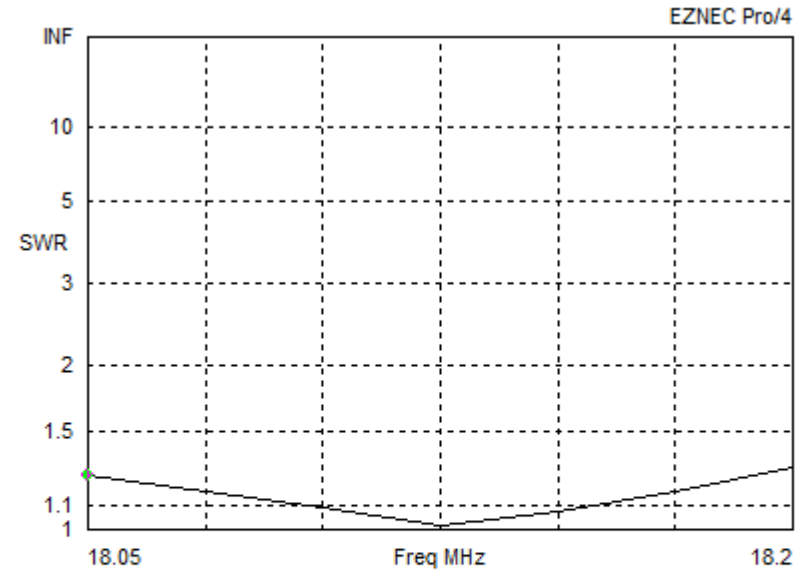


18.1 MHz

Azimuth Plot
 Elevation Angle 0.0 deg.
 Outer Ring 7.44 dBi

Cursor Az 0.0 deg.
 Gain 7.42 dBi
 0.0 dBmax

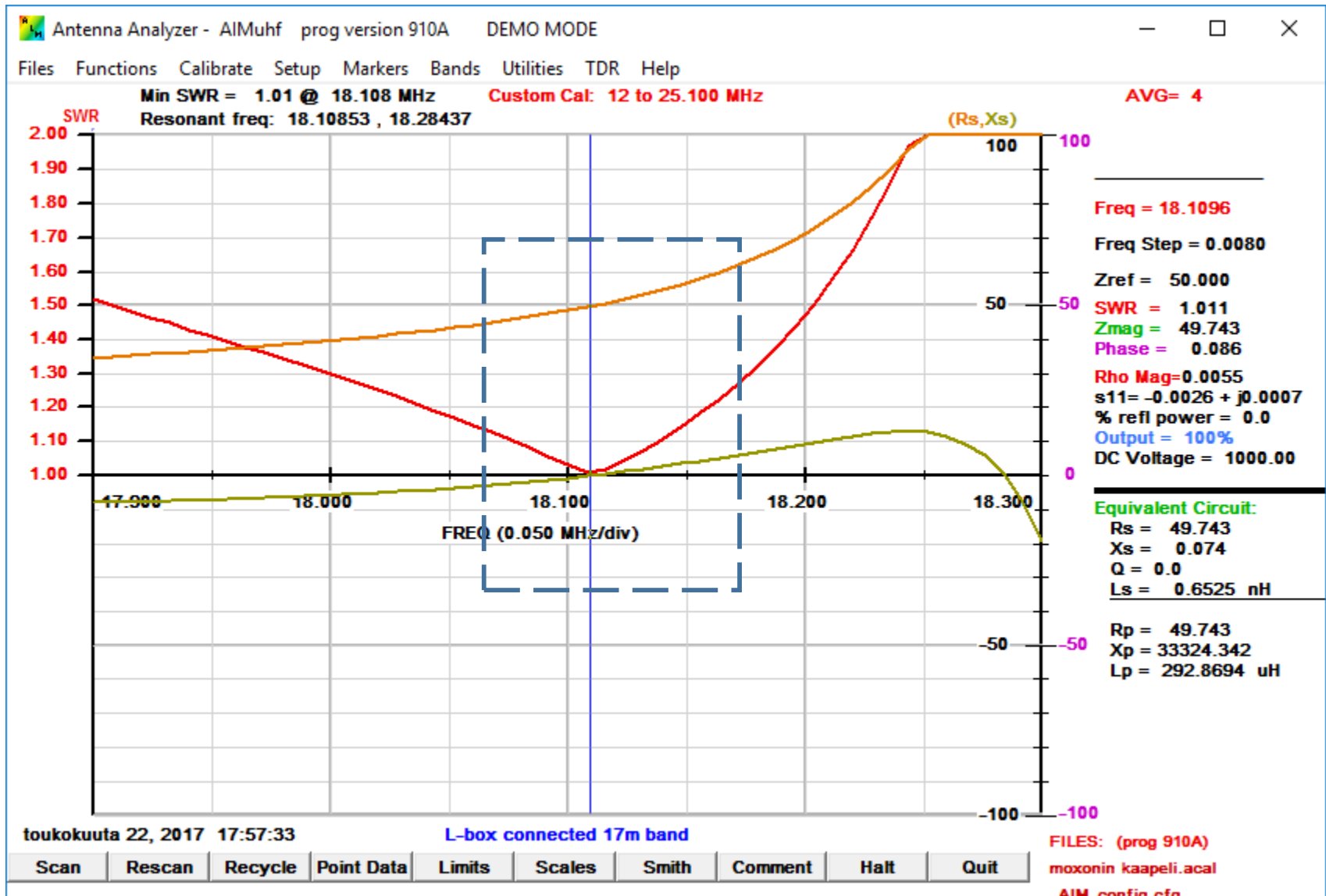
Slice Max Gain 7.42 dBi @ Az Angle = 0.0 deg.
 Front/Back 37.07 dB
 Beamwidth 67.6 deg.; -3dB @ 326.2, 33.8 deg.
 Sidelobe Gain -18.35 dBi @ Az Angle = 111.0 deg.
 Front/Sidelobe 25.77 dB



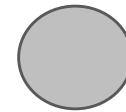
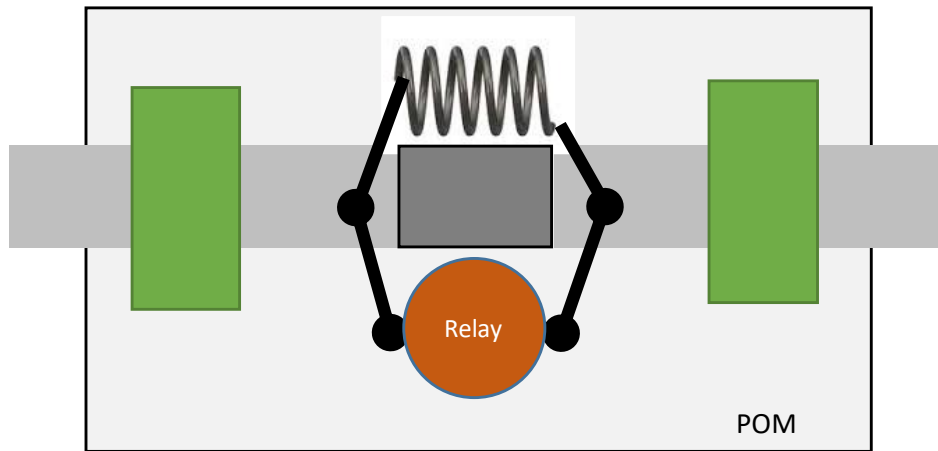
Freq 18.05 MHz
 SWR 1.25
 Z 41.63 at -7.3 deg.
 = 41.29 - j 5.293 ohms
 Refl Coeff 0.1115 at -145.4 deg.
 = -0.09175 - j 0.0633
 Ret Loss 19.1 dB

