# 5-, 7-, 9- and 11-el Yagi for 2m band

OH1TV

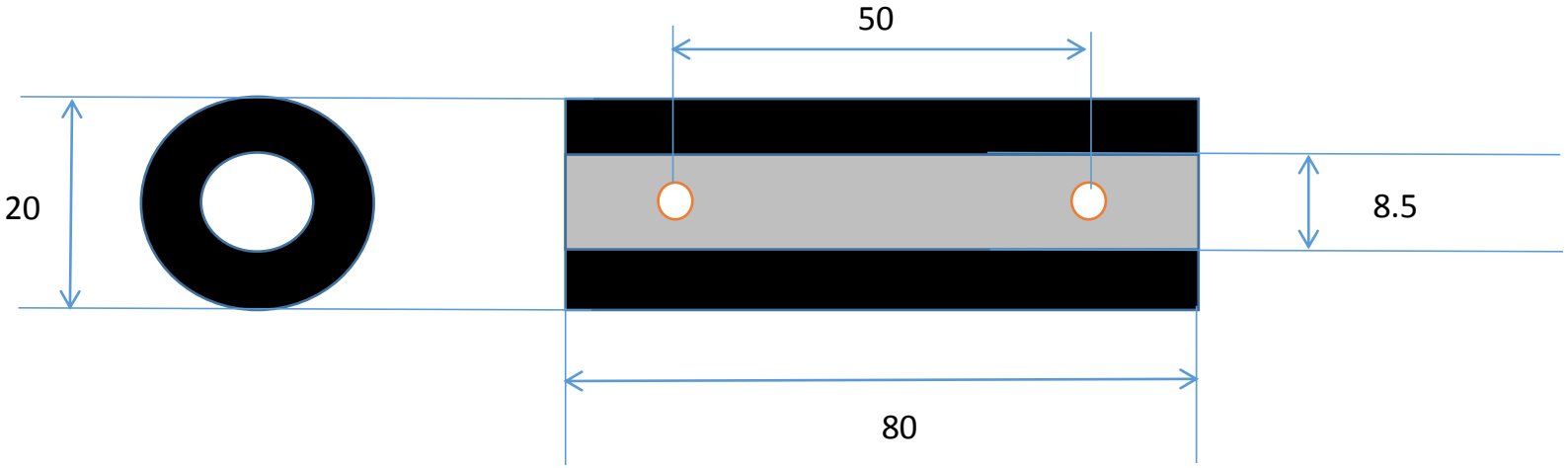
# General information

- All elements are spaced 0.25 lamda except driven element, which is added to between the reflector and first director.
  - Driven element location is set to achieve 50 ohm input impedance.
- All elements are isolated. Stauff clamps are used.
  - This way boom influence is minimized but is still there
- Modeling is made with Eznec Pro/4 v.5.0
  - To compensate boom influence, 2mm is added to both ends of each element, 4mm total
  - Only 1mm is added to both ends of driven element as Y-termination of coax cable adds some inductance to the feed point.
  - If different boom construction is used, this addition has to be checked with measurement (the model doesn't tell it)
- SWR is broadband and low, less than 1.1 over the whole 144-146MHz band
  - Current balun |Z|>250 ohm is used at the feed point

