

# A 6 Meter Moxon Antenna

Getting RF out of an antenna restrictive condominium

By

Ron Todd, K3FR

# I needed an antenna

- I've been working 2 meters and could work 70 cm.
- I have a dual band whip.
- My rig has 6 meter capability.
- I wanted to do better in contests.
- I wanted a new operating challenge.
- I needed a "tier-II" 6 meter antenna!

# Goals of the K3FR antenna project

- Horizontally polarized
- 6 meters directional with gain
- Good bandwidth (50.0 MHz to 52.0 MHz for  $< 2:1$  swr)
- Low cost, simple materials, simple tools
- Integrate with existing Cushcraft A270-10S (5 el each on 2m & 70cm)
- Turning radius less than 65" (2 el Yagi = 66" turning radius)
- 50 Ohm coax feed

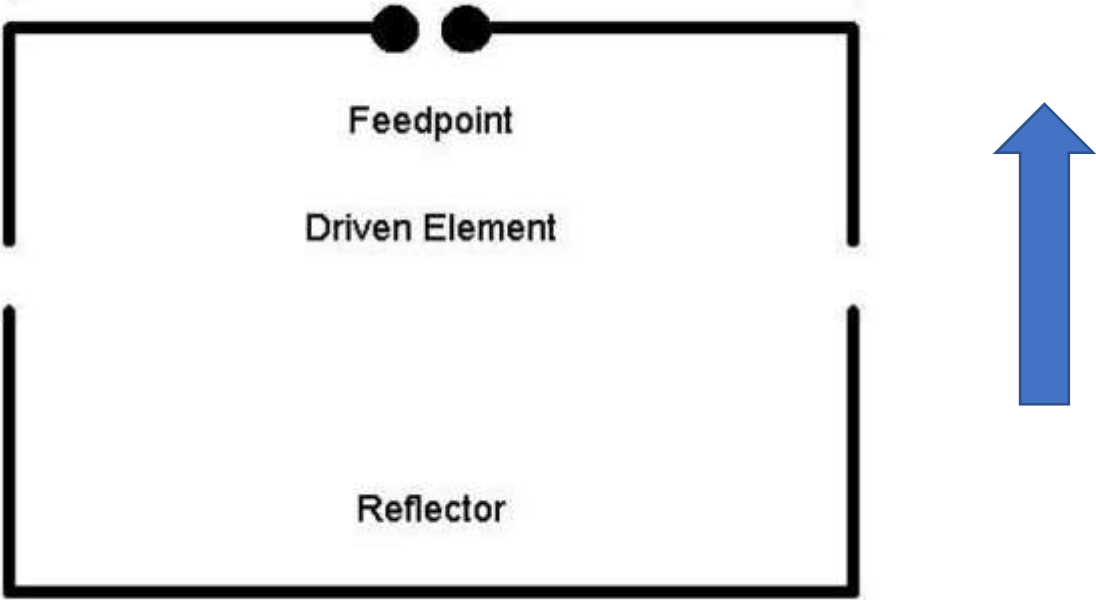
# Options

- 2 element Yagi (turning radius too large)
- 2 element Quad (turning radius and height too large)
- Horizontal loop (not directional minimal gain)
- Small magnetic loop (bandwidth too narrow)
- Moxon (looks like momma bear's chair – just right!)

