

STEALTH ANTENNAS

In search of maximal performance
indoor antennas

Interior Antennas - Good & Bad

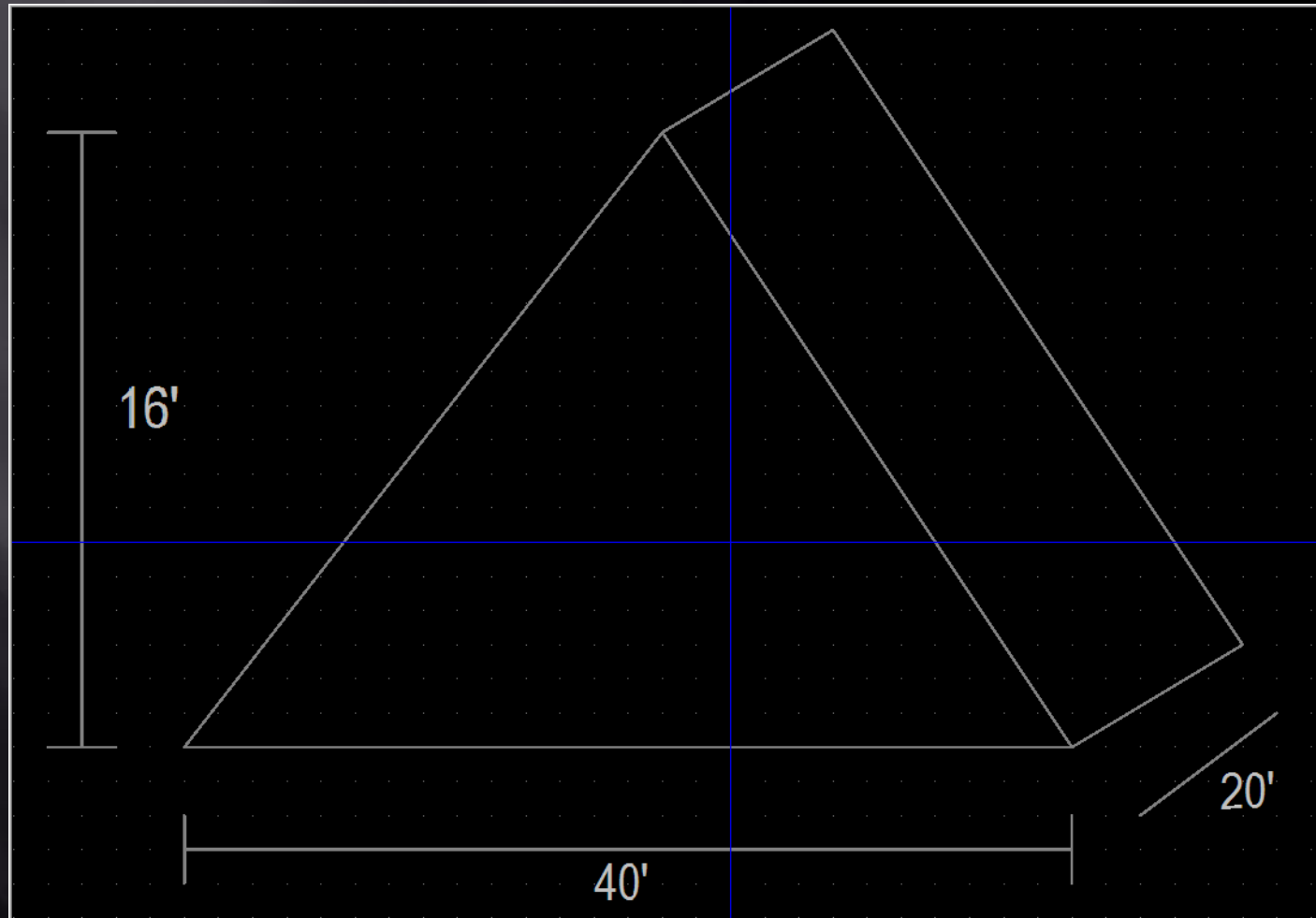
▣ Good:

- No weather considerations
- No weather damage
- Convenient to work on
- Loss < 3db worst case vs. free-space
- Invisible - no C&R enforcement surprises

▣ Bad:

- Loss: 3db is 3db
- Closer proximity to noise sources
- Coupling to adjacent items
- Increased RFI problems in house

Fertile Farmland



Top of roof is about 44' above ground

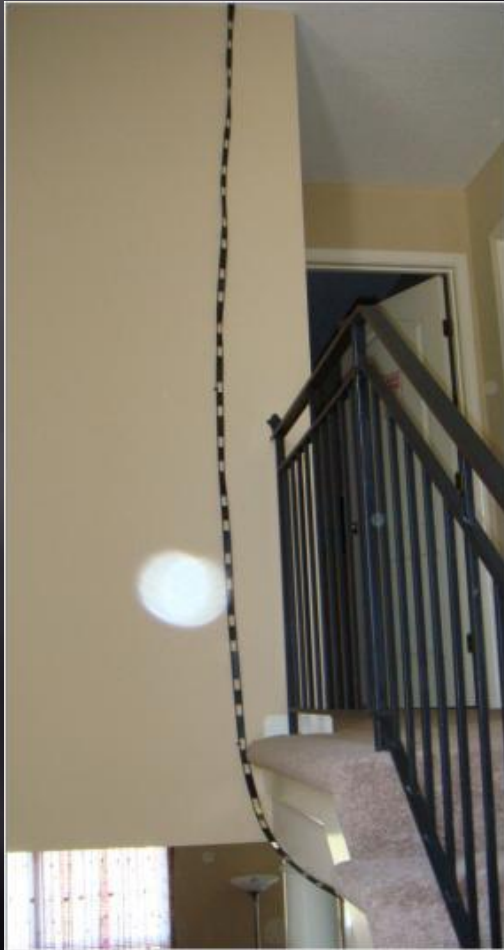
Few Metals In The Area



First Generation: DEZ

- ▣ Based on review of Cebik publications
- ▣ 88' 20m Double Extended Zepp
- ▣ Open wire fed - 450 ohm ladder line
- ▣ Benefits:
 - Some gain on 20m
 - Dipole-class performance on 10/15/30/40
 - Requires tuner
- ▣ Disadvantage:
 - Poor 80m/zero 160m performance

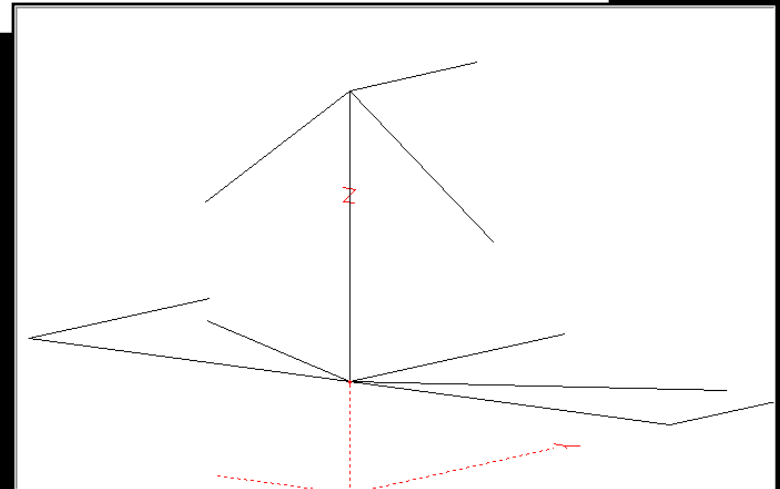
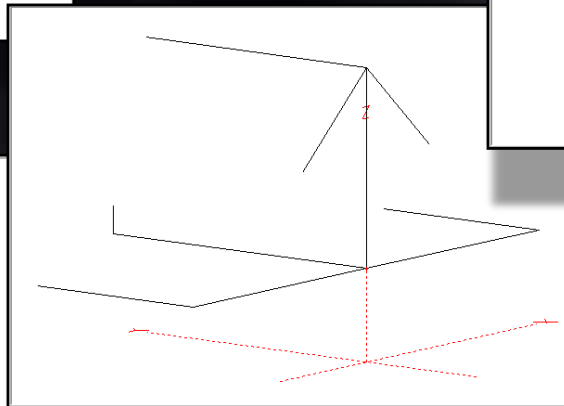
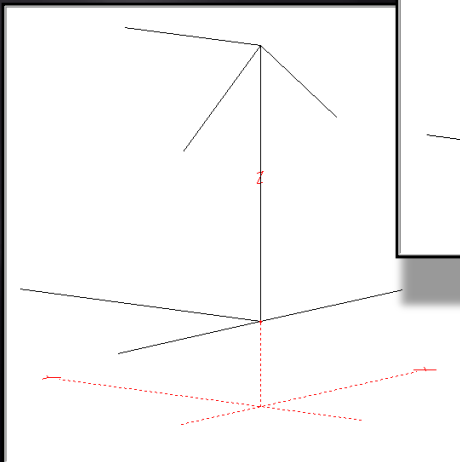
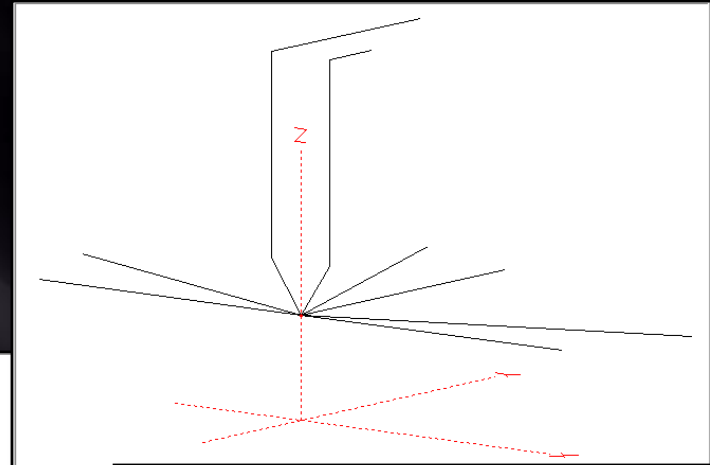
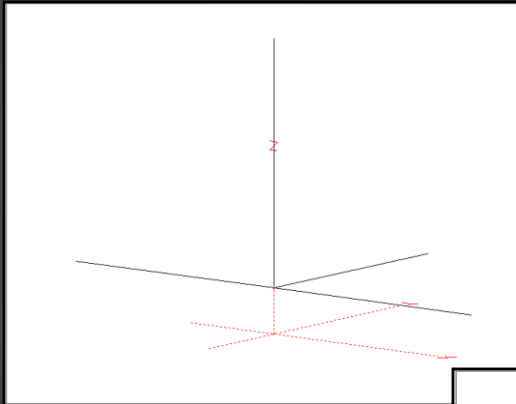
First Generation: DEZ



