

Contesting and DX Antennas for Restricted Lots



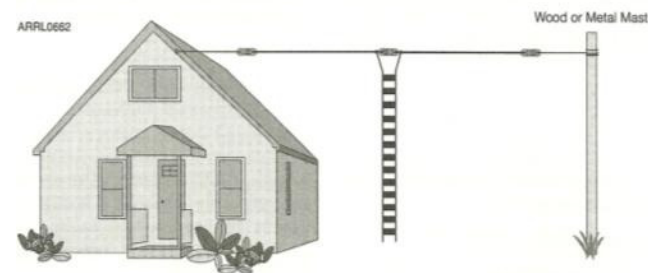
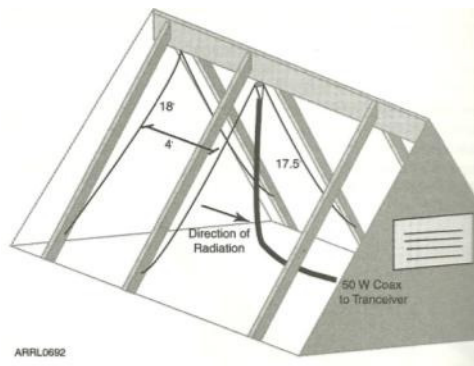
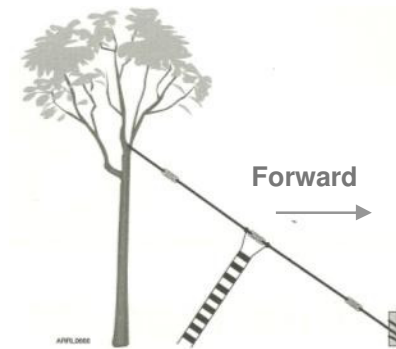
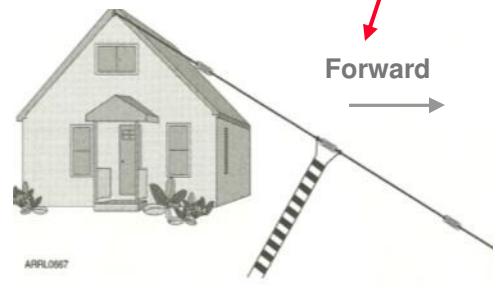
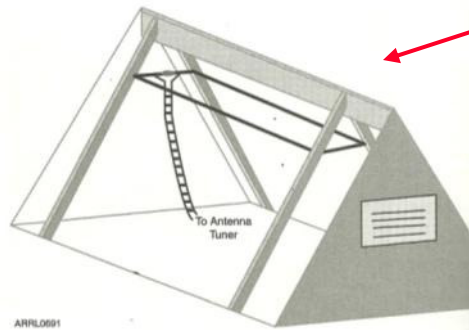
by

Dick Weber, K5IU

DWEBTX@yahoo.com

The goal of this presentation is to provide information so you can make reasonable “fact based” decisions / choices.

Caution: There's a large amount of incorrect information in books and articles - some of it unforgivable.



(All above from ARRL publications)

Opening Comments

- Assume no tower - looking at lower profile antennas either **outside or attic mounted**
- Will cover **40-10M antennas**
 - Antennas for 160 and 80M should be covered as a **separate topic** due to large difference (4-16X) in scale compared to 40-10M
- Assume **space is limited** requiring antennas **to be multiband**
 - Will assess **20-10M performance** of a range of antennas
 - Will assess **40-10M performance** of a range of antennas
- Antenna options assessed at **25 and 35 ft heights** using NEC2 models over average ground
- All performance data shown at **20 degrees elevation.**
- Use information here **to point you** down the better/best path based on your unique circumstances
- Goal is to provide information so you can make reasonable **“fact based”** decisions / choices



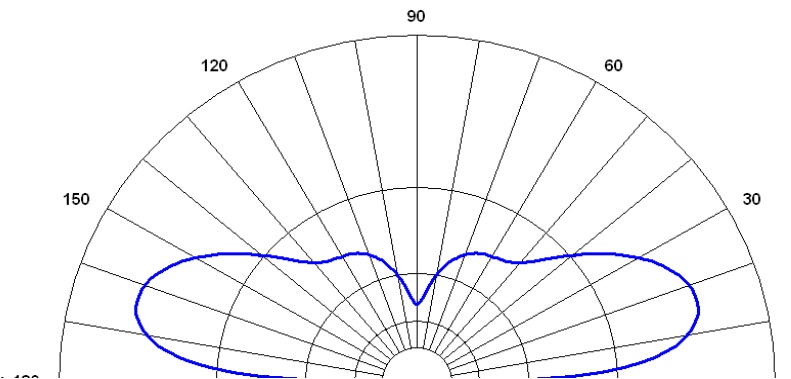
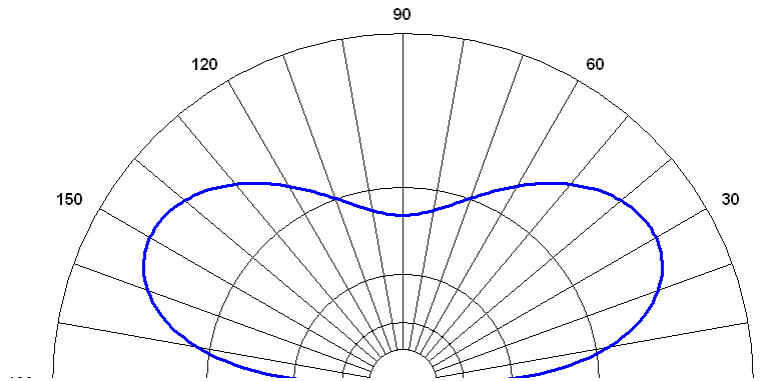


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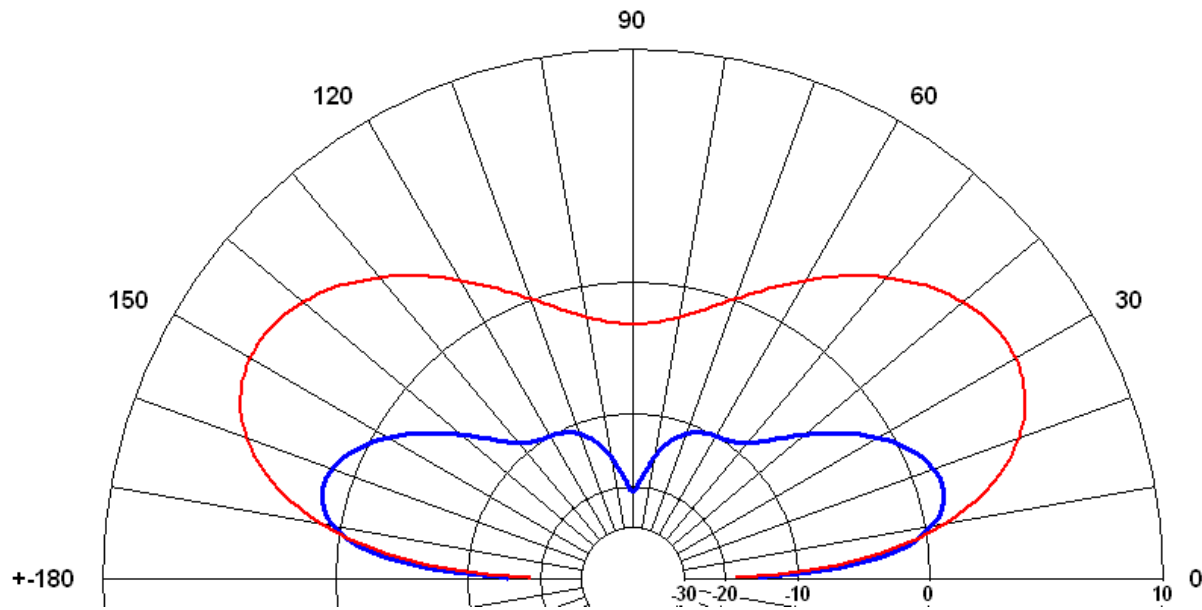
After CQ Magazine - February, 2013

If you're so good at this, Stan why is it
you can hear them but they can never hear you?

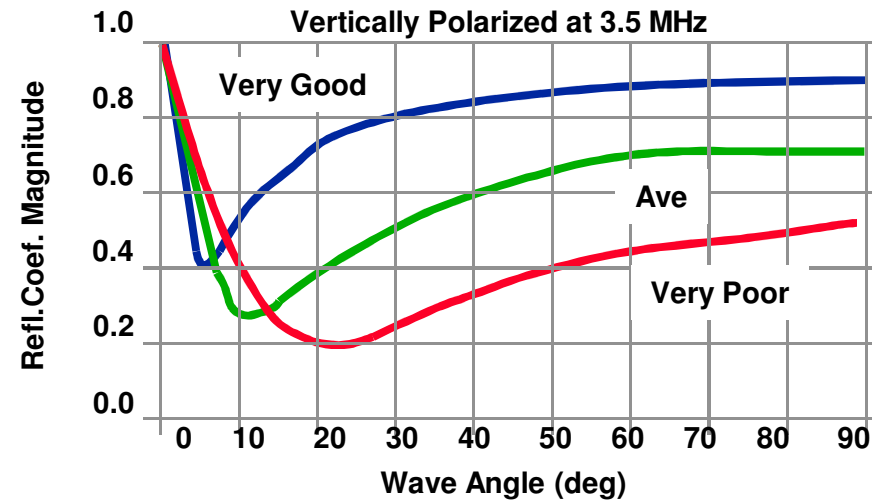
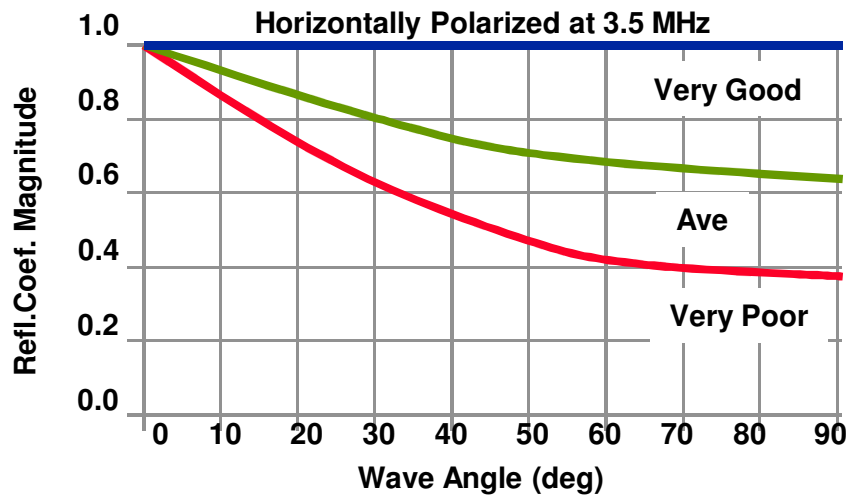
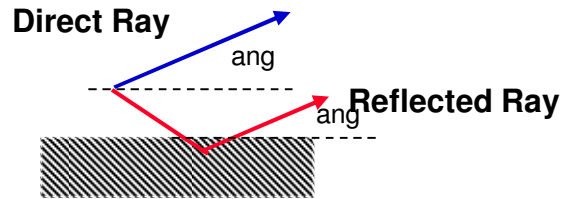
Trick Question #1: Which Would You Prefer for Working DX?



Trick Question #2: Which Would You Prefer for Working DX?