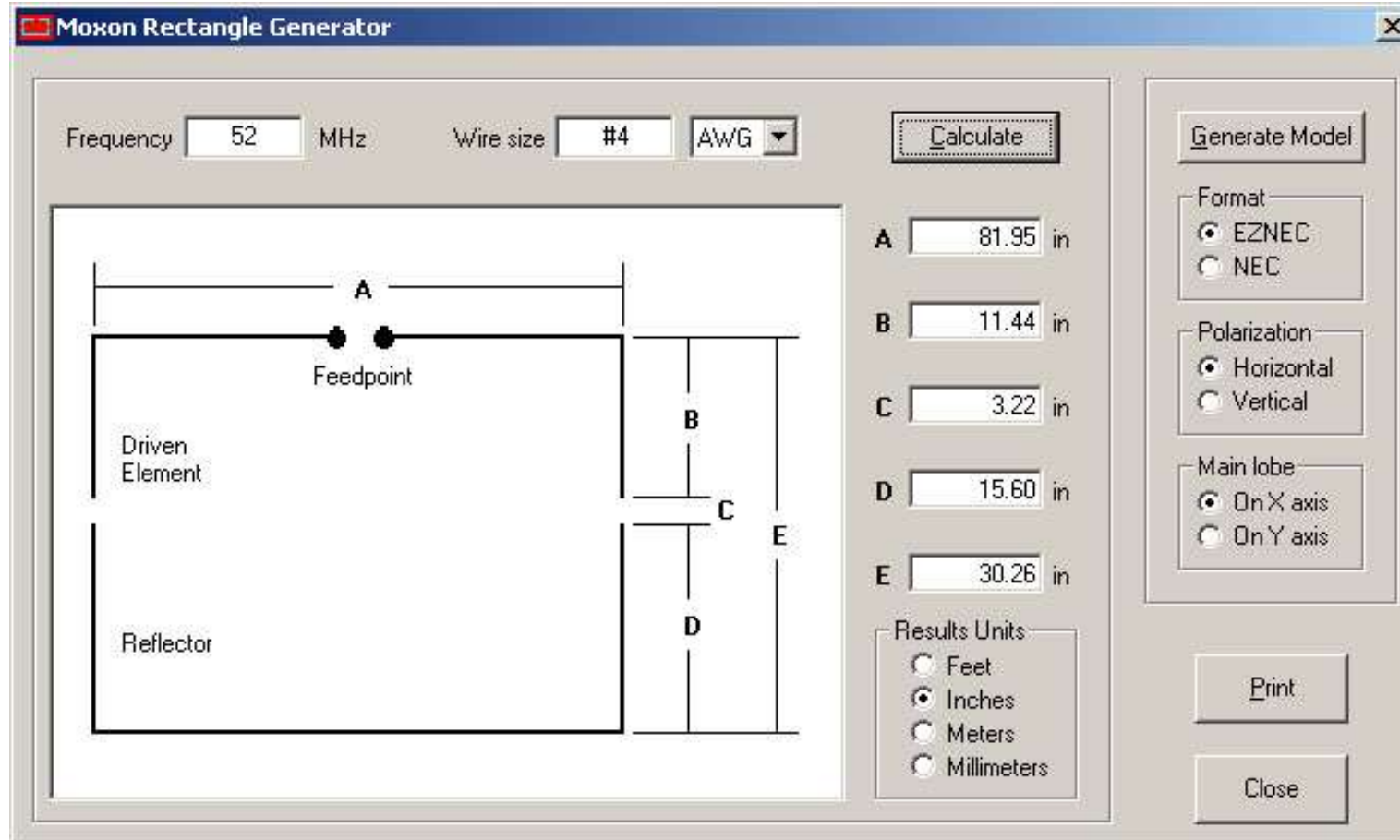
# What is a Moxon antenna?

- A 2 element Yagi (reflector and driven element)
  - The frontal lobe is broad 70° to 80°
  - The f/b ratio is quite good 25+dB but ...
  - It will not win a gain contest 9dB to 11dB (comparable to a small Yagi)
- The ends of the elements are bent back toward each other
  - Increases inter-element coupling
  - Mechanically shortens the elements
  - And, physically narrows the antenna (smaller turning radius)
  - Helps achieve a 50 Ohm feed point impedance through capacitive loading
- Note, there is little to be gained by adding director elements