Source # 1
 Z0 50 ohms

17m, measured at L-box input, height 16m



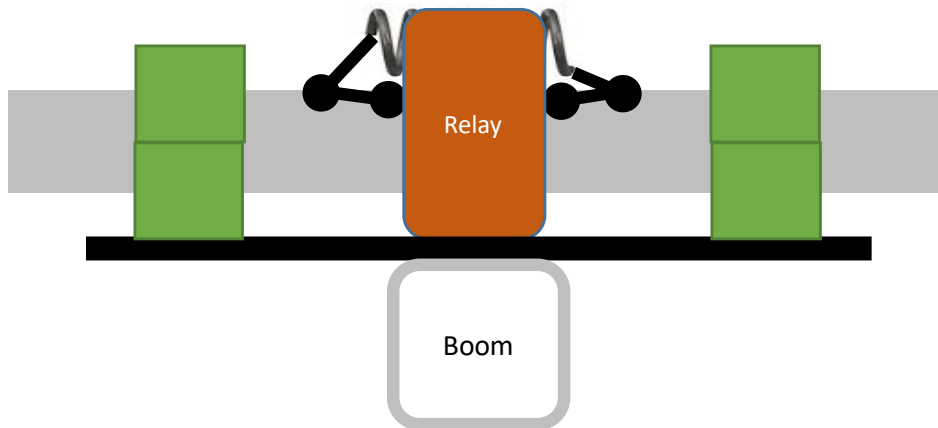
Band switch 15m/17m with relay

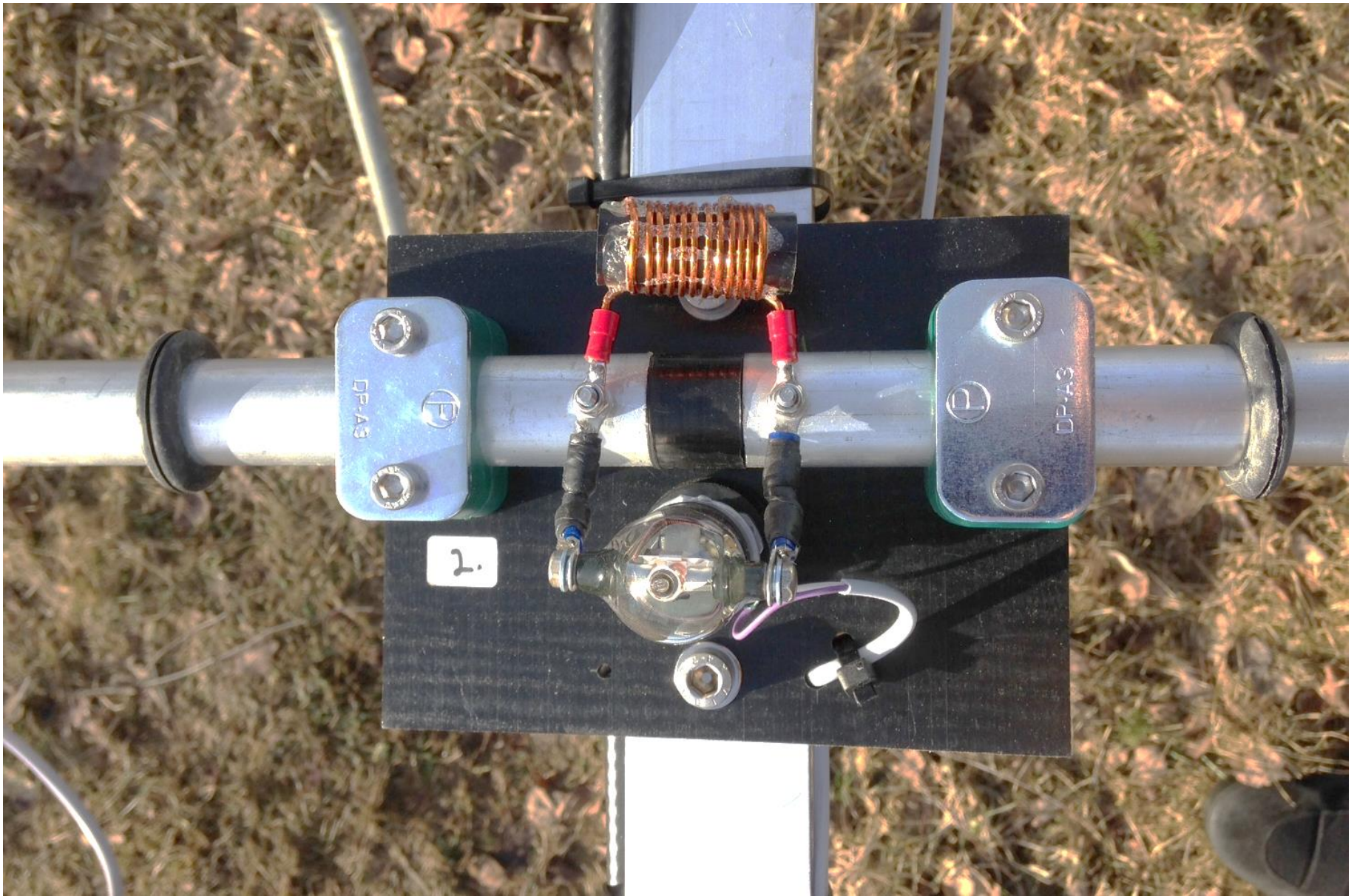


With 2 kW input max voltage over inductor on 17m is 750V @ 11.5A.

