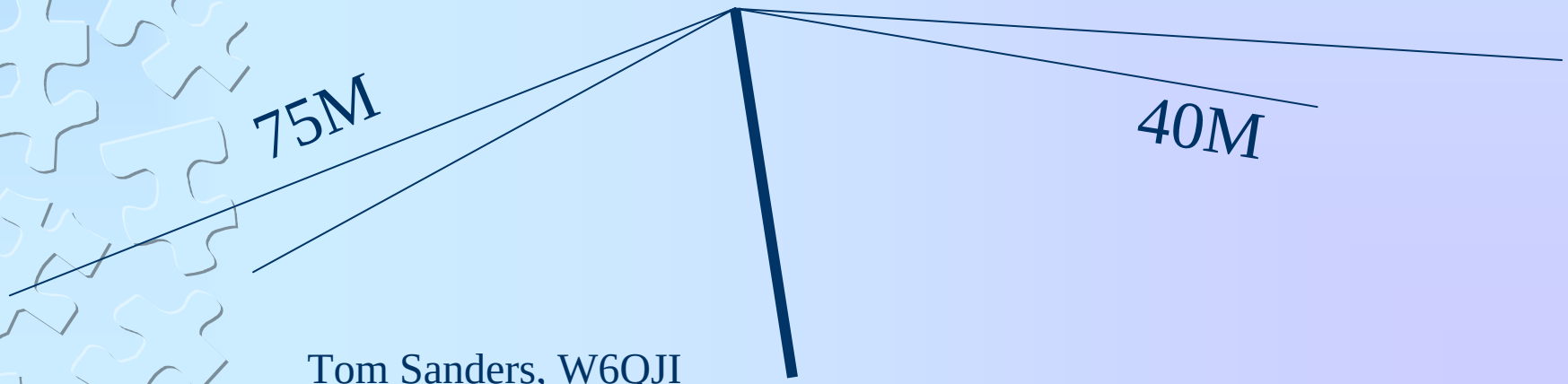
Space Challenged NVIS Antenna



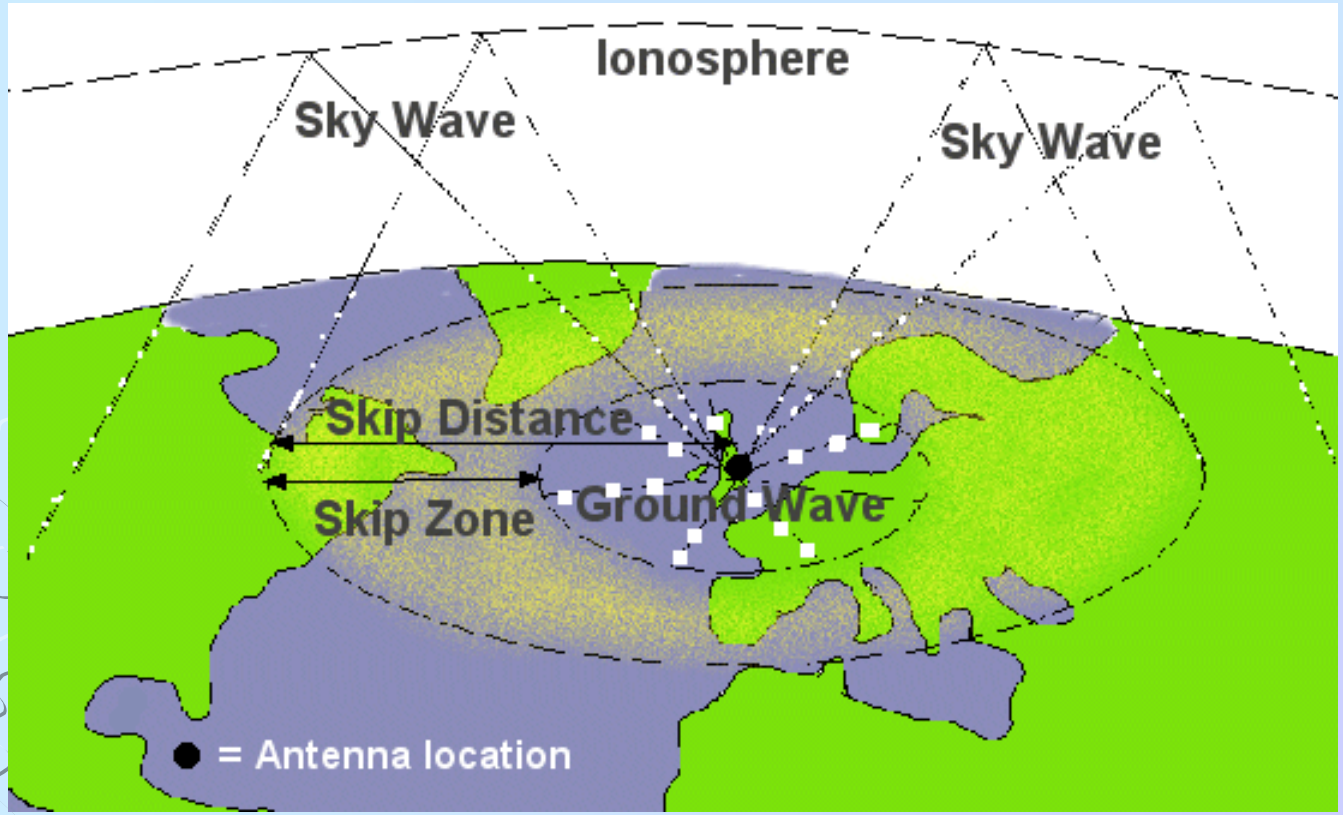
Tom Sanders, W6QJI
Ed Bruette, N7NVP

What is NVIS?