# The basic Moxon antenna layout



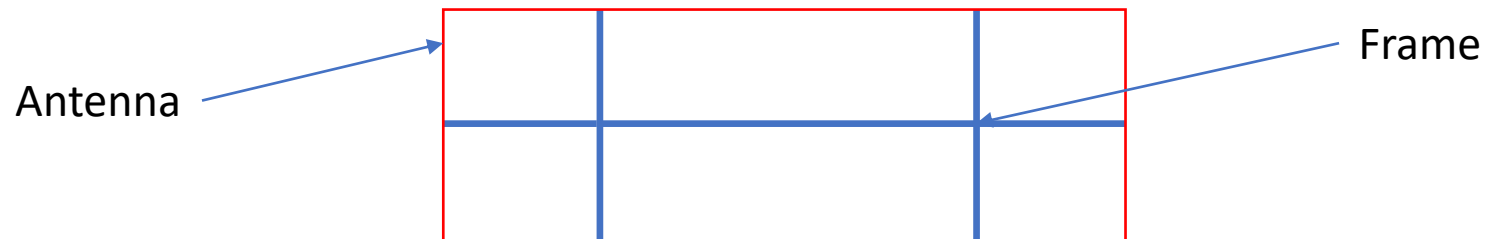
# It's all about the numbers



$r_t = 44''$

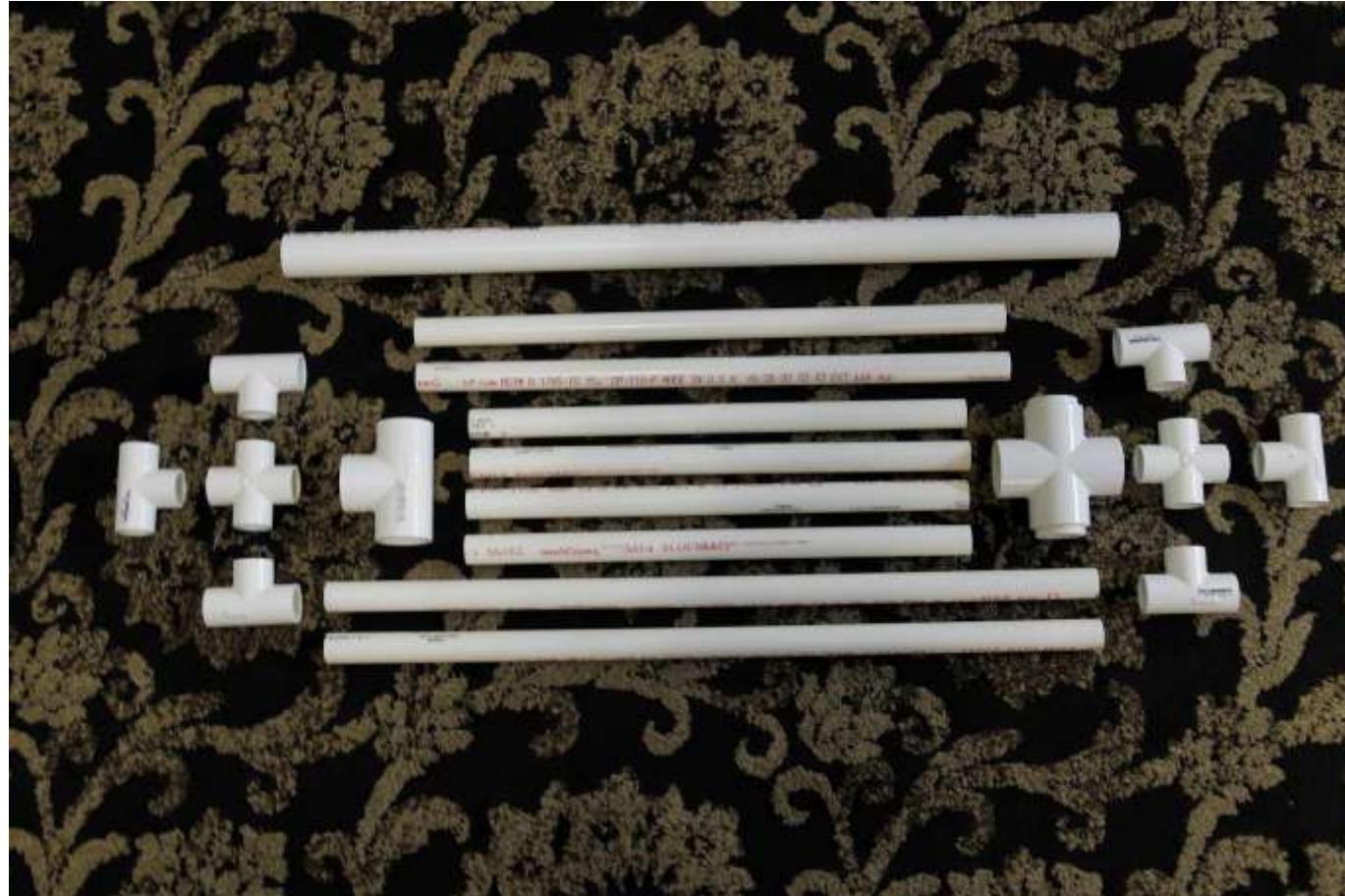
# How do I support this much wire

- A lot of people use an “X” frame but there were issues:
  - Use of fiberglass arms
  - Needs a solid center support
  - The angles are not  $90^\circ$  or  $45^\circ$
- I had seen a skeleton frame using PVC tubing in a YouTube video.





PVC Frame parts to support the wire.



Details of the feed point connection and element end spacers.



This is the way we bend the wire:  
#4 annealed soft drawn copper ground wire  
(it's tough stuff). Cut with linesman's pliers.



Just about ready. You must make the last reflector bend after inserting the wire in the frame.

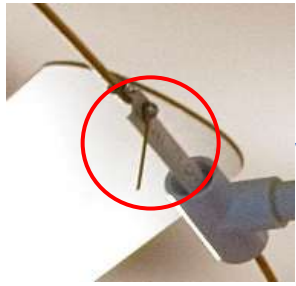


# Bird's eye view mounted with my Cushcraft A270-10S (5 el on 2m + 5 el on 70cm).



Detail of Yagi mounting

Worm's eye view (just to be fair). Note the short tuning stub silhouetted by fan blade on left.



You may also tune the antenna by expanding the width a bit. That requires re-bending the wire.