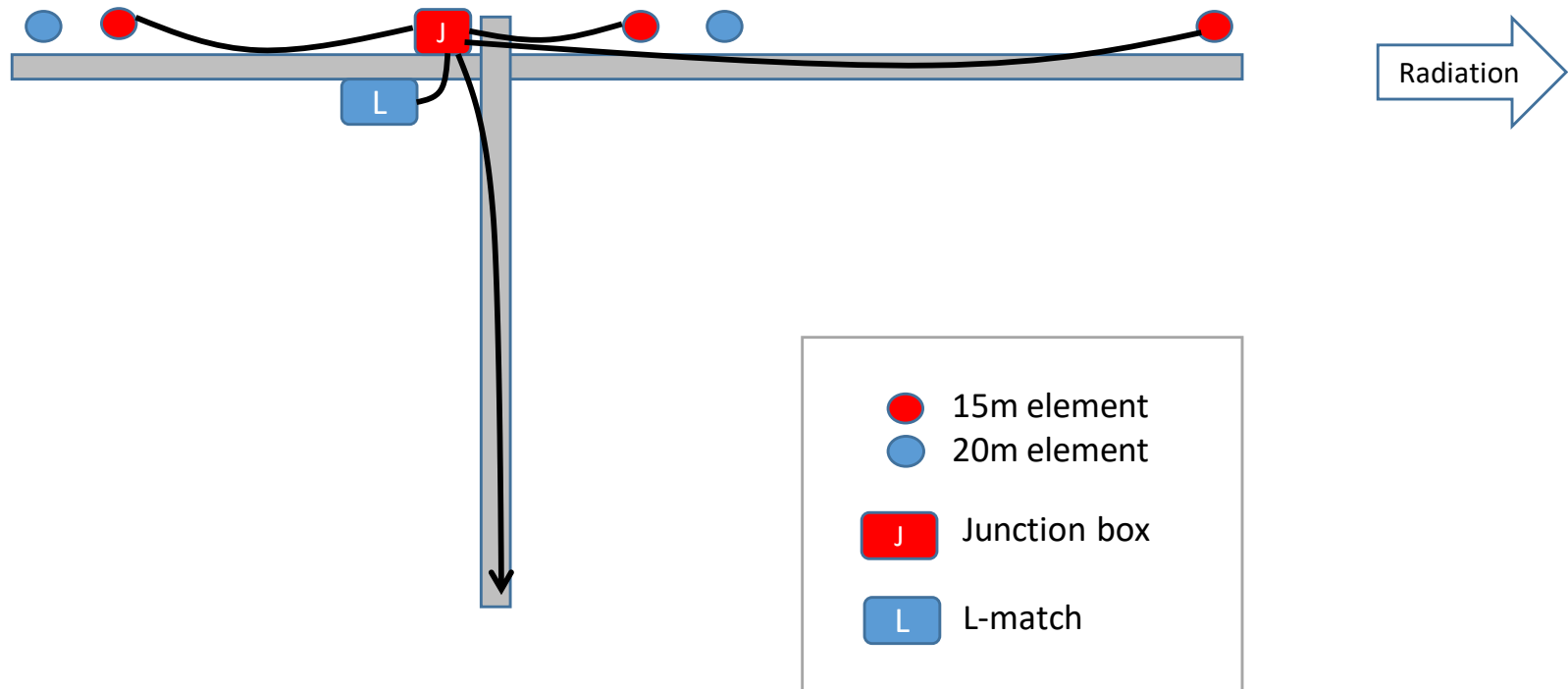
Russian relay B1B (V1V) is 3kV 10A

Relay + wiring inductance is 60nH @ 15m

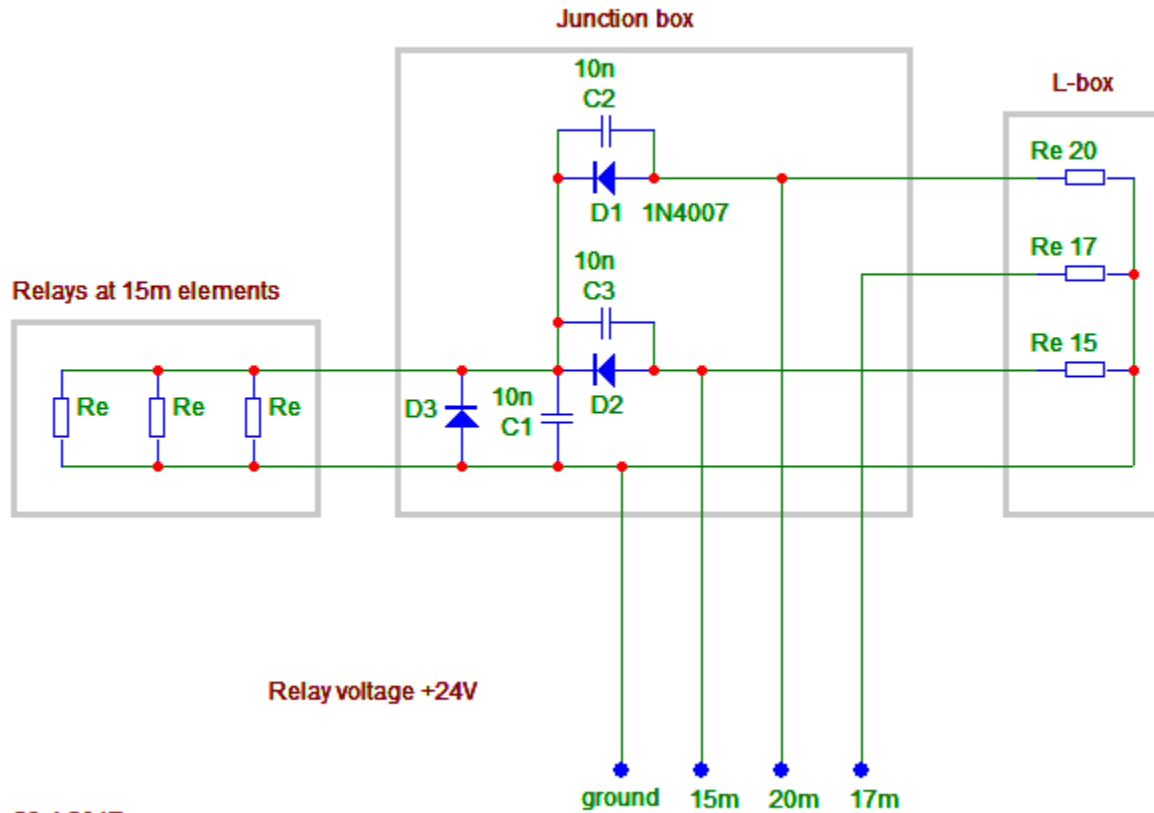




Relay wiring

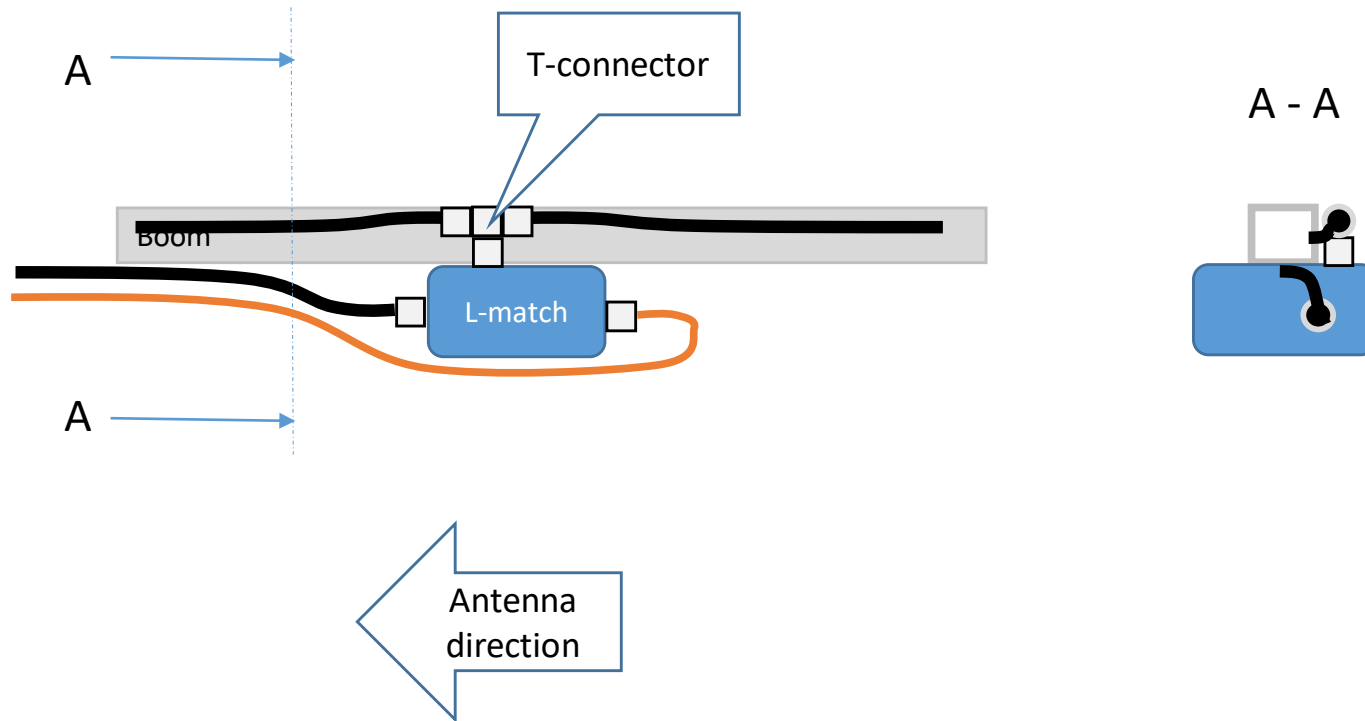


Model 323 relay connections

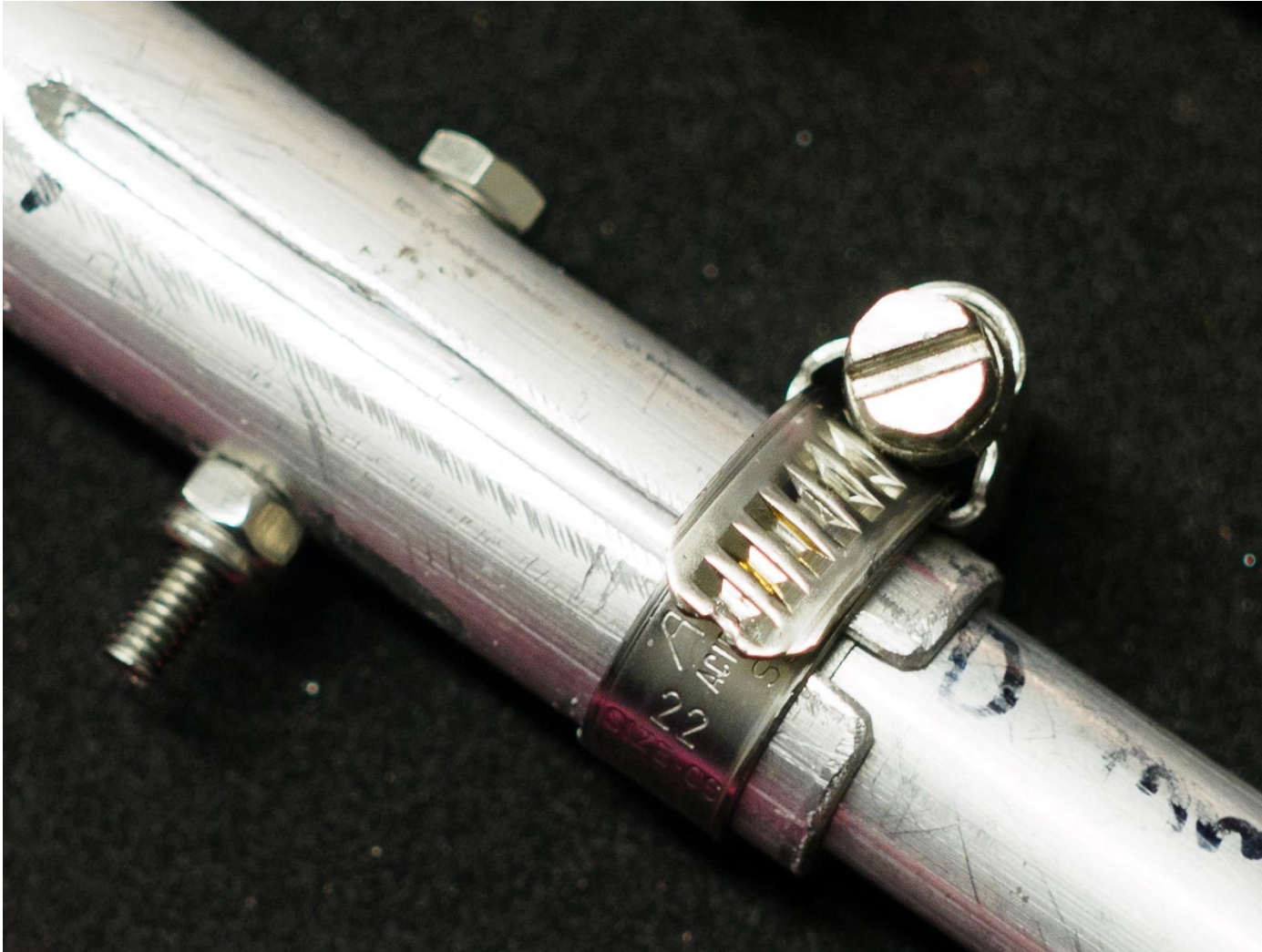


28.4.2017
OH1TV

L-match installation



Element detail



Dimensions

Tapering plan for 20m elements

Dimensions for one side only, mm

Dia	net length	cut length	cumulative	pcs
30	7.5	center isolator	7.5	2
30	992.5	992.5	1000	4
25	1000	1100	2000	4
19	1000	1100	3000	4
15	1000	1100	4000	4
12	1308	1450	5308 rear	2
12	788	900	4788 front	2

In tuning phase 13mm was added to the four 20m-element tips, which is included in the values above.

Taper 3d

Tapering plan for 15m elements

Dimensions for one side only, mm

<u>Dia</u>	<u>net length</u>	<u>cut length</u>	<u>cumulative</u>	<u>pcs</u>
25	10	center isolator	10	3
25	490	490	500	6
19	1000	1060	1500	6
15	1000	1100	2500	6
12	1124	1250	3624	rear 2
12	937	1050	3447	middle 2
12	713	850	3213	front 2

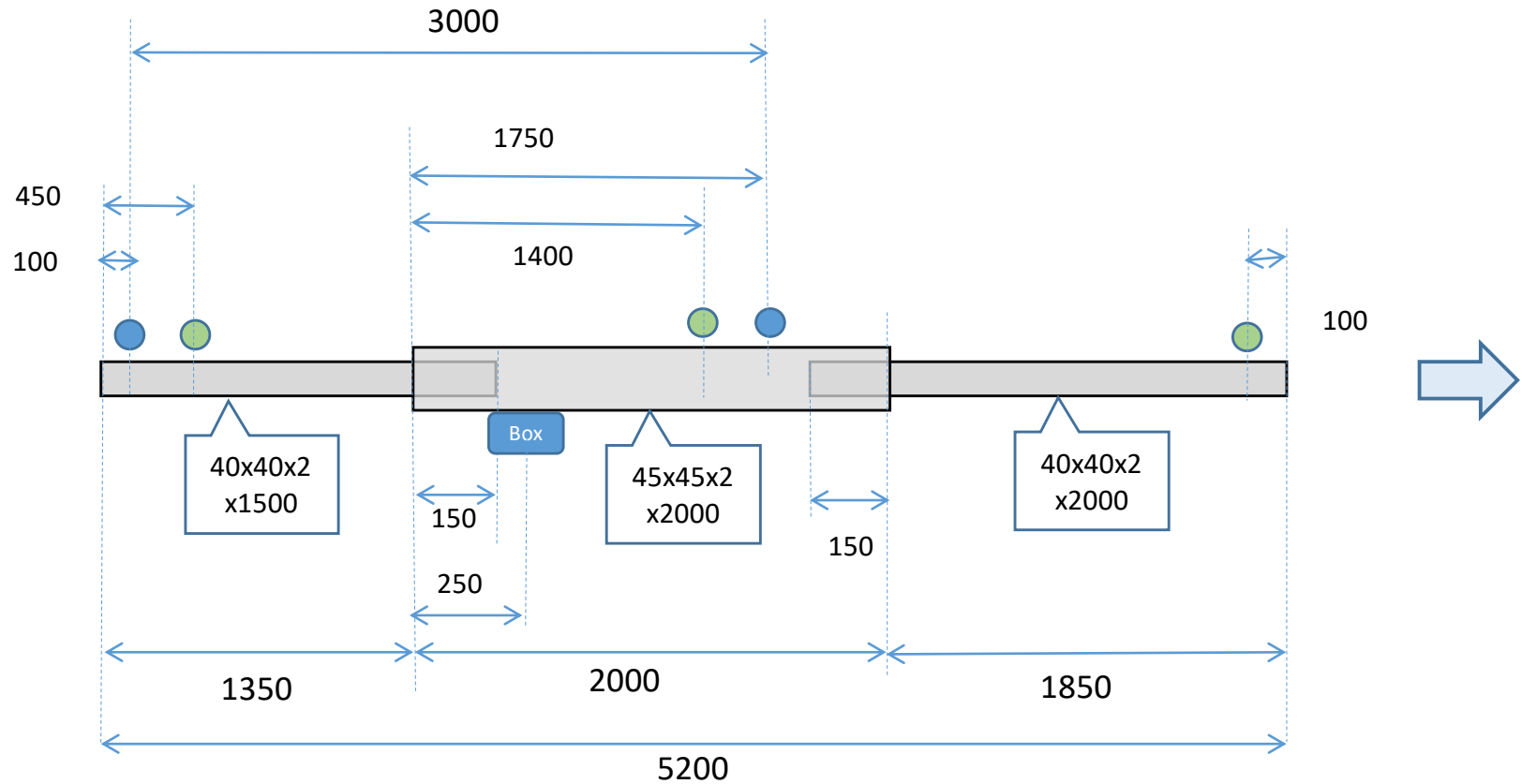
In tuning phase 36mm was added to the six 15m-element tips, which is included in the values above.