Ground Reflection Effect Example



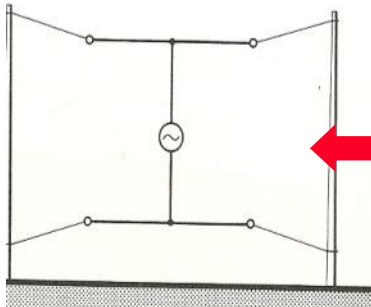
20-10M Antennas

- Vpol**
- Hpol**
- Comparison**

20M Verticals

- **Elevated radial verticals, or similar constructs, offer better performance than ground mounted verticals**
- **Will evaluate three versions - bases set at 6 feet**
 - essentially self supporting or guyed with monofilament line
 - assume coils and matching is lossless / use ave ground

HF Antennas for All Locations
Moxon, G6XN 1983 p121



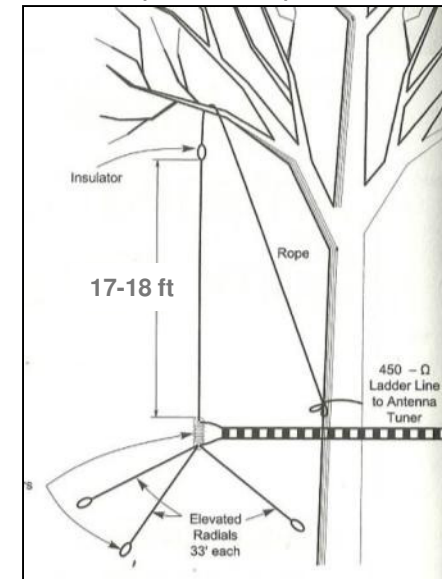
Force 12 -Sigma Vertical Dipole



N6BT Bravo Verticals

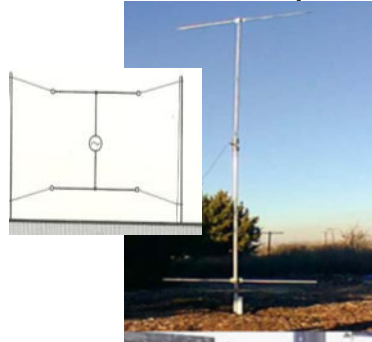


Low Profile Amateur Radio
(and others) ARRL

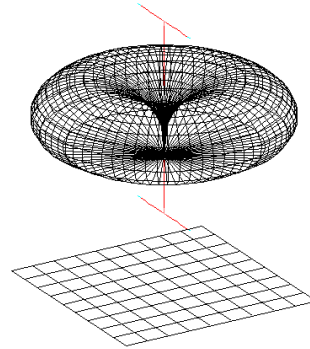


20M Verticals Over Average Ground

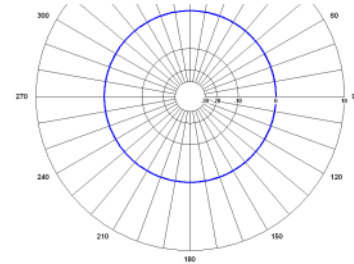
Moxon / Force 12 -20M Sigma
Vertical Dipole



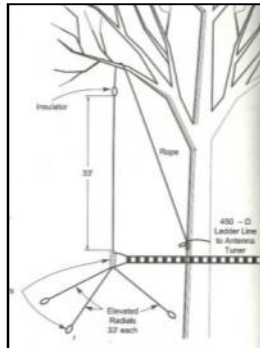
16 ft + 6 ft = 22 ft



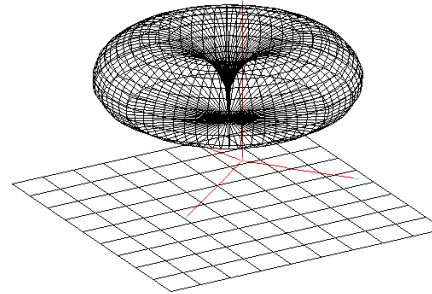
0.0 dBi @ 20 deg el



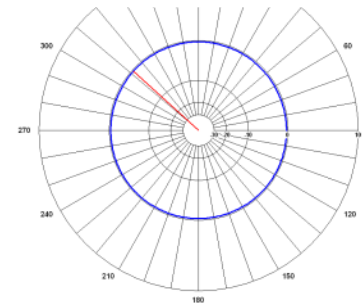
17.5 vert - 12 ft radials (3)



17.5 ft + 6 ft = 23.5 ft



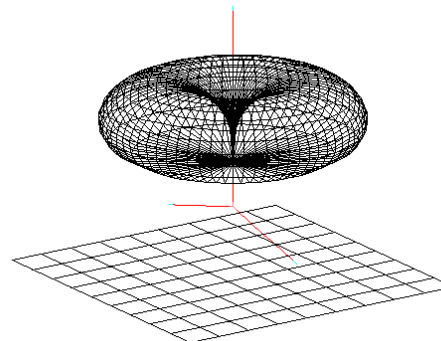
-0.2 dBi @ 20 deg el



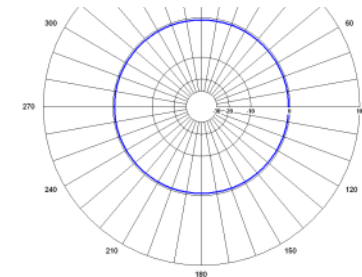
N6BT Bravo 20M Vertical



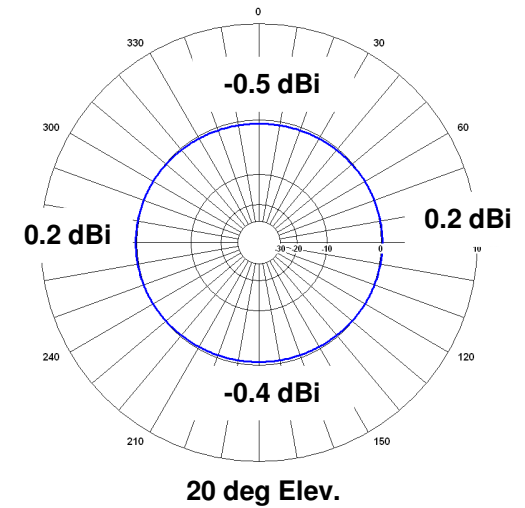
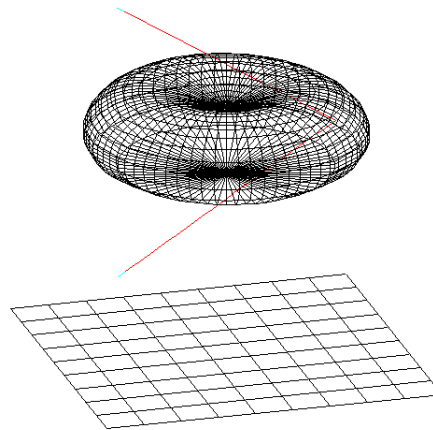
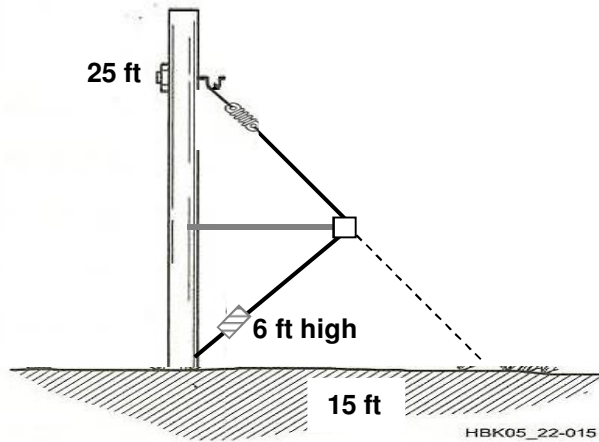
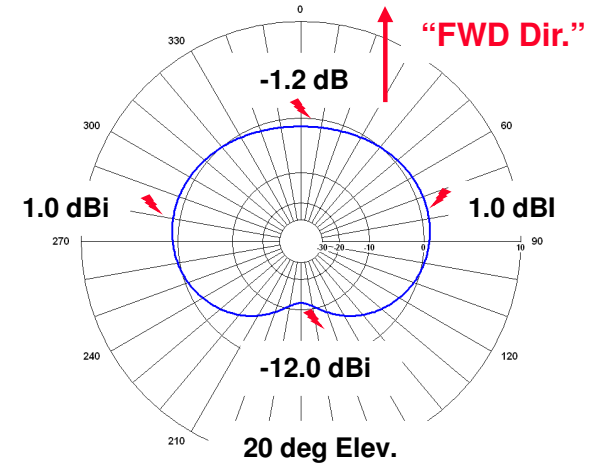
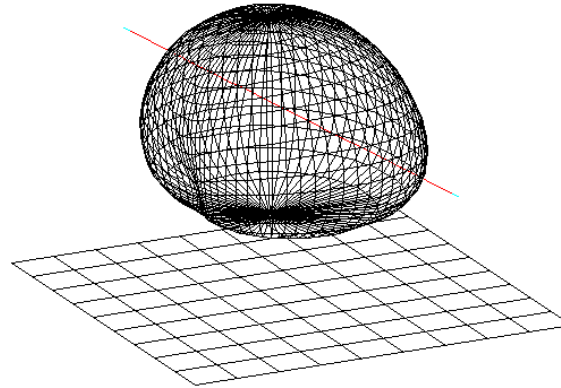
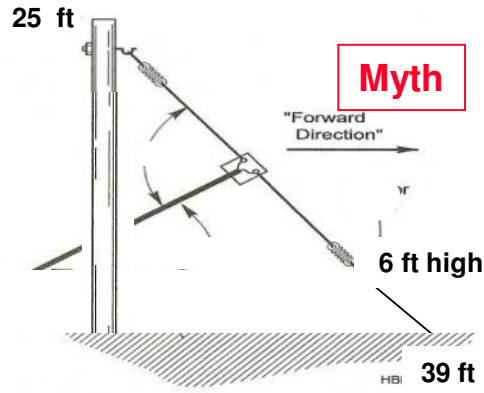
24 ft + 6ft = 30 ft



-0.4 dBi @ 20 deg el

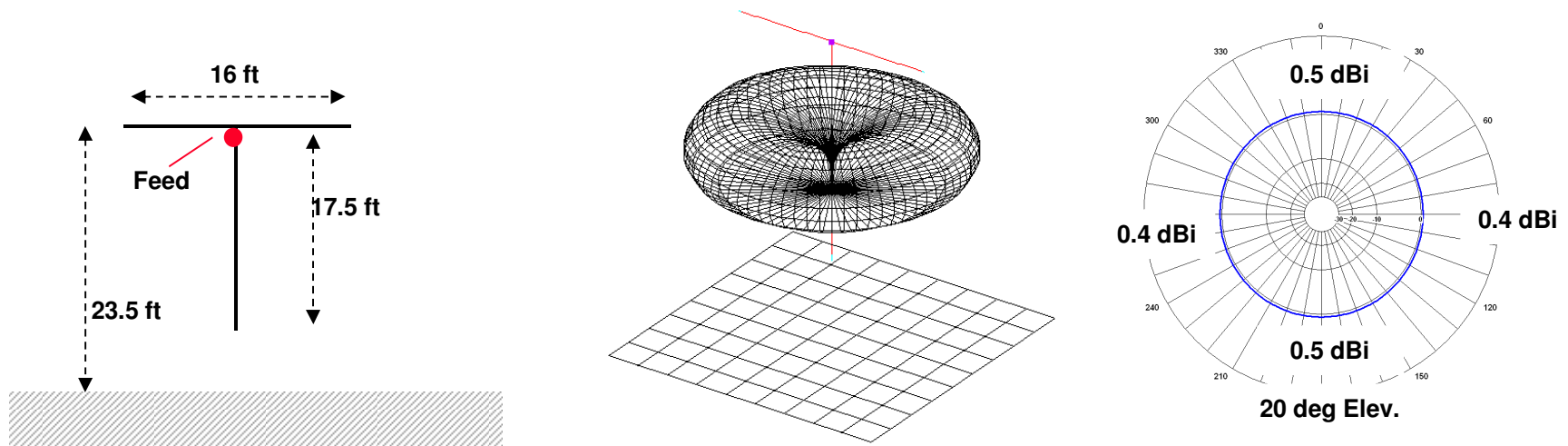


20M Sloping and Bent Vertical-Like Antennas

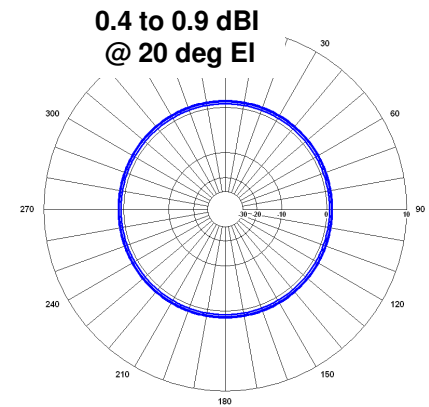
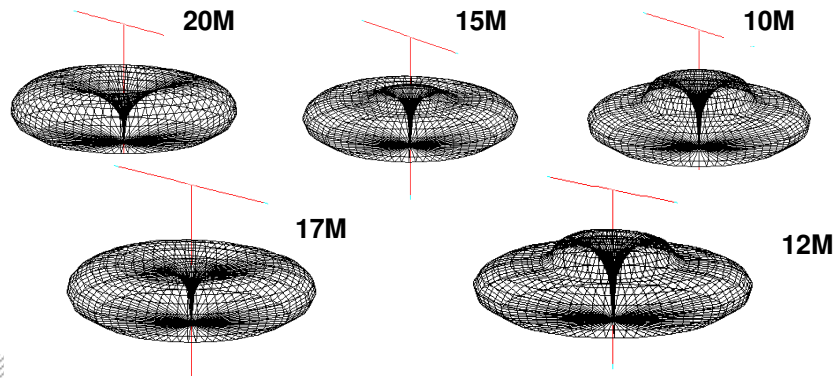
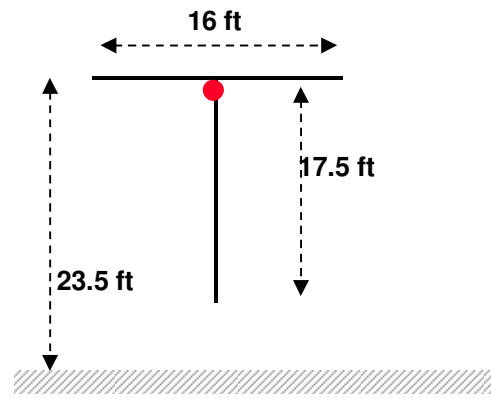