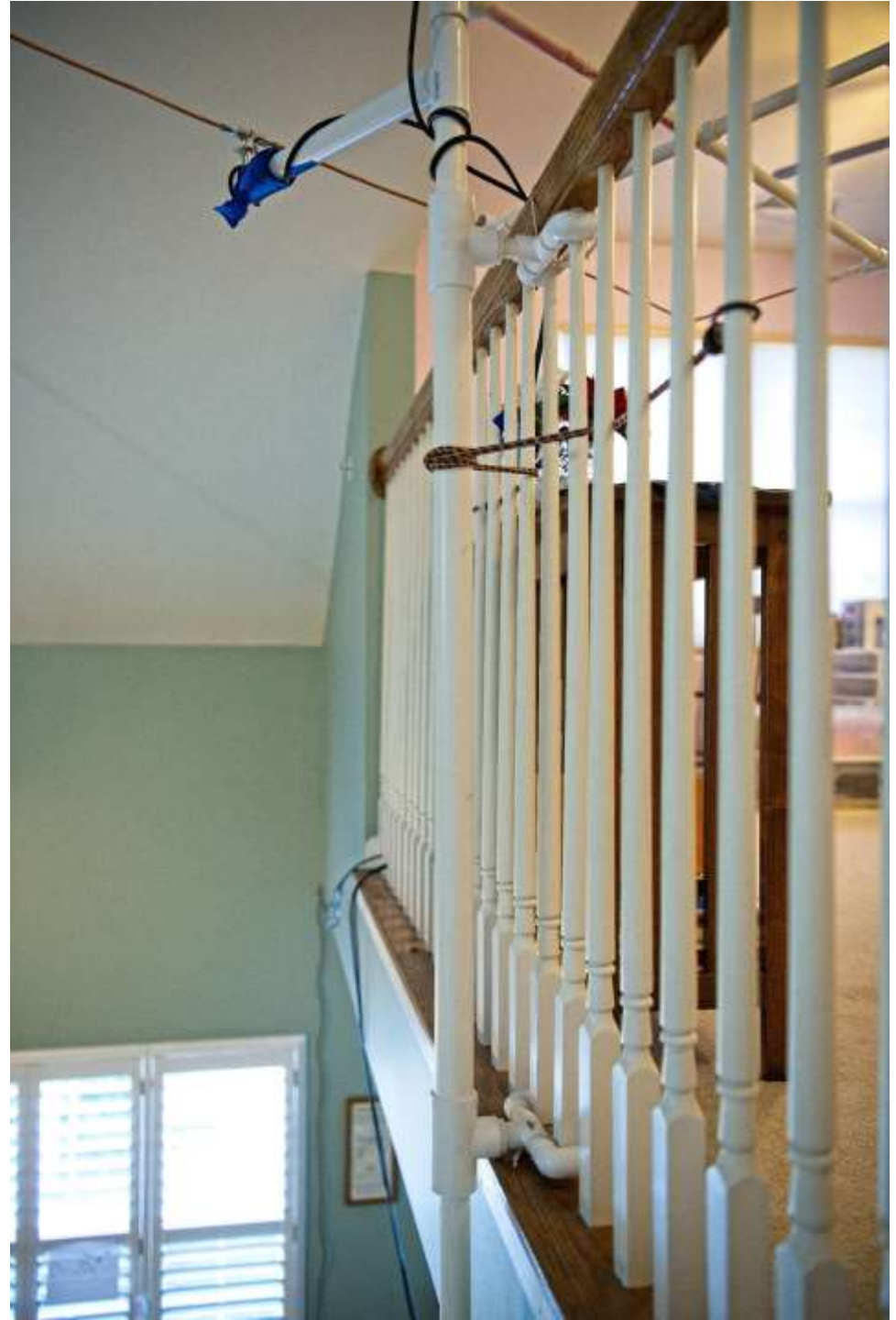
## Detail of the top guide and bearing

1" pvc fits loosely inside 1-¼" sched 40 pvc

The locators were fabricated to straddle newel posts of the loft railing.

The mount is held in place by cord fed through the locators, the bungee cord is just extra tension.

Looks like I need to re-tape the air balun (9 turns of RG-8X).