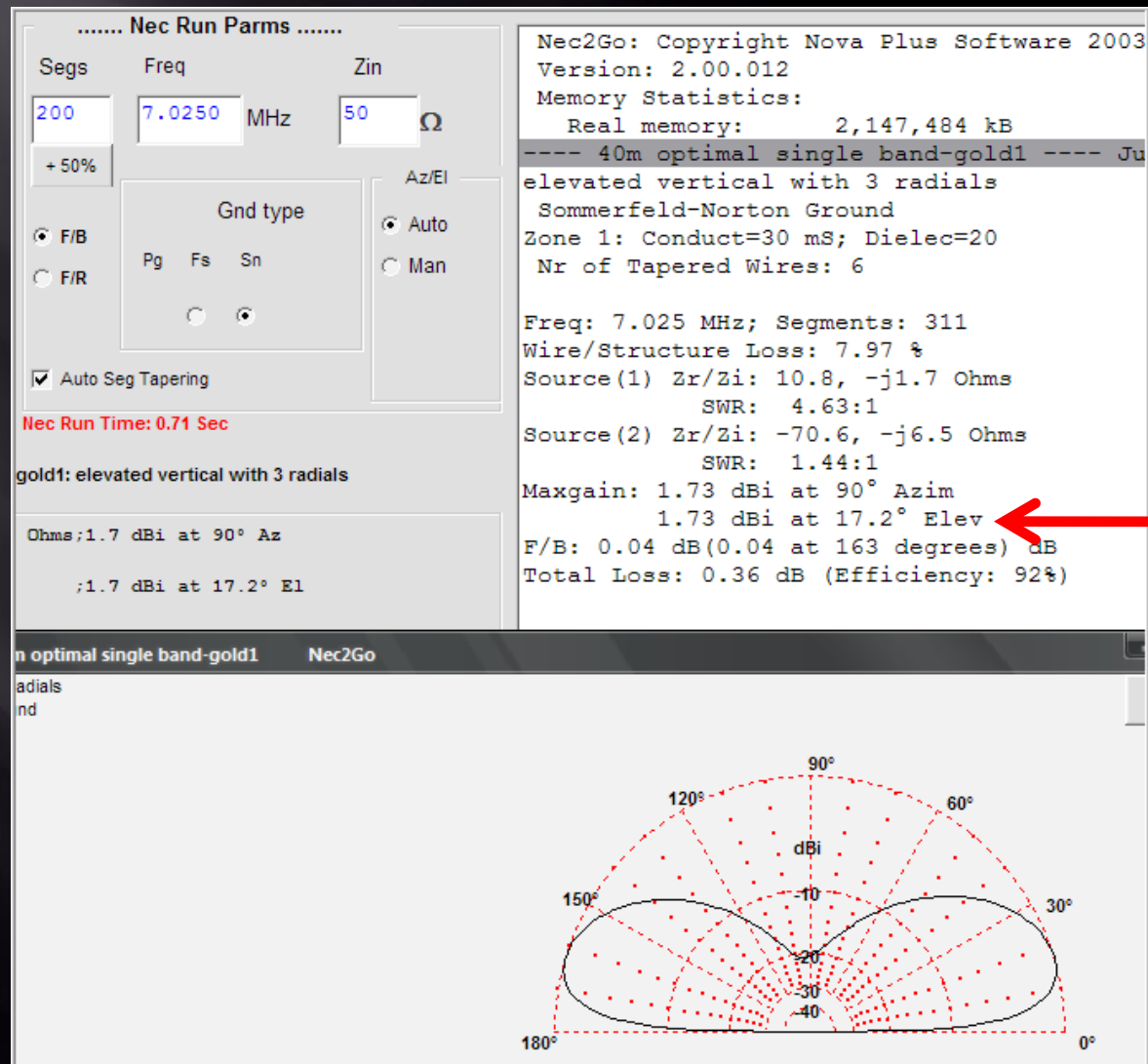
Automatic Tuner



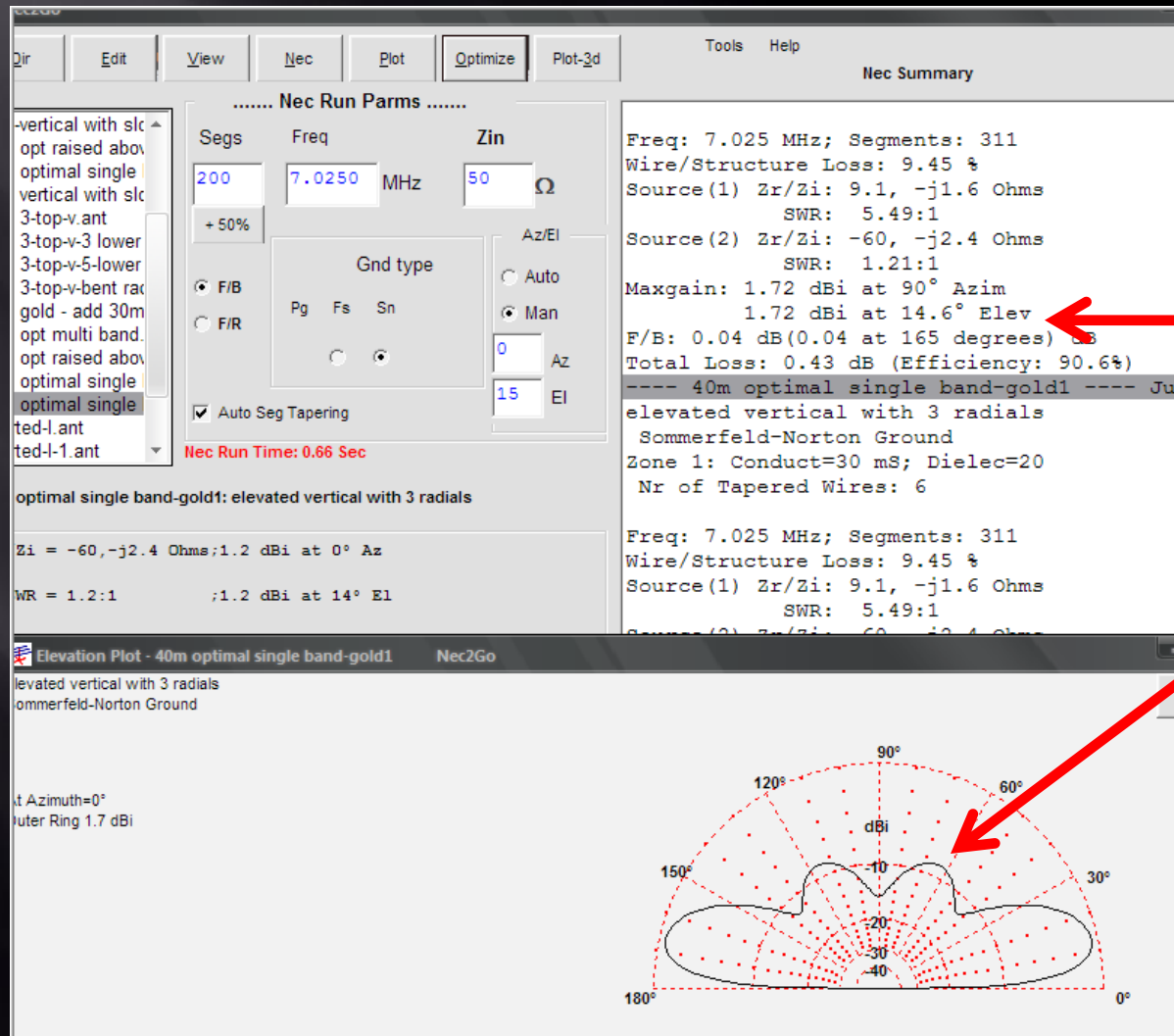
Looking for Something Better



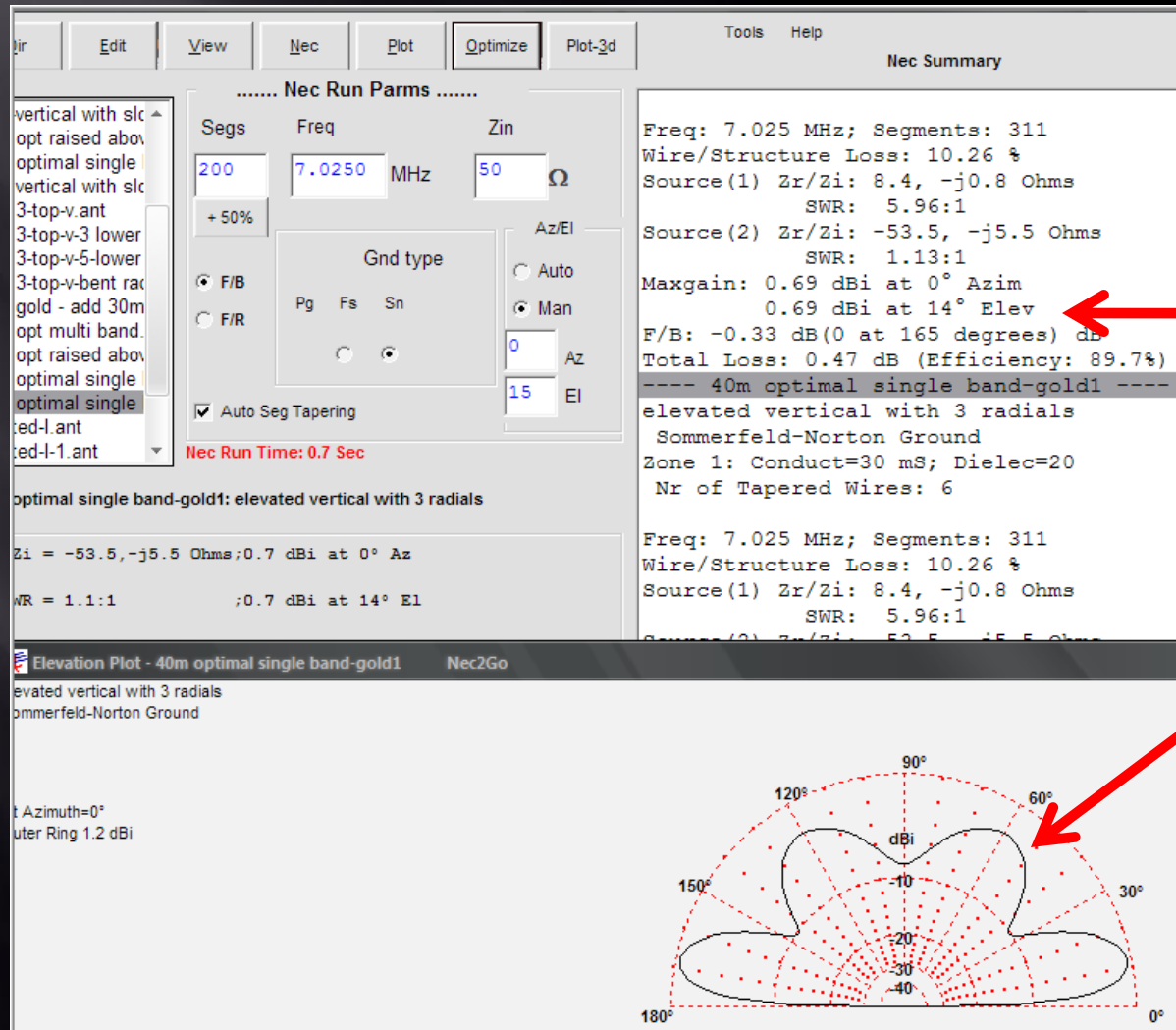
Vertical - 24' Base Height AGL



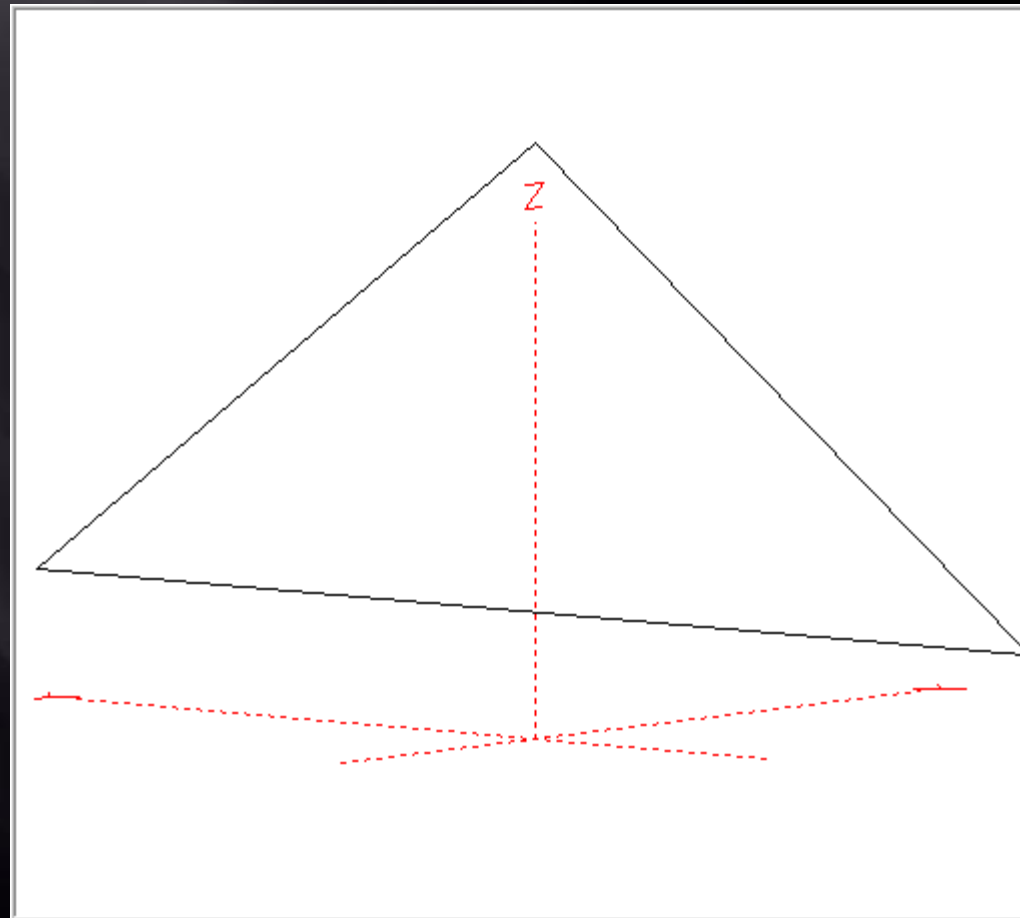
Vertical - 34' Base Height AGL



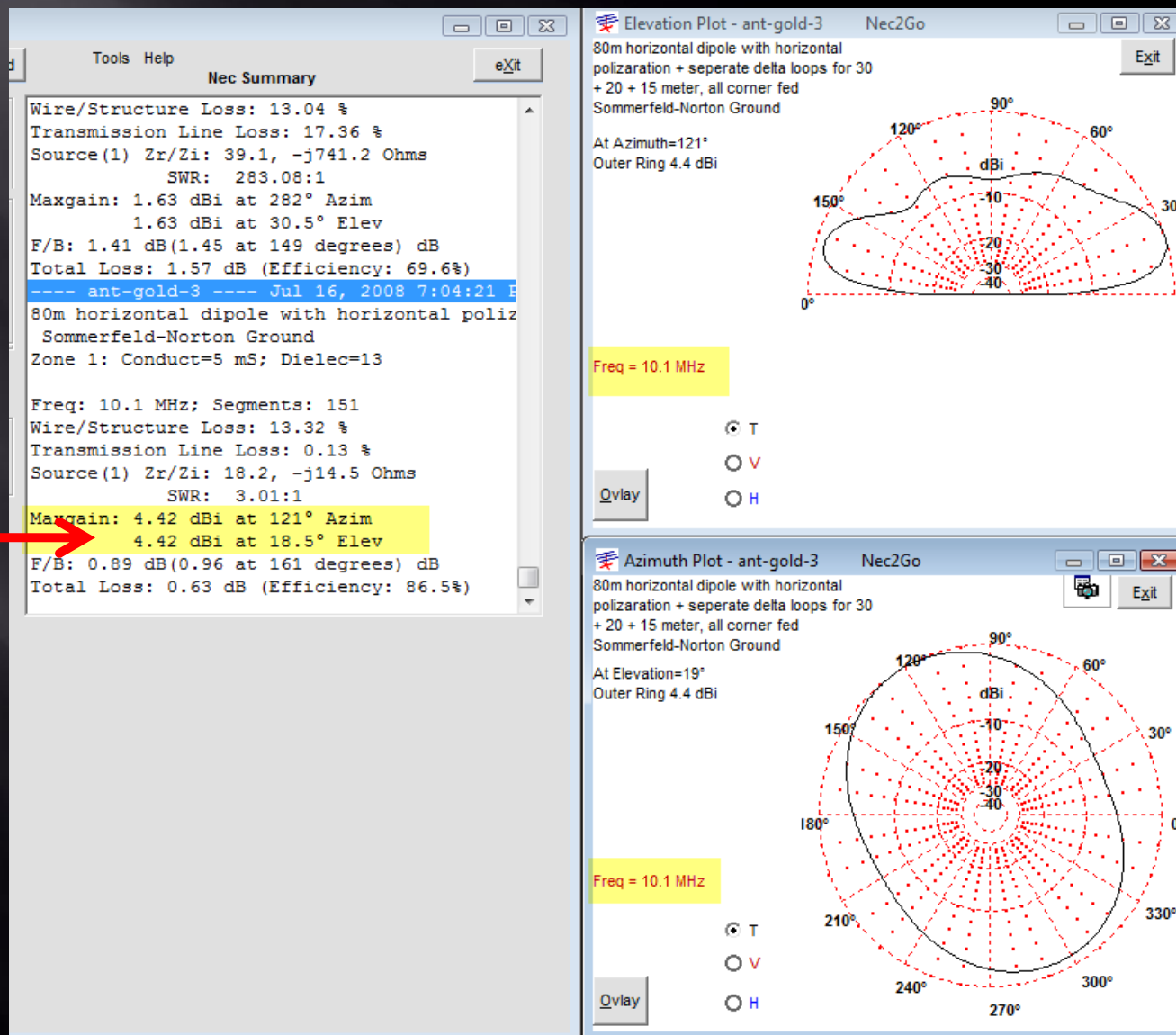
Vertical - 44' Base Height AGL