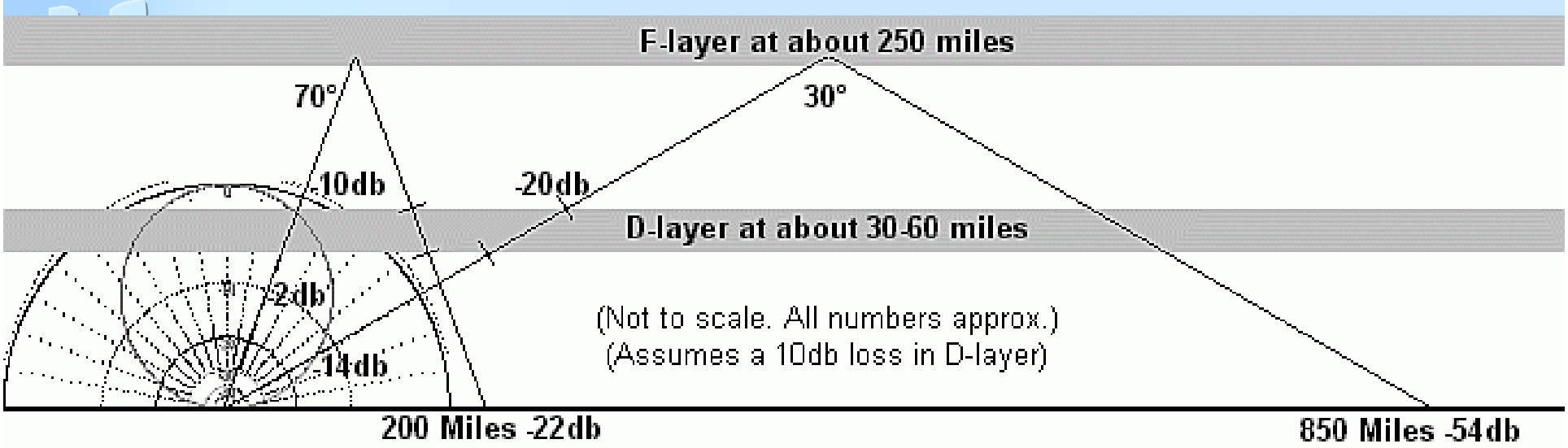
- Near
- Vertical
- Incident
- Skywave

- Cloud Warmer

Propagation Theory

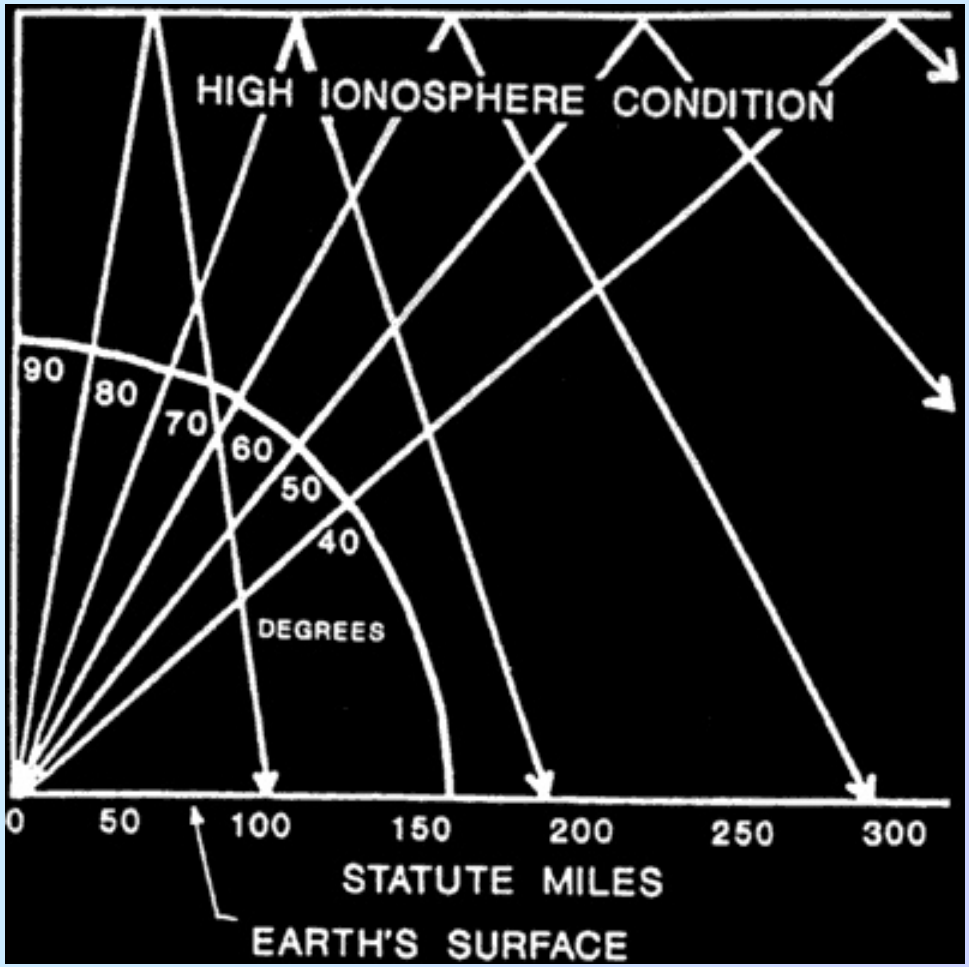


Propagation Theory

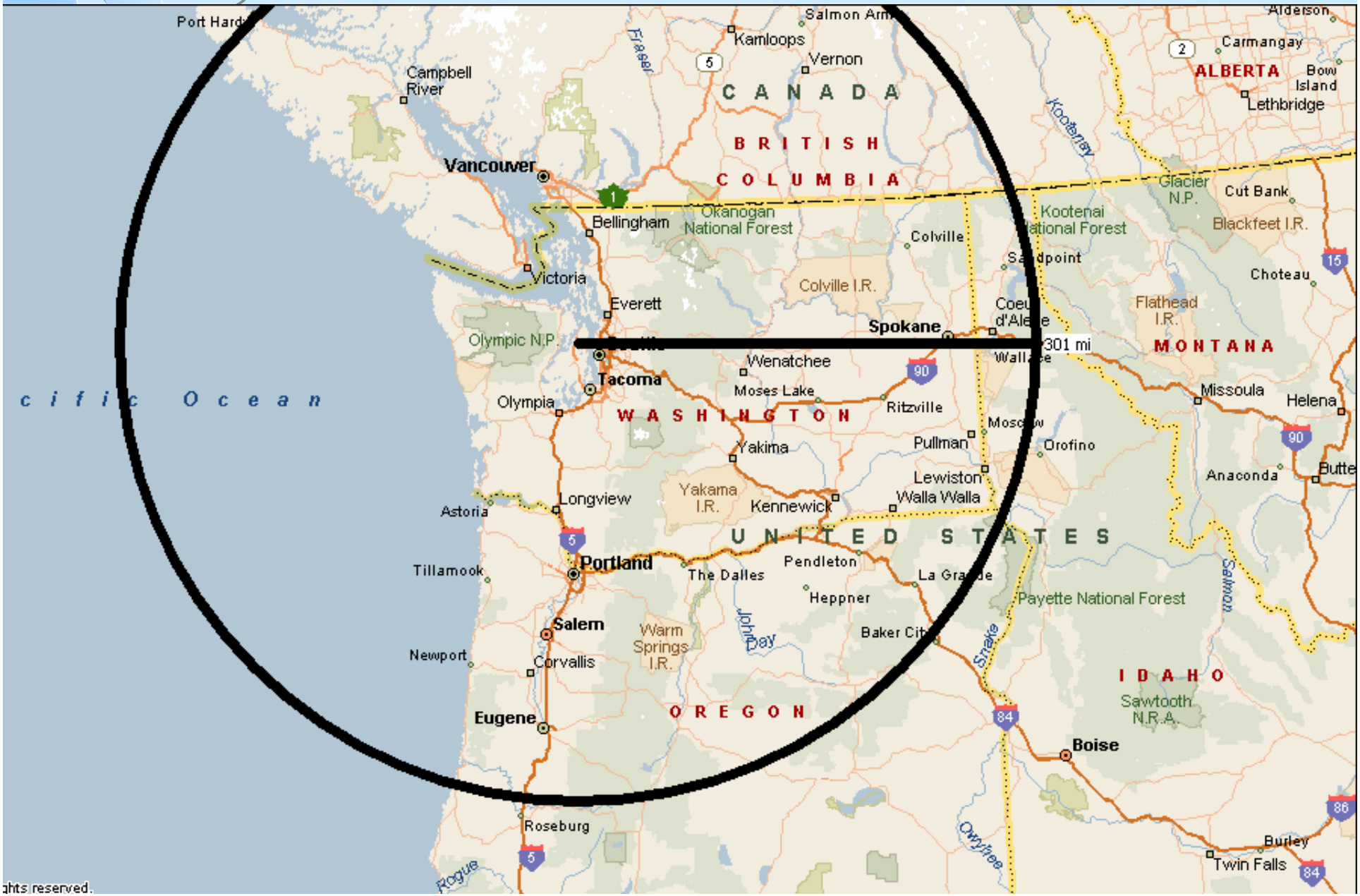