# Element mount

# Driven element

# Center isolator of the driven element

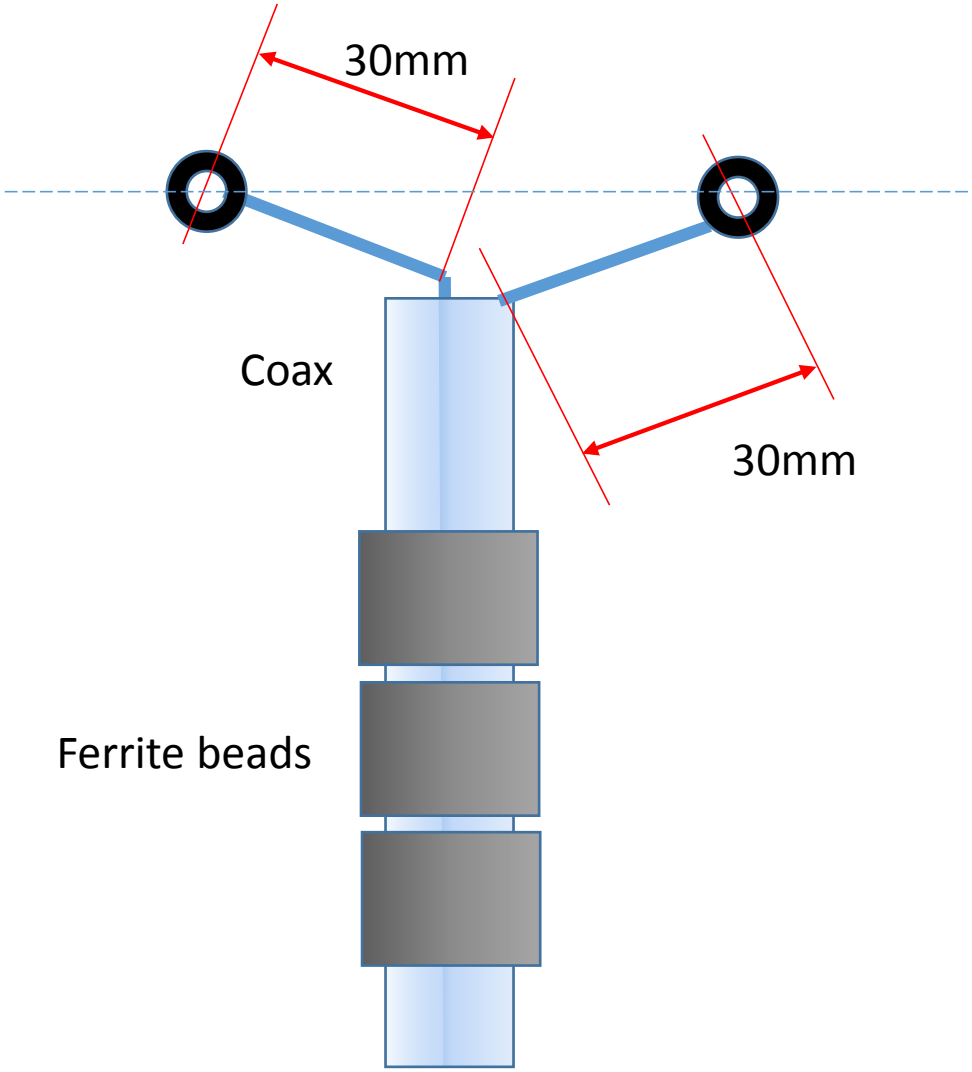



Material is dia 20mm POM, 80mm long
Drill dia 8.5mm hole through it, best done on a lathe
3.5mm holes 15mm from each end for cable screws

Driven element has 20mm air gap in the center. Dia 2mm holes for cable screws are drilled 15mm from the element end . Cable screws are 3.5x16mm sheet metal screws.

# Coax cable Y- termination

- Cable terminals shall be good for dia 3.5mm screws
- Good ferrite beads for RG8 and similar cables are for example Amidon FB-43-1020



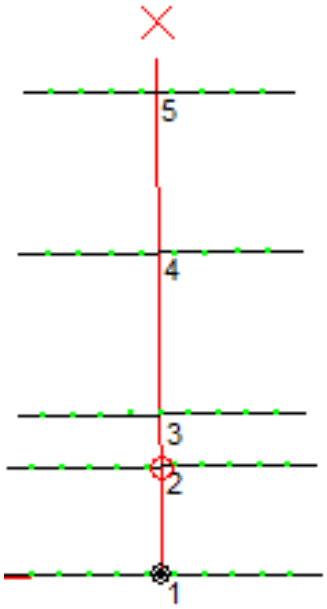
# 5-element Yagi for 2m

I have built and tested this antenna.

4mm was added to Eznec modeled element lengths.

# 5-el in vertical position

# Dimensions 5-el



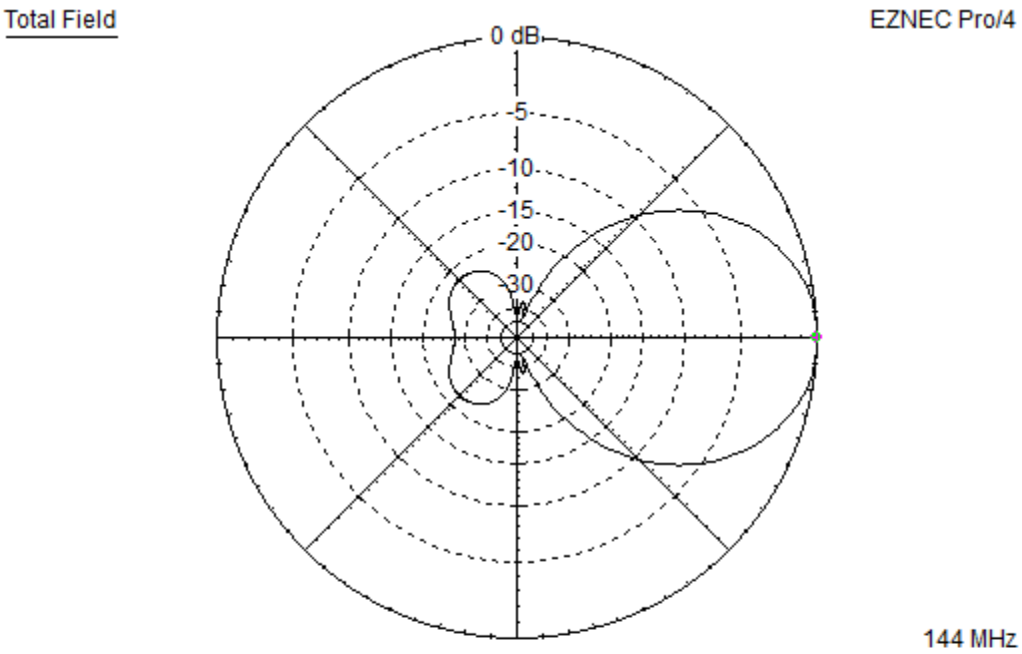

| | Length | Position x |
|---|---|---|
| D3 | 888 mm | 1560 mm |
| D2 | 918 | 1040 |
| D1 | 936 | 520 |
| D | 1008 | 350 |
| R | 1032 | 0 |

Boom 20x20x2000 square aluminum tube

All elements dia 8mm alu tube

Elements are 4mm longer than in Eznec model except driven element is 2mm longer. The reason is boom influence.