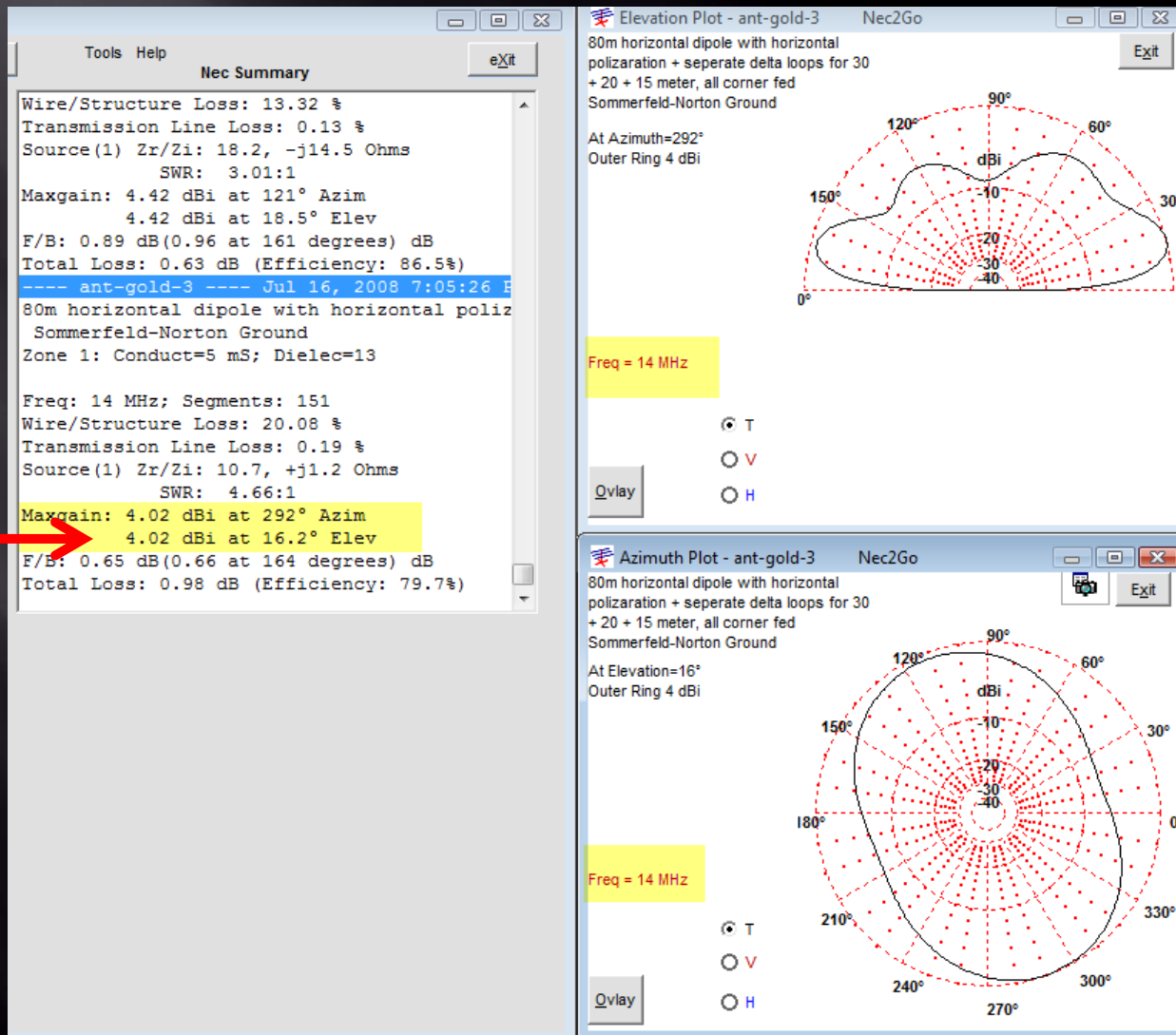
Second Generation: Delta Loops



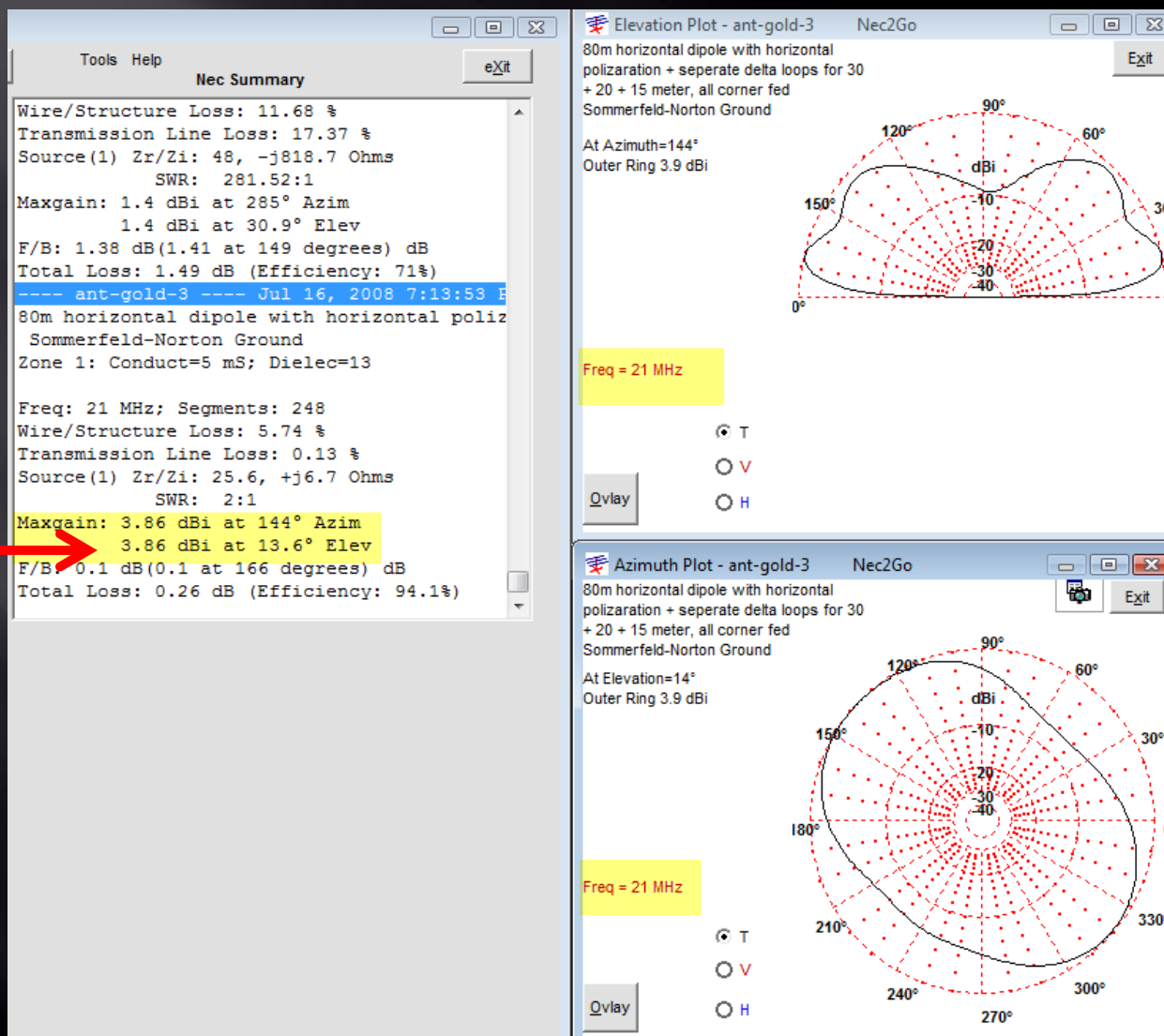
Delta Loop - 30m



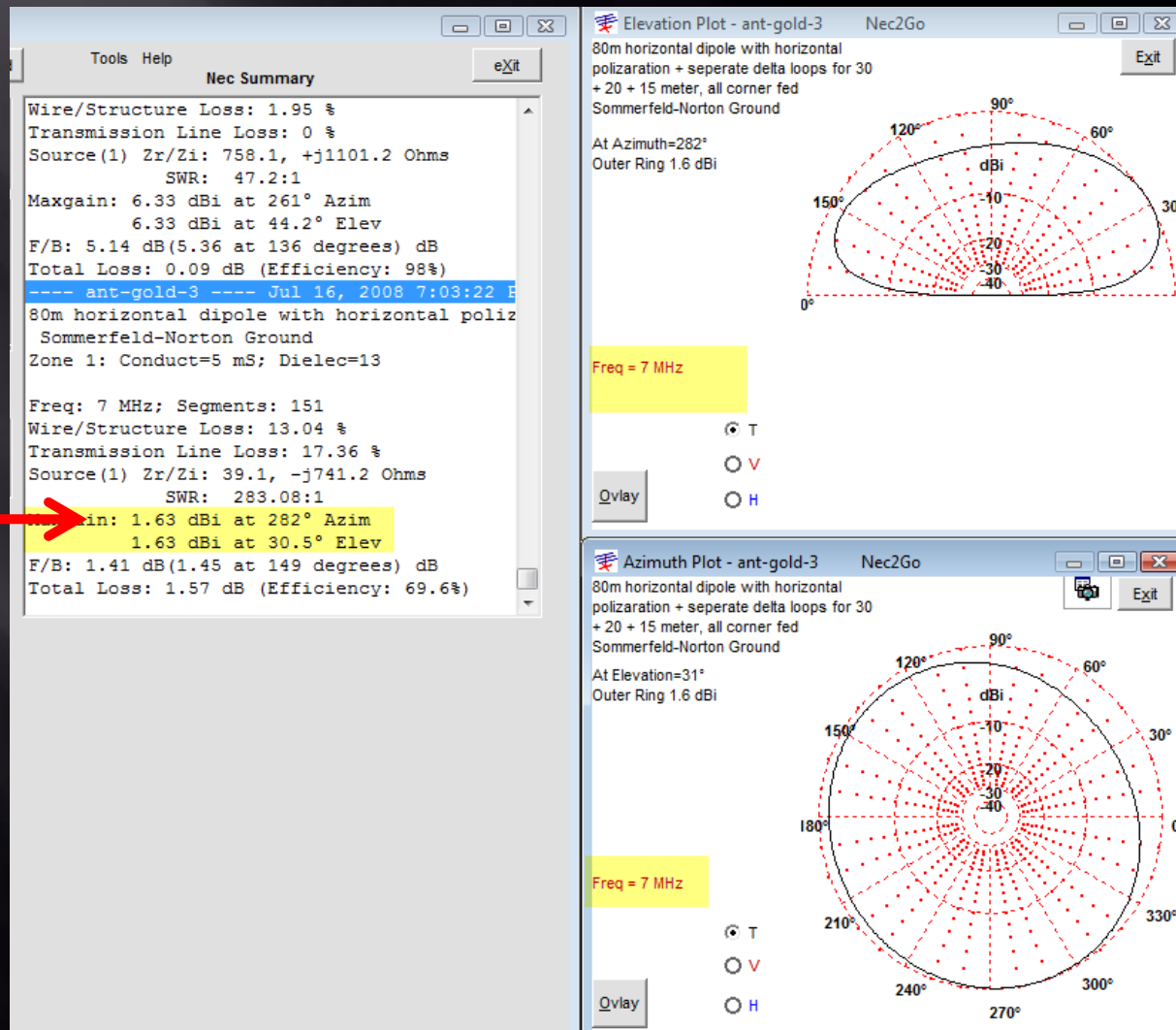
Delta Loop - 20m



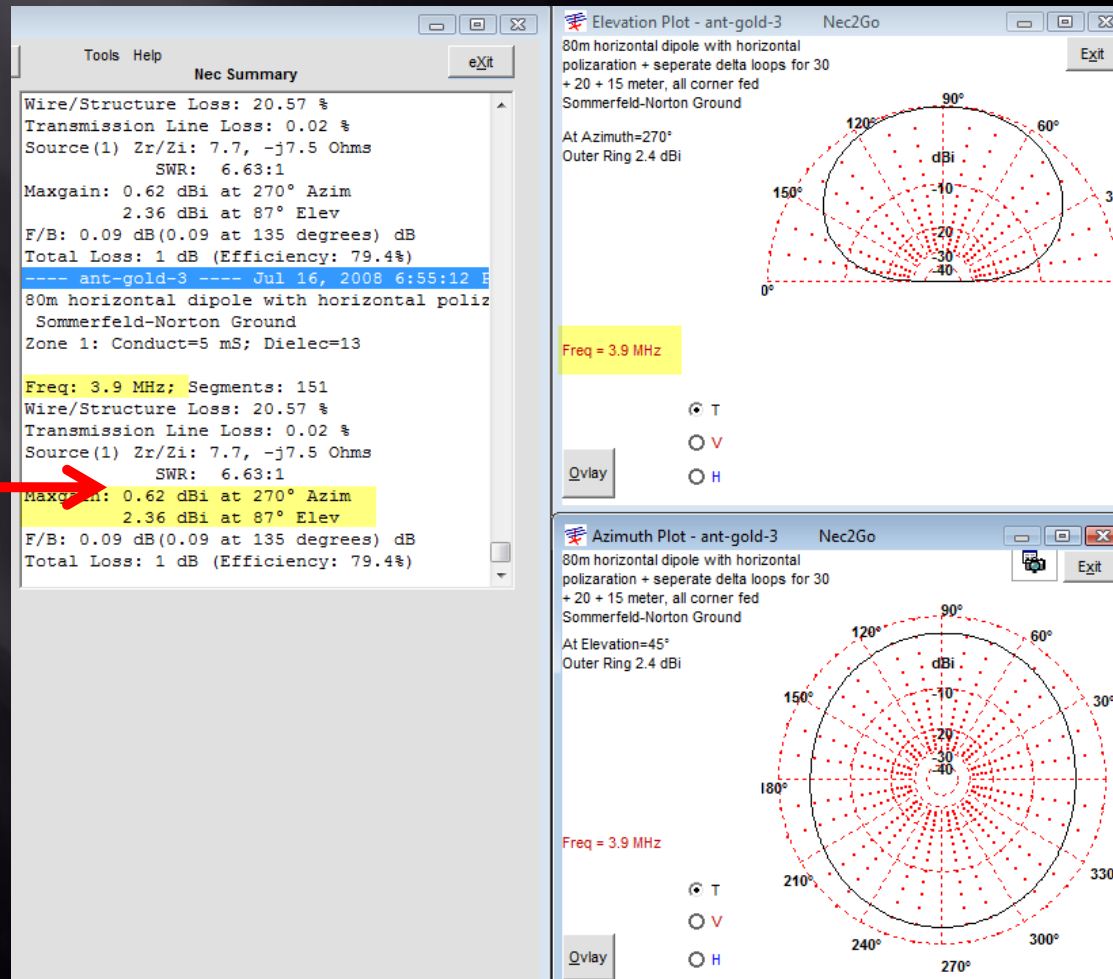
Delta Loop: 15m



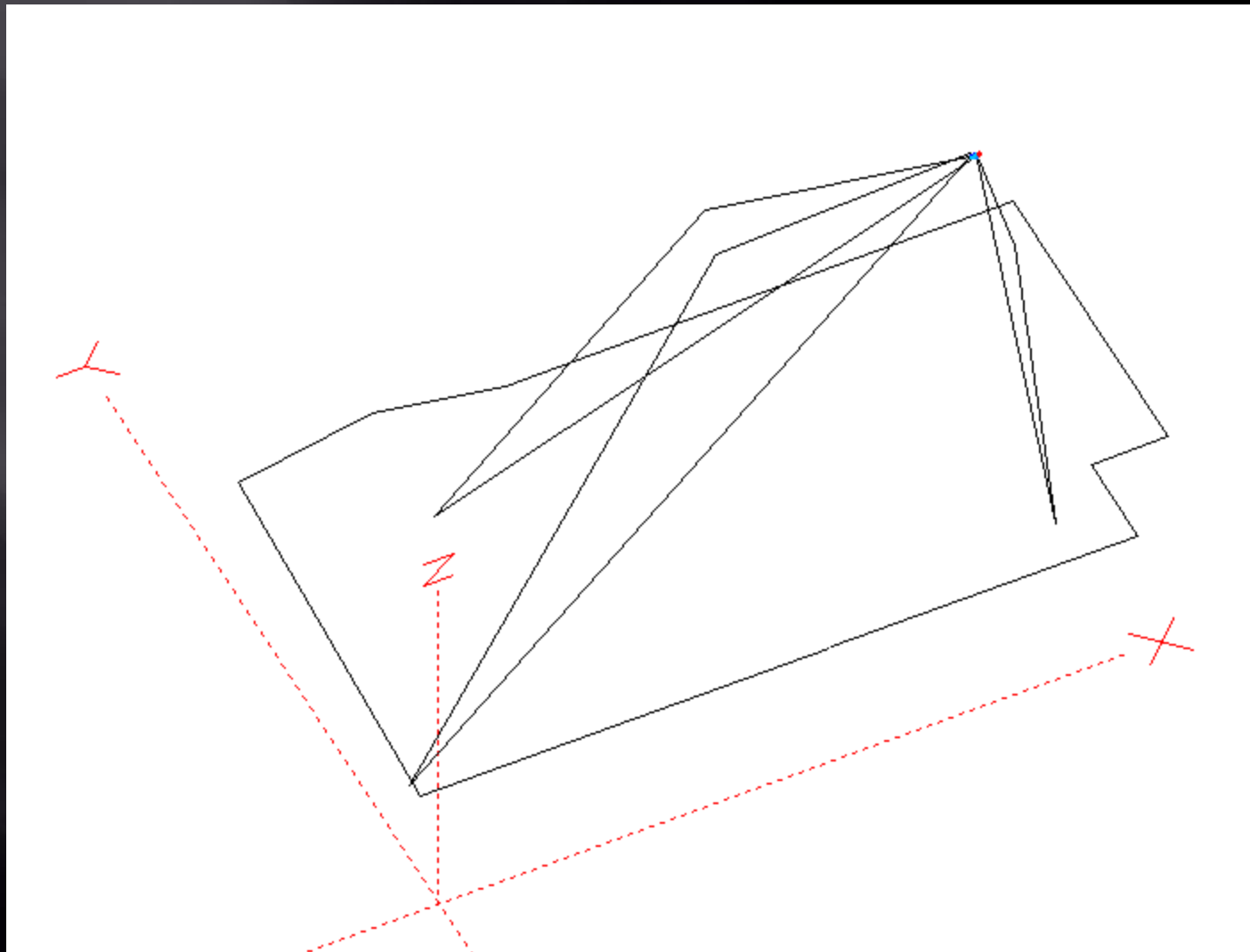
Delta Loop: 40m (non-resonant)