Waterwerks
www.waterwerks.com.au

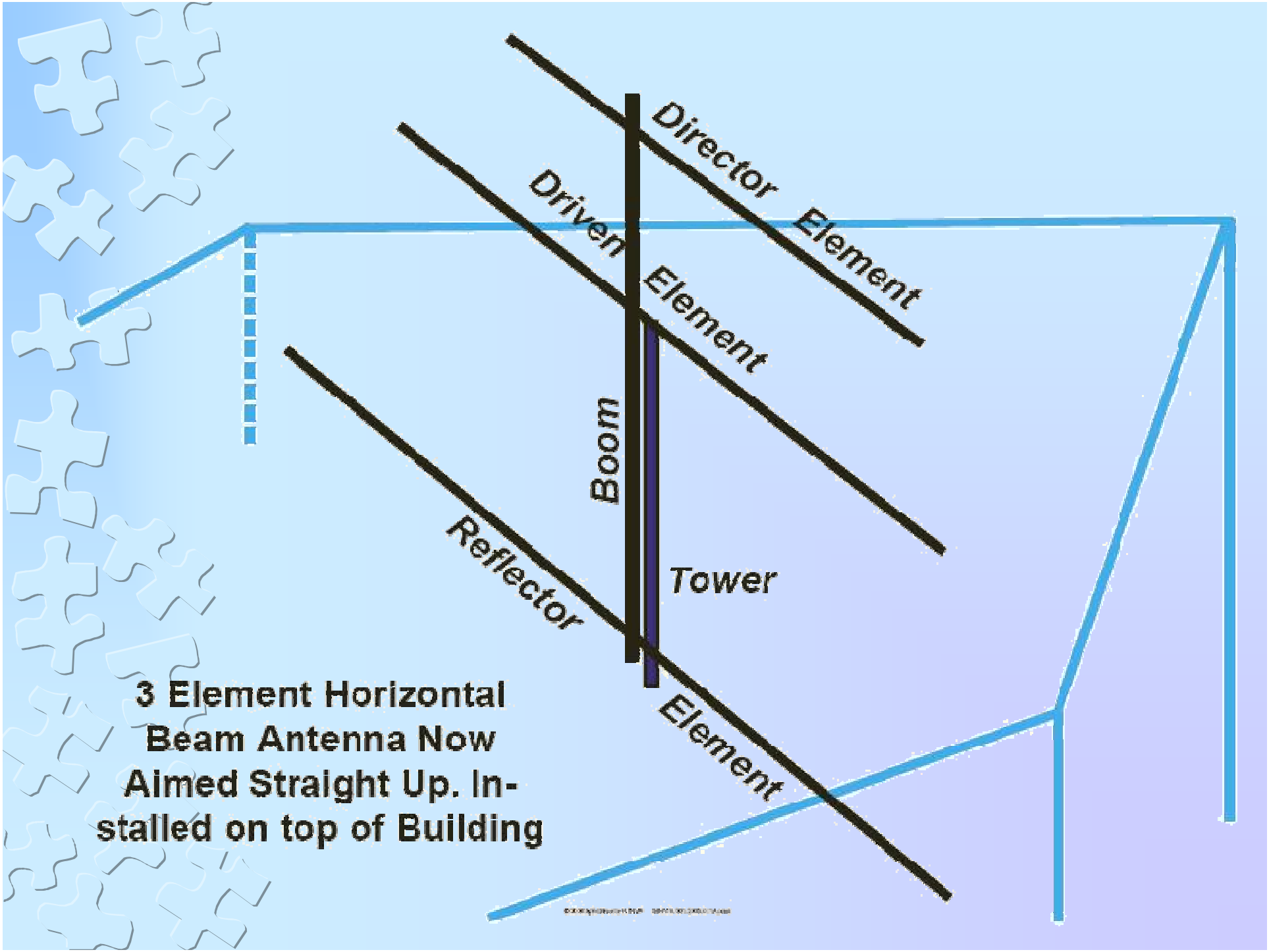
NVIS Effect

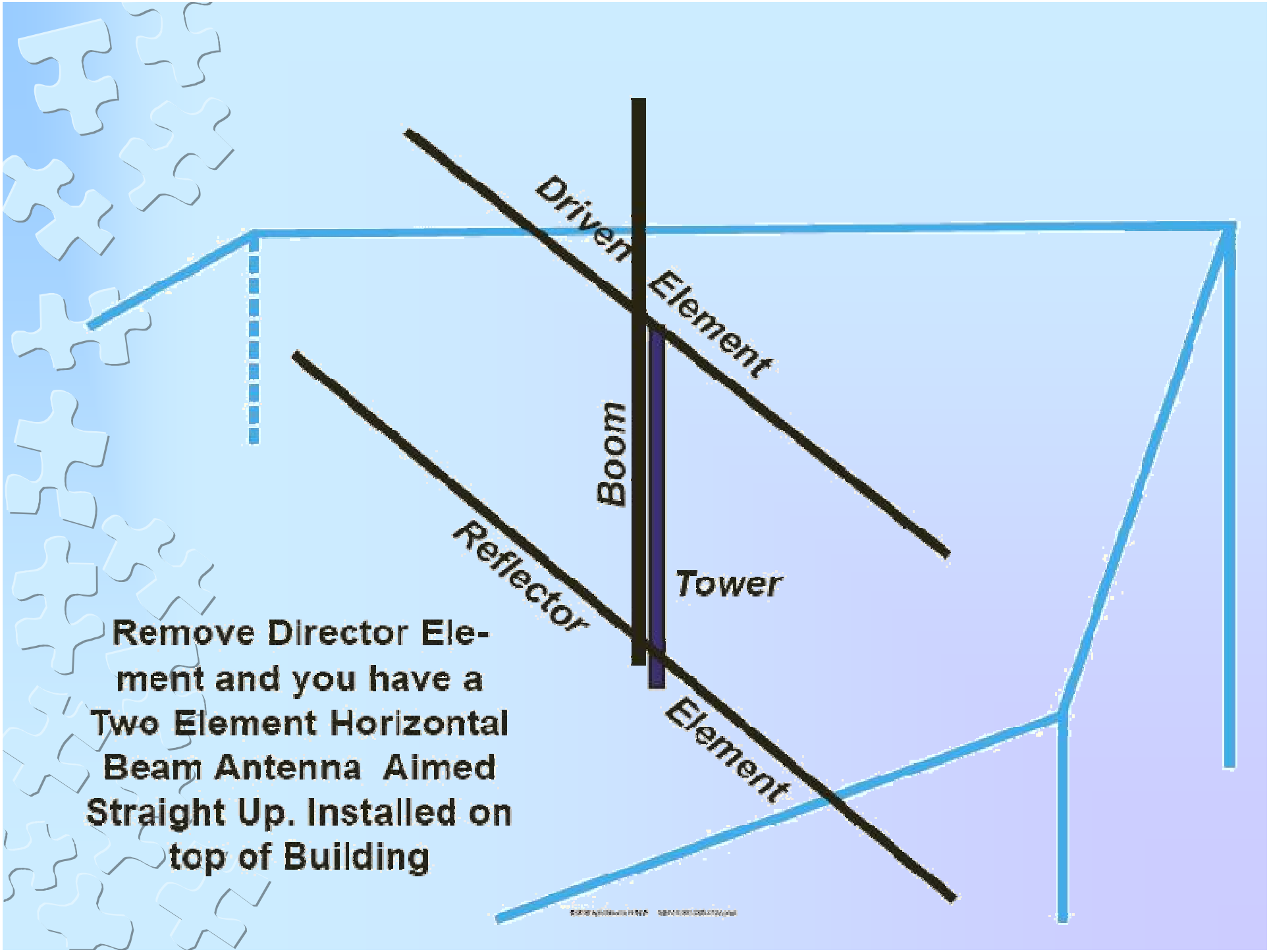

HIGH IONOSPHERE CONDITION
90
80
70
60
50
40
DEGREES
0
50
100
150
200