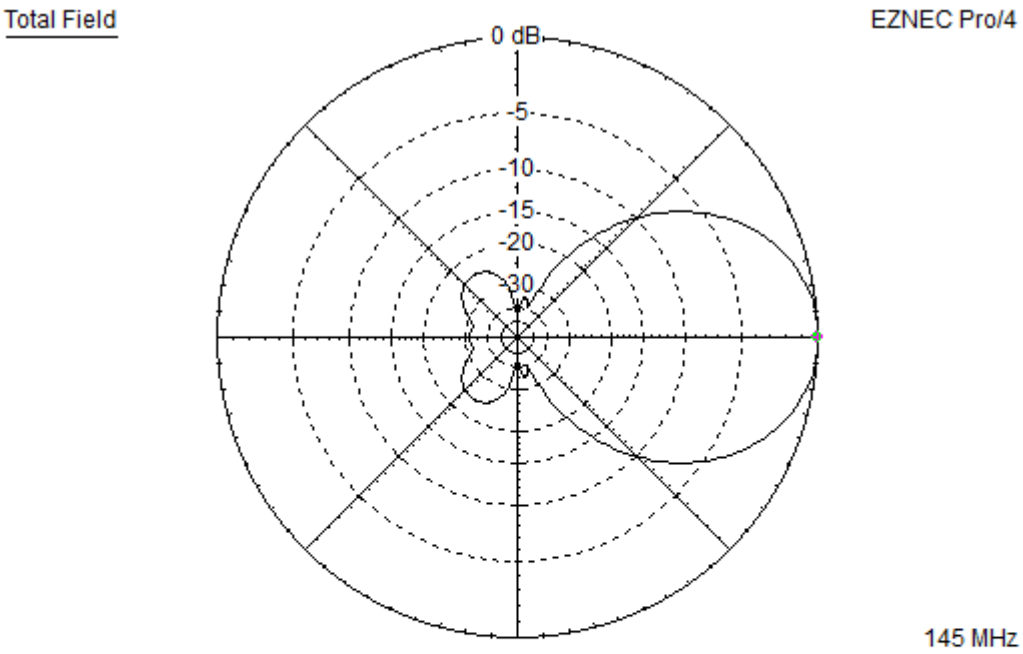
# 5-el Horizontal pattern 144MHz




| | | | |
|---|---|---|---|
| Azimuth Plot | | Cursor Az | 0.0 deg. |
| Elevation Angle | 0.0 deg. | Gain | 10.28 dBi |
| Outer Ring | 10.28 dBi | | 0.0 dBmax |

| | |
|---|---|
| Slice Max Gain | 10.28 dBi @ Az Angle = 0.0 deg. |
| Front/Back | 27.03 dB |
| Beamwidth | 53.4 deg.; -3dB @ 333.3, 26.7 deg. |
| Sidelobe Gain | -12.14 dBi @ Az Angle = 136.0 deg. |
| Front/Sidelobe | 22.42 dB |

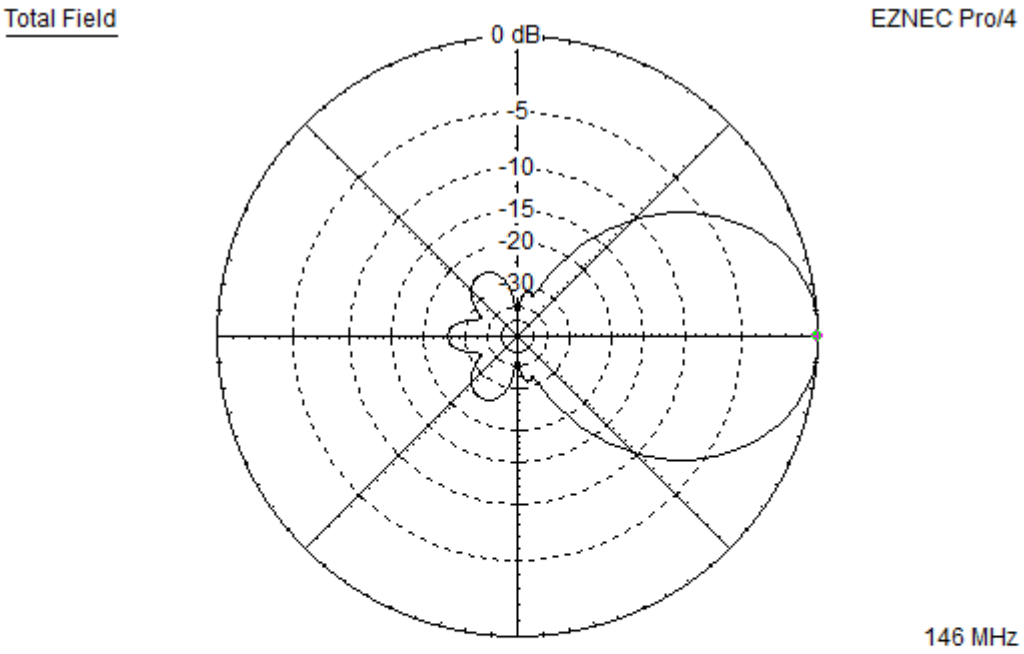
# 5-el Horizontal pattern 145MHz




| | | | |
|---|---|---|---|
| Azimuth Plot | | Cursor Az | 0.0 deg. |
| Elevation Angle | 0.0 deg. | Gain | 10.43 dBi |
| Outer Ring | 10.43 dBi | | 0.0 dBmax |

| | |
|---|---|
| Slice Max Gain | 10.43 dBi @ Az Angle = 0.0 deg. |
| Front/Back | 31.37 dB |
| Beamwidth | 52.6 deg.; -3dB @ 333.7, 26.3 deg. |
| Sidelobe Gain | -13.22 dBi @ Az Angle = 127.0 deg. |
| Front/Sidelobe | 23.65 dB |