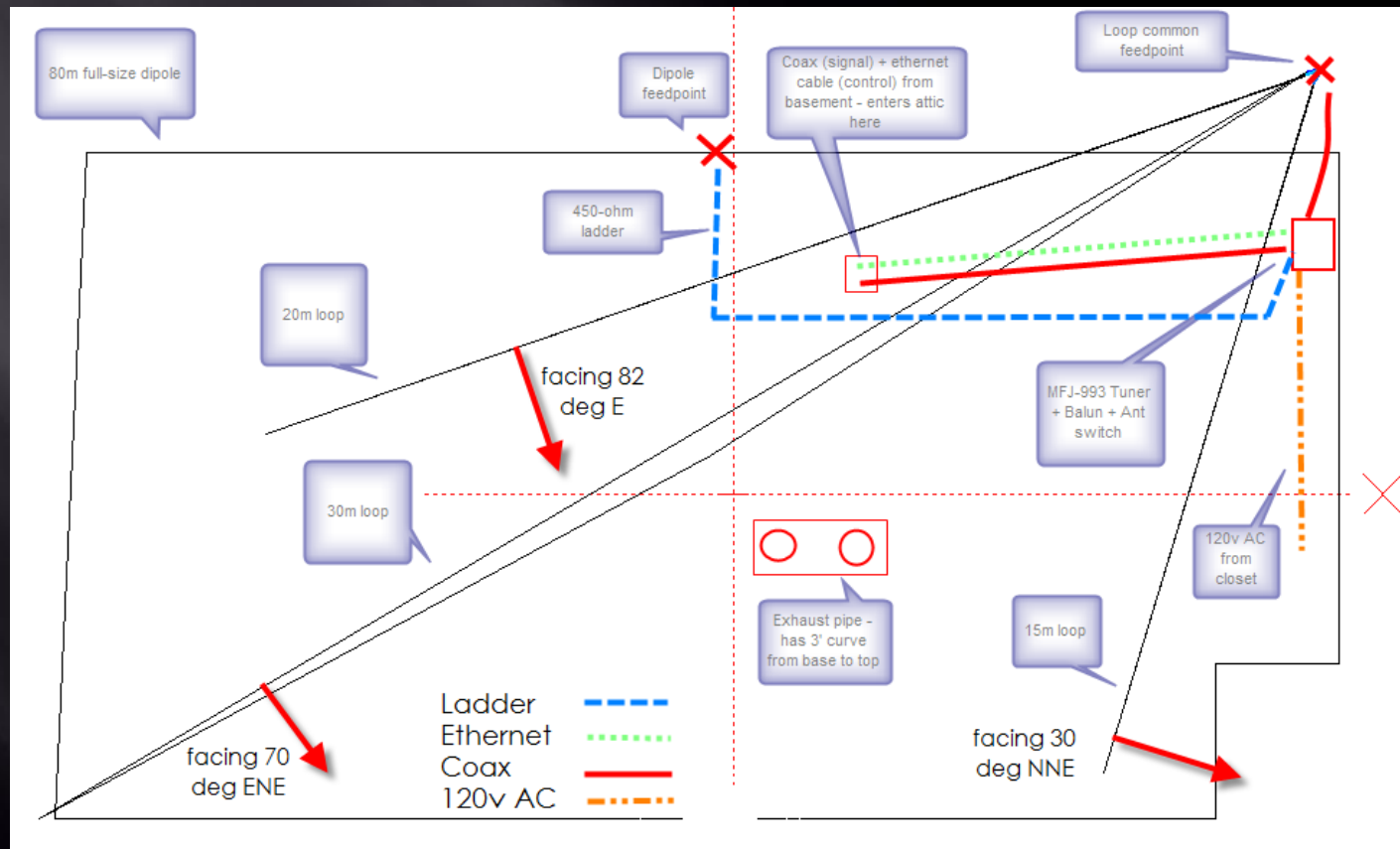
Loop Dipole: 80m



Delta Loops - Perspective View



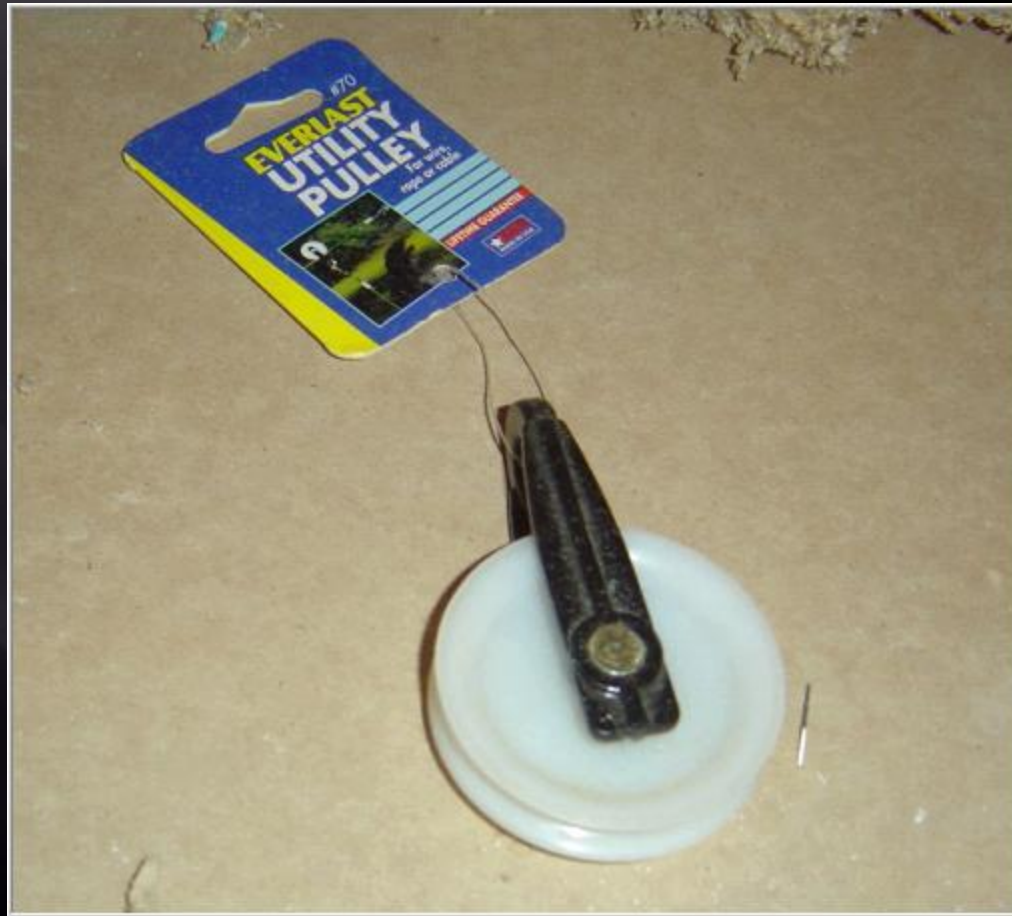
Delta Loops - Layout - Top View



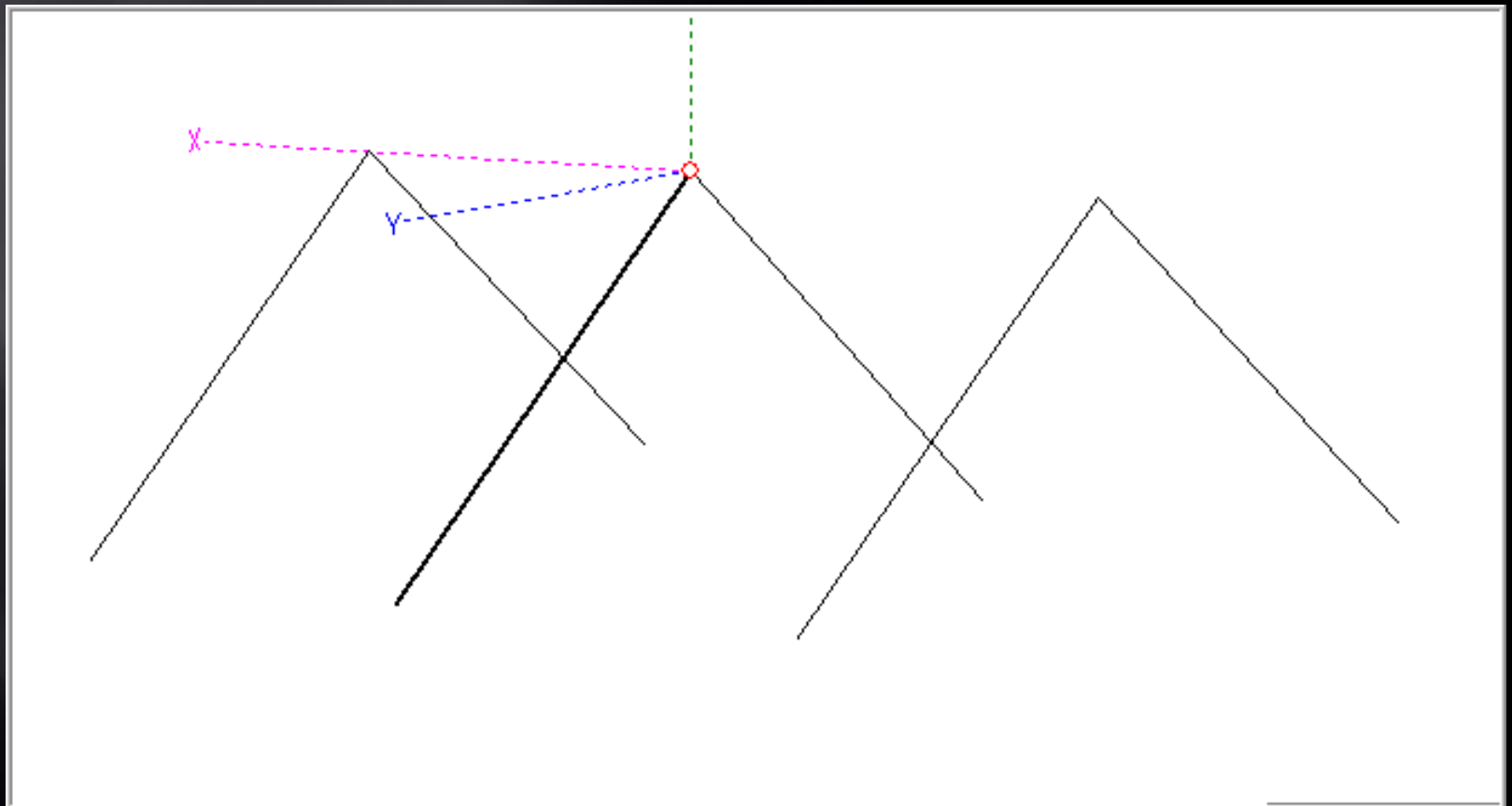
Delta Loops - Shared Feed Point



Delta Loops - #1 Construction Secret



Third Generation: Wire Beam



Stationary Wire Beam - Pro/Con

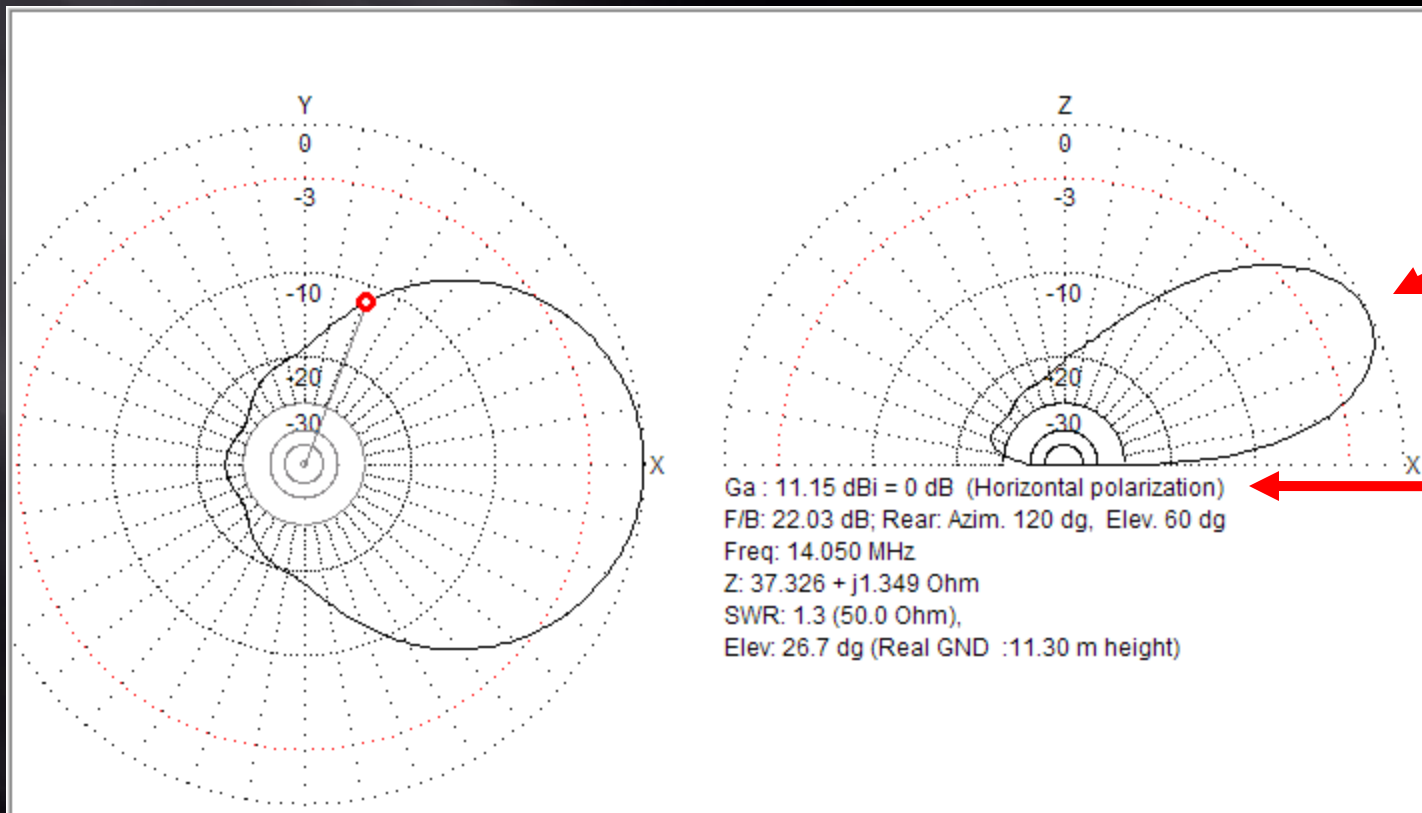
▣ Pro

- Gain
- F/B

▣ Con

- Direction is fixed
- TOA is higher vs. Delta Loop
- Single band