20M Vertical “T” with Elevated Feed Point

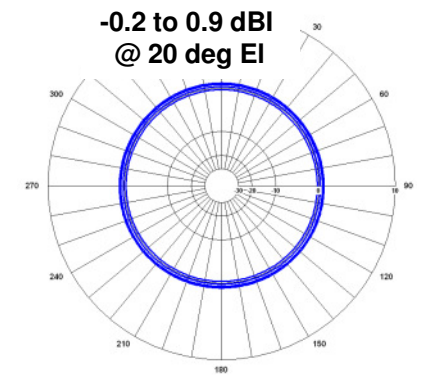
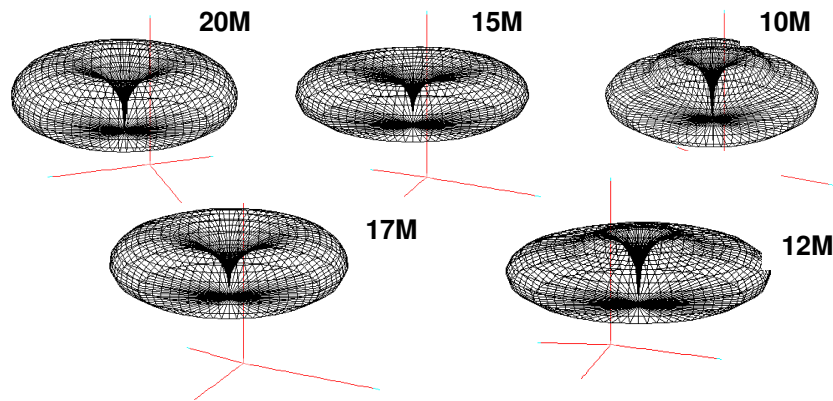
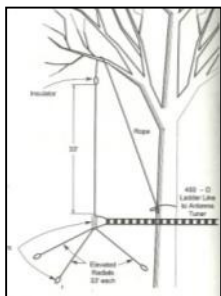
- By moving the maximum current point up there is a positive effect on gain
- Moves maximum current point away from shrubs, fence, other stuff...
- Do not use 1/4 wl sections for “T” wire - if you do, you cannot force currents to be near equal on legs resulting in pattern lifting and skewing



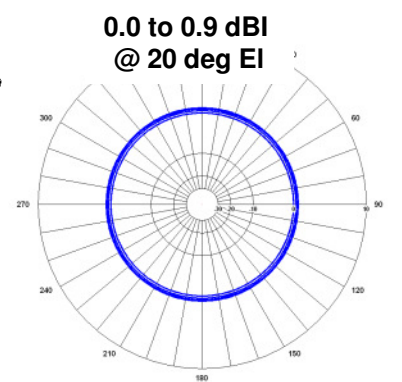
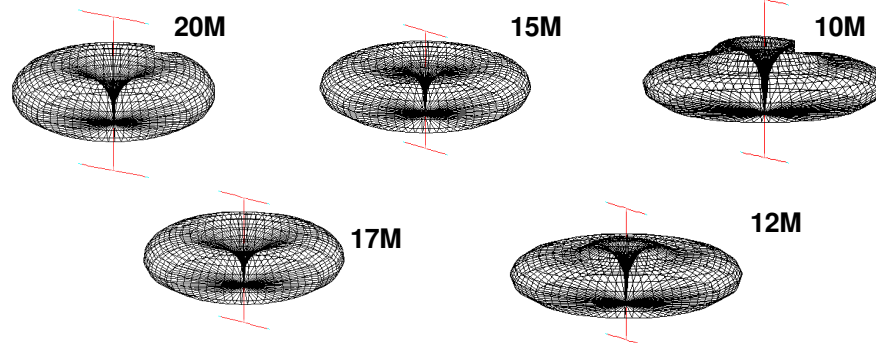
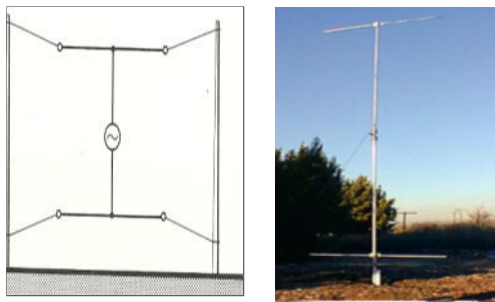
Multi Band Verticals on 20, 17, 15, 12, and 10M



17.5 ft vert - 12 ft radials (3)



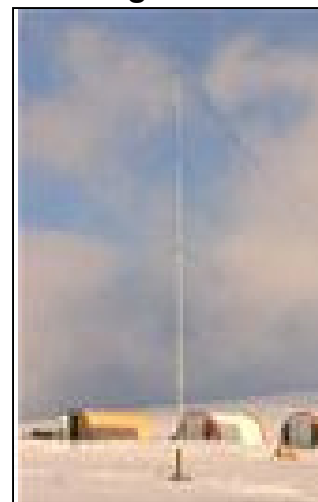
Moxon // Force 12 Sigma



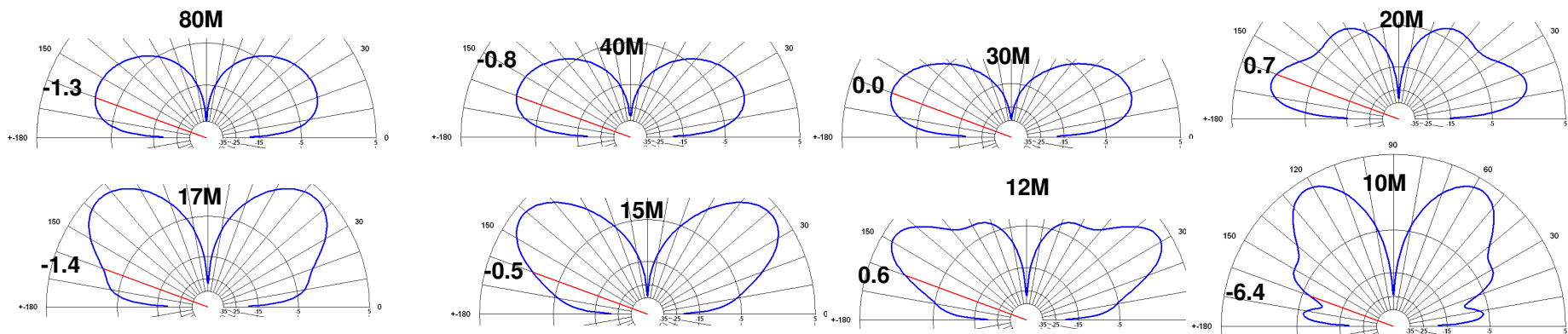
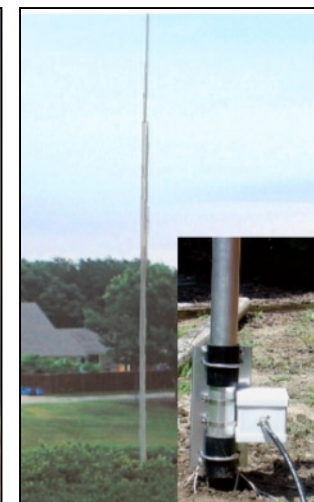
43 Ft Vertical Ground Mounted - Look 1 of 2

- 43 ft vertical exceeds 35 ft limitation - shown for reference / information
- Would be susceptible to probable interaction with ground level obstructions
- For 20-10M there are other antennas that will perform better that meet height restriction of 35 ft
- There are antennas at 25 ft that will be significantly better

DX Eng 80VA-3

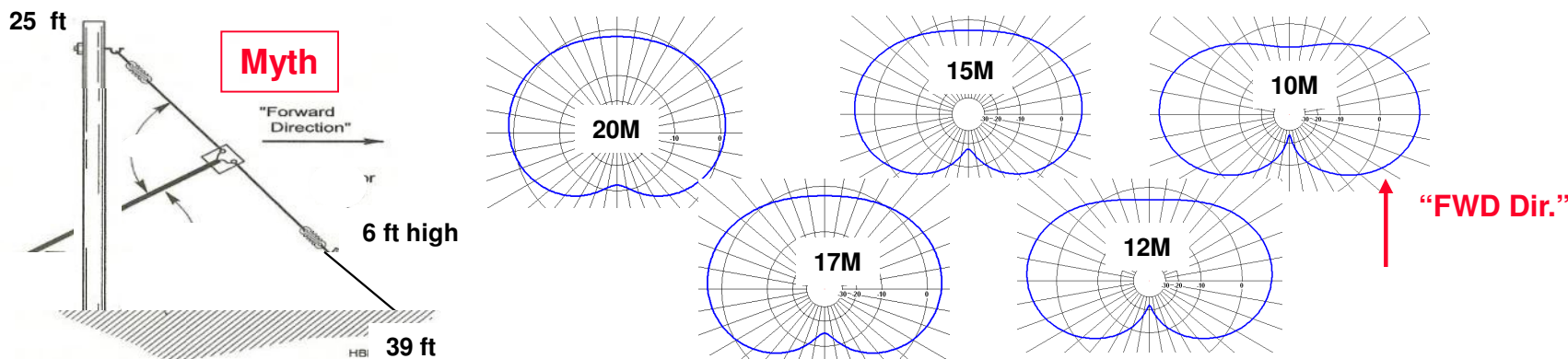


MFJ -2990 /
Hy-Gain 6160



Band	80	40	30	20	17	15	12	10
Gain (dBi)	-1.3	-0.8	0.0	0.7	-1.4	-0.5	0.6	-6.4

20M 1/2 Wave Sloping Dipole as a Multiband Antenna



Band (M)	Peak (dBi)	Minimum (dBi)	Null (dBi)
20	1.0	-1.2	-12.0
17	2.3	-1.6	-14.0
15	3.3	-2.0	-17.0
12	5.0	-2.4	-23.0
10	6.3	-5.0	-25.0

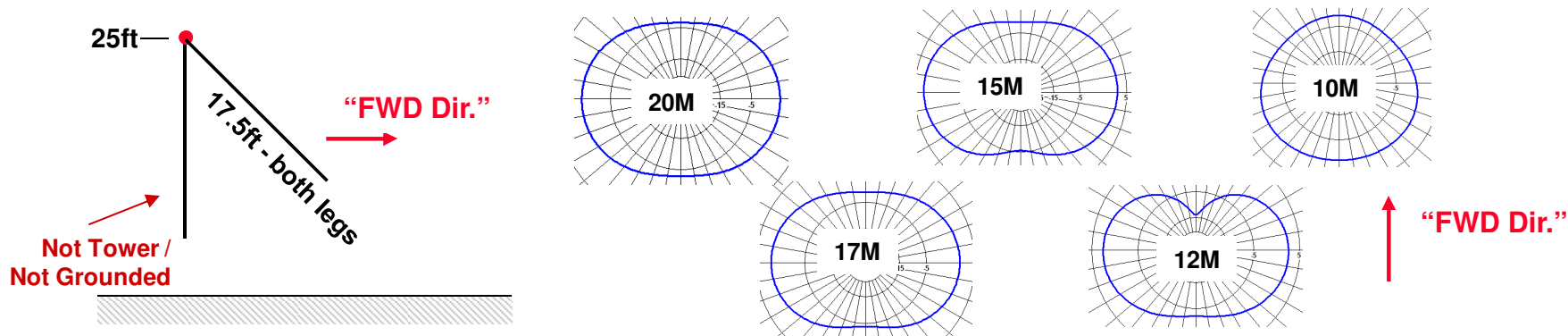
- Peak of pattern is near broadside to wire
- “Null” is to rear of wire slant
- “Minimum is toward sloping front of wire i.e. “ Forward” (...Myth thing again...)

- Consider pointing “Broadside” to a favored direction / option to move lower end manually to move the peak of beam (or move null)
- Or have two of these pointed in different directions
- A viable “set-up” from omni antennas - with minimal impact to implement

Verticals From Prior Slide

Configuration	20M Gain at 20 deg Elev. (dBi)	20-10M gain Range (dBi)	Comments
Top Fed “T”	0.4	0.4 to 0.9	patterns near circular
F12 Sigma	0.0	0.0 to 0.9	patterns near circular
Elevated GP	-0.2	-0.2 to 0.9	patterns near circular

20M 1/4 Sloper as a Multiband Antenna (No Grounded Leg)



Band (M)	Peak (dBi)	Minimum (dBi)	Null (dBi)
20	0.9	-3.5	-3.9
17	2.5	-2.4	-4.0
15	3.5	-2.1	-5.4
12	3.1	-2.9	-14.0
10	1.1	0.3	-2.1

- Peak of pattern is generally near broadside to wires
- Null and minimum move around a bit
- Vertical wire is neither a tower nor grounded at lower end.