250
300
STATUTE MILES
EARTH'S SURFACE

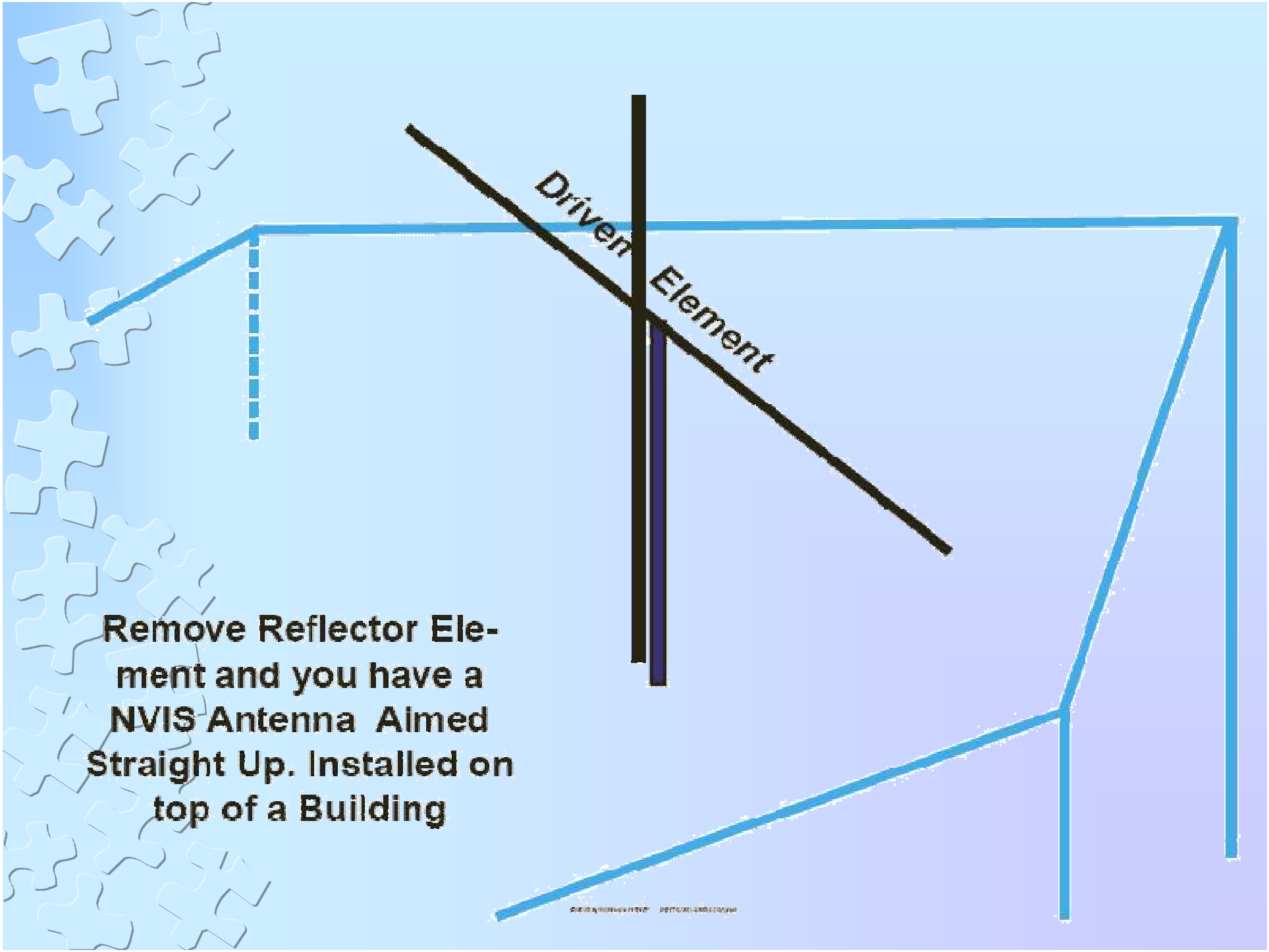
300 Mile Coverage



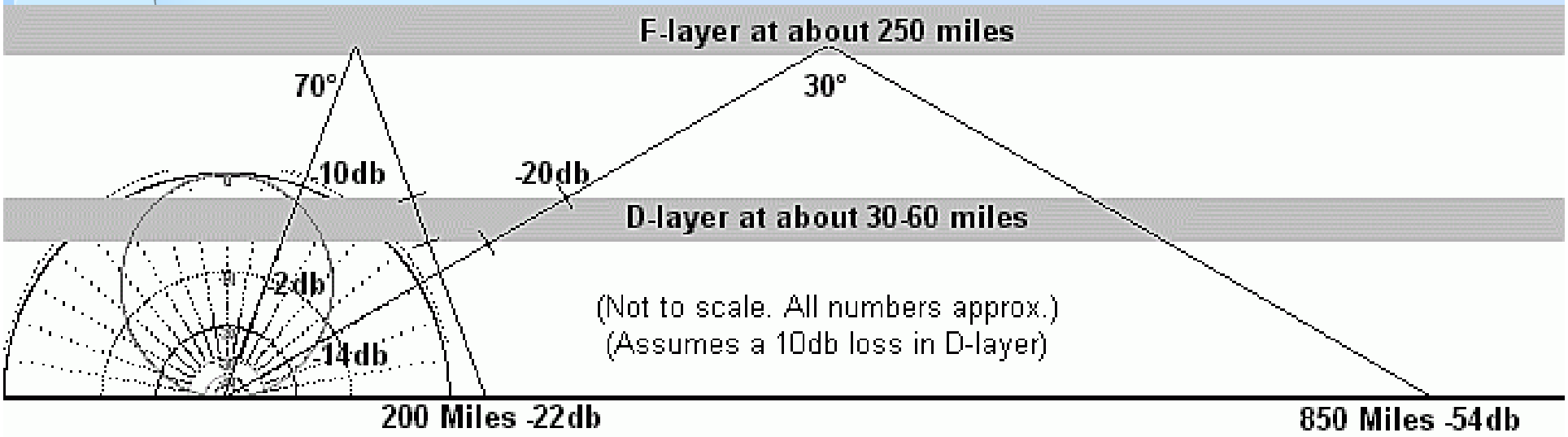
Radio Wave Goes Straight Up
And Reflects Back Down To Distant Stations