3-el 20m Monoband - 20' boom



VE3RGW Ninja Wire Beam

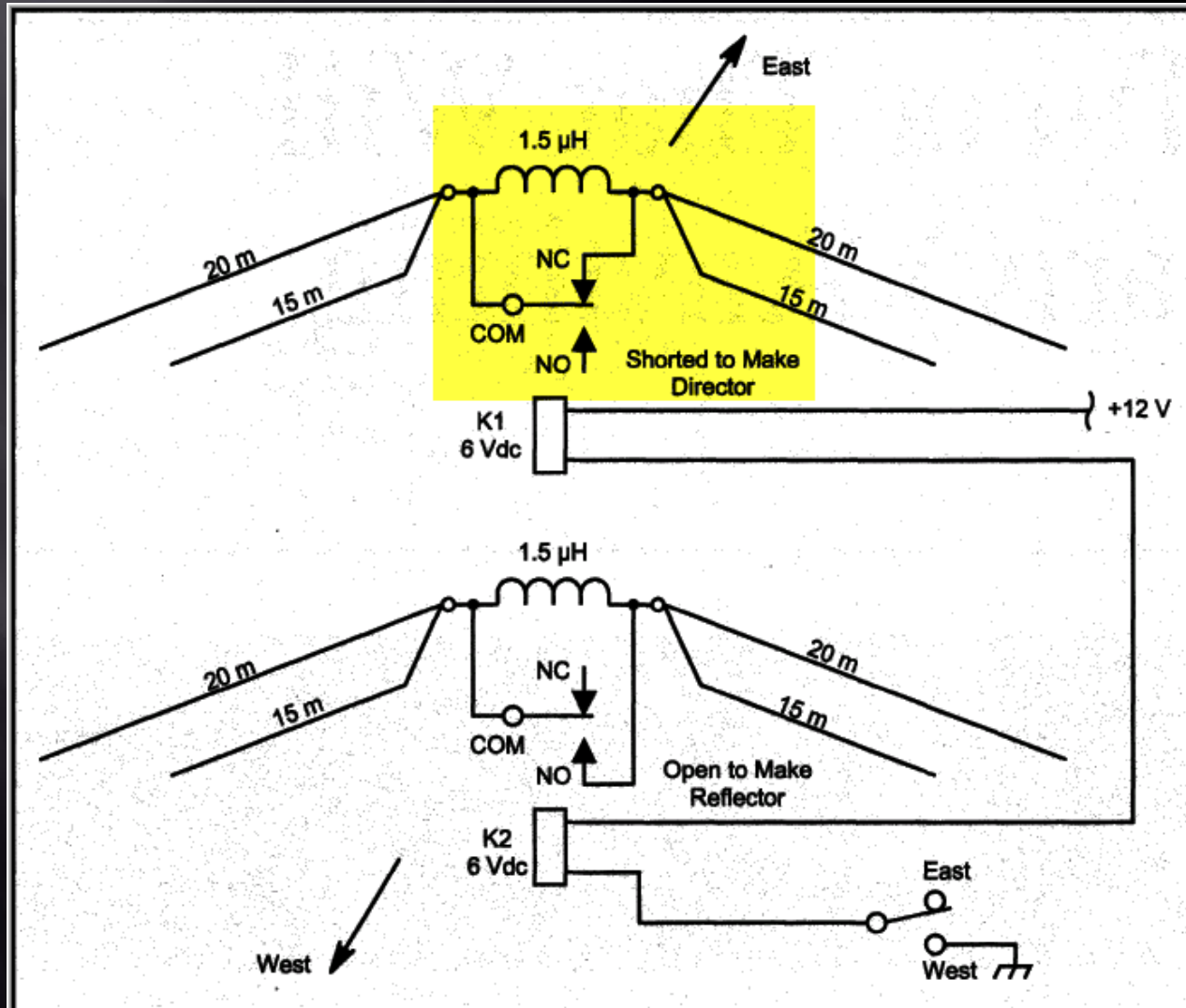
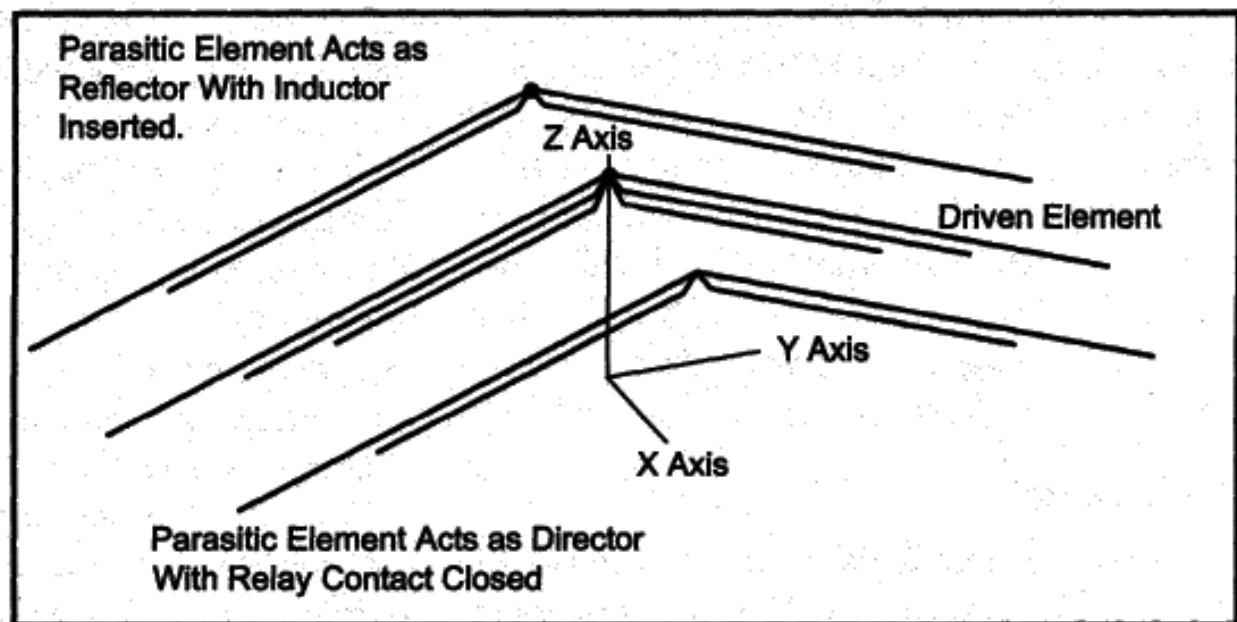


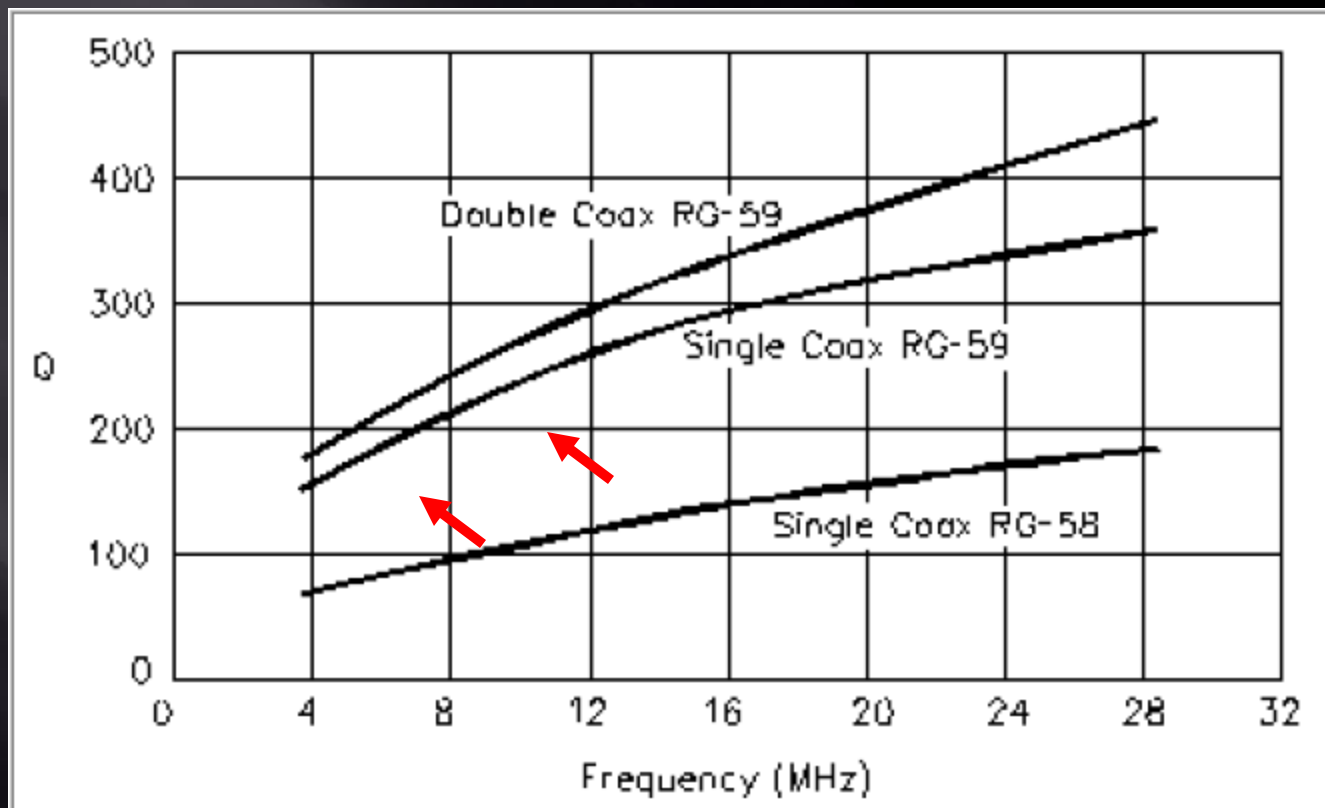
Fig 4—Schematic of the switching system for turning a director into a reflector.

VE3RGW Ninja Wire Beam

Fig 1—Layout of the VE3RGW In-attic wire Yagi. Each parasitic element can be tuned using relays as a director or reflector to switch the direction of the array.

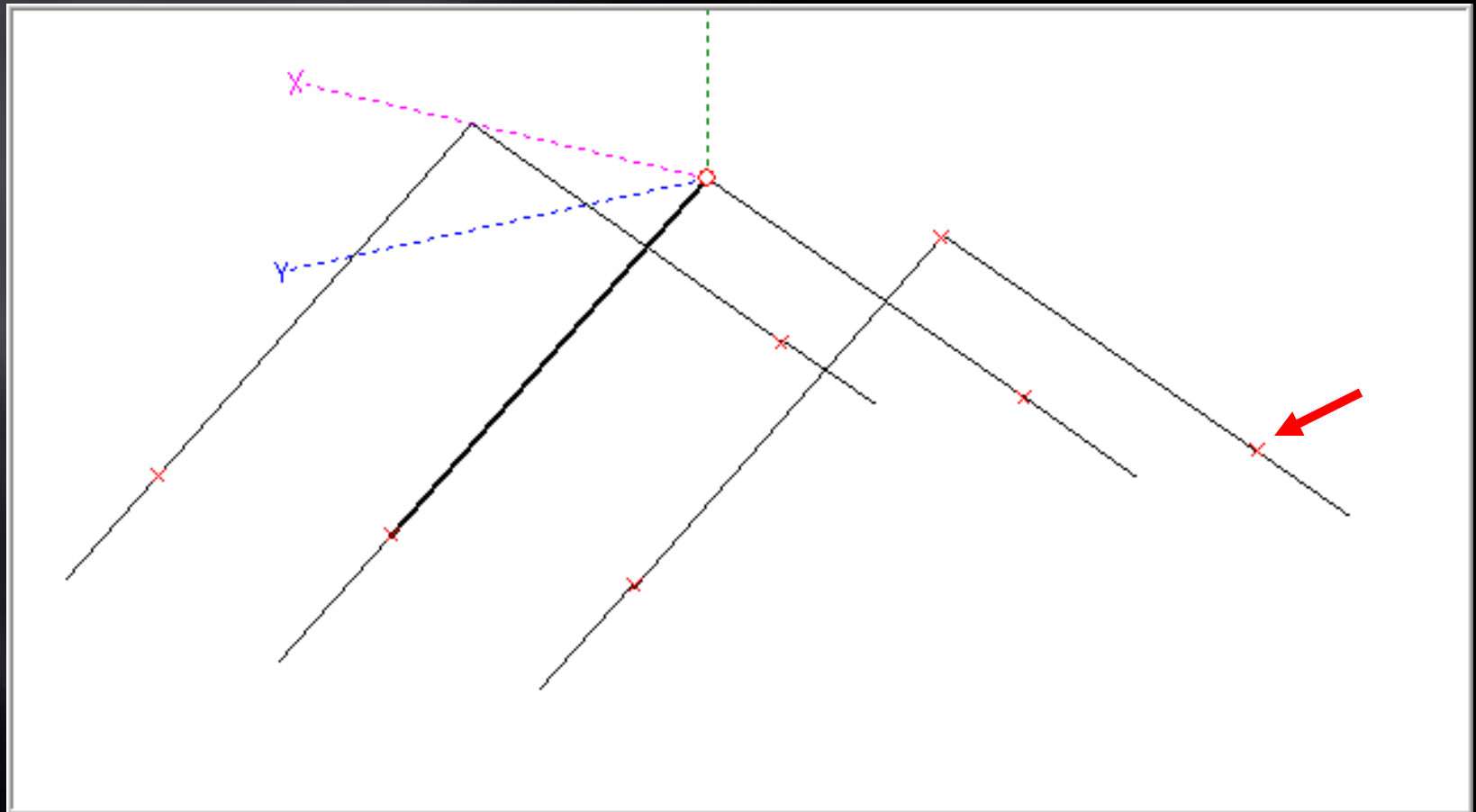


Traps As the Solution?