- Consider pointing to a favored direction / option to move lower end manually to move the peak of beam (or move null)
- Or have two of these pointed in different directions
- A viable "set-up" from omni antennas - with minimal impact to implement

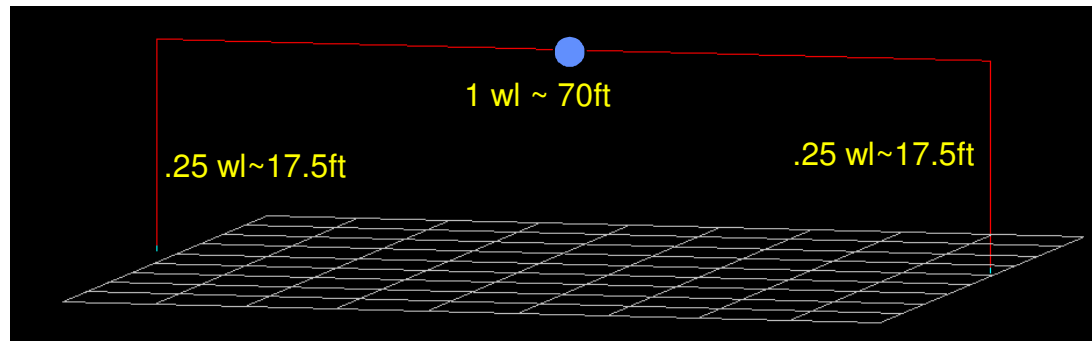
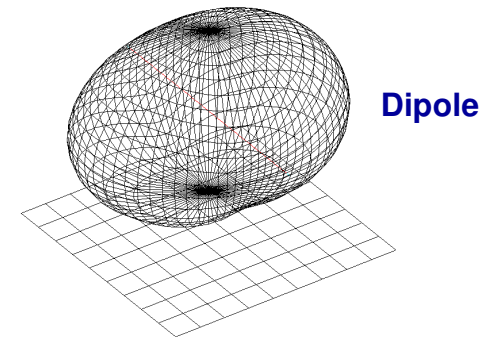
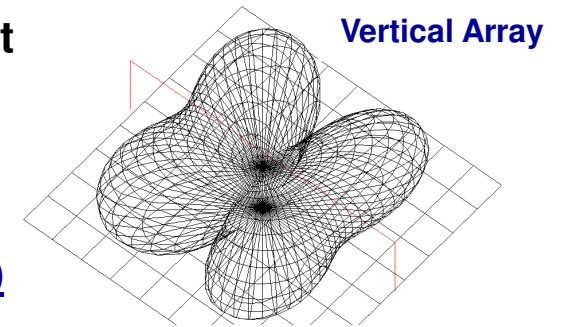
Verticals From Prior Slide

Configuration	20M Gain at 20 deg Elev. (dBi)	20-10M gain Range (dBi)	Comments
Top Fed "T"	0.4	0.4 to 0.9	patterns near circular
F12 Sigma	0.0	0.0 to 0.9	patterns near circular
Elevated GP	-0.2	-0.2 to 0.9	patterns near circular

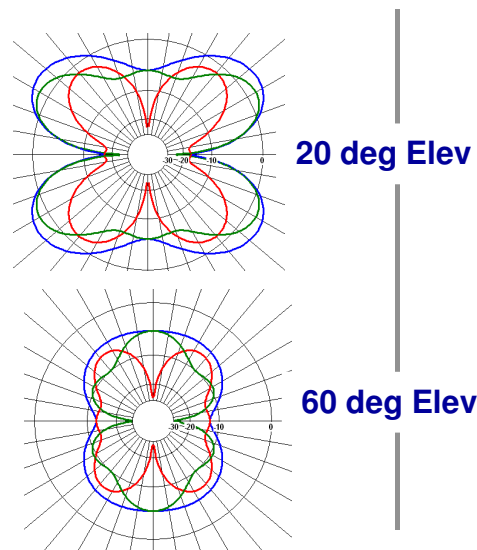
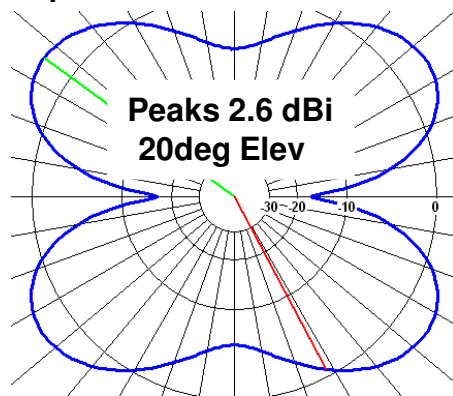
Higher Performance 20M Verticals

20M Top Fed, Phased Verticals - Attractive “Low Profile” Option

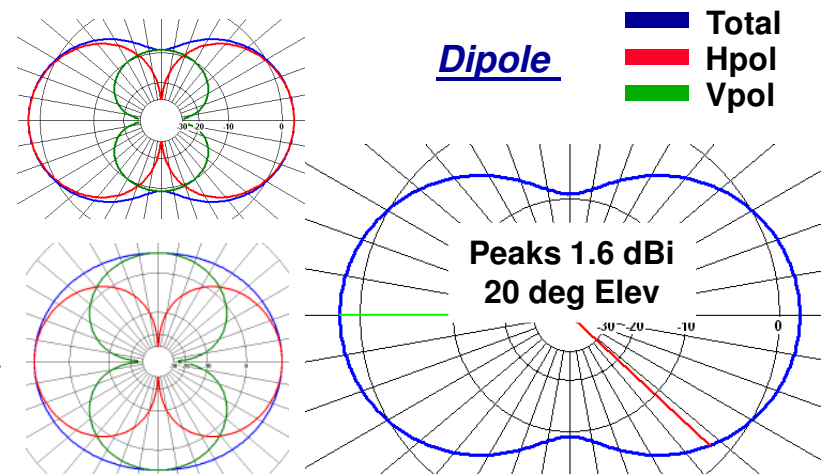
- No ground radials - fed in middle - requires minimal height ~ 18ft
- Comparison to a 20M dipole at 18 ft (both at 20 deg Elev)
- Vertical array has less gain than dipole at high angles - will be quieter than dipole
- Vert has 4 lobes at 2.6 dBi / Dipole has 2 at 1.6 dBi (20 deg elev.)



█ Total
█ Hpol
█ Vpol
Vertical Array



█ Total
█ Hpol
█ Vpol
Dipole



Garden Beam - QST April 2013

- Rotatable vertical Yagi for 20M
- Give 4.5 dBi at 20 deg elevation
- Base at 6 ft - 24 ft overall height
- See QST - April, 2013 (KL7AJ)
- Need to compare to an inverted vee, dipole and W8JKJ array.

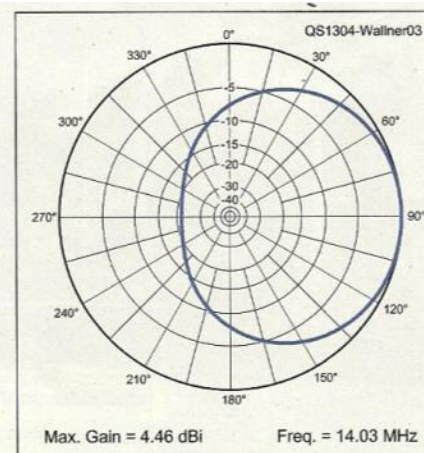


Figure 2 — EZNEC azimuth pattern of the Garden Beam in the peak of its elevation pattern.

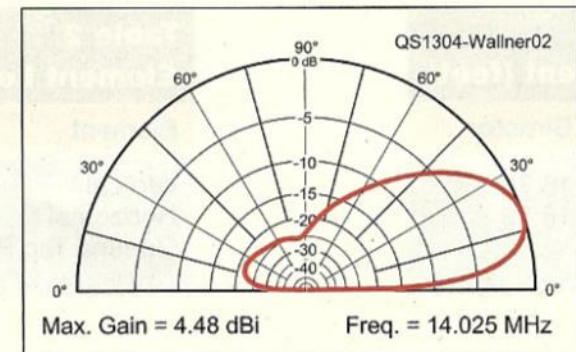
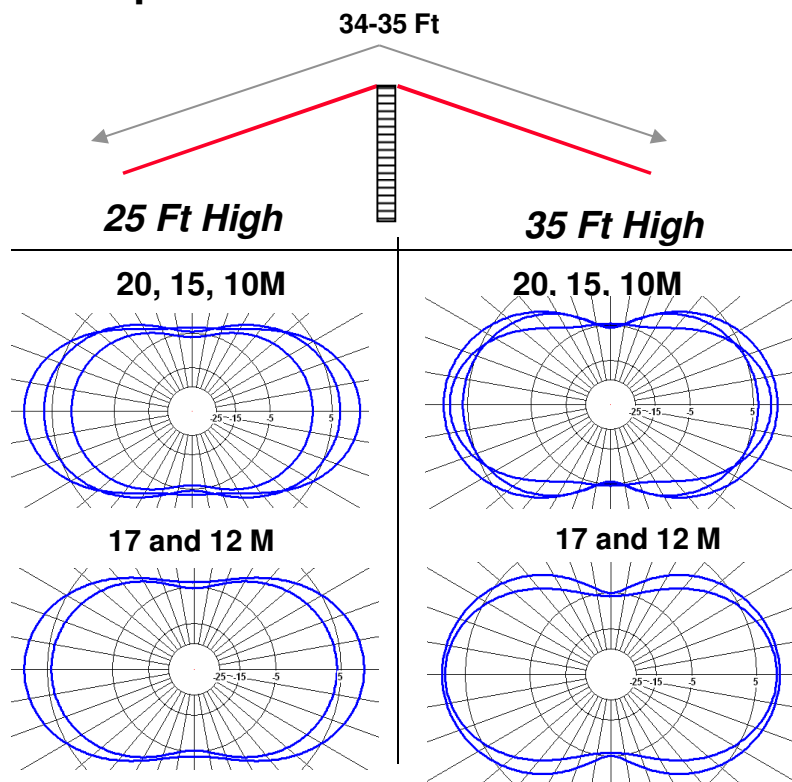


Figure 1 — EZNEC elevation pattern of the Garden Beam in the peak of its azimuth pattern. Note that the gain at the lower DX favored elevation angles is not greatly diminished.

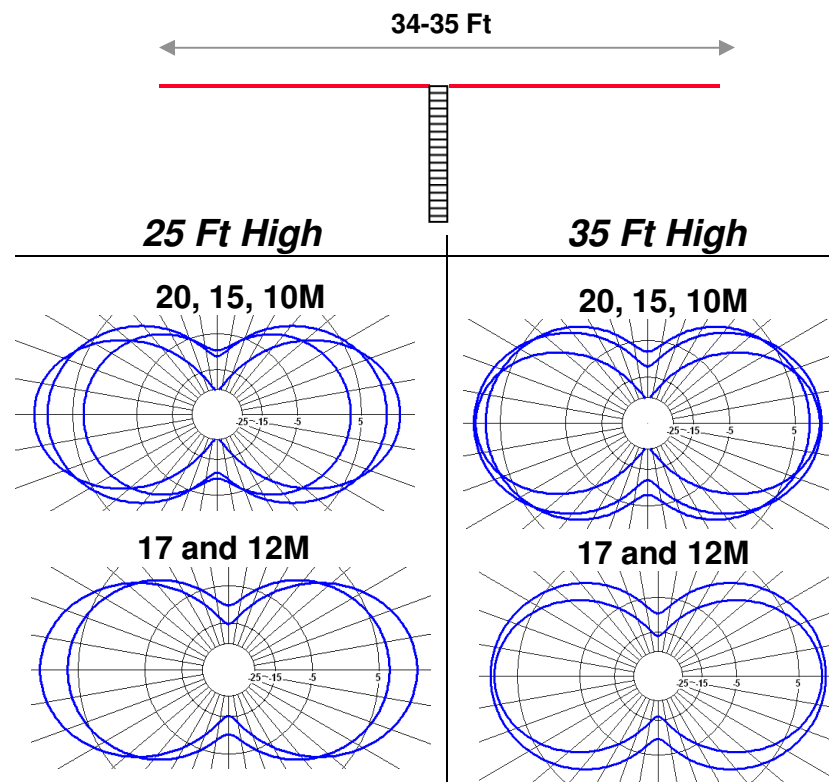
20-10M Multiband Horizontal (kinda) Antennas

20M 1/2 wl Inverted Vee and Dipole at 25 and 35 Ft - Used Multiband

- 20-10M multiband inverted vee at 25 and 35 feet with 120 deg included angle
- Dipole could be rotated with a TV rotator / hand
- All plots at 20 deg elevation



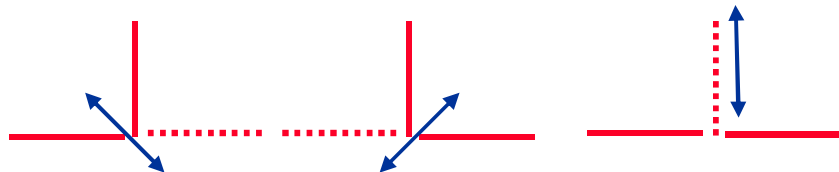
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	2.5	5.6
17	4.5	7.3
15	6.0	7.0
12	7.5	7.6
10	8.1	7.7



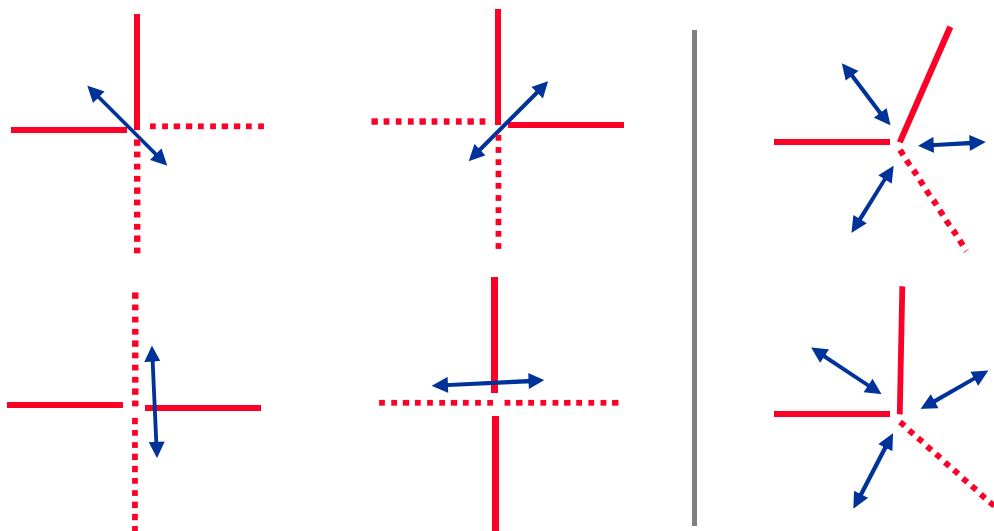
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	3.7	6.6
17	6.2	7.6
15	7.8	7.7
12	8.9	8.0
10	9.0	7.8