Taper 3d

Element spacing

<u>Position</u>	<u>Element</u>
0 mm	20m rear
350 mm	15m rear
2650 mm	15m middle
3000 mm	20m front
5000 mm	15m front
1500 mm	T-connection, L-match
Abt 2000	Mast

Boom, made of 3 parts, or just one



OH1XFE and OH1EVI made the boom in one piece, 5200 long 45x45x2 alu tube.

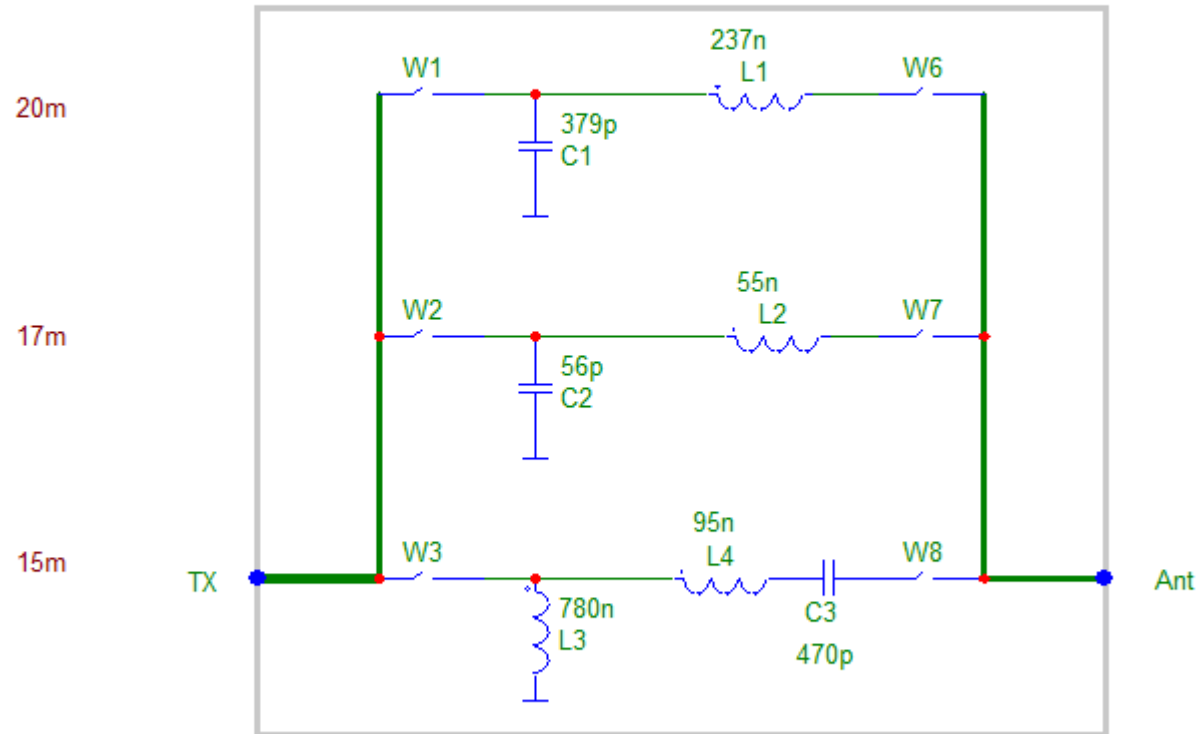
Tuning the elements

- In the Eznec model the antenna was set to height corresponding the tuning height (16m). Impedance pattern at the T-connector was recorded, on each band. The instrument was AIM 4170B, calibrated to show impedance at the T-connector.
- First tuning was the 20m band. Impedance pattern offset was corrected by adjusting both 20m elements, same amount.
- Next 15m was tuned using the same idea, removing the offset, same change to all three elements.
- Last tuning was 17m. Only the coil values can tune 17m. No change was needed. Coils were accurate!
- All 3 built antennas were a bit different, even same dimensions were used. Individual tuning therefore was a good idea. Trusting on mechanical dimensions would have been a mistake.