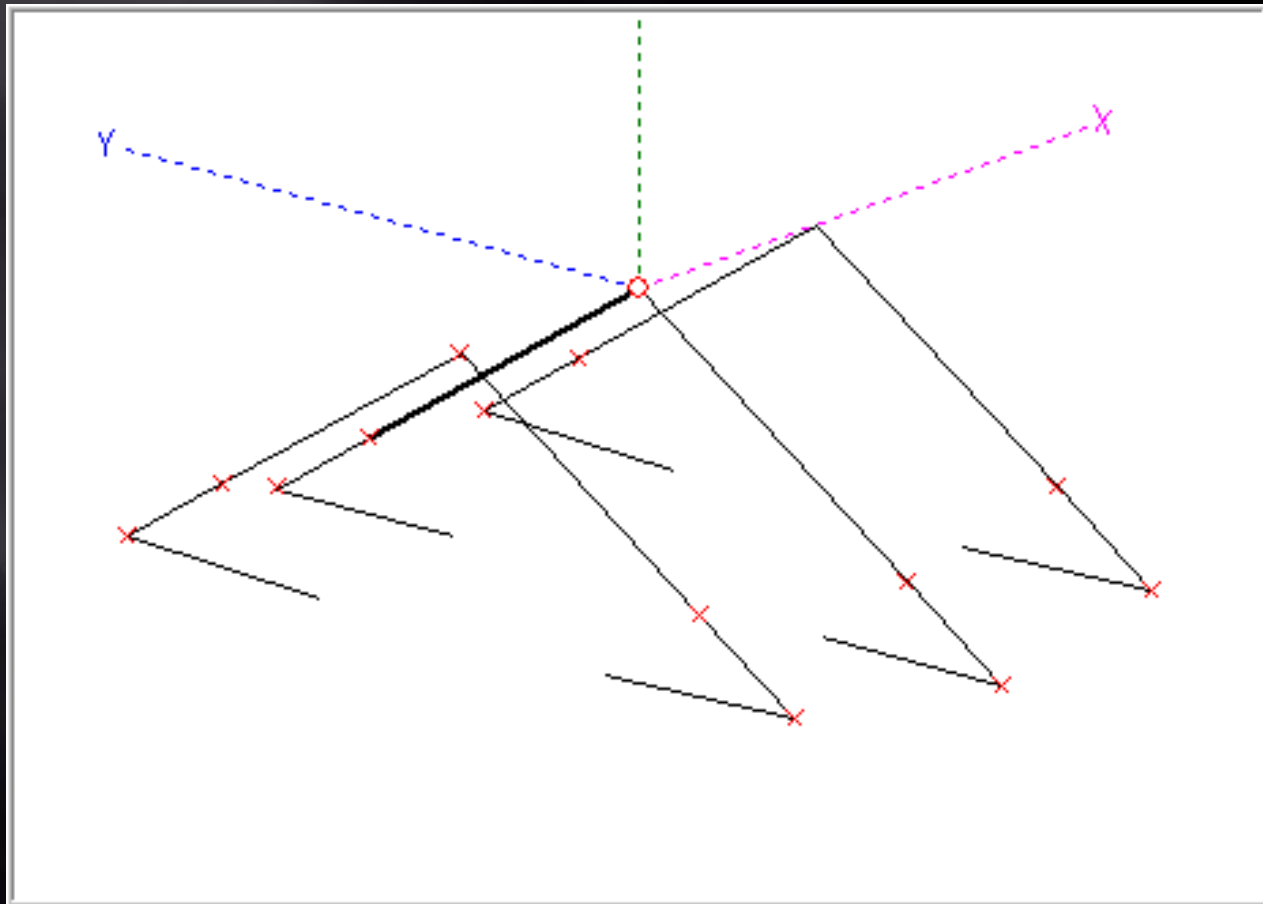


Bonus feature of traps: sagging

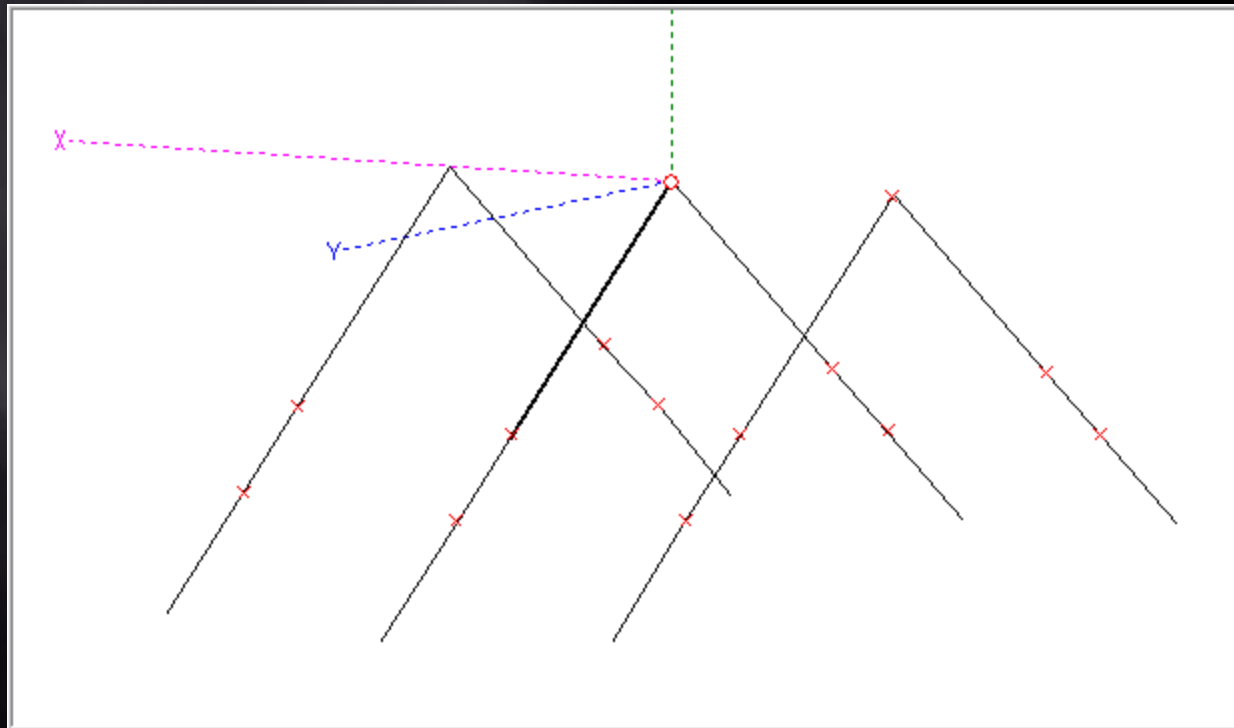
3-ele 20m/30m Trap Design



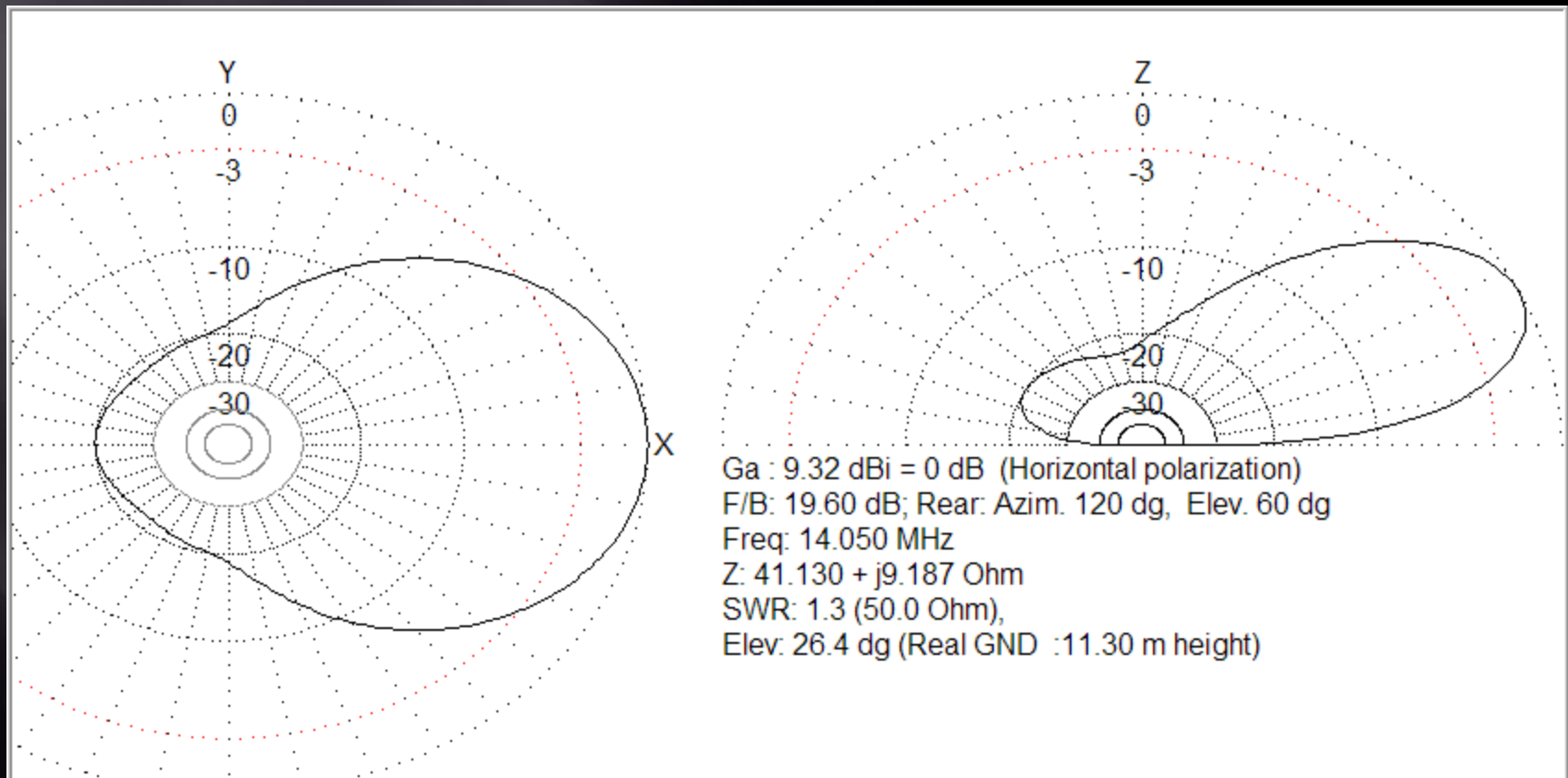
3-ele 20/30/40 - Initial Design



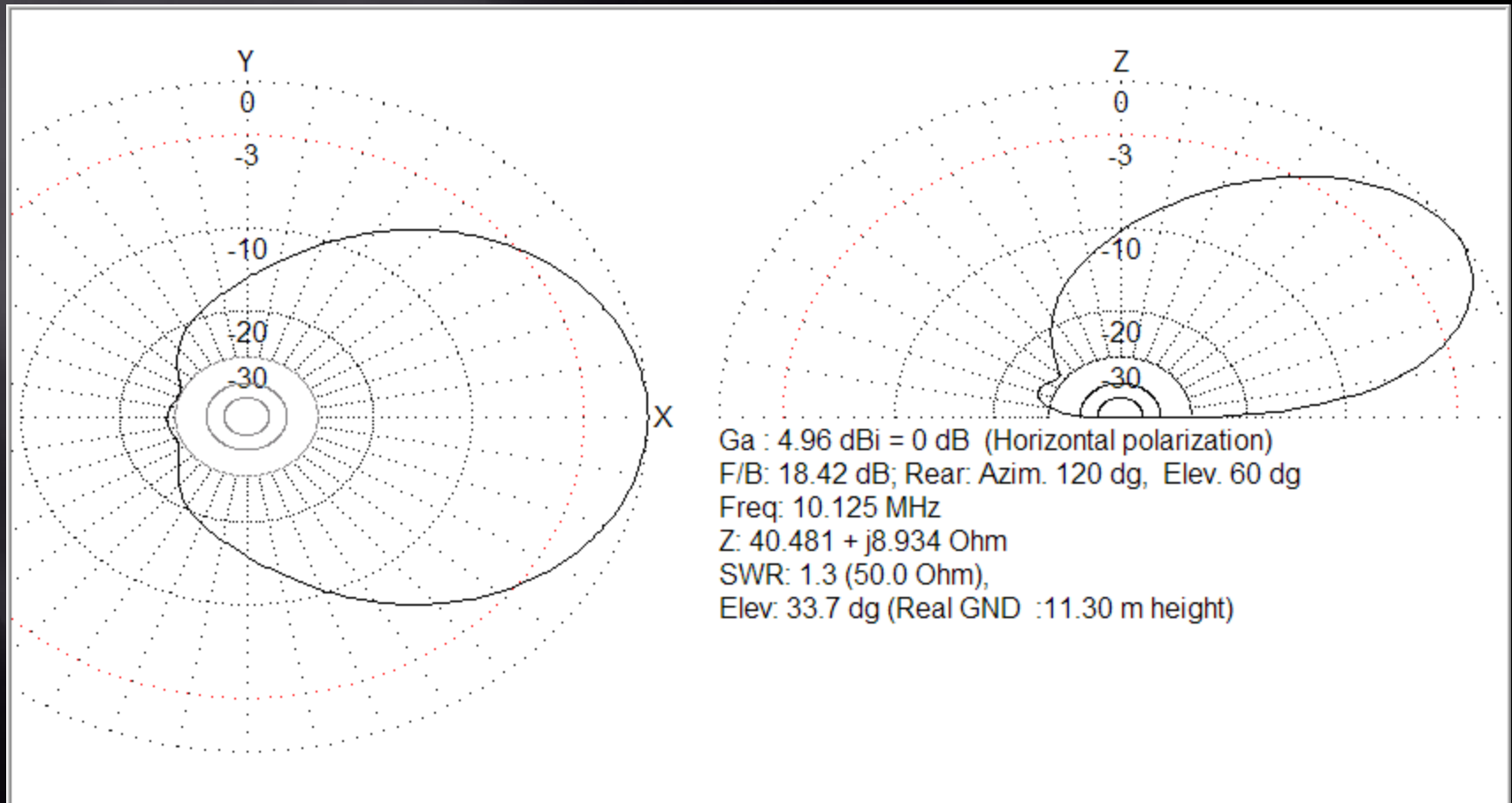
3-ele 20m/30/40m - Final Design



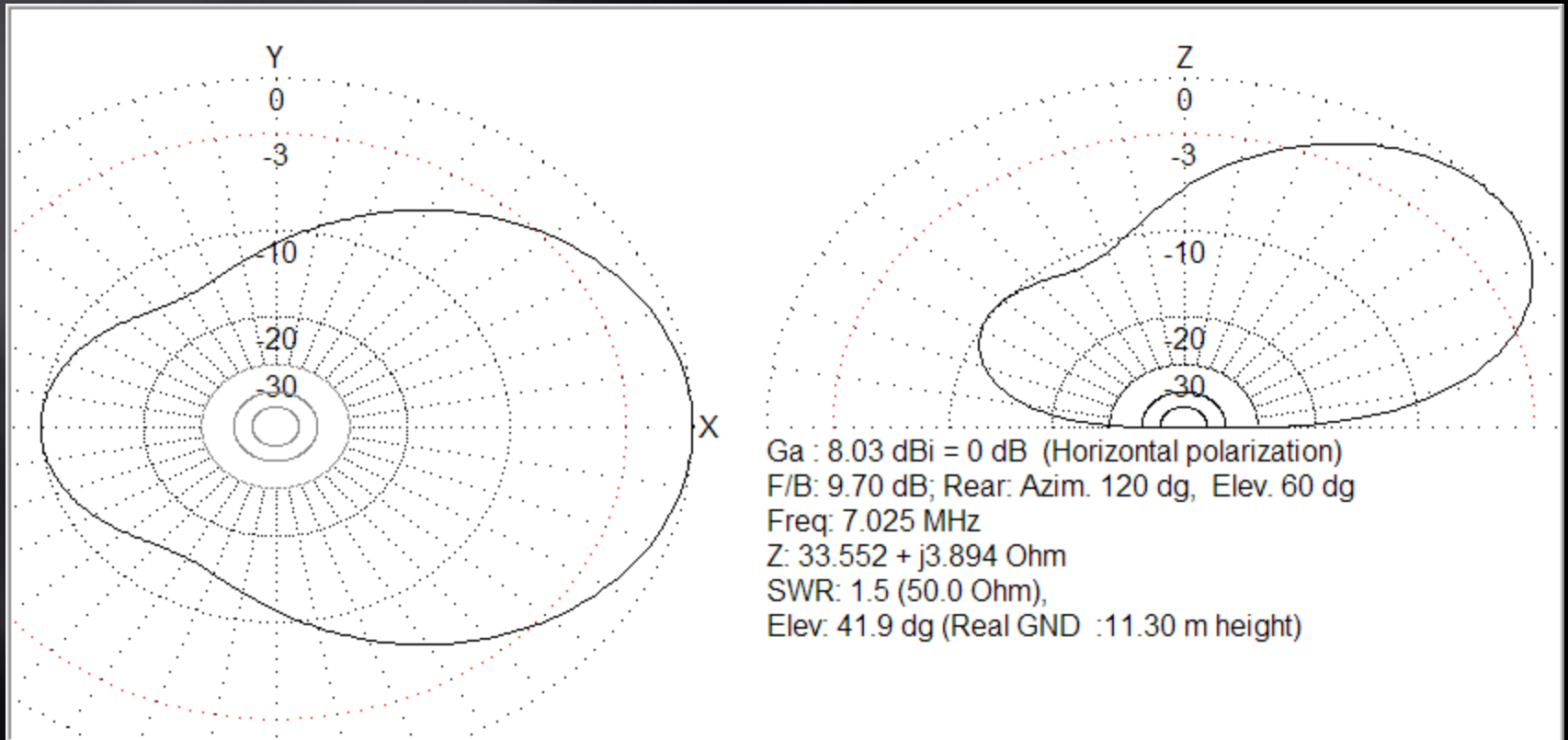
Model: 20m Performance



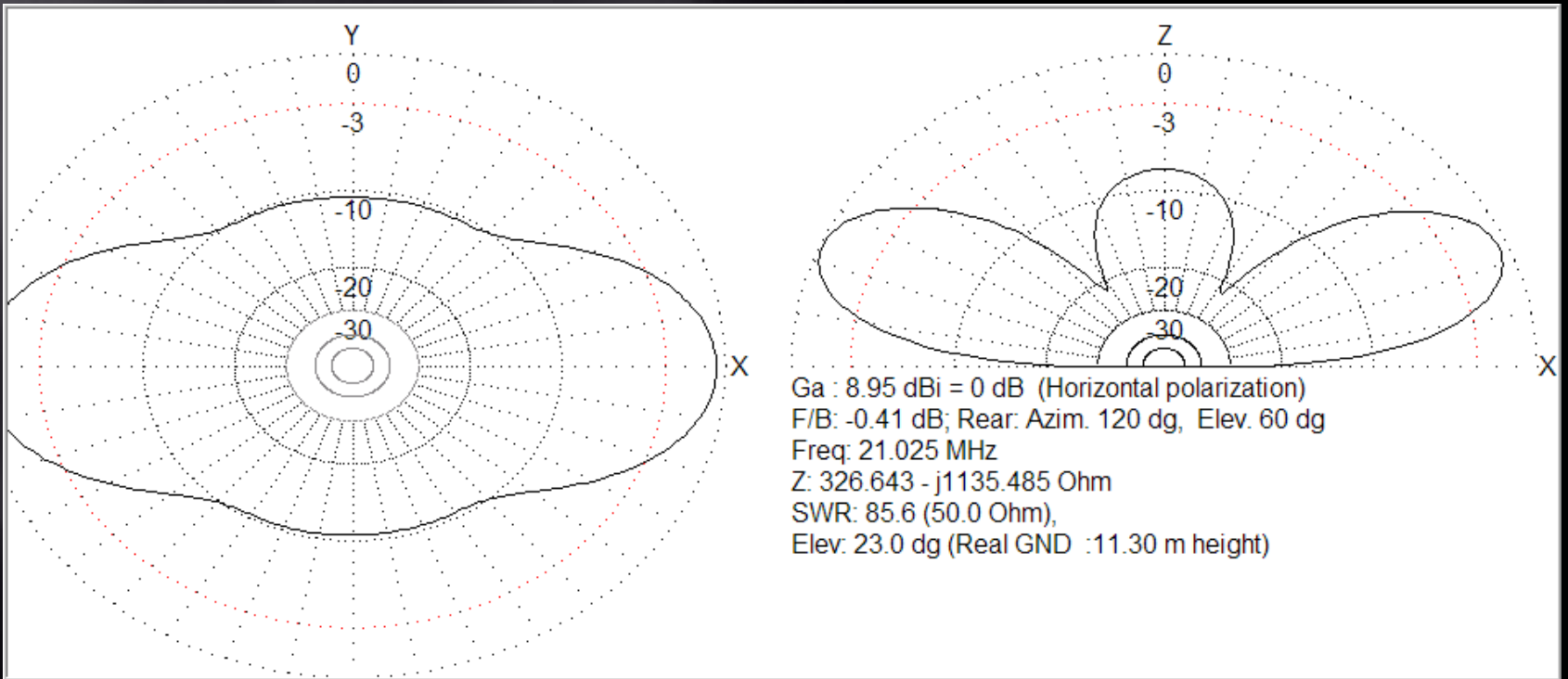
Model: 30m Performance



Model: 40m Performance



Model: 15m Performance



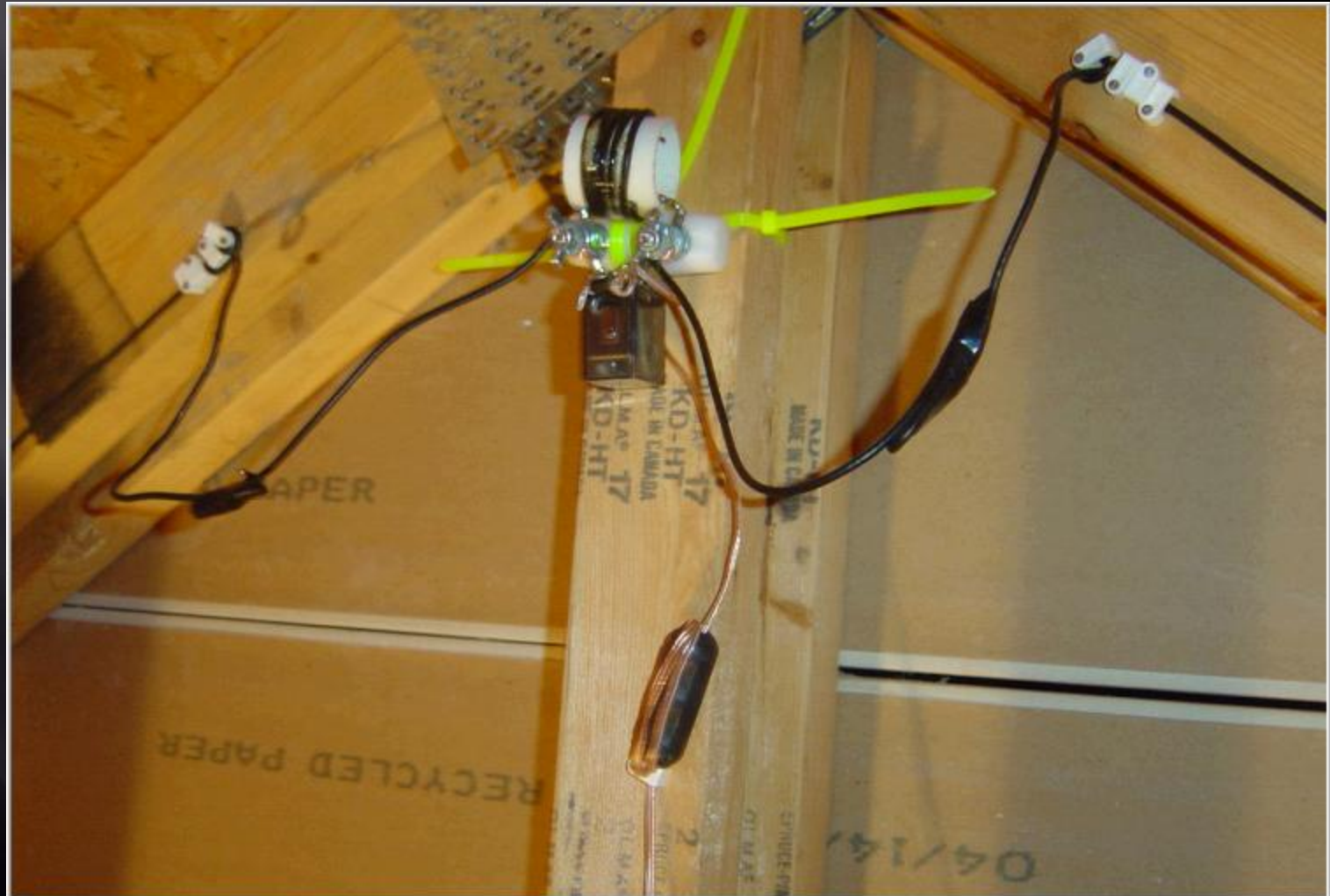
Center Element



High-Q Coax Traps



End Elements



Looking Down The Boom



Common Mode Choke



MFJ-998 ATU - Mod'd for R/C



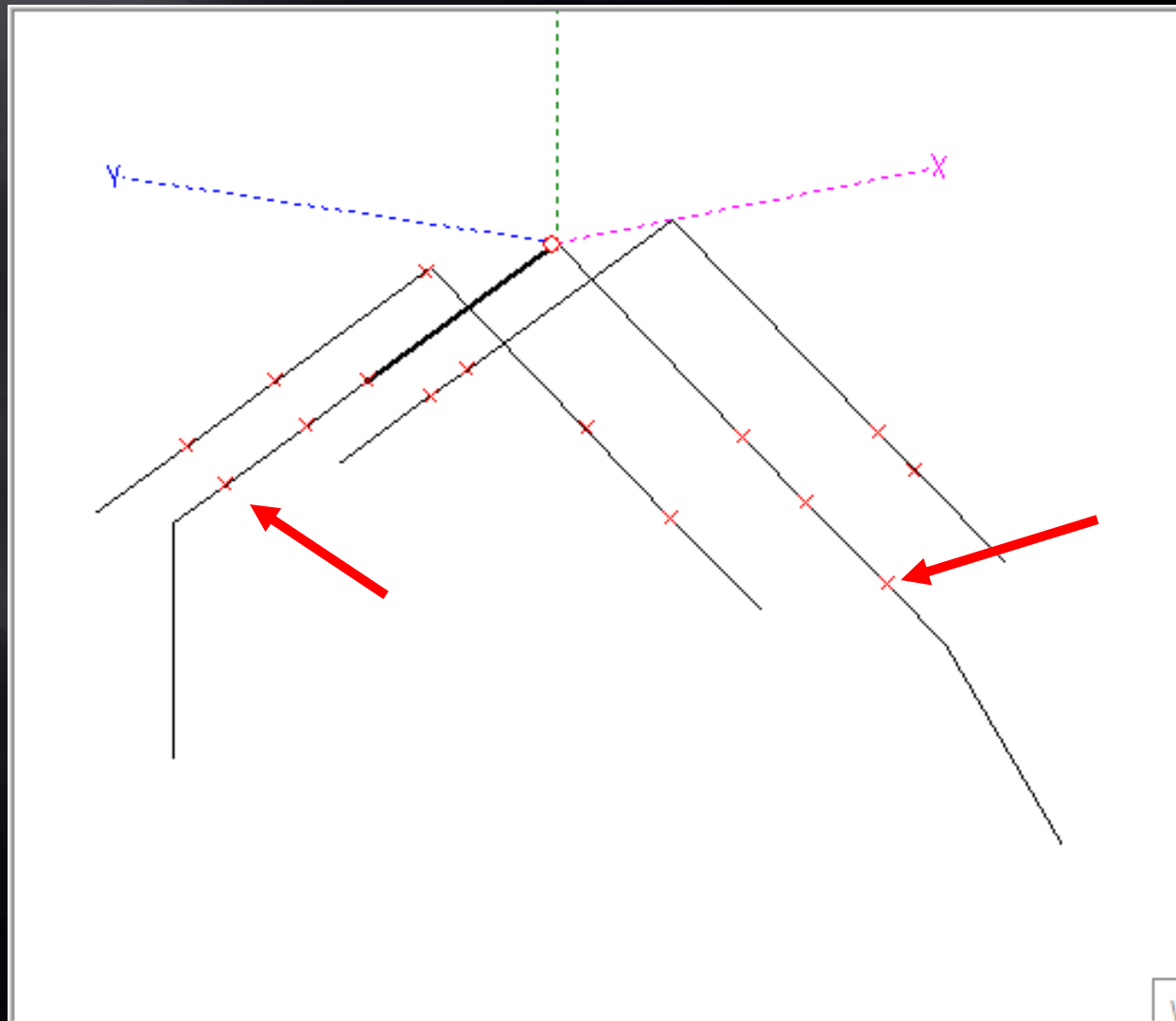
Relay Switched Inductor/Insulator



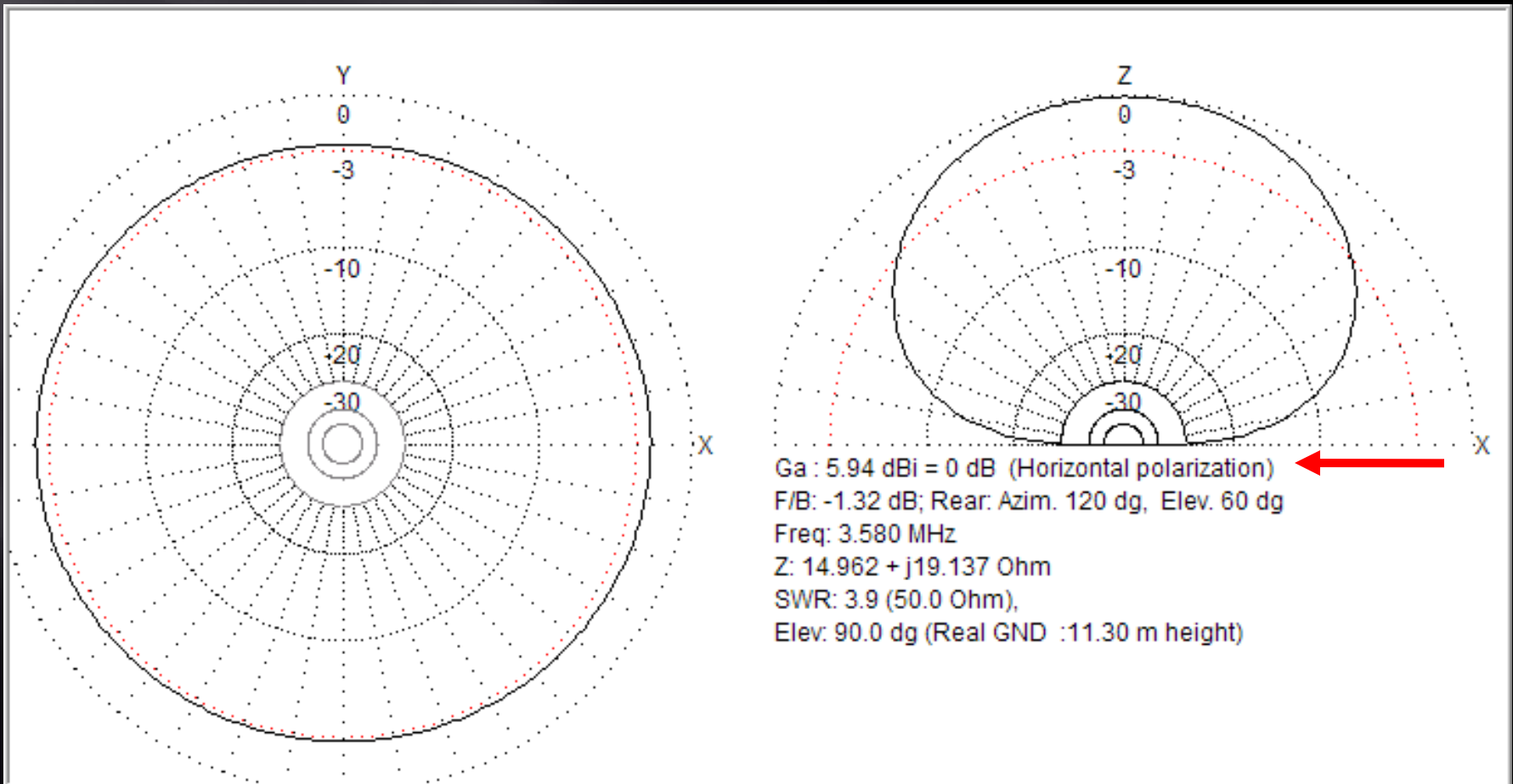
Handling Hard to Reach Places



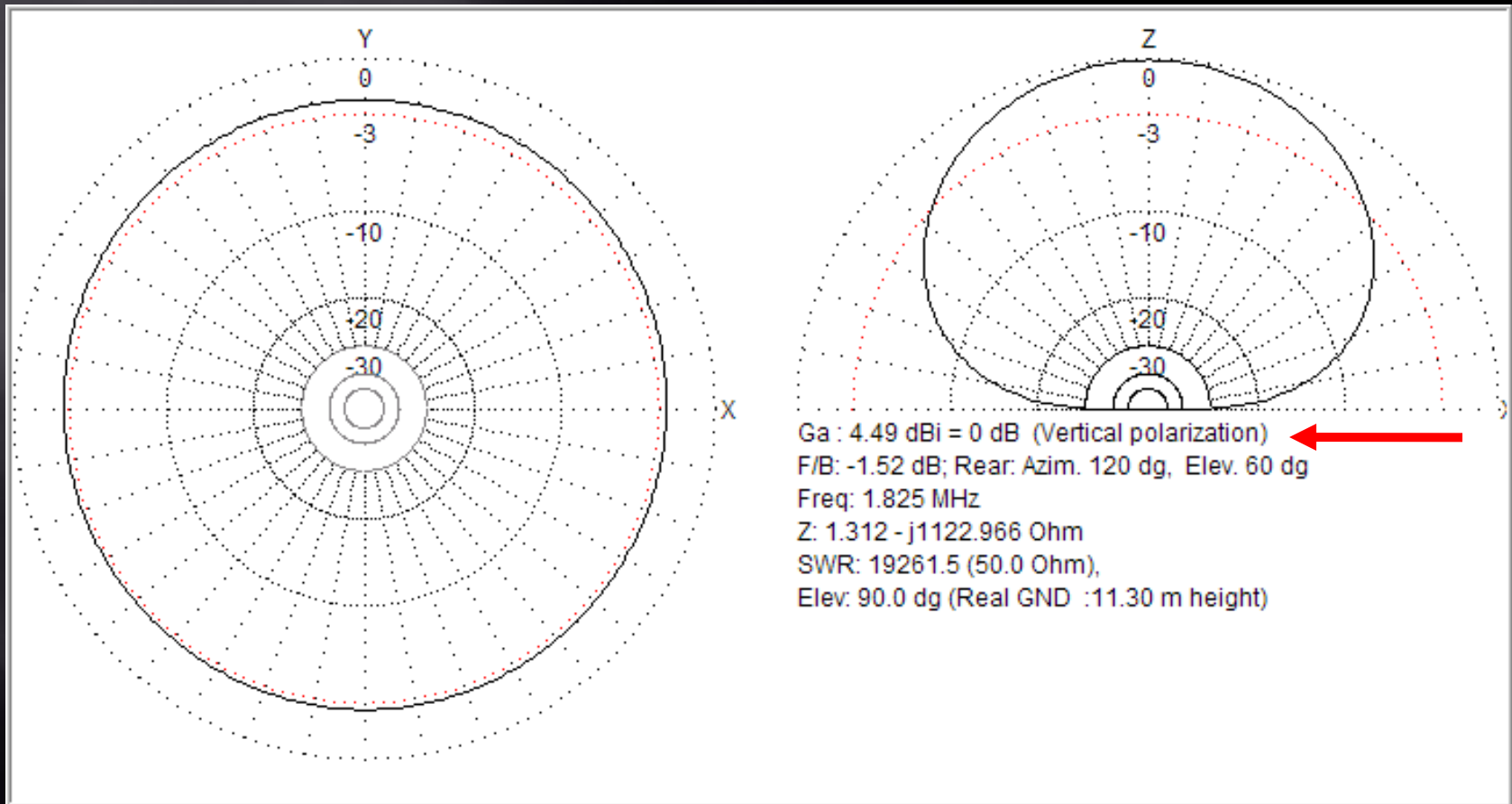
Fourth Generation: 80m & 160m



80m Performance Nearly Equal to FS Dipole



160m Performance Comparable to a 80m Loaded Dipole



Implementation Required Testing the XYL's Limit of Sympathetic Understanding



Review: Specifications Summary

- ▣ Inverted-v shape at 44' apex
- ▣ 3-elements - resonant on CW seg - 20/30/40m
- ▣ Up to 10db FWD gain; 20db F/B
- ▣ Electrically reversible
- ▣ 100% remote operation from shack op pos
- ▣ Trap dipole performance on 80m
- ▣ Loaded dipole performance on 160m
- ▣ Off resonance operation capable (via ATU)
- ▣ Hosts 2 antennas - remotely switched
- ▣ Power handling capability - >1400w

Results

Antenna Farm - Harvest Timeline:

- ▣ DEZ - May 08
- ▣ Loops - July 08
- ▣ Wire beam - Oct 08, 80/160m - Nov 08

Cumulative

May 2008-Feb 2009
2400 QSO Total

| Band | QSO | qso % | CW | cw % | SSB | ssb % | RTTY | rtty % | DXCC | WAZ | ITU |
|-------|------|-------|-----|------|-----|-------|------|--------|------|-----|-----|
| 160 | 92 | 4 | 91 | 12 | 1 | 4 | 0 | 0 | 2 | 2 | 5 |
| 80 | 307 | 13 | 244 | 31 | 6 | 23 | 57 | 4 | 17 | 9 | 11 |
| 40 | 504 | 21 | 160 | 21 | 3 | 12 | 341 | 22 | 38 | 16 | 19 |
| 20 | 1384 | 58 | 262 | 34 | 16 | 62 | 1106 | 73 | 106 | 27 | 33 |
| 15 | 36 | 2 | 21 | 3 | 0 | 0 | 15 | 1 | 14 | 13 | 12 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2323 | | 778 | | 26 | | 1519 | | 177 | 67 | 80 |

ARRL CW DX 2009

| Band | QSO | qso % | CW | cw % | SSB | ssb % | RTTY | rtty % | DXCC | WAZ | ITU |
|-------|-----|-------|----|------|-----|-------|------|--------|------|-----|-----|
| 160 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 17 | 18 | 17 | 21 | 0 | 0 | 0 | 0 | 13 | 7 | 8 |
| 40 | 15 | 16 | 15 | 18 | 0 | 0 | 0 | 0 | 12 | 6 | 6 |