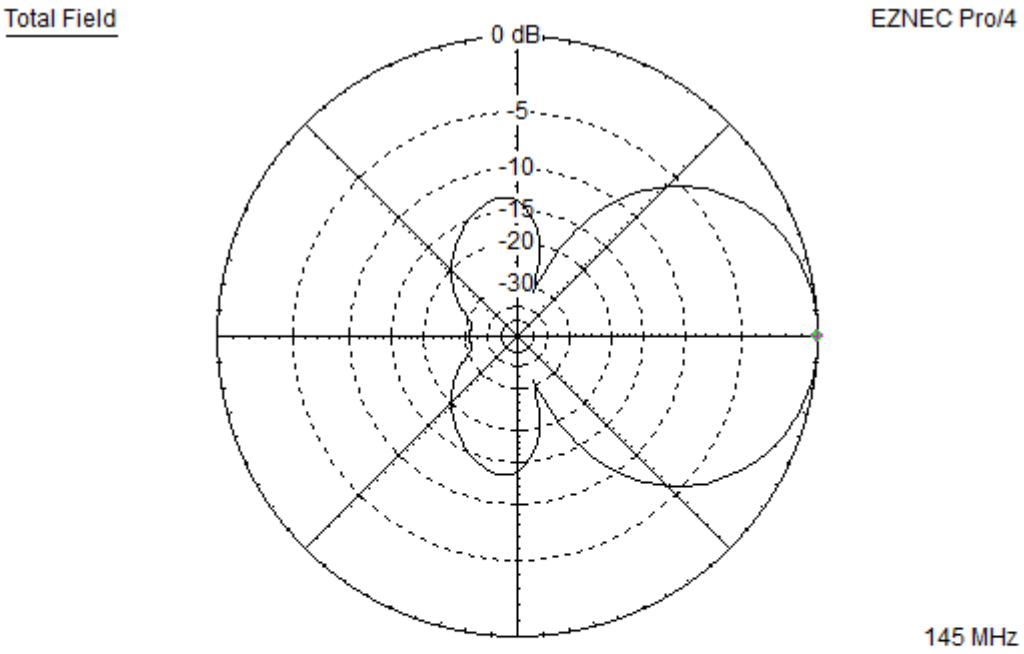
# 5-el Horizontal pattern 146MHz




| | | | |
|---|---|---|---|
| Azimuth Plot | | Cursor Az | 0.0 deg. |
| Elevation Angle | 0.0 deg. | Gain | 10.56 dBi |
| Outer Ring | 10.56 dBi | | 0.0 dBmax |

| | |
|---|---|
| Slice Max Gain | 10.56 dBi @ Az Angle = 0.0 deg. |
| Front/Back | 25.13 dB |
| Beamwidth | 51.8 deg.; -3dB @ 334.1, 25.9 deg. |
| Sidelobe Gain | -14.08 dBi @ Az Angle = 121.0 deg. |
| Front/Sidelobe | 24.64 dB |

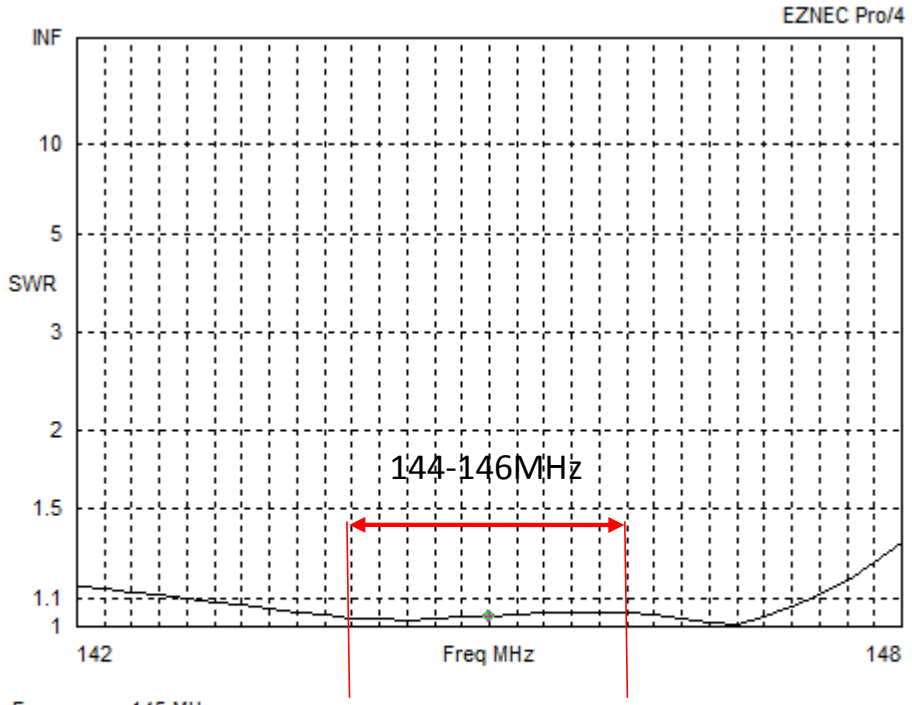
# 5-el Vertical pattern 145MHz




| | | | |
|---|---|---|---|
| Elevation Plot | | Cursor Elev | 0.0 deg. |
| Azimuth Angle | 0.0 deg. | Gain | 10.43 dBi |
| Outer Ring | 10.43 dBi | | 0.0 dBmax |