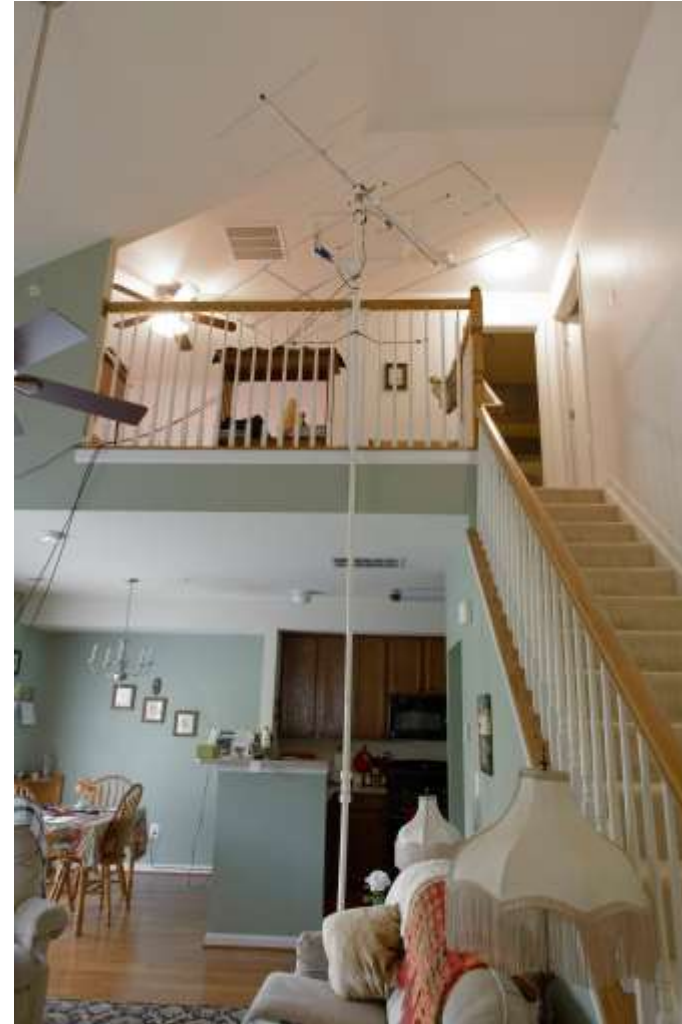


# My View

Mast is 1" PVC turning inside the upper guide of 1-¼" SCH 40 PVC

There is a sprinkler line running front to back at the ceiling joint with the right wall, it influences the antenna pattern and resonance.