| 20 | 53 | 57 | 50 | 61 | 0 | 0 | 3 | 1E2 | 42 | 15 | 16 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 85 | | 82 | | 0 | | 3 | | 67 | 28 | 30 |

Attic Farming: Essentials

- ▣ Measure space available
- ▣ Directional is better than omni-directional
- ▣ Use MMANA-GAL to easily test ideas
- ▣ Expect excellent performance (but not ideal)
- ▣ Put ferrites (mix #31 or #77) on all wires in proximity
(square law - 2x turns gives 4x inductance...)
- ▣ Execute S&D mission on noise sources
- ▣ More power beats less power
- ▣ F/B may reverse pattern - far off frequency

Attic Farming: Common Issues

- ▣ RFI complaint level
 - High: Powered speakers
 - Low: Cordless tele, TV, most stereo
 - Solution: Profile by band, isolate, trail/error to find optimal choke locations - orientation may help

- ▣ Safety
 - Ceiling damage
 - Human body exposure to RF power levels
 - Insulate high-voltage points (traps, ends) - 30KV/in

Attic Farming: Common Issues

- ▣ Model vs. Real World
 - Expect coupling
 - Surprises - stucco underlayment is metal
- ▣ Dimensions are Critical
 - Follow model resonant frequency - not dims
 - Open unused elements in center when trimming
 - Pre-stretch or use CW or Flexweave

How-TO: S&D Noise Sources

- ▣ Required: UPS or independent power source
- ▣ Establish baseline
 - Slow AGC - preamps enabled - no tuner
 - Record on paper S-meter levels
 - Minimize variables - constant parameters
- ▣ Power off house mains at fuse panel
- ▣ Localizing - flip breakers one by one - all bands!
- ▣ Test anything plugged into the wall
- ▣ Prime suspects: switching power supplies

AI4FR: A Profile in Minimalism

- ▣ Rigs
 - Icom 756 Pro II @ 100W
 - Kenwood TS-440 SAT @ 100W
- ▣ Antenna farm:
 - 10/15m: 1/2 wave end-fed vert
 - 17m & below: 102' G5RV @ 18'



AI4FR: 4-Year 10K QSO/YR Average

AI4FR QSO Statistics

Band/Mode Breakdown

| | CW | SSB | RTTY | AM | THROB | FM | HELL | MT63 | MFSK | Olivia | PSK31 | PSK63 | TOR | SSTV | PSK125 |
|------|-------------|--------------|--------------|----------|----------|-----------|------------|----------|-----------|-----------|-------------|------------|----------|----------|------------|
| 160m | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80m | 340 | 382 | 1411 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 152 | 9 | 0 | 0 | 33 |
| 40m | 1213 | 2479 | 7846 | 0 | 1 | 0 | 9 | 1 | 11 | 3 | 1026 | 55 | 2 | 0 | 42 |
| 30m | 3 | 0 | 8 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 23 | 3 | 0 | 1 | 0 |