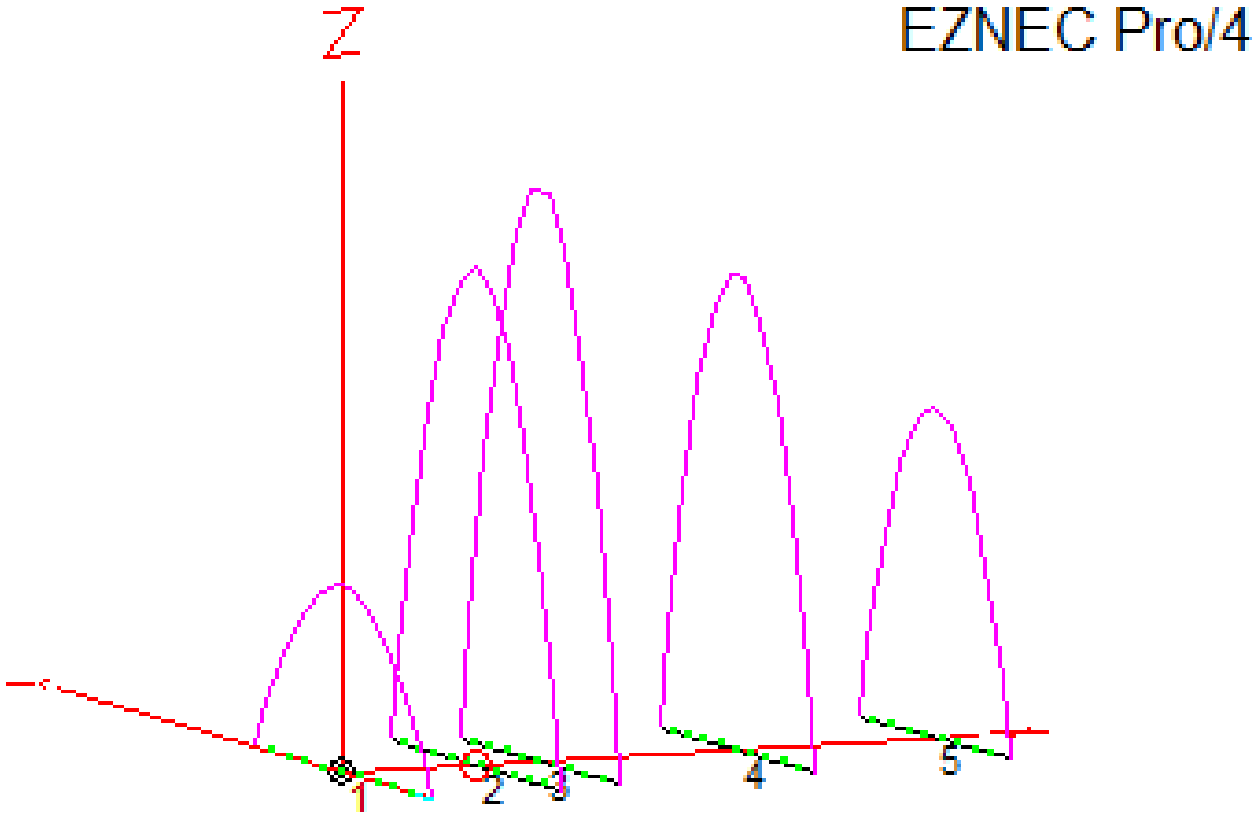
| | |
|---|---|
| Slice Max Gain | 10.43 dBi @ Elev Angle = 0.0 deg. |
| Front/Back | 31.37 dB |
| Beamwidth | 67.6 deg.; -3dB @ 326.2, 33.8 deg. |
| Sidelobe Gain | -2.82 dBi @ Elev Angle = 97.0 deg. |
| Front/Sidelobe | 13.25 dB |

# 5-el SWR 142-148MHz, impedance 50 ohms




| | |
|---|---|
| Freq | 145 MHz |
| **SWR** | **1.038** |
| Z | 49.35 at 2.0 deg. |
| | = 49.32 + j 1.719 ohms |
| Refl Coeff | 0.01863 at 110.7 deg. |
| | = -0.006586 + j 0.01743 |
| Ret Loss | 34.6 dB |

# 5-el Current distribution



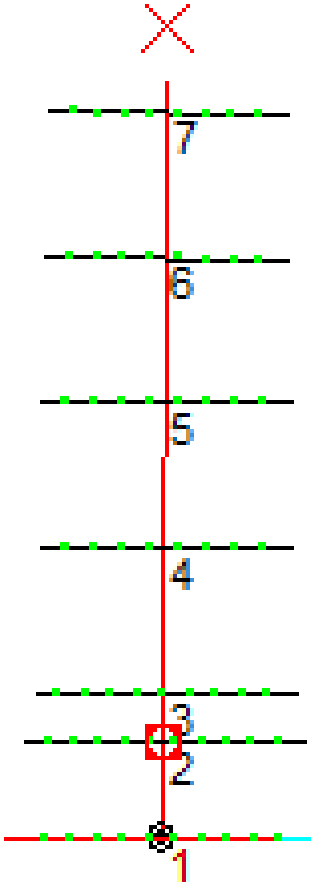
# 5-el Part list

- Reflector: dia 8mm alu tube 1032mm long
- Director 1: dia 8mm alu tube 936mm long
- Director 2: dia 8mm alu tube 918mm long
- Director 3: dia 8mm alu tube 888mm long
- Driven: 2 pcs dia 8mm alu tube 494mm long
- Boom: Square alu tube 20x20x1mm, 2000mm long
- 4 pcs Stauff clamp for dia 8mm
- 1 pc Stauff clamp for dia 20mm
- POM plastic dia 20mm 80mm long
- Allen screws: 8pcs M6x 50, 2pcs M6x 60 for Stauff clamps
- 2pcs sheet metal screws 3.5x16mm for cable connection
- Ferrite for current balun, |Z|>250ohm
- Mast to boom clamp: as needed, installed behind the reflector

# 7-element Yagi for 2m

I have not built this antenna. The same 4mm has been added to the element lengths as learned with the 5-element antenna.