20M 1/2 wl, Bent, Horizontal Dipole at 25 and 35 Ft - Used Multiband

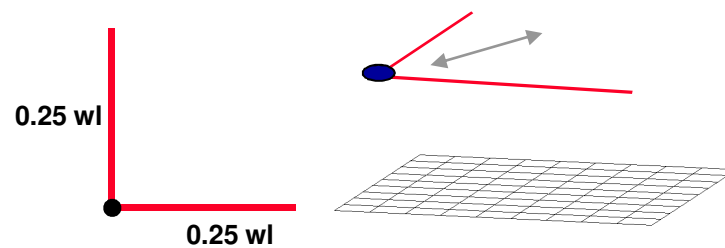
- 20-10M multiband, bent dipole - bent 90 degrees
- Might be a good choice to put in an attic space
- Maybe be able to switch between two legs



- Or Switch between four legs (or three)



- Could be done as inverted vees with single center support

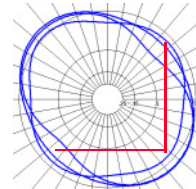
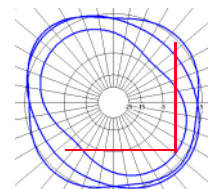


25 Ft High

35 Ft High

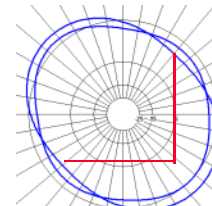
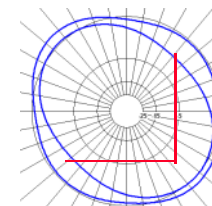
20, 15, 10M

20, 15, 10M



17 and 12 M

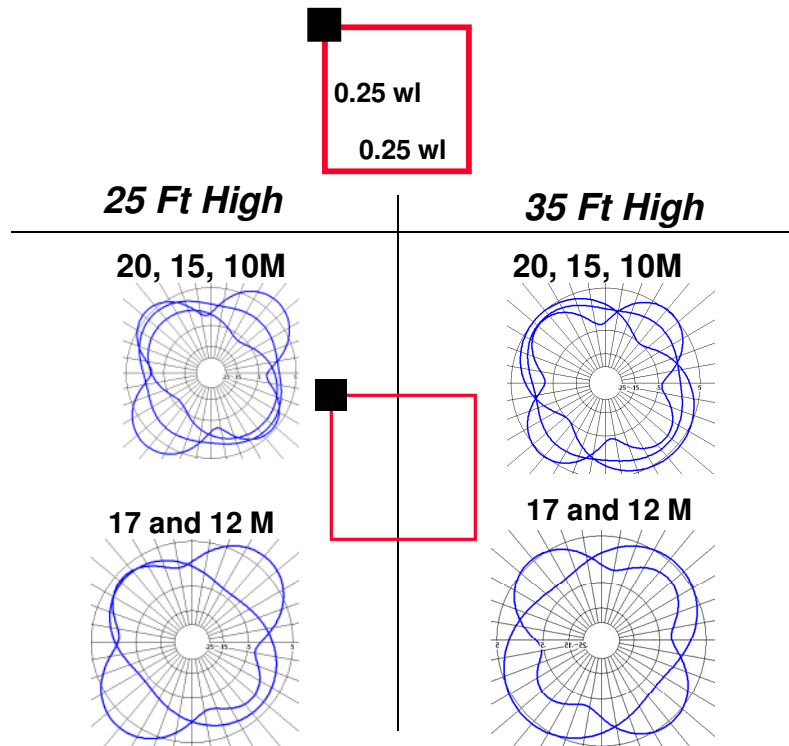
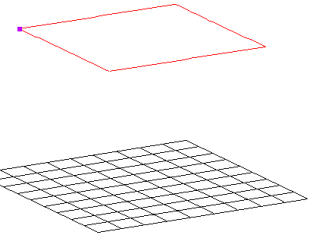
17 and 12 M



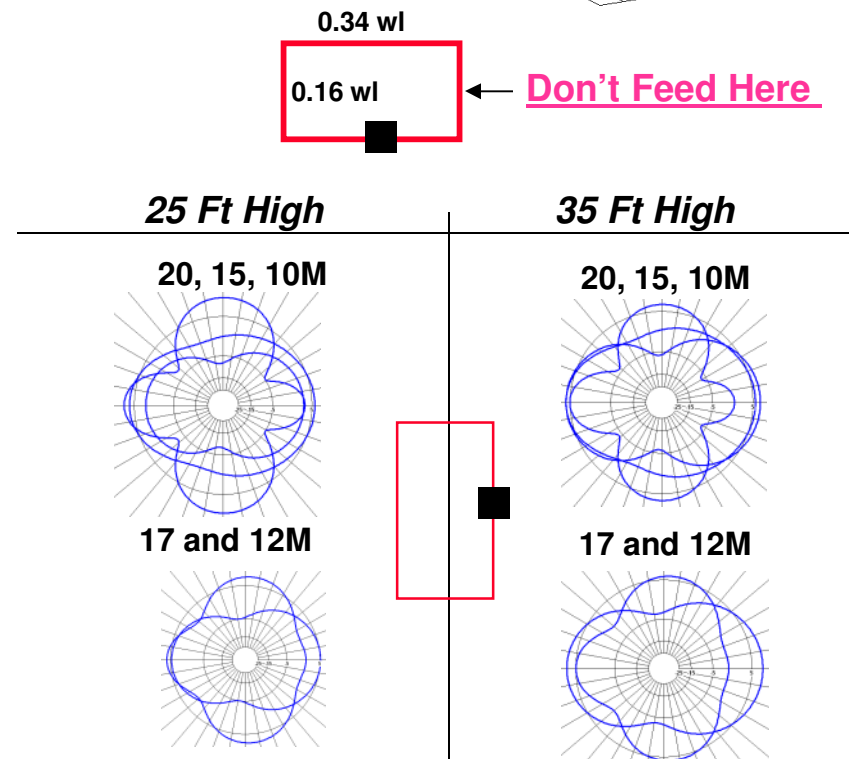
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	3.4	5.3
17	5.3	5.9
15	6.4	6.2
12	6.9	7.1
10	6.9	6.6

20M Horizontal Loops (Parallel to Ground)

- Look at square, horizontal loop - 1/4 wl on a side / corner fed
- Will compare to a horizontal loop with a 2:1 aspect ratio (maybe easier to put up in an attic space than a square loop)



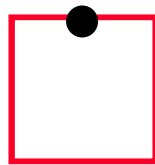
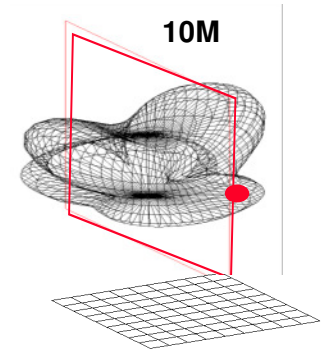
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	2.3	5.5
17	3.7	5.5
15	3.7	3.4
12	6.9	5.4
10	7.3	5.2



Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	3.4	5.4
17	5.1	7.0
15	5.5	6.3
12	6.9	5.7
10	8.3	6.3

20 M Loops (Perpendicular to Ground)

- Look at feeding on vertical and horizontal side of loop
- Delta loops not as good as square loops - lower leg may touch ground
- Square Loop much better if at 35 ft and fed on horizontal leg

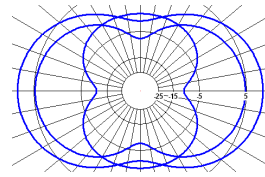
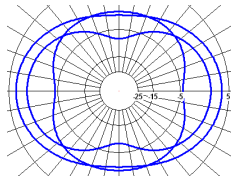


25 Ft High

35 Ft High

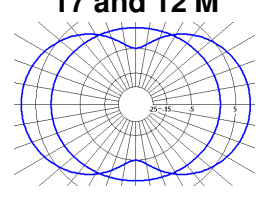
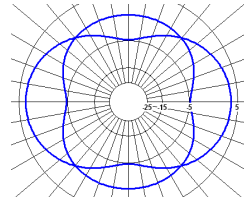
20, 15, 10M

20, 15, 10M



17 and 12M

17 and 12 M



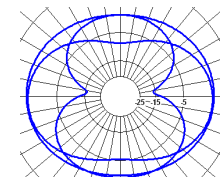
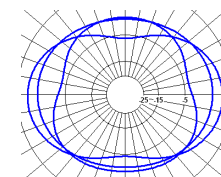
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	1.9	4.9
17	3.9	7.3
15	3.8	7.5
12	1.0	2.1
10	-0.6	-0.5

25 Ft High

35 Ft High

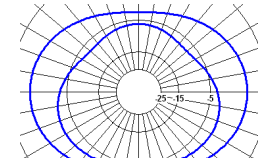
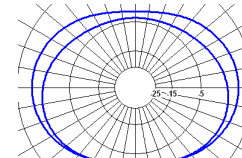
20, 15, 10M

20, 15, 10M



17 and 12M

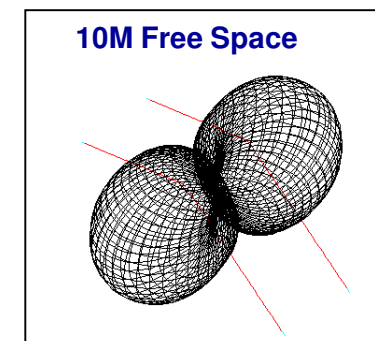
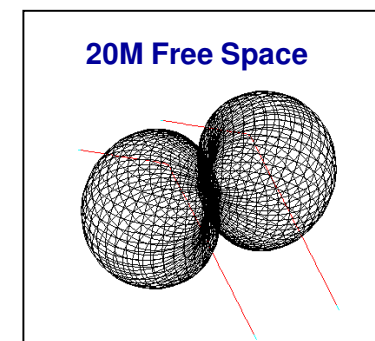
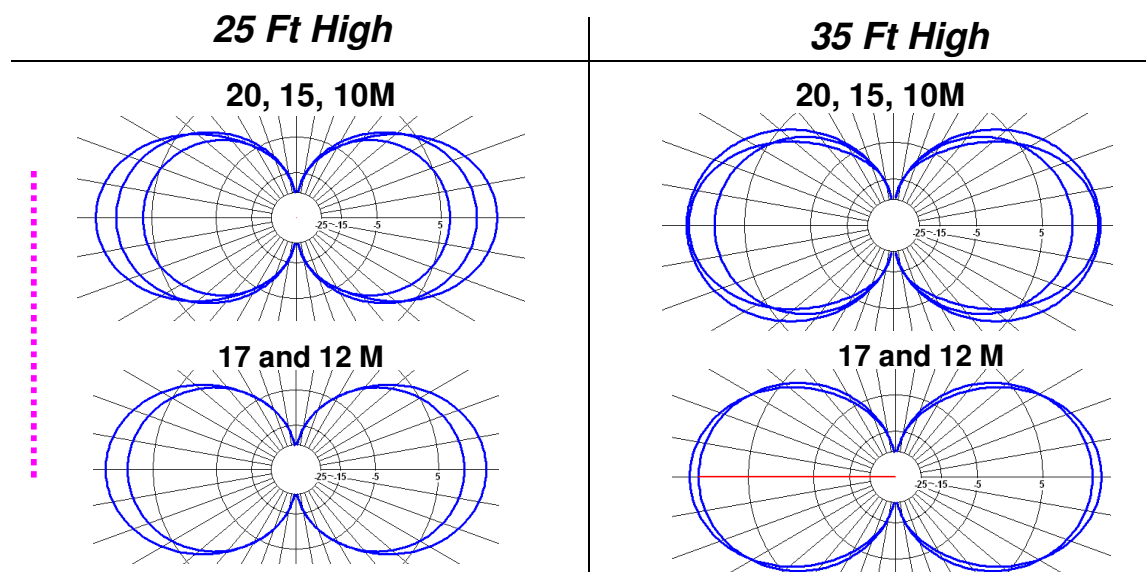
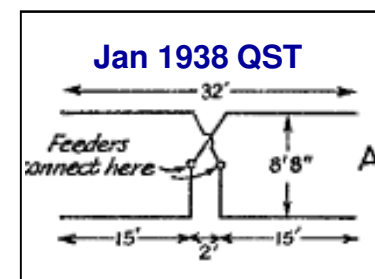
17 and 12M



Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	1.5	1.7
17	2.6	2.1
15	3.3	1.5
12	1.2	-2.4
10	-0.4	-1.0

20-10M W8JK Antenna of Inverted Vee Form at 25 and 35 Feet

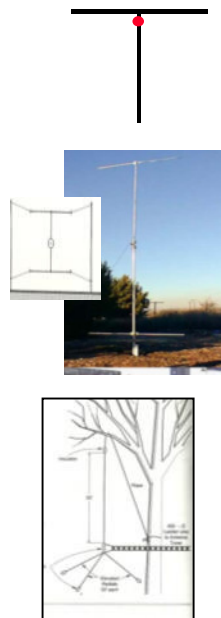
- 20-10M multiband inverted vee form at 25 and 35 feet with 120 deg included angle
- 35 ft elements - 8 foot separation
- All plots at 20 deg elevation - patterns well behaved 20 to 10M
- FYI - gains slightly higher if elements are fully horizontal