For comfort, I can set up on the couch. This weekend, I set up at the dining table to the left.





Upper bearing is packed with Bounty for friction.

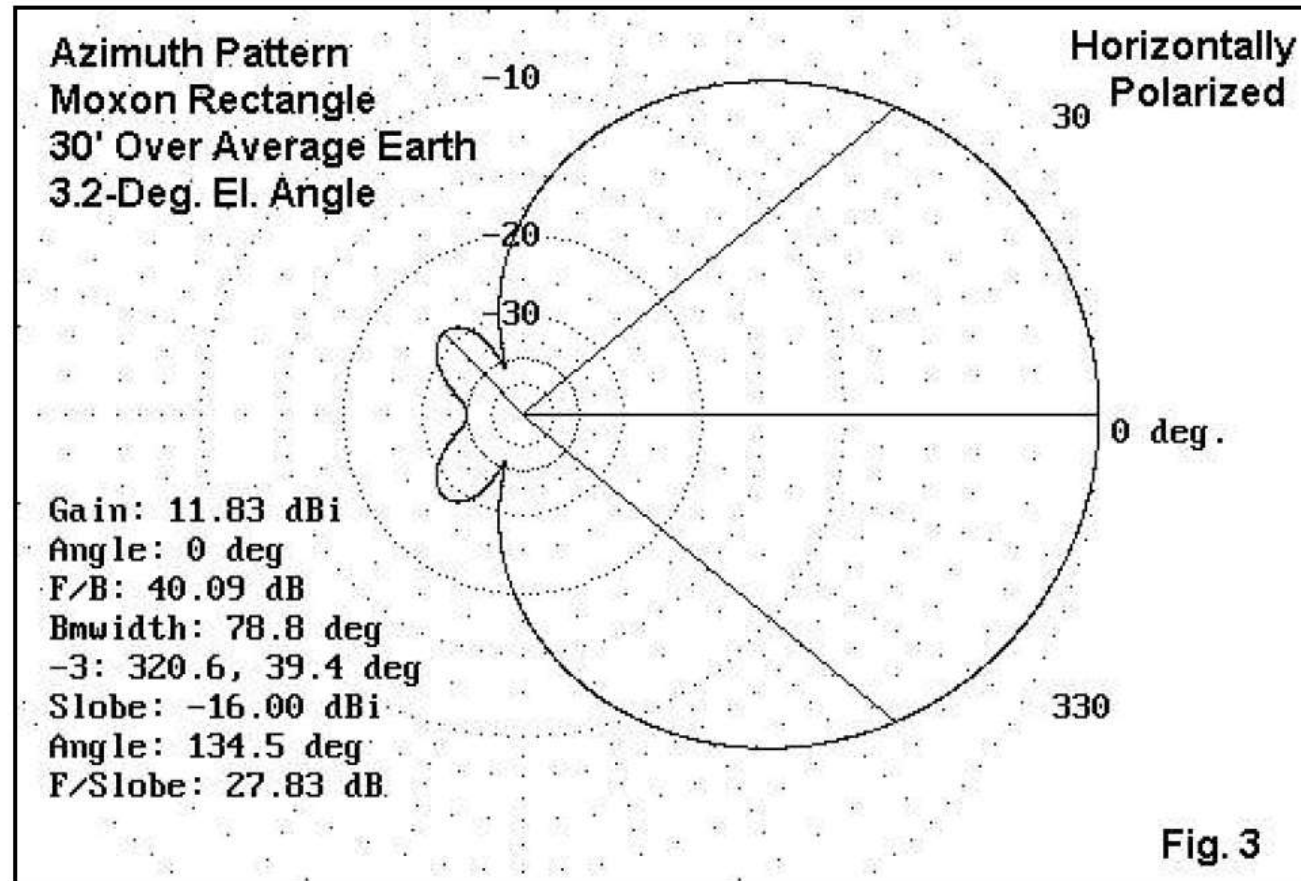
Duh, what can I say?