# Dimensions 7-el



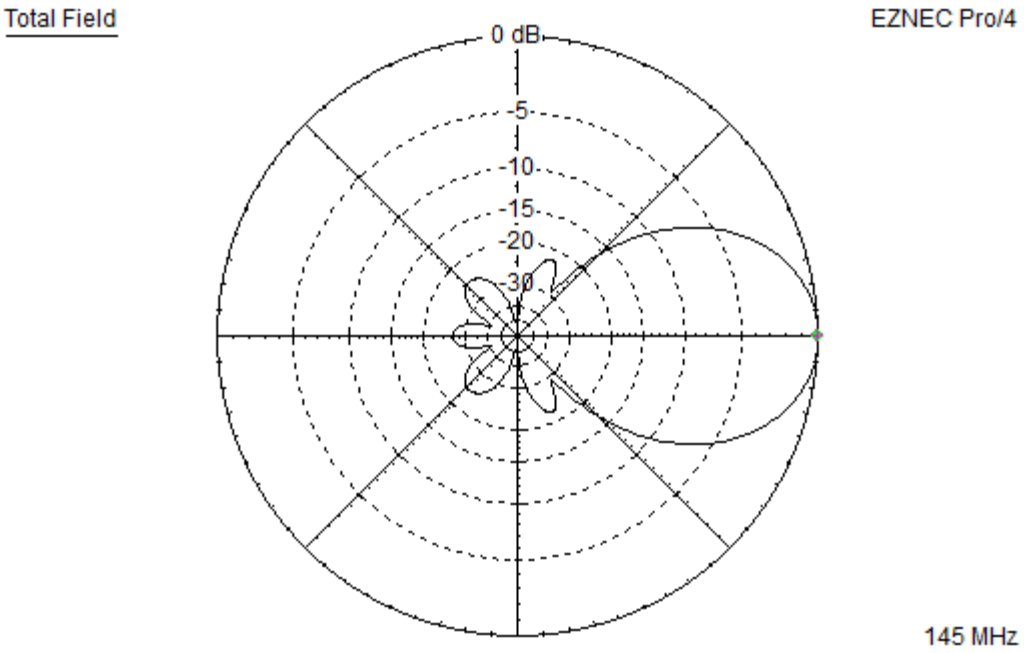

| | Length | Position x |
|---|---|---|
| D5 | 864 mm | 2600 mm |
| D4 | 888 | 2080 |
| D3 | 904 | 1560 |
| D2 | 912 | 1040 |
| D1 | 938 | 520 |
| D | 1006 | 350 |
| R | 1032 | 0 |

Boom 20x20mm square aluminum tube.

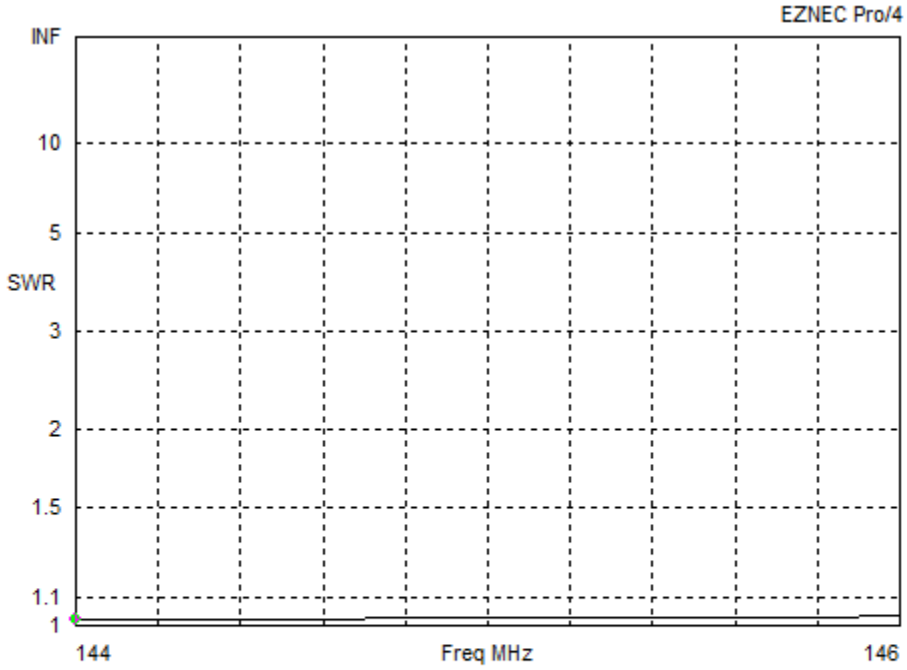
All elements dia 8mm alu tube.

Elements are 4mm longer than in Eznec model except driven element is 2mm longer. The reason is boom influence.

# 7-el Horizontal pattern on 145MHz



# 7-el SWR, impedance 50 ohm

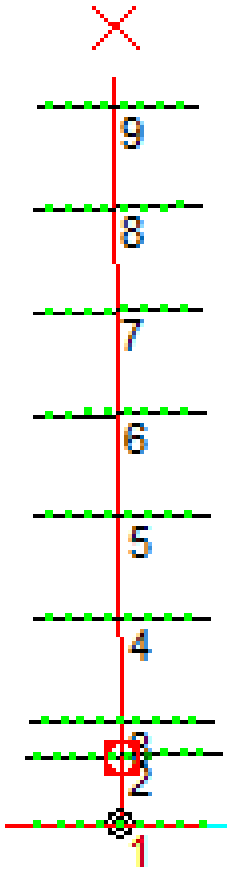



| | | | |
|---|---|---|---|
| Freq | 144 MHz | Source # | 1 |
| **SWR** | **1.021** | Z0 | 50 ohms |
| Z | 49 at 0.12 deg. | | |
| | = 49 + j 0.1012 ohms | | |
| Refl Coeff | 0.01019 at 174.18 deg. | | |
| | = -0.01014 + j 0.001033 | | |
| Ret Loss | 39.8 dB | | |

# 9-element Yagi for 2m

I have not built this antenna. The same 4mm has been added to the element lengths as learned with the 5-element antenna.