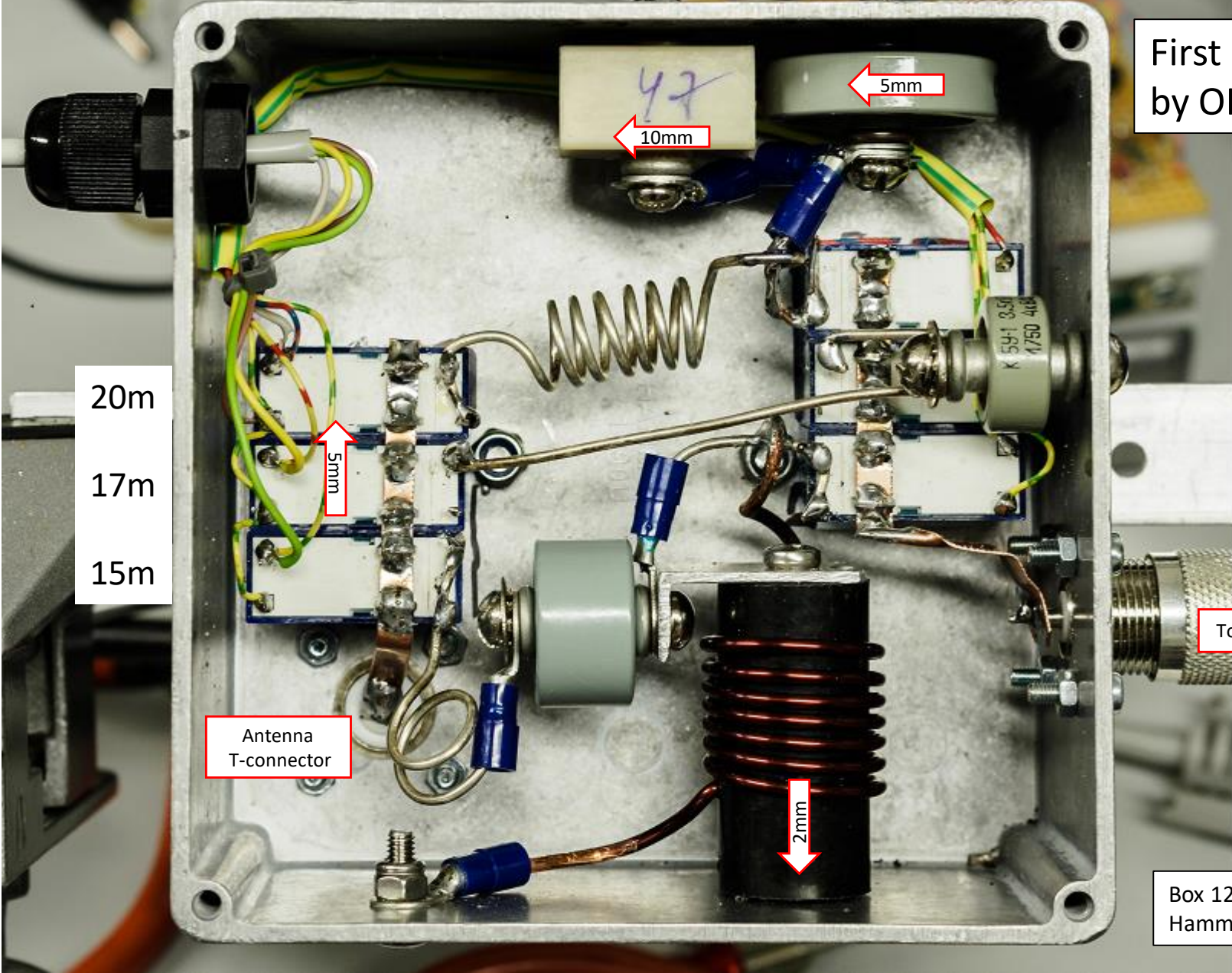
L-box

Antenna tuner at the feedpoint, L-match

L-match for Model 323 - 20 15 17



20.4.2016
OH1TV



First prototype
by OH1TV

20m
17m
15m

Antenna
T-connector

To radio

Box 120x120x59
Hammond 1590U

← = suggested movement

Second L-box by OH1XFE

20m

17m

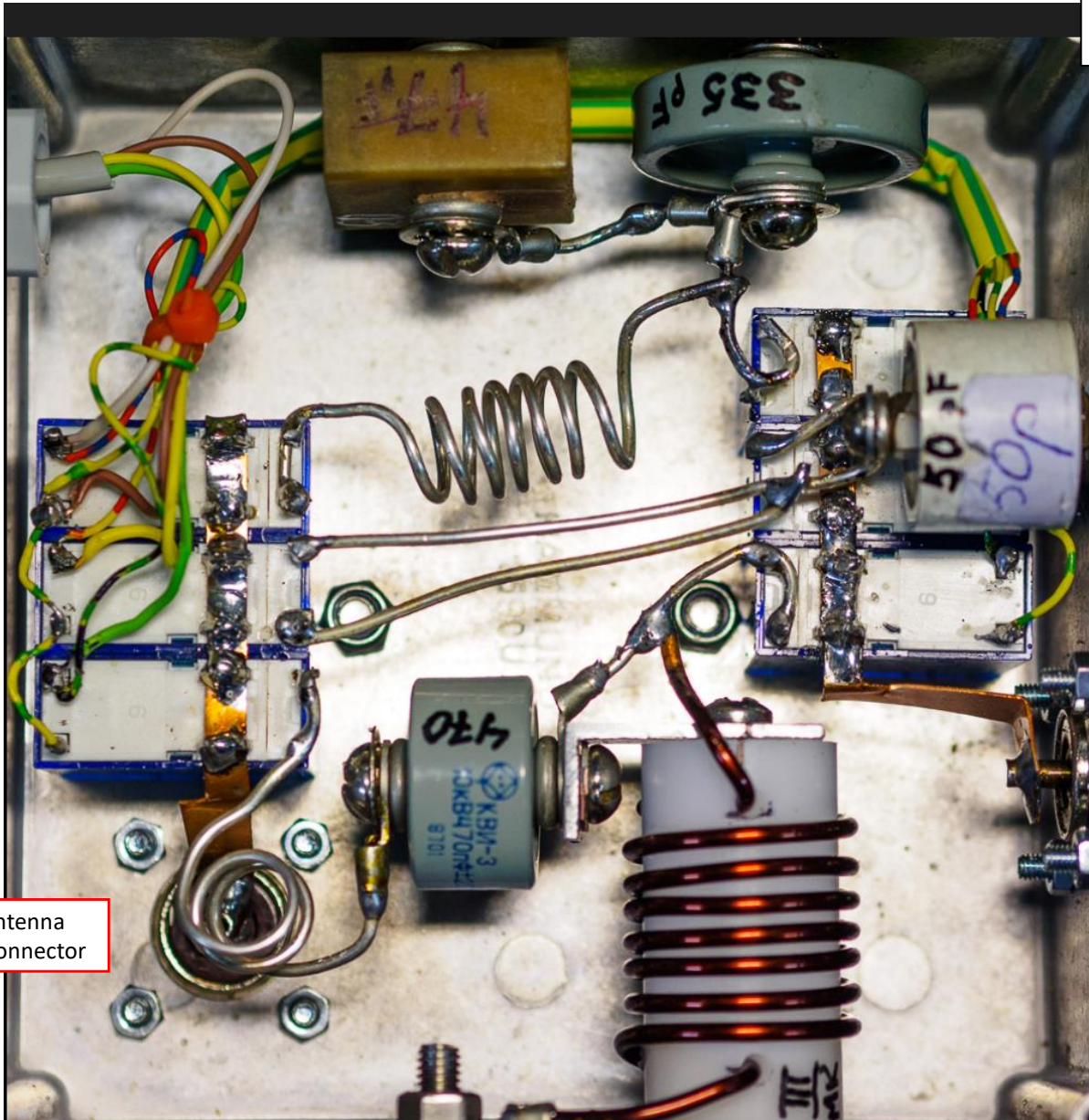
15m

Antenna
T-connector

To radio

Box 120x120x59
Hammond 1590U

Third L-box by OH1EVI



Antenna
T-connector

20m

17m

15m

To radio

Aligning the L-box

- Make the tuning in the lab, the box removed from the antenna
- Use antenna analyzer, AIM 4170B or similar quality.
 - Calibrate the instrument at the end of connecting cable, max 1m long.
 - Connect the cable to the antenna input (where the T-connector comes to)
 - Terminate the TX-connector with good quality 50 ohm calibration pad.
- Target values on point frequencies are:
 - 21275kHz: $39.49 + j 16.18$ ohm
 - 14175kHz: $12.12 - j 0.74$ ohm
 - 18125kHz: $45.72 - j 9.37$ ohm
 - The frequencies are the points where minimum SWR of the full antenna should appear
 - The target impedances are conjugate values of the antenna itself, seen from the T-connector
- Trim with component values

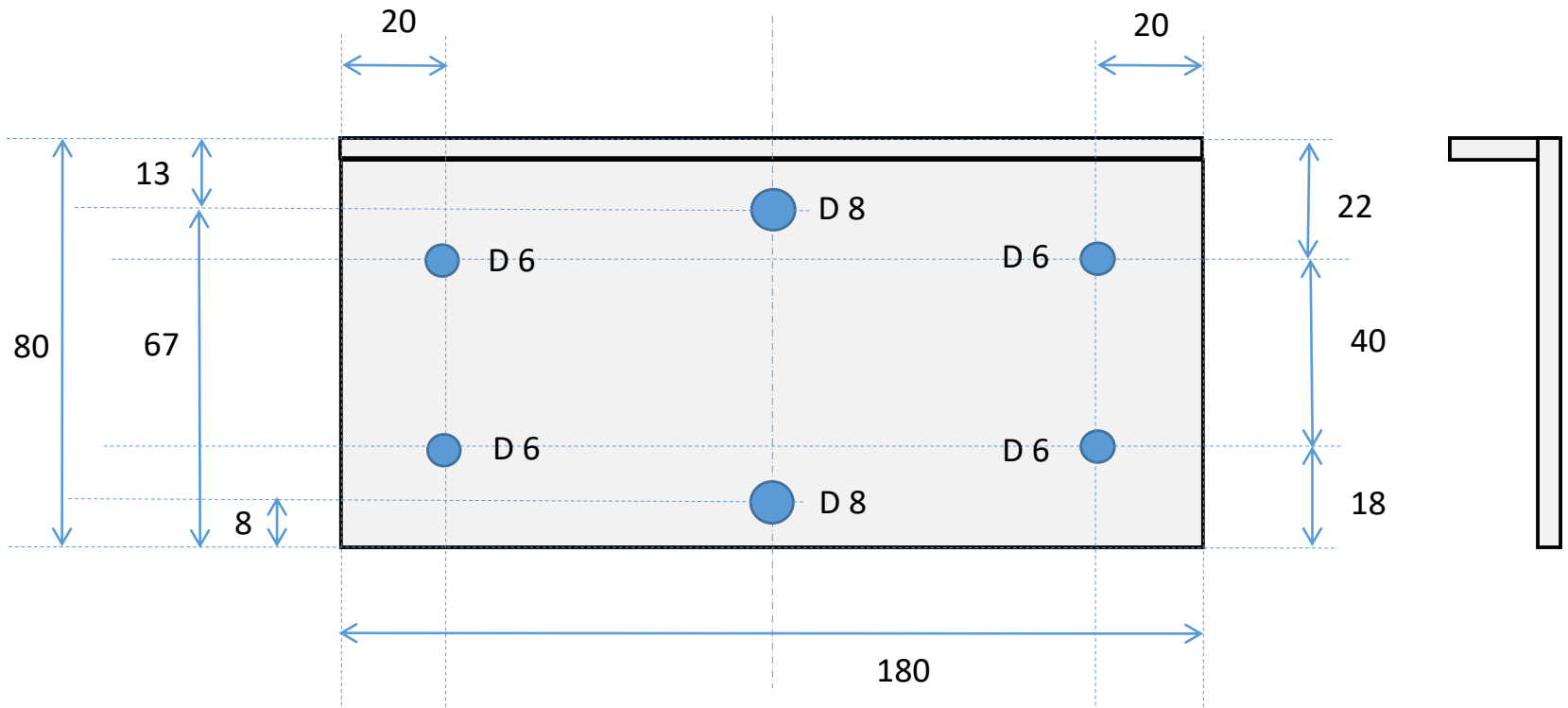
Parts

20m: 2 elements OVF

15m: 3 parasitic elements, 2 of them open sleeve to 20m elements

17m: 15m elements with inductive loading at the element center

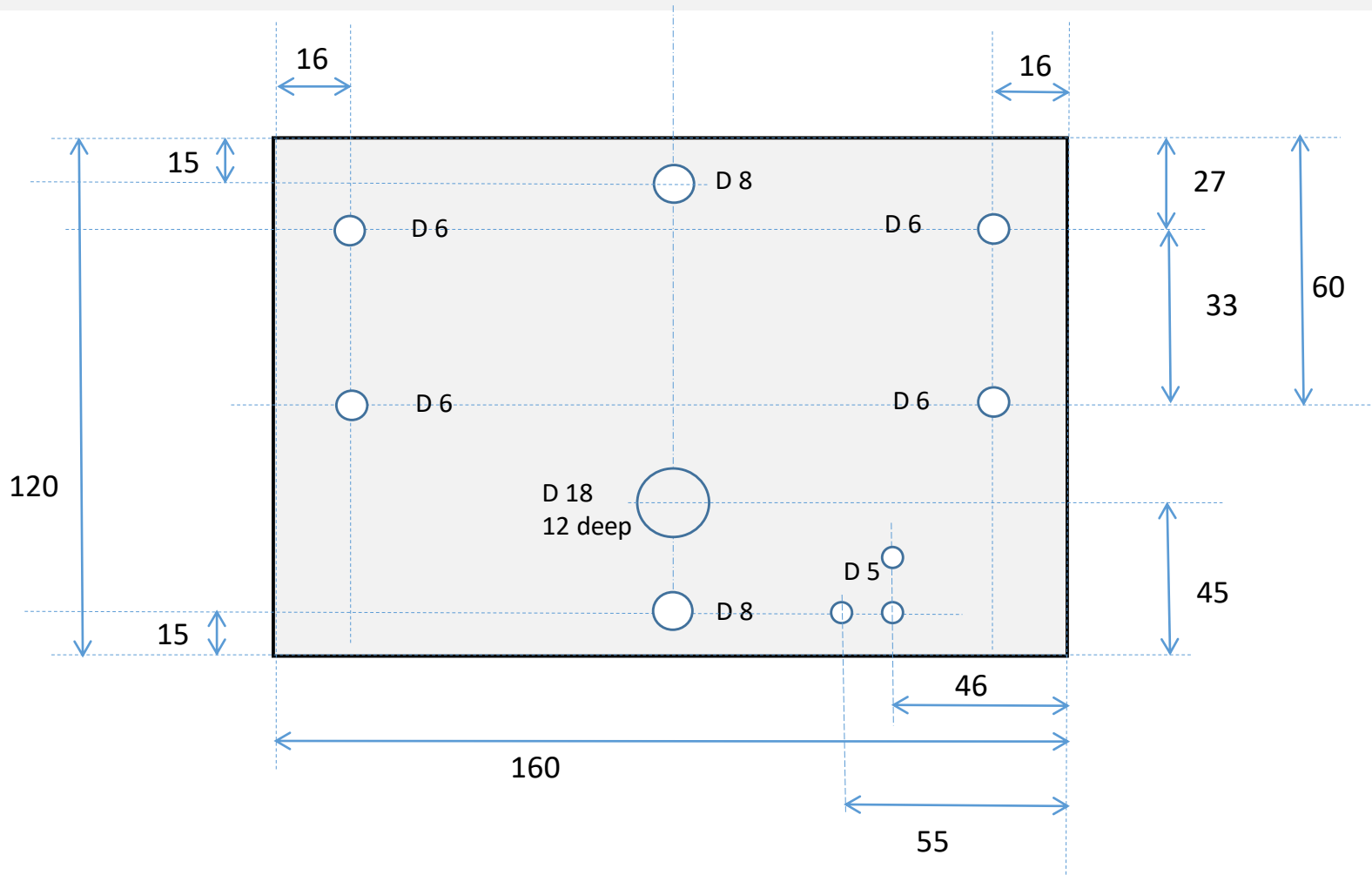
20m element (dia 30mm) mounting bracket 2 pcs needed