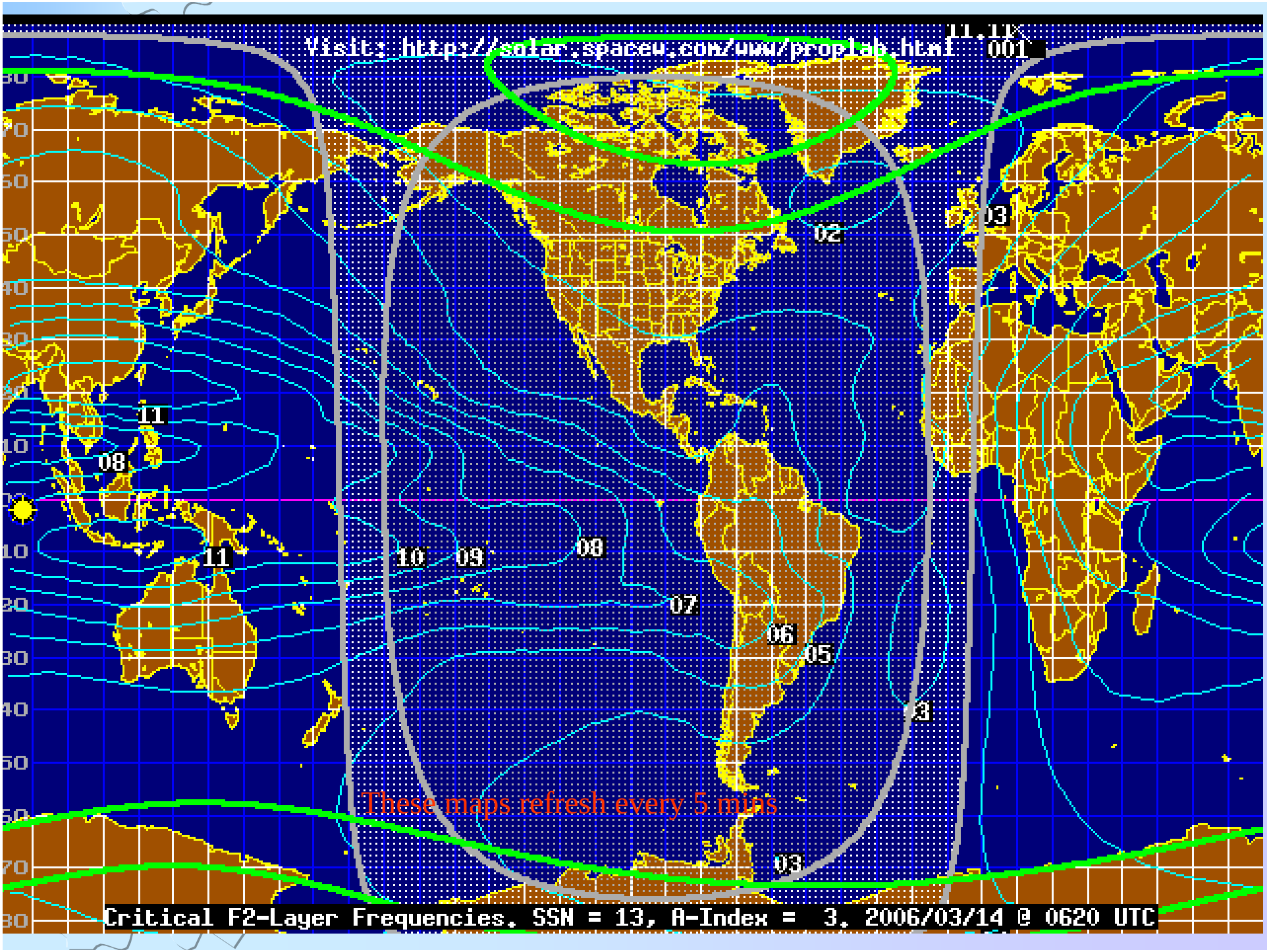

Director Element
Driven Element
Boom
Reflector
Tower
Element
3 Element Horizontal Beam Antenna Now Aimed Straight Up. Installed on top of Building


Driven
Element
Boom
Reflector
Tower
Element
Remove Director Ele-
ment and you have a
Two Element Horizontal
Beam Antenna Aimed
Straight Up. Installed on
top of Building


Driven
Element
Remove Reflector Ele-
ment and you have a
NVIS Antenna Aimed
Straight Up. Installed on
top of a Building

Propagation Considerations




Visit: http://solar.spaceu.com/www/proplab.html 001
11
08
11
10
09
08
07
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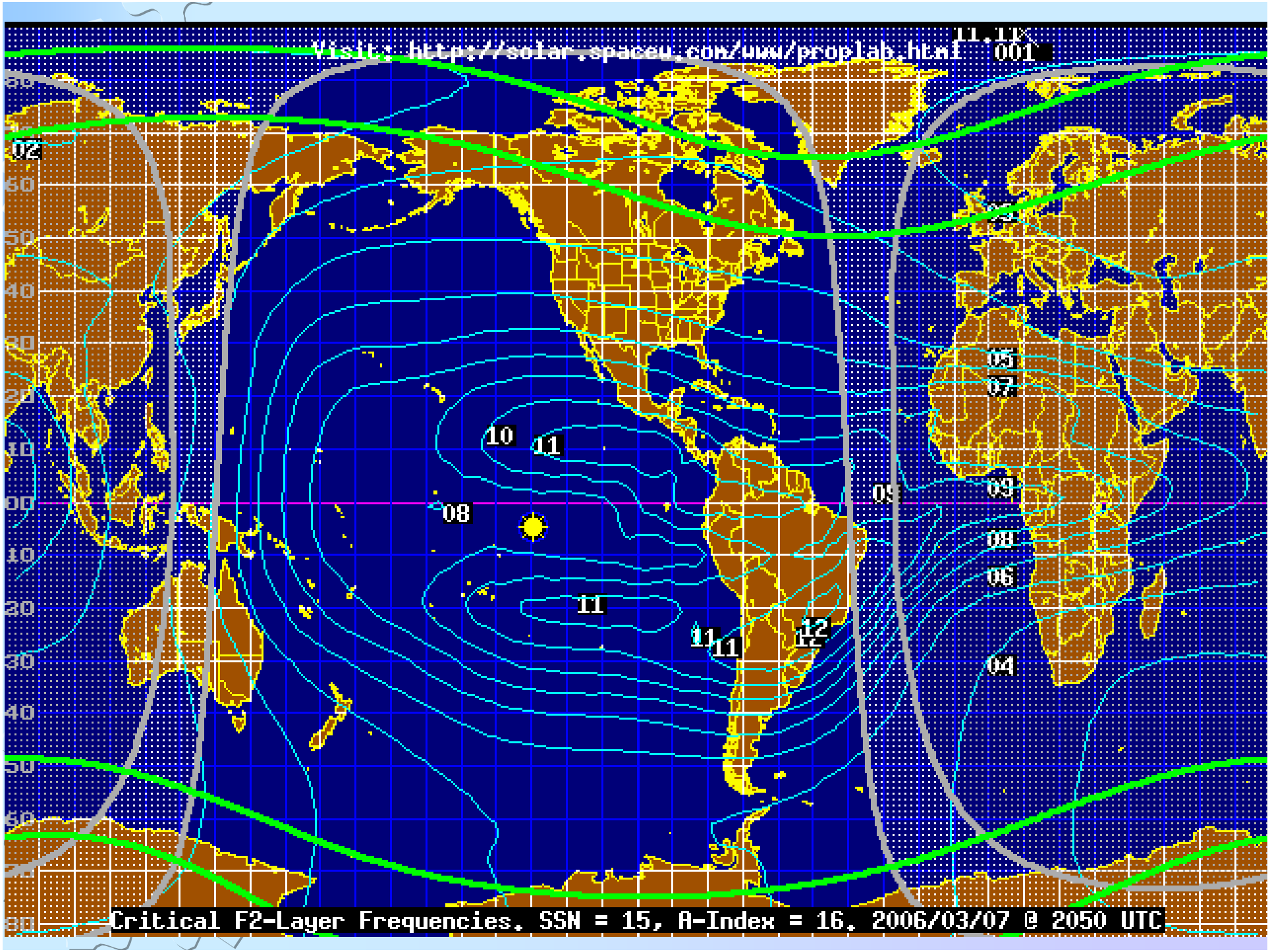
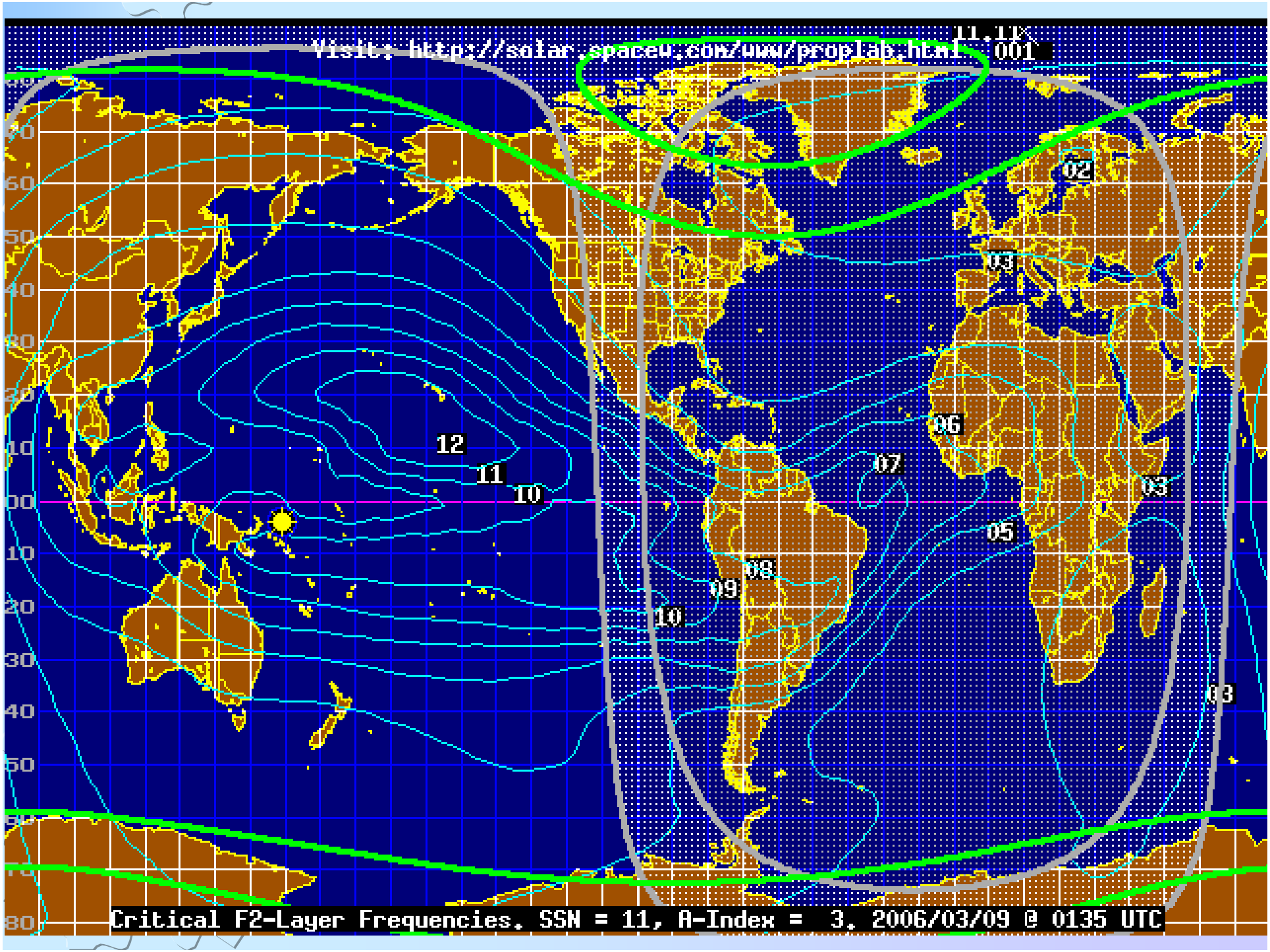
03
These maps refresh every 5 mins
Critical F2-Layer Frequencies, SSN = 13, A-Index = 3, 2006/03/14 @ 0620 UTC