# Dimensions 9-el



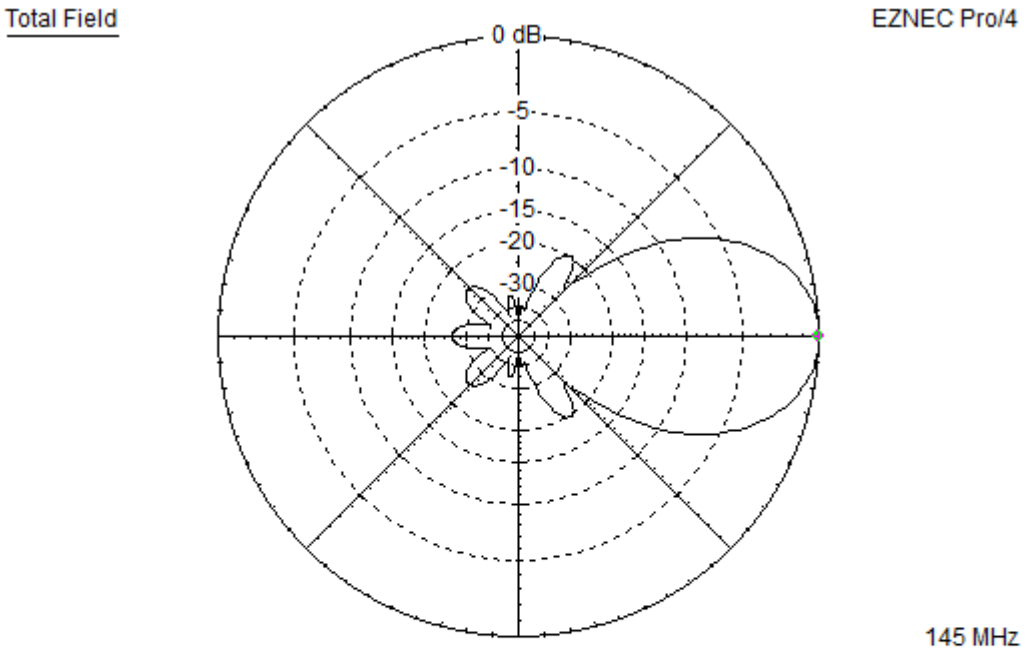

| | Length | Position x |
|---|---|---|
| D7 | 842 | 3640 |
| D6 | 860 | 3120 |
| D5 | 864 | 2600 |
| D4 | 884 | 2080 |
| D3 | 910 | 1560 |
| D2 | 912 | 1040 |
| D1 | 938 | 520 |
| D | 1008 | 350 |
| R | 1032 | 0 |

Boom 20x20mm square aluminum tube

All elements dia 8mm alu tube

Elements are 4mm longer than in Eznec model except driven element is 2mm longer. The reason is boom influence.

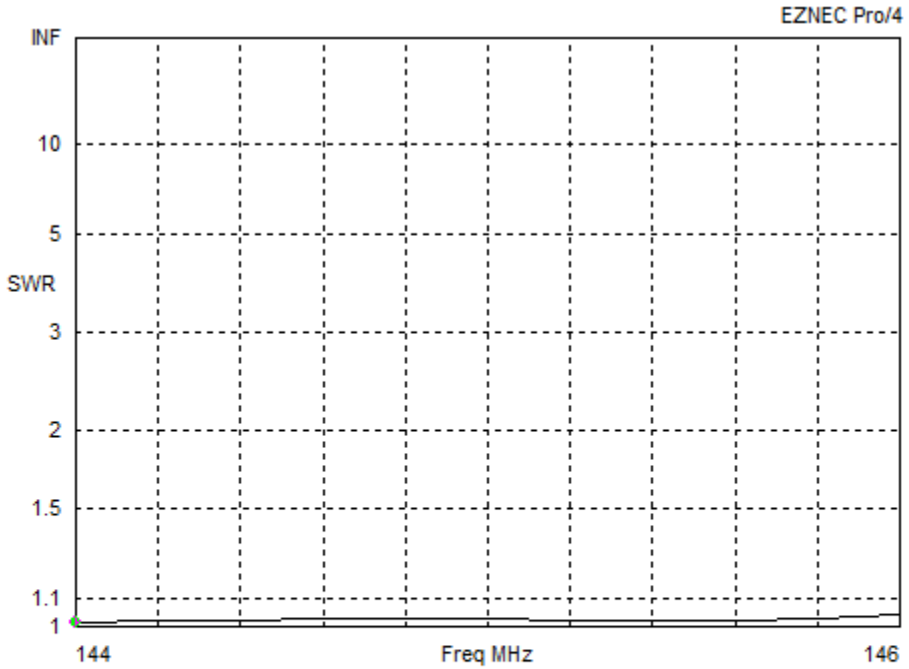
# 9-el Horizontal pattern on 145MHz




| | | | |
|---|---|---|---|
| Azimuth Plot | | Cursor Az | 0.0 deg. |
| Elevation Angle | 0.0 deg. | Gain | 13.04 dBi |
| Outer Ring | 13.04 dBi | | 0.0 dBmax |

| | |
|---|---|
| Slice Max Gain | 13.04 dBi @ Az Angle = 0.0 deg. |
| Front/Back | 26.06 dB |
| Beamwidth | 40.6 deg.; -3dB @ 339.7, 20.3 deg. |
| Sidelobe Gain | -6.61 dBi @ Az Angle = 57.0 deg. |
| Front/Sidelobe | 19.65 dB |

# 9-el SWR, impedance 50 ohm

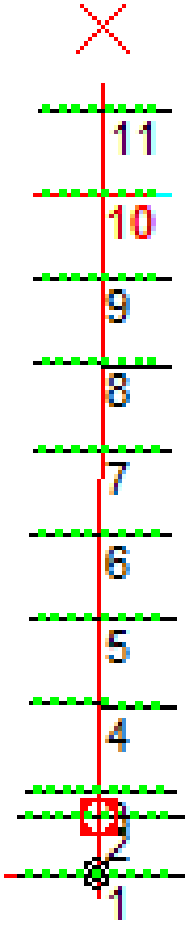



| | | | |
|---|---|---|---|
| Freq | 144 MHz | Source # | 1 |
| **SWR** | **1.011** | Z0 | 50 ohms |
| Z | 50.18 at 0.58 deg. | | |
| | = 50.18 + j 0.5071 ohms | | |
| Refl Coeff | 0.005368 at 70.26 deg. | | |
| | = 0.001813 + j 0.005053 | | |
| Ret Loss | 45.4 dB | | |

# 11-element Yagi for 2m

I have not built this antenna. The same 4mm has been added to the element lengths as learned with the 5-element antenna.