Material: Aluminum 80x30x5 x180, L-profile

Screws for Stauffs 4pcs M6x60
Bracket to boom 2pcs M8x 70

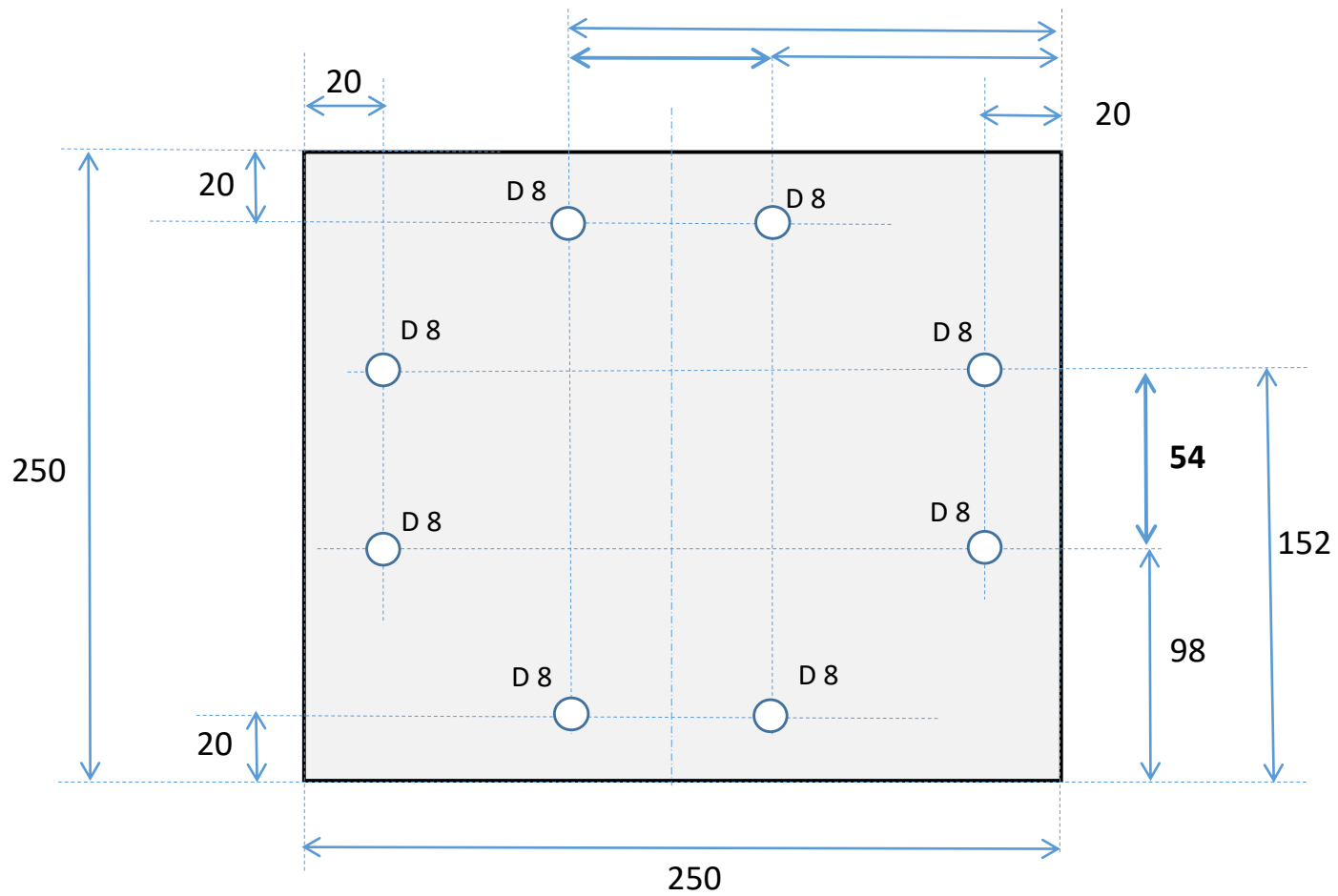
15m element (dia 25mm) mounting bracket, new 3 pcs needed



Material: POM 16 x160x120 black

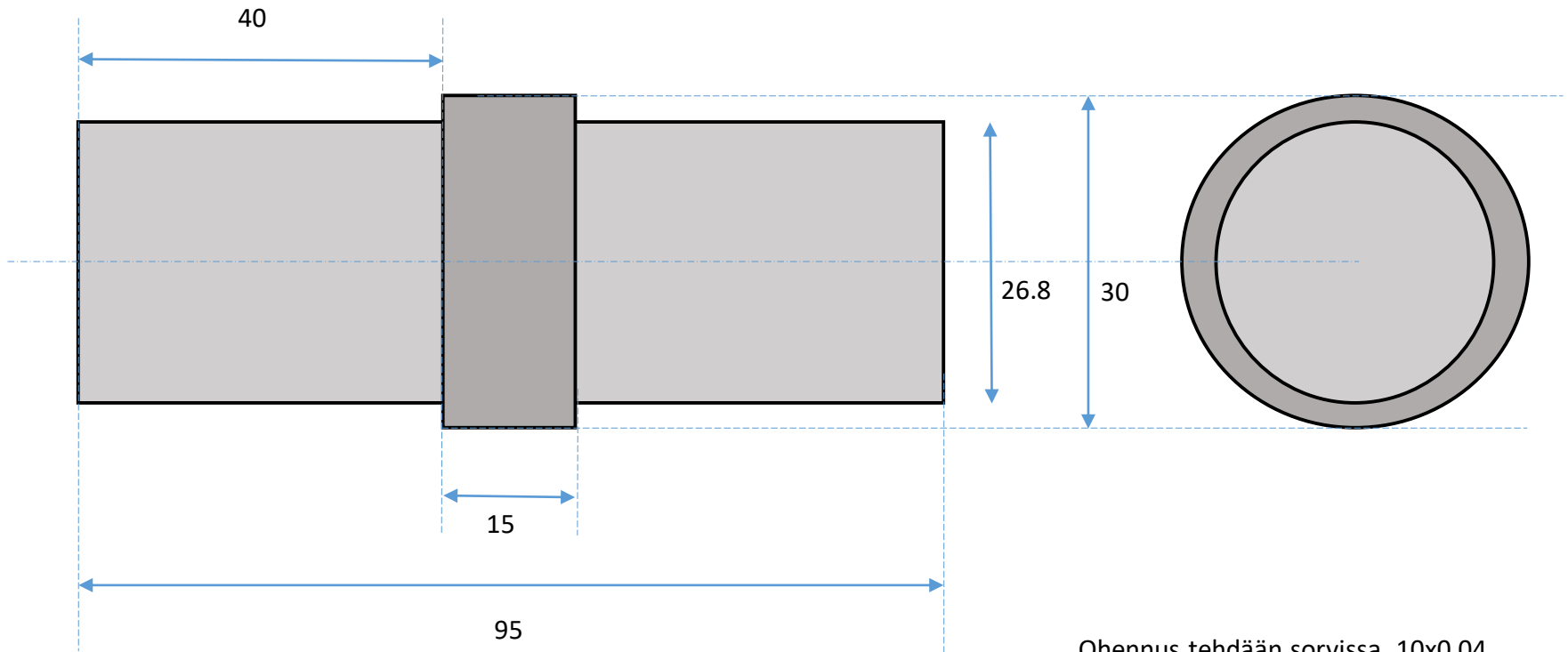
Screws for Stauffs 4pcs M6x70
Bracket to boom 2pcs M8x 70