Visit: http://solar.spacew.com/www/proplab.html
Critical F2-Layer Frequencies. SSN = 15, A-Index = 16. 2006/03/07 @ 2050 UTC


Visit: http://solar.spaceu.com/www/proplab.html
11.11
001
02
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12
11
10
Critical F2-Layer Frequencies. SSN = 11, A-Index = 3. 2006/03/09 @ 0135 UTC

1 ATU

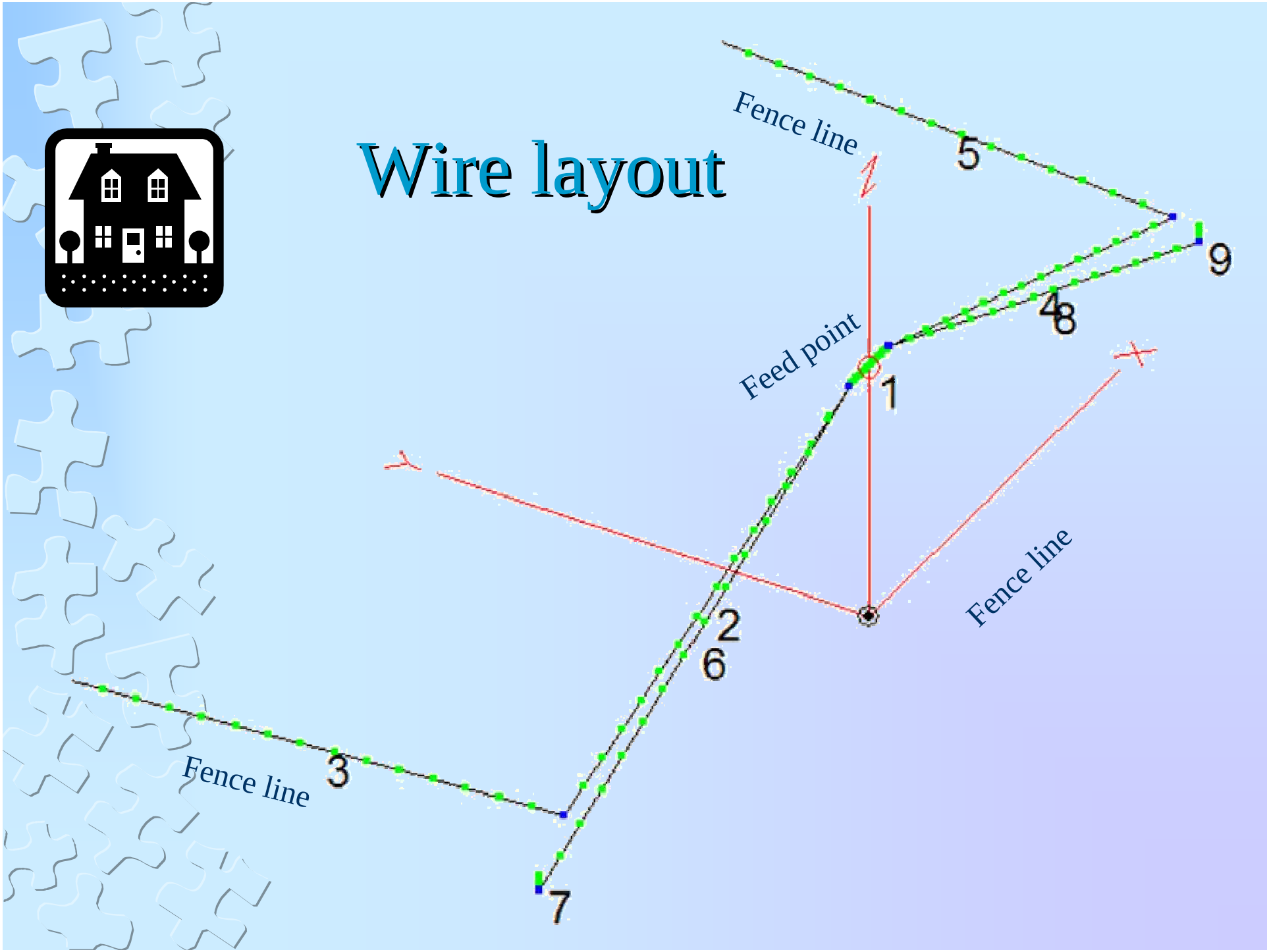
- Equals installation of NVIS antenna

Does this look like your neighborhood?