# Dimensions 11-el



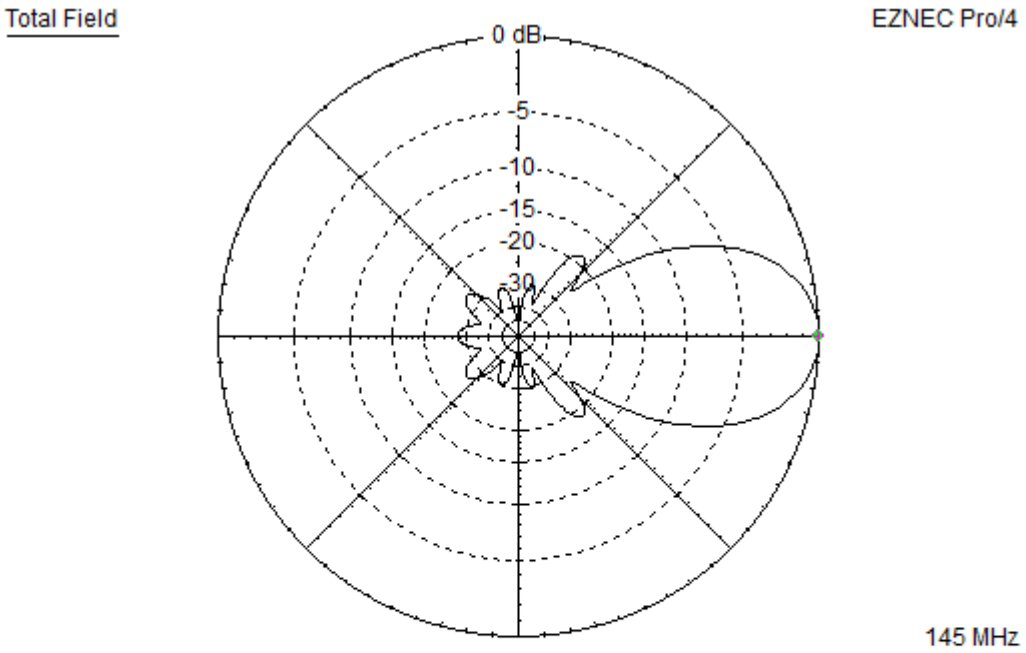

| | Length | Position x |
|---|---|---|
| D9 | 824 | 4680 |
| D8 | 844 | 4160 |
| D7 | 840 | 3640 |
| D6 | 860 | 3120 |
| D5 | 872 | 2600 |
| D4 | 884 | 2080 |
| D3 | 910 | 1560 |
| D2 | 910 | 1040 |
| D1 | 936 | 520 |
| D | 1008 | 350 |
| R | 1032 | 0 |

Boom 20x20mm square aluminum tube

All elements dia 8mm alu tube

Elements are 4mm longer than in Eznec model except driven element is 2mm longer. The reason is boom influence.

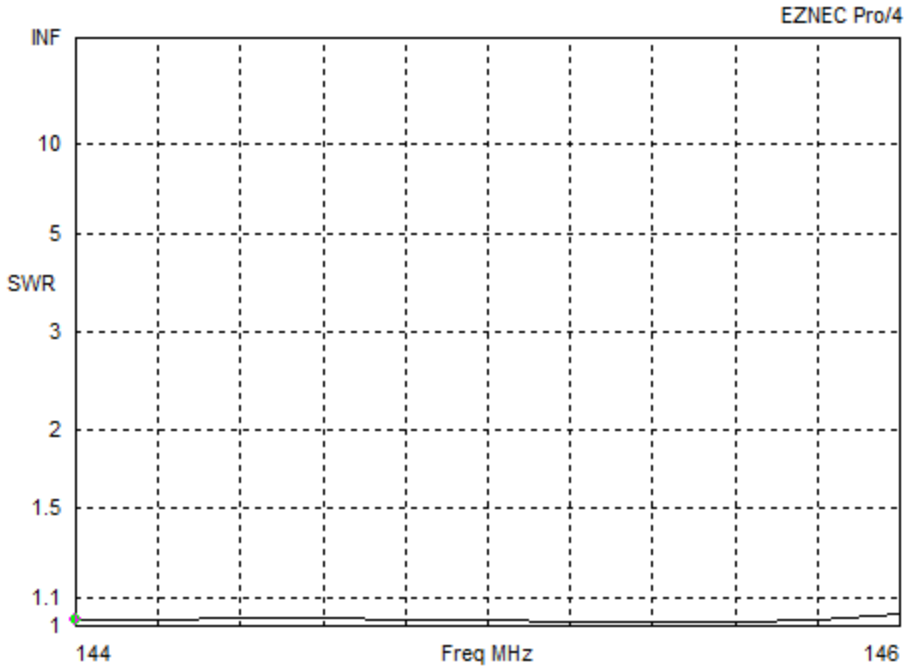
# 11-el Horizontal pattern on 145MHz




| | | | |
|---|---|---|---|
| Azimuth Plot | | Cursor Az | 0.0 deg. |
| Elevation Angle | 0.0 deg. | Gain | 13.82 dBi |
| Outer Ring | 13.82 dBi | | 0.0 dBmax |

| | |
|---|---|
| Slice Max Gain | 13.82 dBi @ Az Angle = 0.0 deg. |
| Front/Back | 27.36 dB |
| Beamwidth | 37.4 deg.; -3dB @ 341.3, 18.7 deg. |
| Sidelobe Gain | -4.68 dBi @ Az Angle = 51.0 deg. |
| Front/Sidelobe | 18.5 dB |

# 11-el SWR, impedance 50 ohm




| | | | |
|---|---|---|---|
| Freq | 144 MHz | Source # | 1 |
| **SWR** | **1.022** | Z0 | 50 ohms |
| Z | 51.09 at -0.21 deg. | | |
| | = 51.09 - j 0.1885 ohms | | |
| Refl Coeff | 0.01093 at -9.71 deg. | | |
| | = 0.01078 - j 0.001844 | | |
| Ret Loss | 39.2 dB | | |

# 11-el  Current distribution