Boom to mast bracket



Material: Aluminum plate 6x250x250

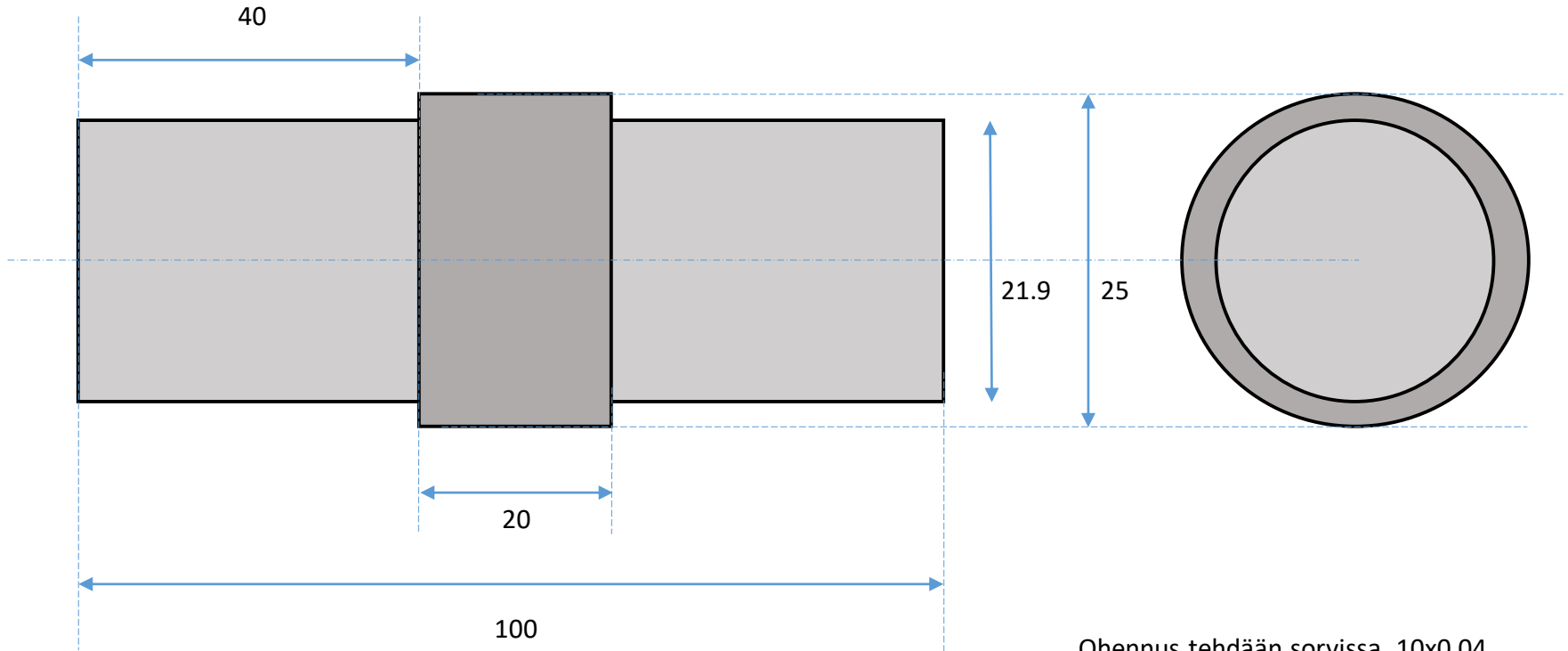
Element center isolator for 30mm tube 2 pcs needed



Ohennus tehdään sorvissa. 10x0.04
siivuinä. 48-50 x 0.04 antaa oikean
lopputuloksen. Tarkistetaan tulkillä, joka
on 30mm putki.

Material dia 30mm POM

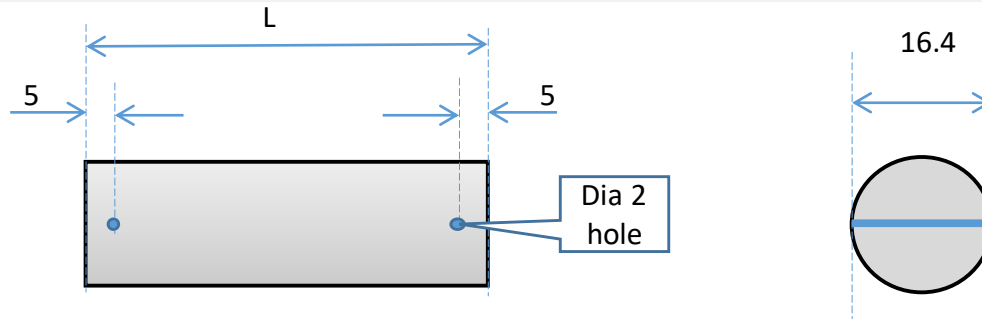
Element center isolator for 25mm tube 3 pcs needed



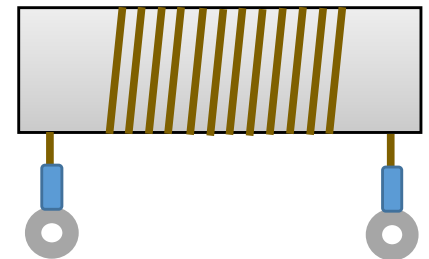
Ohennus tehdään sorvissa. 10x0.04
siivuna. 48-50 x 0.04 antaa oikean
lopputuloksen. Tarkistetaan tulkilla, joka
on 25mm putki.

Material dia 25mm POM

Coils for 17m, taper 3d 3 different needed



- Inductance values needed
 - Rear 1.12uH
 - Middle 1,19uH
 - Front 1.42uH
- 1.5mm emaled cu wire on dia 16.4mm POM form
 - 1.12uH = 11 turns, 28mm long, L=38mm POM
 - 1.19uH = 12 turns, 30mm long, L=40mm POM
 - 1.42uH = 13 turns, 33mm long, L=43mm POM
- Q = abt 400

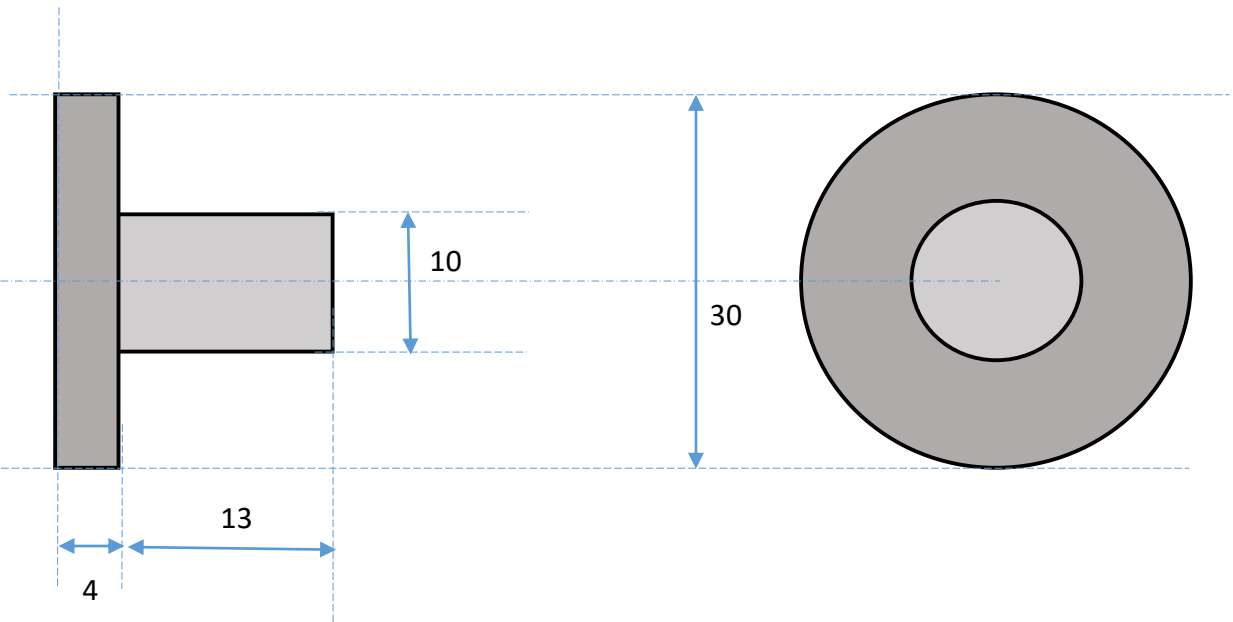


17m coil



Relay foot

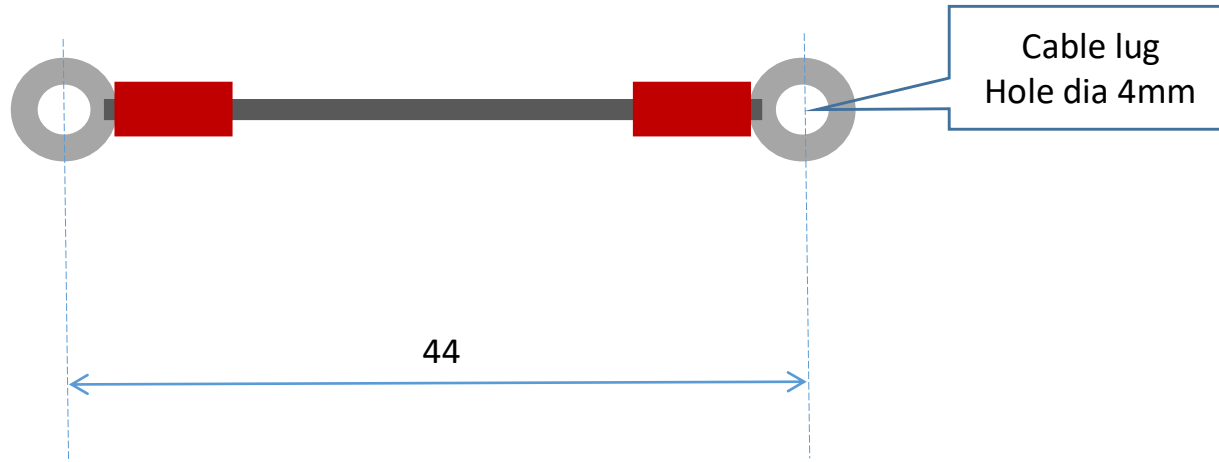
3 pcs needed



Material dia 30mm POM

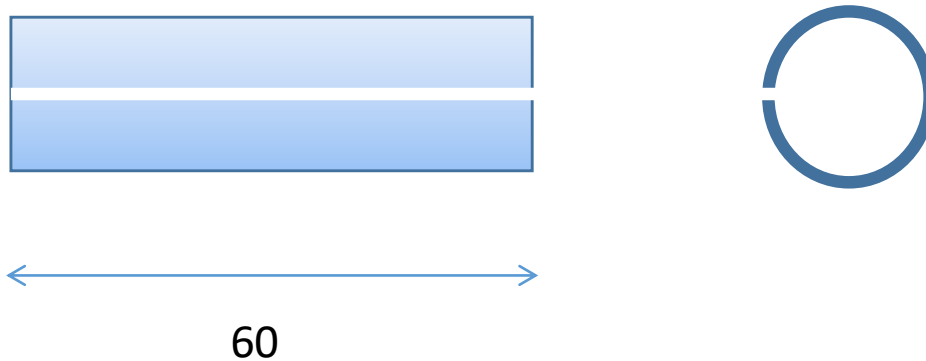
Ohennus tehdään sorvissa. 20x0.04 siivuina. -260 x 0.04 antaa oikean lopputuloksen.