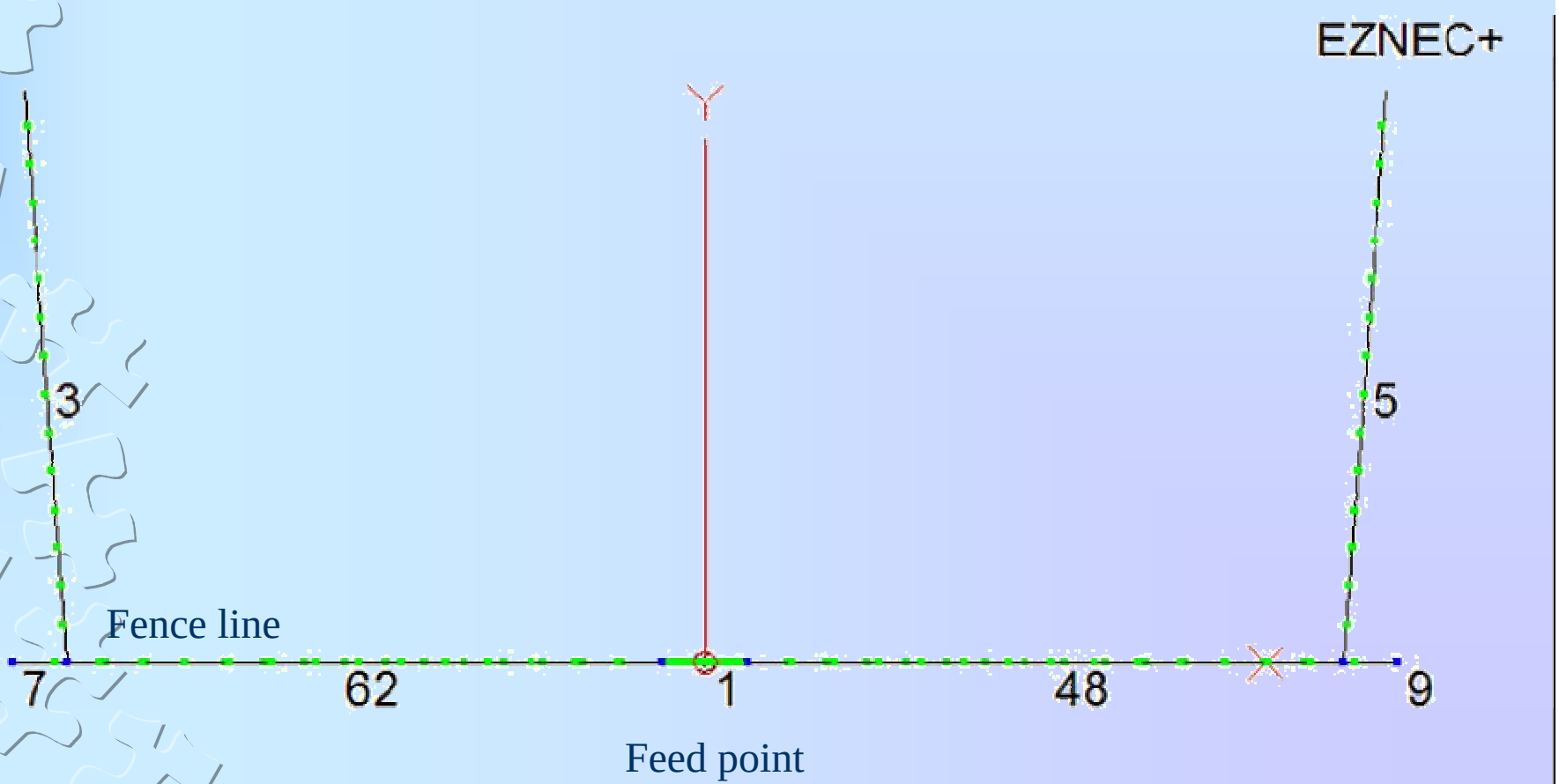
Can you spot the antenna?