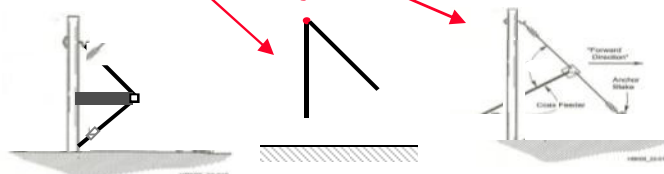
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	6.1	8.2
17	7.8	10
15	8.8	10.5
12	9.9	10.8
10	10.6	10.7

20-10M Comparison (1 of 2)

Vpol Antennas



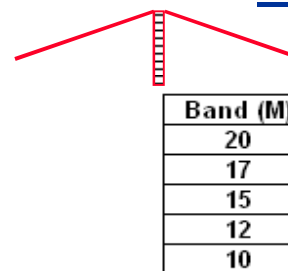
Configuration	20M Gain at 20 deg Elev. (dBi)	20-10M gain Range (dBi)
Top Fed "T"	0.4	0.4 to 0.9
F12 Sigma / Moxon	0.0	0.0 to 0.9
Elevated GP	-0.2	-0.2 to 0.9
N6BT Bravo	-0.4	-0.4 to 0.9
1/2 Wave Bent Vertical	-0.5 to 0.2	
1/2 Wave sloper	-1.2 to 1.0	
1/4 Wave Sloper	-3.5 to 0.9	



See next Slide

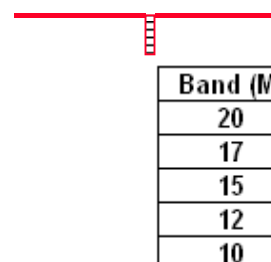
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	1.5	1.7
17	2.6	2.1
15	3.3	1.5
12	1.2	-2.4
10	-0.4	-1.0

Hpol Antennas



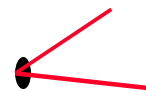
Inverted Vee

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	2.5	5.6
17	4.5	7.3
15	6.0	7.0
12	7.5	7.6
10	8.1	7.7



Dipole

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	3.7	6.6
17	6.2	7.6
15	7.8	7.7
12	8.9	8.0
10	9.0	7.8



Horizontal 90 deg Bent Dipole

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	3.4	5.3
17	5.3	5.9
15	6.4	6.2
12	6.9	7.1
10	6.9	6.6



Hpol Vertical Square Loop

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	1.9	4.9
17	3.9	7.3
15	3.8	7.5
12	1.0	2.1
10	-0.6	-0.5



Horizontal Rectangular Loop

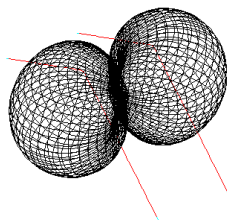
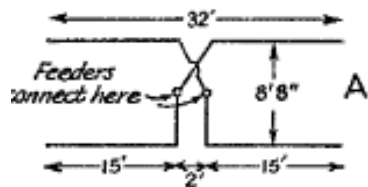
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	3.4	5.4
17	5.1	7.0
15	5.5	6.3
12	6.9	5.7
10	8.3	6.3



Horizontal Square Loop

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	2.3	5.5
17	3.7	5.5
15	3.7	3.4
12	6.9	5.4
10	7.3	5.2

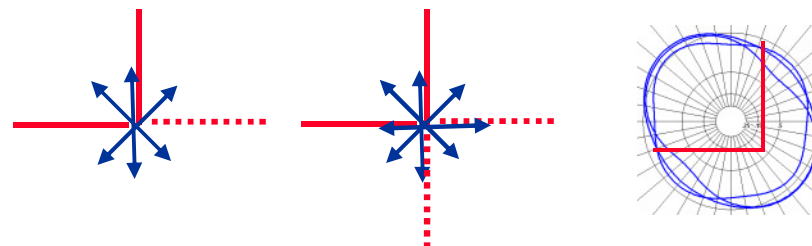
20-10M Comparison 2 of 2 - Variants and Higher Gain Options



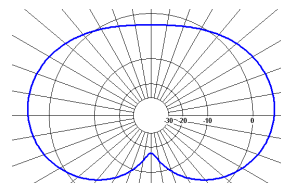
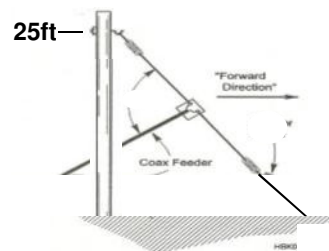
W8JK - Inverted Vee Form

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	6.1	8.2
17	7.8	10
15	8.8	10.5
12	9.9	10.8
10	10.6	10.7

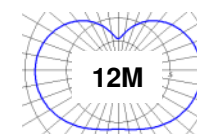
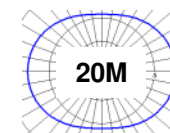
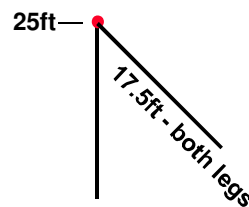
Or build as parallel wires in attic



Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
20	3.4	5.3
17	5.3	5.9
15	6.4	6.2
12	6.9	7.1
10	6.9	6.6



Band (M)	Peak (dBi)	Minimum (dBi)	Null (dBi)
20	1.0	-1.2	-12.0
17	2.3	-1.6	-14.0
15	3.3	-2.0	-17.0
12	5.0	-2.4	-23.0
10	6.3	-5.0	-25.0



Quarter Wave Sloper

Band (M)	Peak (dBi)	Minimum (dBi)	Null (dBi)
20	0.9	-3.5	-3.9
17	2.5	-2.4	-4.0
15	3.5	-2.1	-5.4
12	3.1	-2.9	-14.0
10	1.1	0.3	-2.1

40-10M Antennas

- Vpol**
- Hpol**
- Comparison**

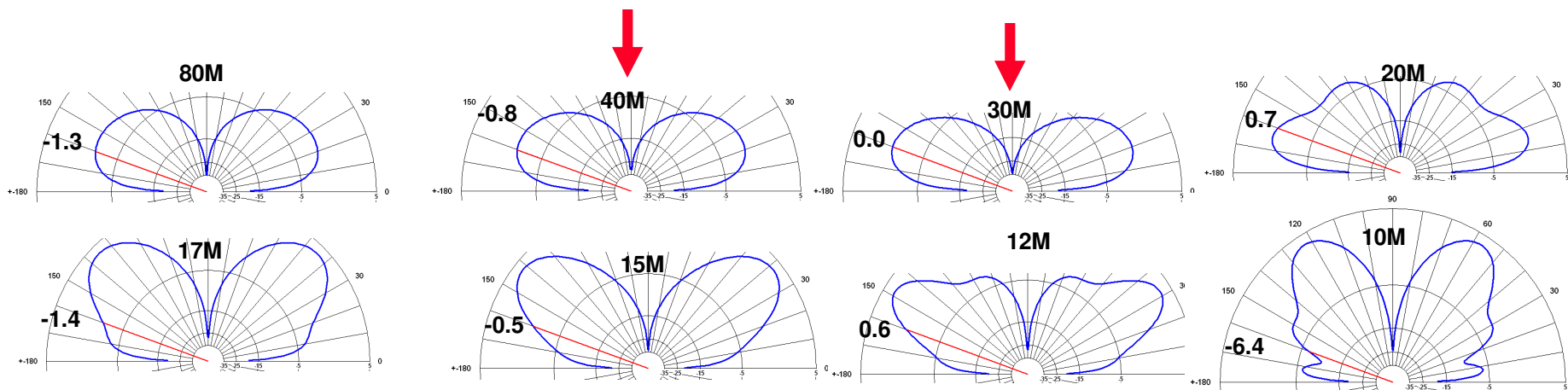
43 Ft Vertical Ground Mounted - Look 2 of 2

- 43 ft vertical exceeds 35 ft limitation - shown for reference / information
- Would be susceptible to probable interaction with ground level obstructions

DX Eng 80VA-3



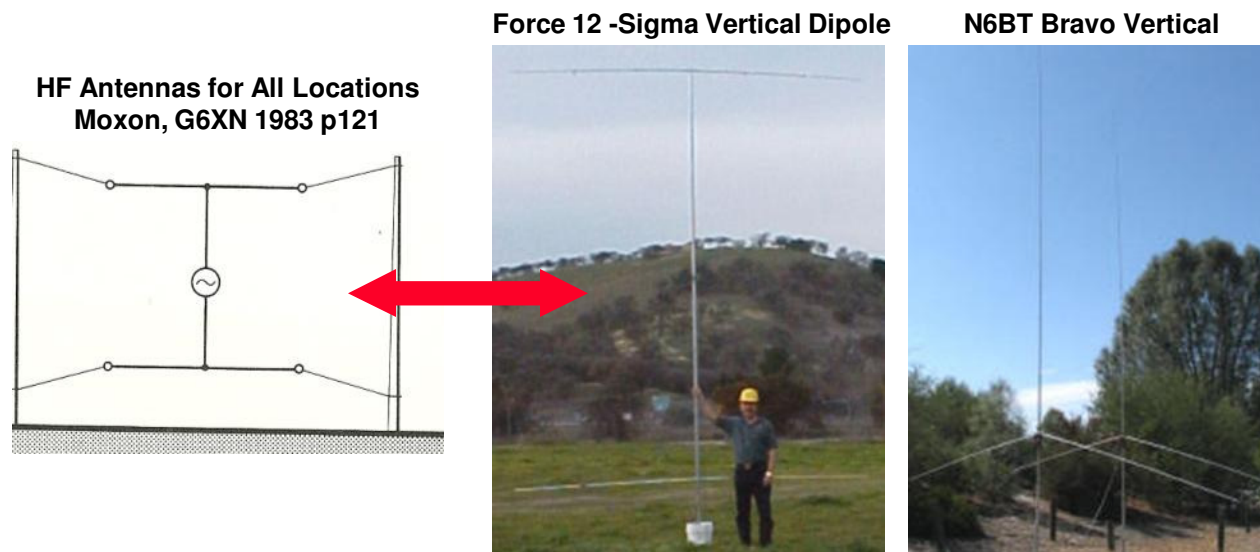
MFJ -2990 / Hy-Gain 6160



Band	80	40	30	20	17	15	12	10
Gain (dBi)	-1.3	-0.8	0.0	0.7	-1.4	-0.5	0.6	-6.4

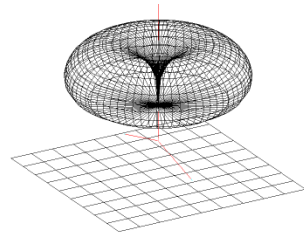
40M Verticals

- **Concerns about ground mounted verticals:**
 - Due to interactions from low obstacles (e.g. fences, shrubs) with high current portion of lower part of vertical element
 - Also extensive ground radial system needed to achieve good efficiency (≥ 16 buried, symmetric radials)
- **Evaluate two versions with bases set at 6 feet**
 - essentially self supporting or guyed with monofilament line
 - assume coils and matching is lossless / use ave ground

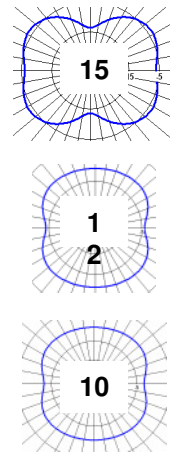
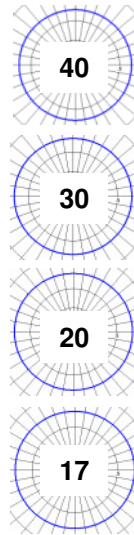


40M Verticals Over Average Ground

N6BT Bravo 40M Vertical

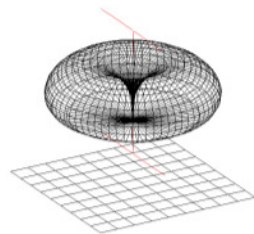


27 ft + 6ft = 33 ft

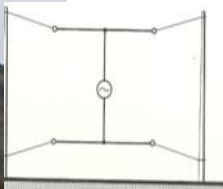


Band (M)	Gain (dBi)
40	-1.2
30	-0.5
20	0.2
17	0.4
15	-4.1
12	-0.9
10	-0.2

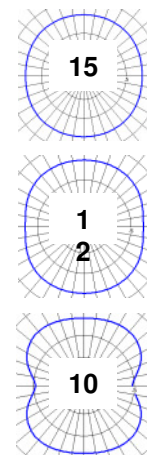
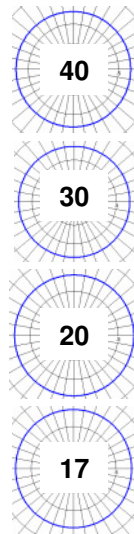
Force 12 -40M Sigma Vertical Dipole