Cable to relay 6 pcs needed



Shield of RG58 is used as cable here. It is thick and flexible
Cable lugs are just crimped, no soldering needed
Align lugs in 90 degree angle on the cable
Cable shall be covered with self vulcanizing tape
> Relay loop total inductance is 60nH

Fitting between dia 25 and 19mm tubes 10 pcs needed



Material dia 22mm aluminum tube, 1.5mm thick.

Katkaise 90mm pala putkea

Ohenna sorvissa 65mm matkalta mittaan 21.5mm.

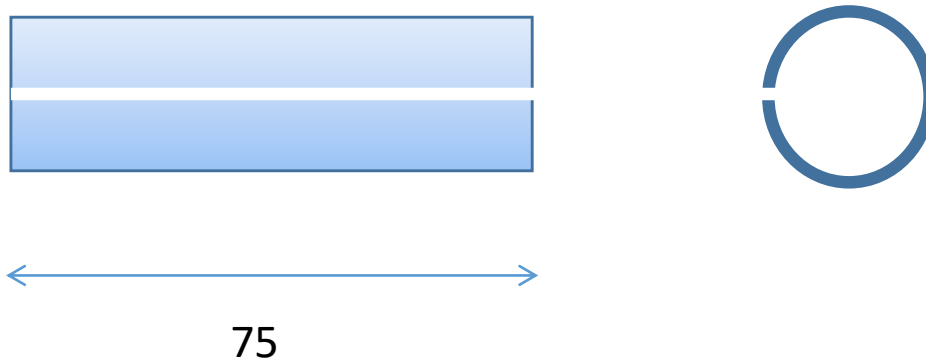
Ota kaksi 5x0.04 paksua kerrosta, yhteensä 10x0.04.

Halkaise aksiaalisesti yhdeltä syrjältä kulmahiomakoneella.

Sahaa irti ja huolittele viilalla.

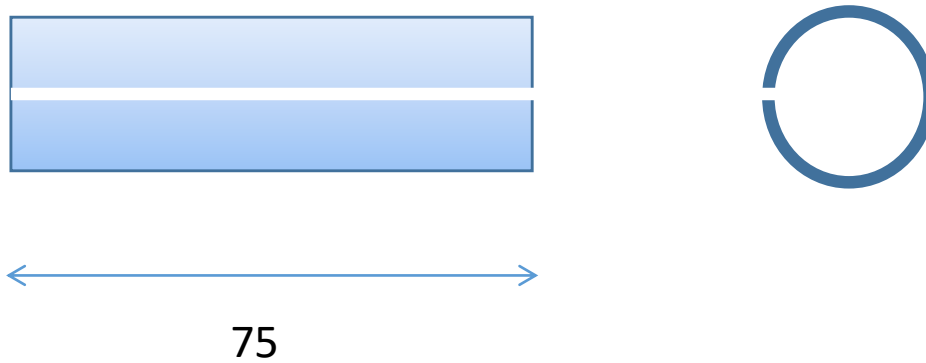
Työnnä 19mm putken päälle

Fitting between dia 19 and 15mm tubes 10 pcs needed



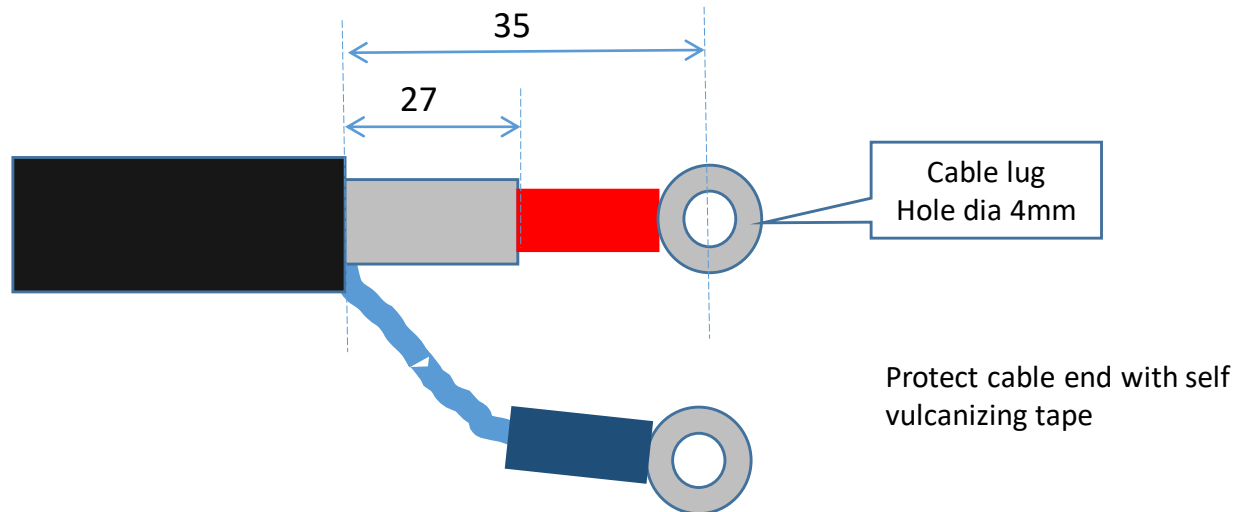
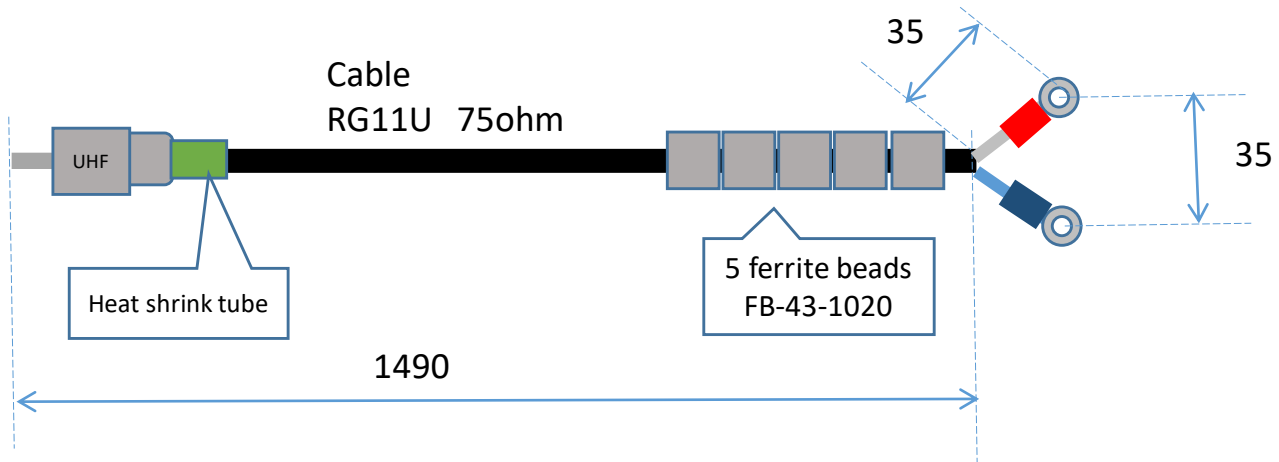
Material aluminum plate, 0.25mm thick.
Cut 75x45mm piece. Roll around dia 15mm tube.

Fitting between dia 15 and 12mm tubes 10 pcs needed

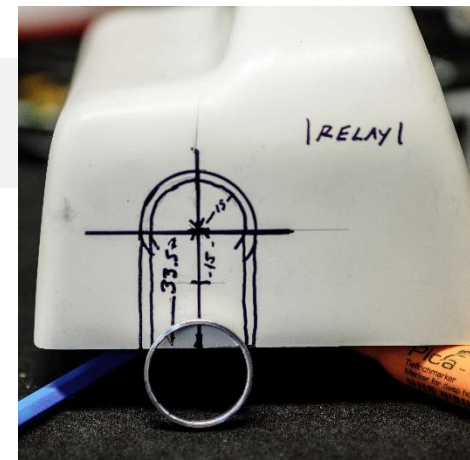


Material aluminum plate, 0.25mm thick.
Cut 75x36mm piece. Roll around dia 12mm tube.

Feed cables for 20m elements, 2pcs



15m elementtien suojakopan työstö



- Hieno koppa tulee Eliakselta OH1XFE. Siihen pitää työstää kolot elementeille ja reiät elementin pohjalevyyn kiinnittämistä varten
- Piirrä päätyihin tussilla merkit kuvaamaan elementin keskilinjaa
- Jos koppa mahtuu kiinni releen ollessa paikallaan + 5mm toleranssia, on elementin keskilinja 33.5mm kopan alareunasta, merkitse. Koppa menee tällöin pohjalevyn alareunaan
- Piirrä ympyrät mitta-sormuksella em. keskipisteenä, sormuksen sisä- ja ulkopuolelle
- Piirrä viivat kohtisuoraan kopan alareunasta niin, että ne leikkaavat em. ympyrät, siis neljä viivaa
- Poraa 6mm puuporalla reikiä niin, että ne sivuavat em. sisäympyrää
- Leikkaa rälläkällä 1mm leikkauslaikalla em. suorat sisimmäiset viivat
- Viimeistele Dremelin hiomarullalla pitkin ulommaista viivaa
- KOLO VALMIS
- Kiinnitysreiät sijaitsevat +/-50mm puomin keskilinjasta ja 6mm kopan reunasta. Reiät 5mm puuporalla
- Pohjalevyyn tehdään vastaavat reiät , ensin 3.5mm poralla 25mm syvä ja sitten 4mm kierre
 - 30mm päästä, 8.3mm reunasta (keskelle). Näin reikien väli sivulla on 100mm

Installation for the first measurements



26.7.2017

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