| 20m | 1614 | 3134 | 11087 | 0 | 1 | 0 | 183 | 0 | 21 | 15 | 1201 | 111 | 2 | 0 | 51 |
| 17m | 5 | 361 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 |
| 15m | 521 | 1596 | 1071 | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 47 | 0 | 1 | 2 | 0 |
| 12m | 2 | 70 | 5 | 0 | 1 | 0 | 1 | 1 | 1 | 2 | 6 | 0 | 1 | 1 | 0 |
| 10m | 320 | 3042 | 125 | 6 | 1 | 26 | 3 | 1 | 2 | 2 | 110 | 0 | 1 | 1 | 0 |
| 6m | 1 | 325 | 2 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| 2m | 0 | 8 | 0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70cm | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23cm | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 4030 | 11401 | 21566 | 9 | 5 | 61 | 200 | 4 | 39 | 26 | 2578 | 178 | 7 | 5 | 126 |


AI4FR: DXCC 7-ways



Log Off

You have **40,290** QSO records
You have **18,963** QSL records

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Application

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Your Logbook DXCC Account (AI4FR - UNITED STATES OF AMERICA)

Account Status

| Award | Selected | Applied | Awarded | Total / Current |
|-----------|----------|---------|---------|-----------------|
| Mixed * | 5 | 0 | 166 | 171 / 171 |
| CW * | 5 | 0 | 100 | 105 / 105 |
| Phone * | 12 | 0 | 125 | 137 / 137 |
| RTTY * | 8 | 0 | 129 | 137 / 137 |
| 160M | 1 | 0 | 0 | 1 / 1 |
| 80M | 2 | 0 | 58 | 60 / 60 |
| 40M * | 4 | 0 | 103 | 107 / 107 |
| 30M | 6 | 0 | 6 | 12 / 12 |
| 20M * | 11 | 0 | 134 | 145 / 145 |
| 17M | 4 | 0 | 46 | 50 / 50 |
| 15M * | 13 | 0 | 106 | 119 / 119 |
| 12M | 1 | 0 | 22 | 23 / 23 |
| 10M | 2 | 0 | 61 | 63 / 63 |
| 6M | 0 | 0 | 10 | 10 / 10 |
| 2M | 1 | 0 | 0 | 1 / 1 |
| Challenge | 44 | 0 | 546 | --- / 590 |

* = Award has been issued

This account includes credits for the following:

AI4FR - UNITED STATES OF AMERICA

This account is linked with DXCC record:

John Whitt, AI4FR

Notes

- Click on the **Awards** item in the menu at the top of the page to select a different LoTW award account.
- You can click on the links in the Account Status table to view the credit list for an individual award.
- When you are ready to apply your LoTW credits to your DXCC record, use [Application](#)
- To view the present and past applications you have submitted, use [Application History](#).

Stealth Antennas - Conclusions

- ▣ Some compromises
- ▣ Can provide excellent performance
- ▣ Preparation, design and testing required

Morale of the Story

The AI4FR example illustrates -
attitude and persistence are
by far
the largest factors in determining
your performance in
Contest and DX work