24 ft + 6ft = 30 ft

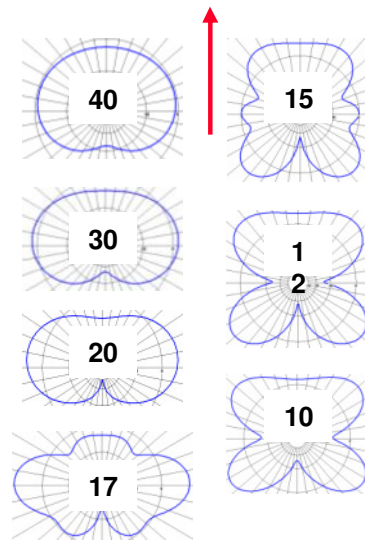
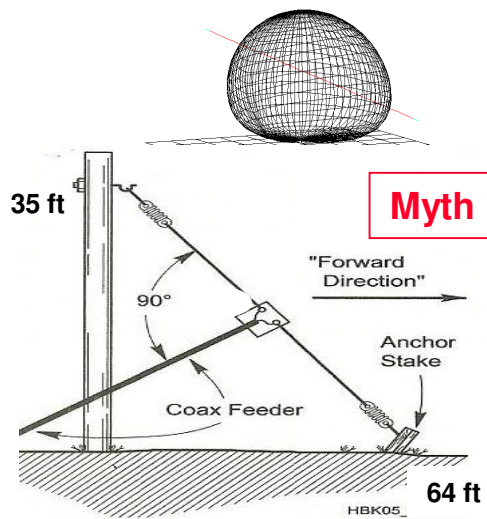


HF Antennas for All Locations Moxon, G6XN 1983 p121

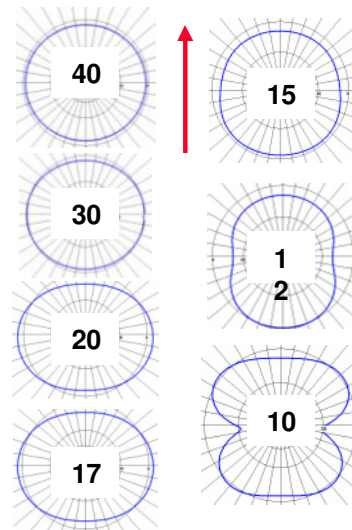
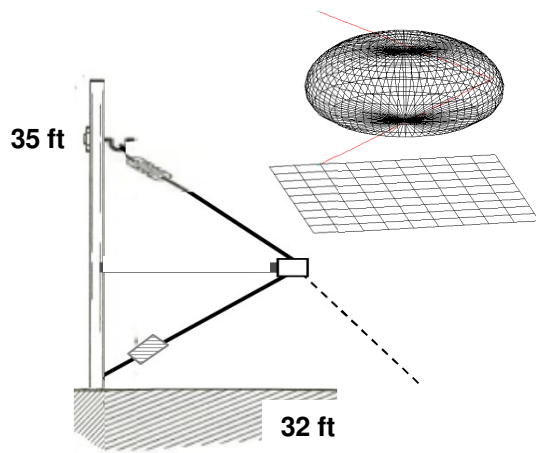


Band (M)	Gain (dBi)
40	-0.9
30	-0.2
20	0.2
17	0.8
15	1.2
12	1.0
10	0.0

40M Sloping and Bent Dipoles on 40-10M



Band (M)	Peak (dBi)	Minimum (dBi)	Null (dBi)
40	-0.4	-2.0	-12.3
30	1.3	-3.5	-16.3
20	4.0	-5.6	-25.0
17	6.6	-3.0	-25.0
15	4.8	3.3	-4.6
12	6.0	2.9	-16.0
10	6.9	1.6	-15.0

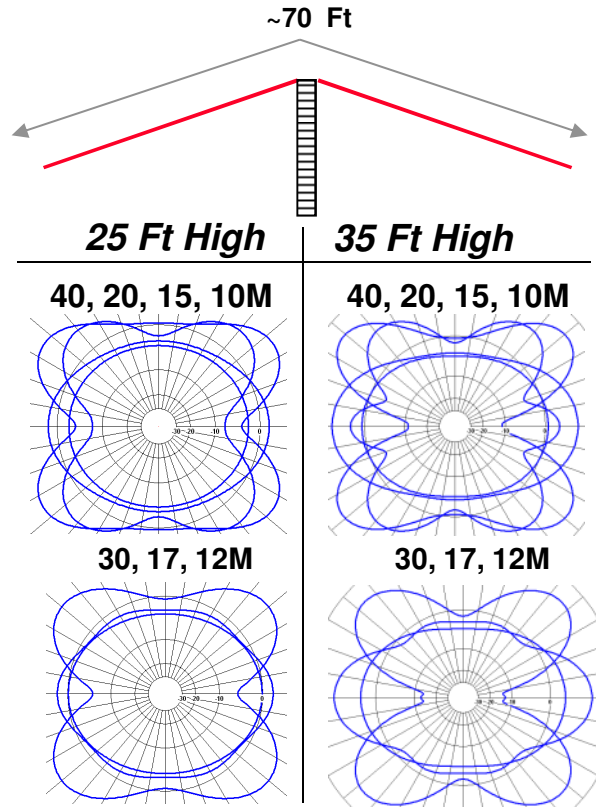


Band (M)	Peak (dBi)	Minimum (dBi)
40	-0.7	-1.4
30	0.2	-1.5
20	1.6	-3.4
17	1.2	-3.0
15	-0.7	-2.4
12	0.3	-6.0
10	0.5	-11.0

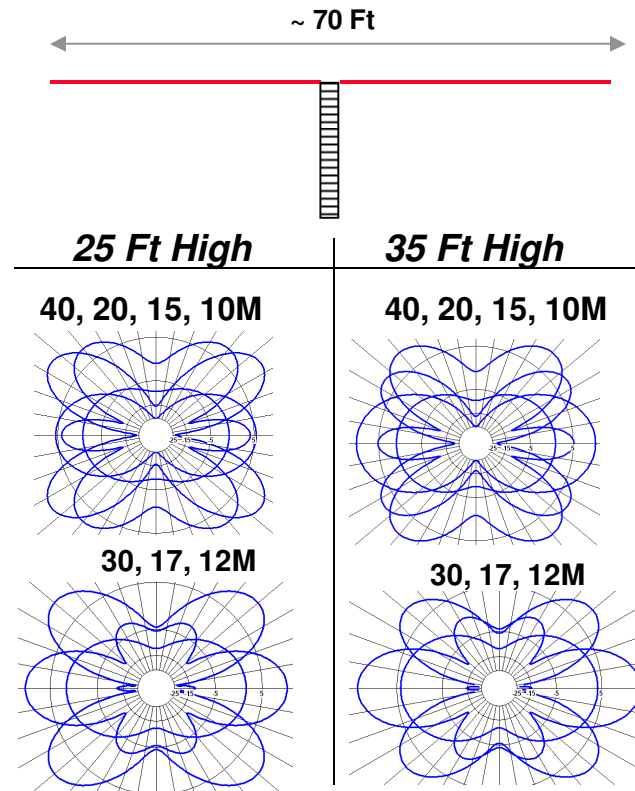
40-10M Multiband Horizontal (kinda) Antennas

40M Invert. Vee and Dipole at 25 and 35 Ft - Used Multiband

- 40-10M multiband inverted vee at 25 and 35 feet with 120 deg included angle
- All plots at 20 deg elevation



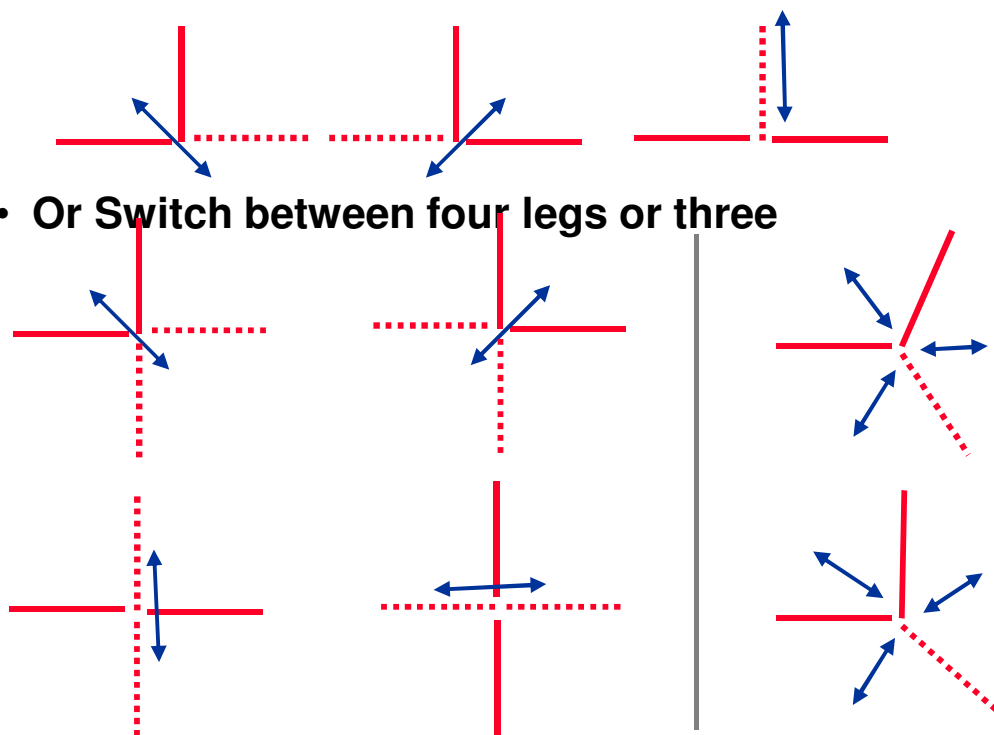
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	-2.0	0.5
30	0.0	2.7
20	1.5	5.3
17	1.8	6.7
15	5.6	7.9
12	5.6	7.7
10	3.6	5.4



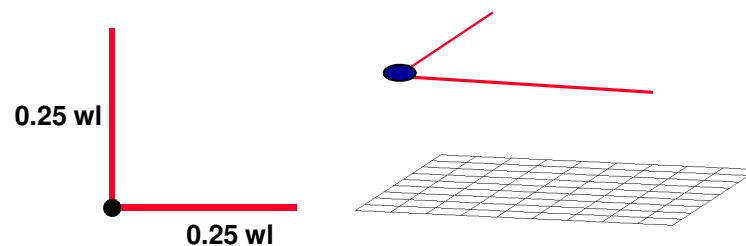
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	0.0	1.6
30	2.2	4.3
20	5.4	8.5
17	8.6	10.6
15	9.5	7.3
12	8.9	8.0
10	7.5	8.5

40M 1/2 wl Bent Dipole at 25 and 35 Ft - Used Multiband

- 40-10M multiband, bent dipole - bent 90 degrees
- Might be a potential choice to put in an attic space
- Maybe be able to switch between two legs



- Could be done as inverted vees with single center support

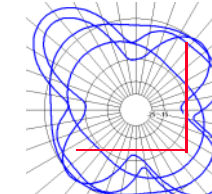
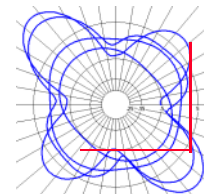


25 Ft High

35 Ft High

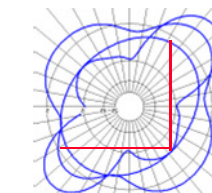
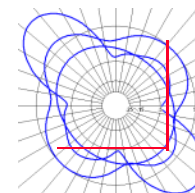
40, 20, 15, 10M

40, 20, 15, 10M



30, 17, 12M

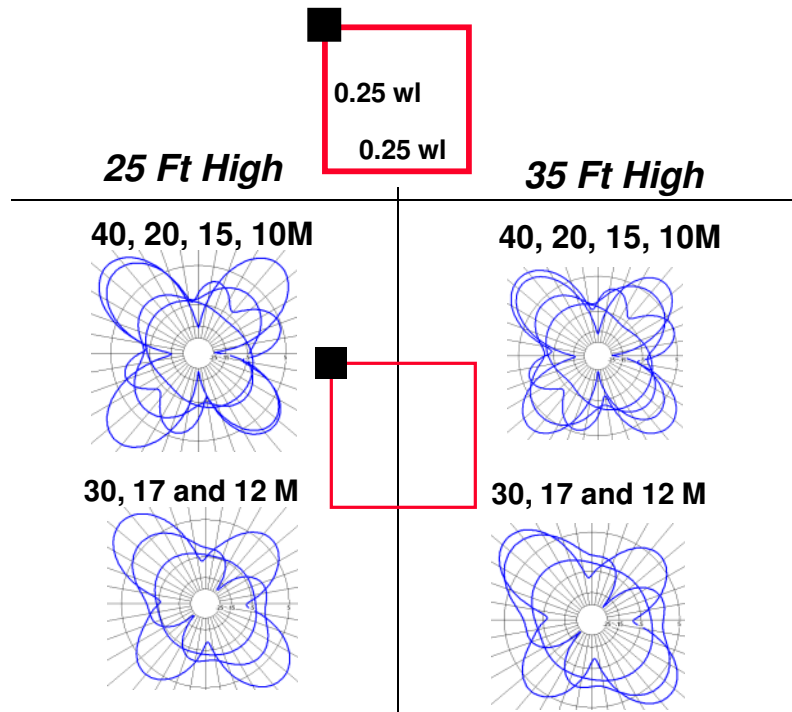
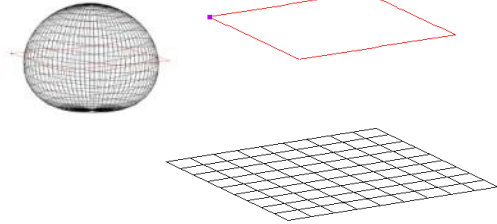
30, 17, 12M