The packing keeps the mast centered in the guide.

You can see some detail of the locators in this photo.

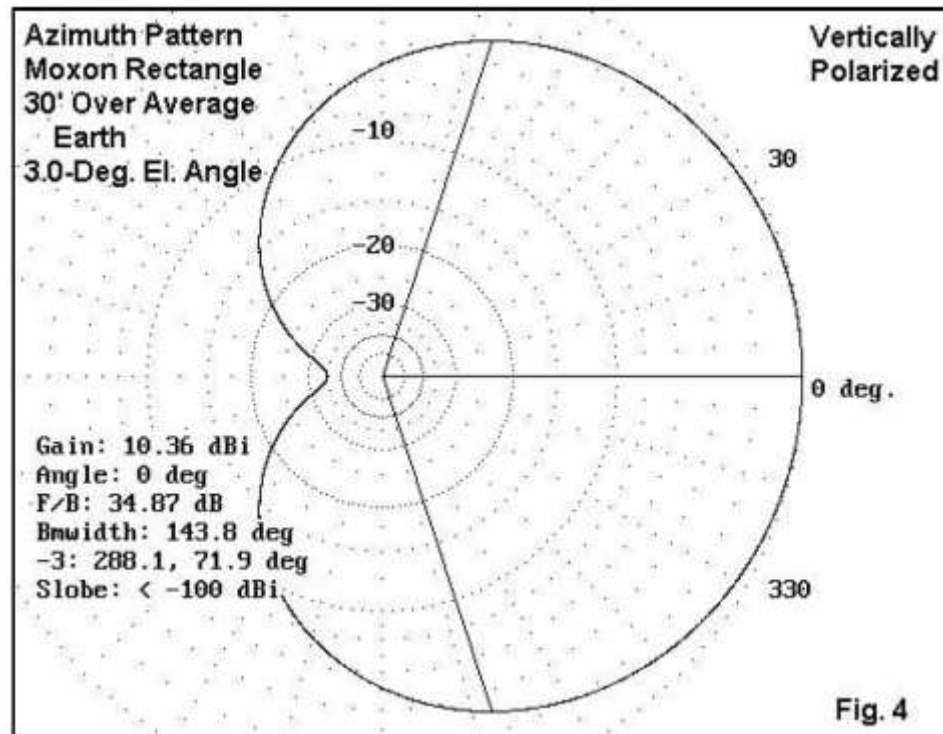


The pattern is broad (a generic 2m Moxon by Cebik).



# Further comments

- The antenna works well vertically polarized as the end-fire pattern closely resembles 2 elements spaced  $1/4\lambda$  and fed  $90^\circ$  out of phase.