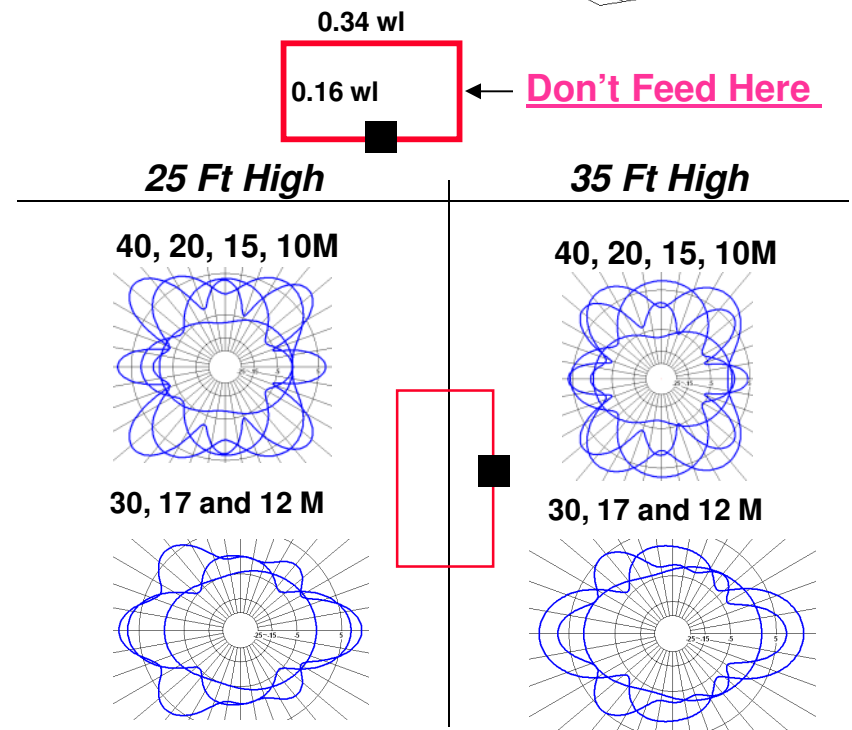
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	0.0	1.7
30	1.6	3.7
20	3.6	6.3
17	6.7	8.6
15	10.2	11.0
12	11.9	11.0
10	11.6	9.7

40M Horizontal Loops (Parallel to Ground)

- Look at square, horizontal loop - 1/4 wl on a side / corner fed
- Will compare to a horizontal loop with a 2:1 aspect ratio (maybe easier to put up in an attic space than a square loop)



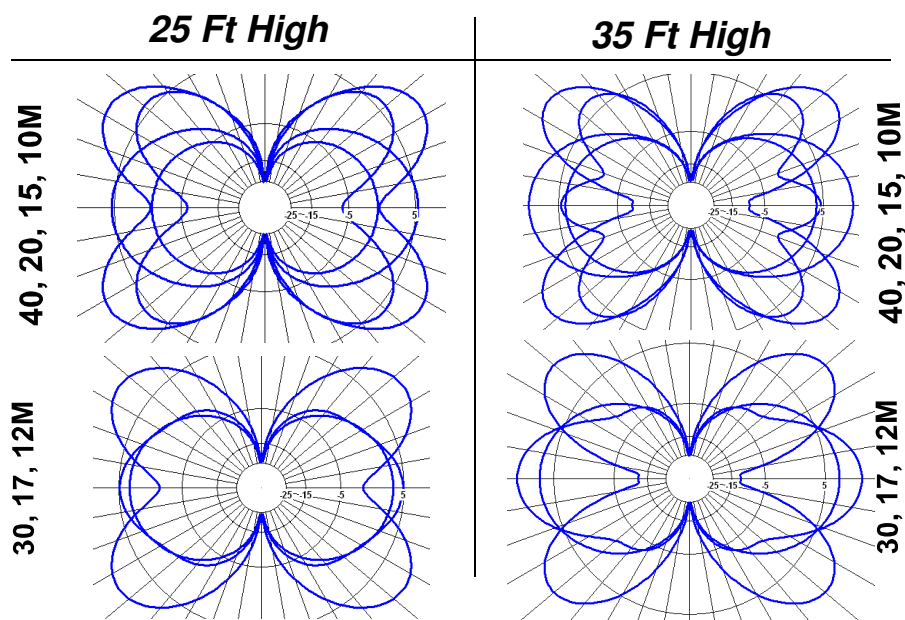
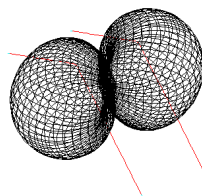
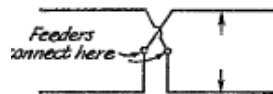
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	-2.2	-0.6
30	-1.8	0.6
20	2.8	5.7
17	5.9	8.4
15	9.8	10.6
12	10.7	10.0
10	11.3	9.6



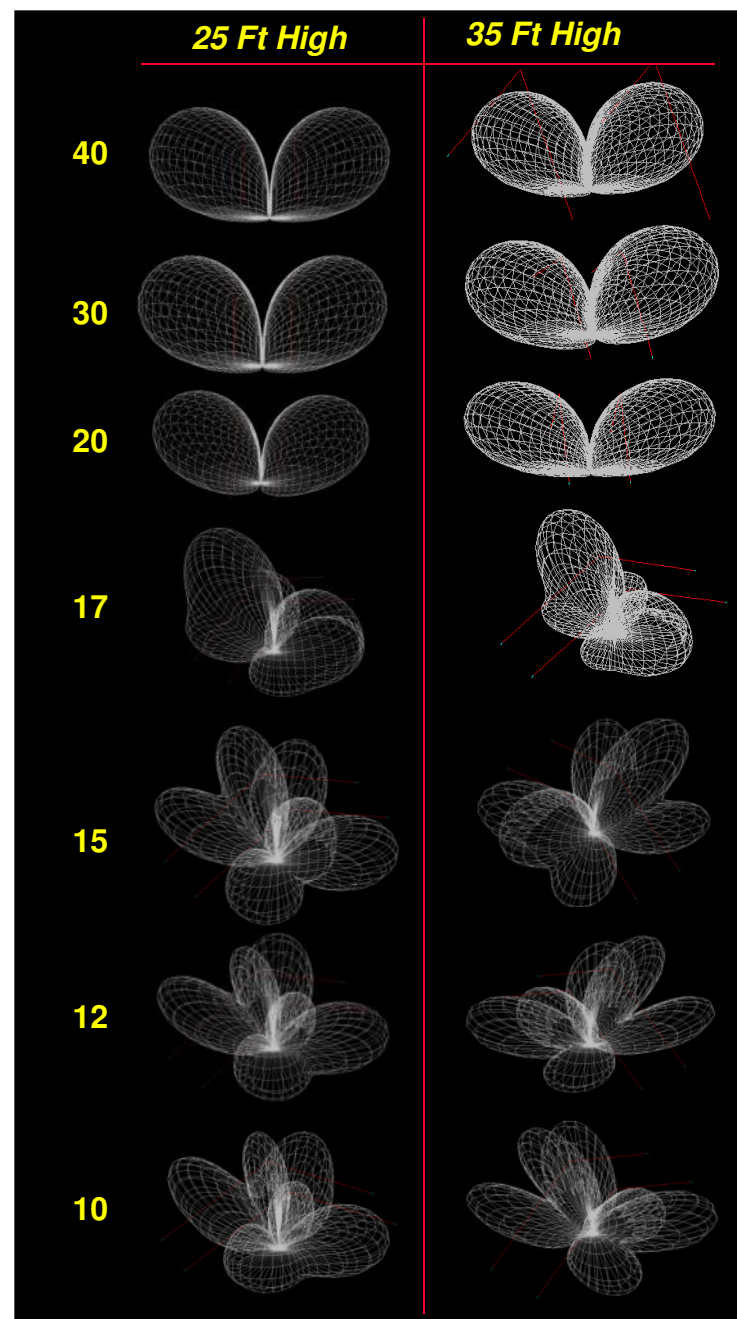
Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	-0.6	1.0
30	0.0	2.4
20	4.0	6.7
17	6.9	9.3
15	6.9	8.2
12	8.1	6.7
10	9.7	7.8

40-10M W8JK Antenna of Inverted Vee Form at 25 and 35 Feet

- 40-10M multiband invert vee form at 25 and 35 feet with 120 deg incl. angle
- 70 ft elements - 16 foot separation
- All plots at 20 deg elevation

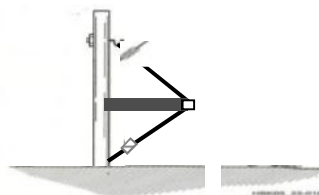
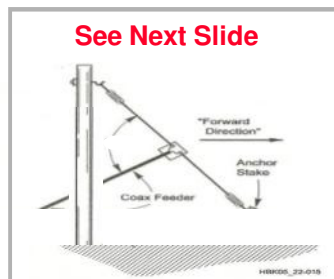


Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	0.1	4.1
30	3.6	6.7
20	5.3	8.5
17	4.9	9.1
15	8.5	9.9
12	8.5	9.5
10	5.8	6.8



40-10M Comparison 1 of 2

Vpol Antennas



Hpol Antennas



Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	-2.0	0.5
30	0.0	2.7
20	1.5	5.3
17	1.8	6.7
15	5.6	7.9
12	5.6	7.7
10	3.6	5.4



Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	0.0	1.6
30	2.2	4.3
20	5.4	8.5
17	8.6	10.6
15	9.5	7.3
12	8.9	8.0
10	7.5	8.5

Band (M)	Gain (dBi)
40	-0.9
30	-0.2
20	0.2
17	0.8
15	1.2
12	1.0
10	0.0

Band (M)	Gain (dBi)
40	-1.2
30	-0.5
20	0.2
17	0.4
15	-4.1
12	-0.9
10	-0.2

Band (M)	Peak (dBi)	Minimum (dBi)
40	-0.7	-1.4
30	0.2	-1.5
20	1.6	-3.4
17	1.2	-3.0
15	-0.7	-2.4
12	0.3	-6.0
10	0.5	-11.0

Horizontal Rectangular Loop

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	-0.6	1.0
30	0.0	2.4
20	4.0	6.7
17	6.9	9.3
15	6.9	8.2
12	8.1	6.7
10	9.7	7.8

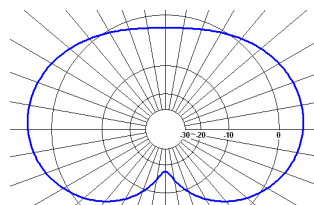
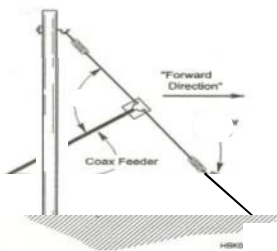
Horizontal Square Loop

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	-2.2	-0.6
30	-1.8	0.6
20	2.8	5.7
17	5.9	8.4
15	9.8	10.6
12	10.7	10.0
10	11.3	9.6

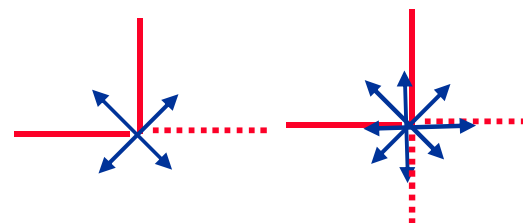
Horizontal Bent Dipole

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	0.0	1.7
30	1.6	3.7
20	3.6	6.3
17	6.7	8.6
15	10.2	11.0
12	11.9	11.0
10	11.6	9.7

40-10M Comparison 2 of 2 - Variants / Higher Gain Options

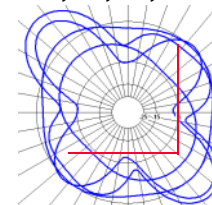


Band (M)	Peak (dBi)	Minimum (dBi)	Null (dBi)
40	-0.4	-2.0	-12.3
30	1.3	-3.5	-16.3
20	4.0	-5.6	-25.0
17	6.6	-3.0	-25.0
15	4.8	3.3	-4.6
12	6.0	2.9	-16.0
10	6.9	1.6	-15.0

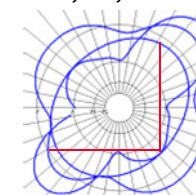


Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	0.0	1.7
30	1.6	3.7
20	3.6	6.3
17	6.7	8.6
15	10.2	11.0
12	11.9	11.0
10	11.6	9.7

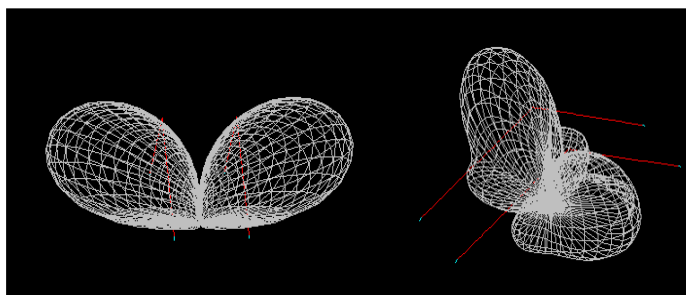
40, 20, 15, 10M



30, 17, 12M



W8JK - 70 ft Elements 16 ft Spacing



W8JK of Inverted Vee Form

Band (M)	25 Ft High (dBi)	35 Ft High (dBi)
40	0.1	4.1
30	3.6	6.7
20	5.3	8.5
17	4.9	9.1
15	8.5	9.9
12	8.5	9.5
10	5.8	6.8

End