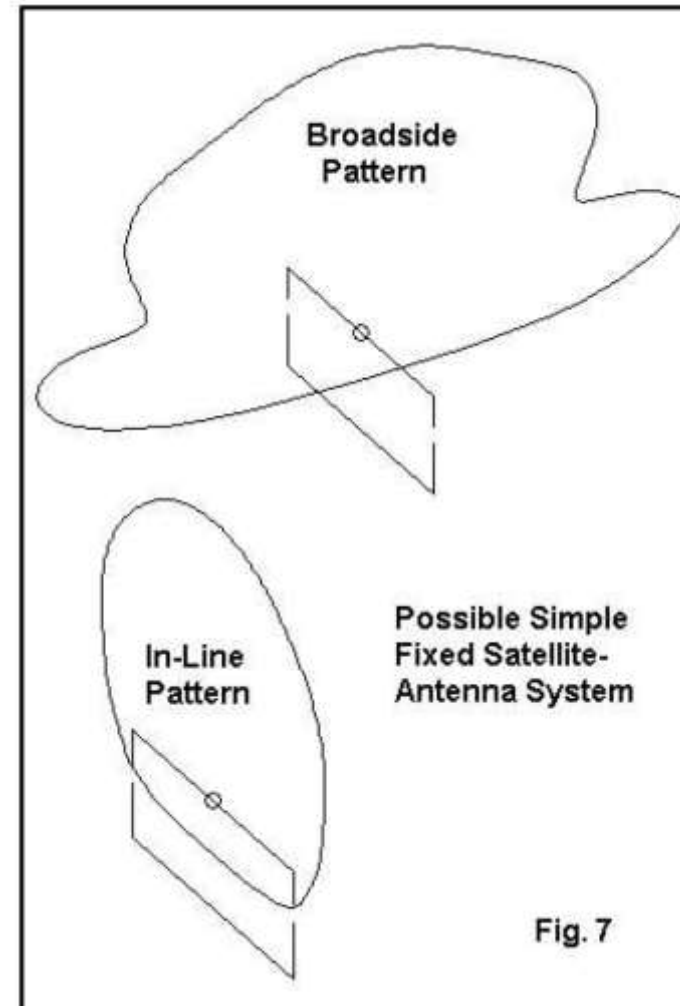
# Makes a decent satellite antenna too.

The surprise comes when you mount the antenna facing skyward!

Cebik suggested mounting a Moxon one wavelength above the ground and orienting it to the sky or even tilted slightly toward the satellite orbit.

Here's the URL to the on-line calculator by Dan Maguire, AC6LA.

<https://www.ac6la.com/moxgen1.html>



# How's it working for me? As of 1/14/21:

- Since November 1, 2020
- Using FT8 and MSK144 on 50 MHz
  - Total QSOs            119
  - Calls                    97
  - Grids                    52
  - States                    25
  - Canadian Prov.        2
  - DX Entities            3 (US, Canada, & Mexico)
  - YES, I have made two random meteor scatter contacts (ME & KS) on 6!
  - Best DX: DL92 (XE2YWH) 2863 km (1779 mi) via Es.
  - Based on best DX, I may be able to work 43 states via MS or single hop Es.
  - Jan 2021 ARRL VHF contest: 73 QSOs, 19 grids (6m stats)

# Goals of the K3FR antenna project

- ✓ Horizontally polarized
- ✓ 6 meters directional with gain
- ✓ Good bandwidth (50.0 MHz to 54.0 MHz for  $< 1.7:1$  swr)
- ✓ Low cost, simple materials, simple tools
- ✓ Integrate with existing Cushcraft A270-10S dual band Yagi
- ✓ Turning radius less than 65", actual: 44"
- ✓ 50 Ohm coax feed

Here's the rotator, no surprises!



# Summary

- All goals met
- It follows the three Rs of beams:
  - It **R**otates
  - It **R**eceives
  - It **R**adiates
- Like all Good antennas, it droops
- What would I do differently?
  - Be more precise bending and cutting the wire
  - Stiffen the central spans of the frame arms (use 1" SCH 40 PVC, not ½")



Thanks for listening,  
any questions?