Left side of dual band

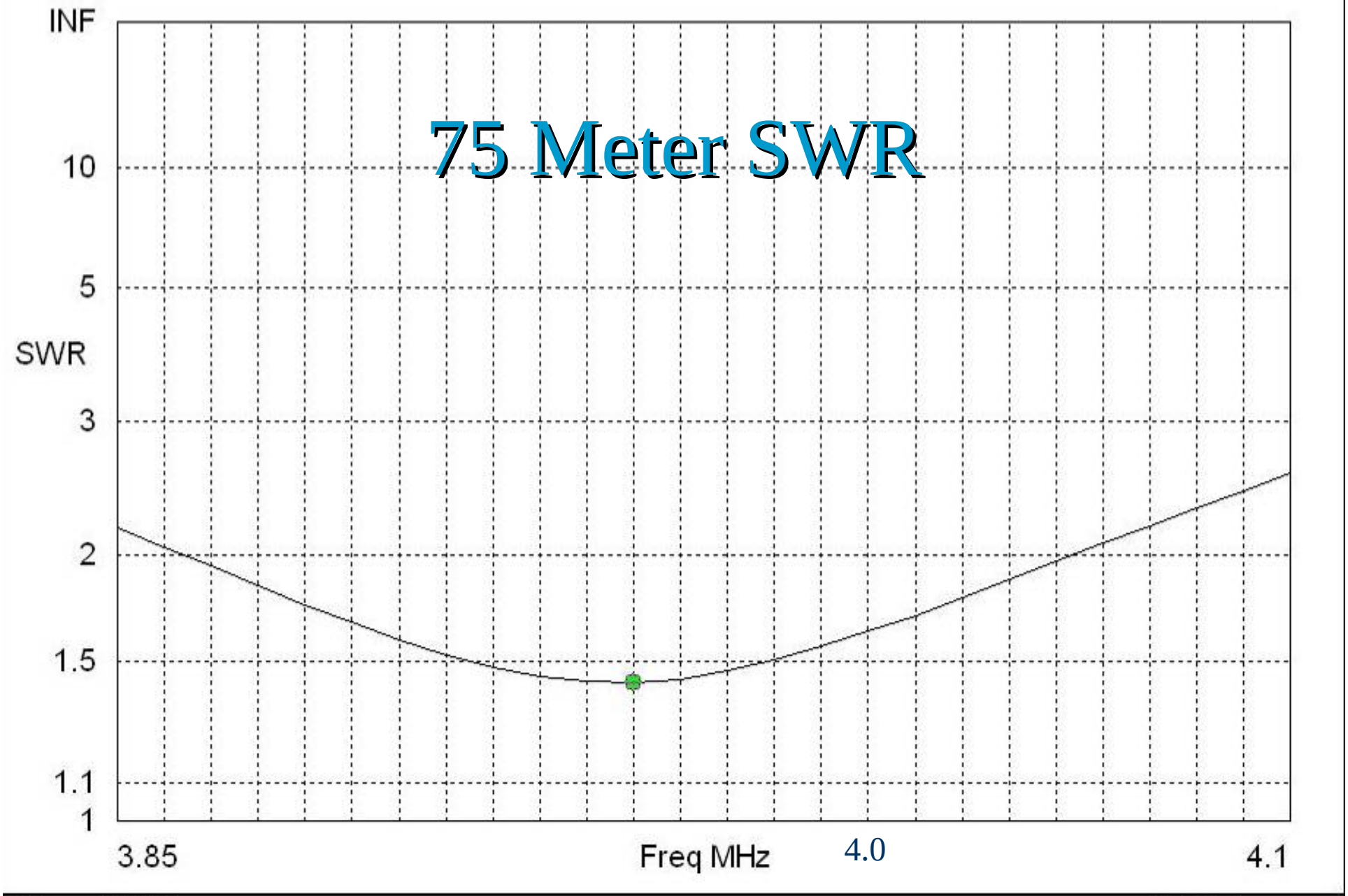
Wire layout



Top down view



75 Meter SWR

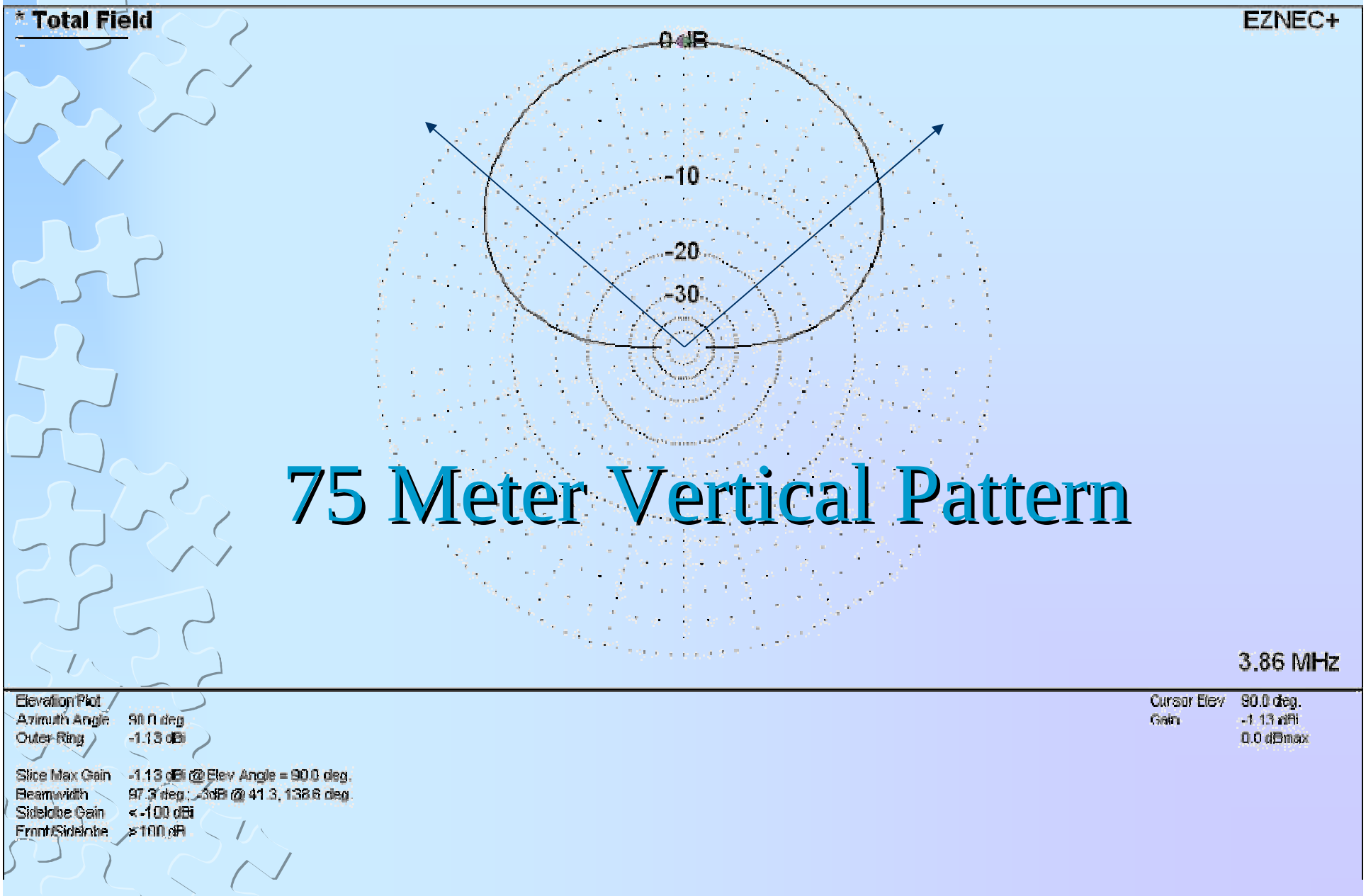


Freq	3.96 MHz
SWR	1.42
Z	35.42 + j 2.23 ohms
Refl Coeff	0.1726 at 169.81 deg.

Source #	1
Z0	50 ohms

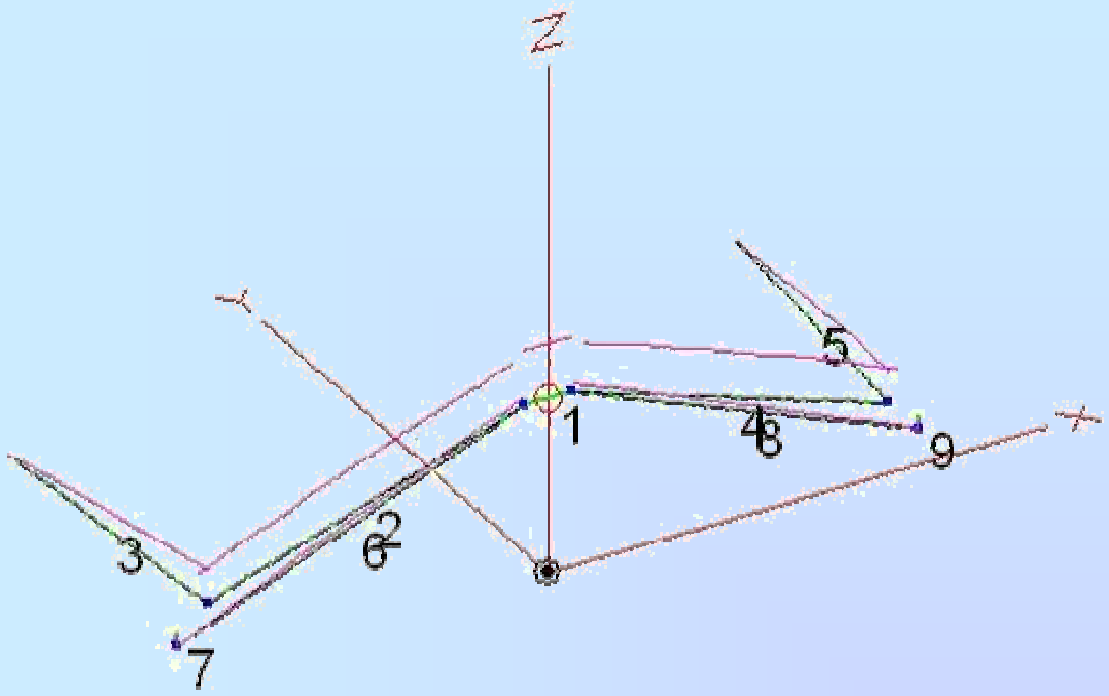
Bandwidth 75 Meters

- 4050 – 2:1
- 3960 – dip
- 3860 – 2:1



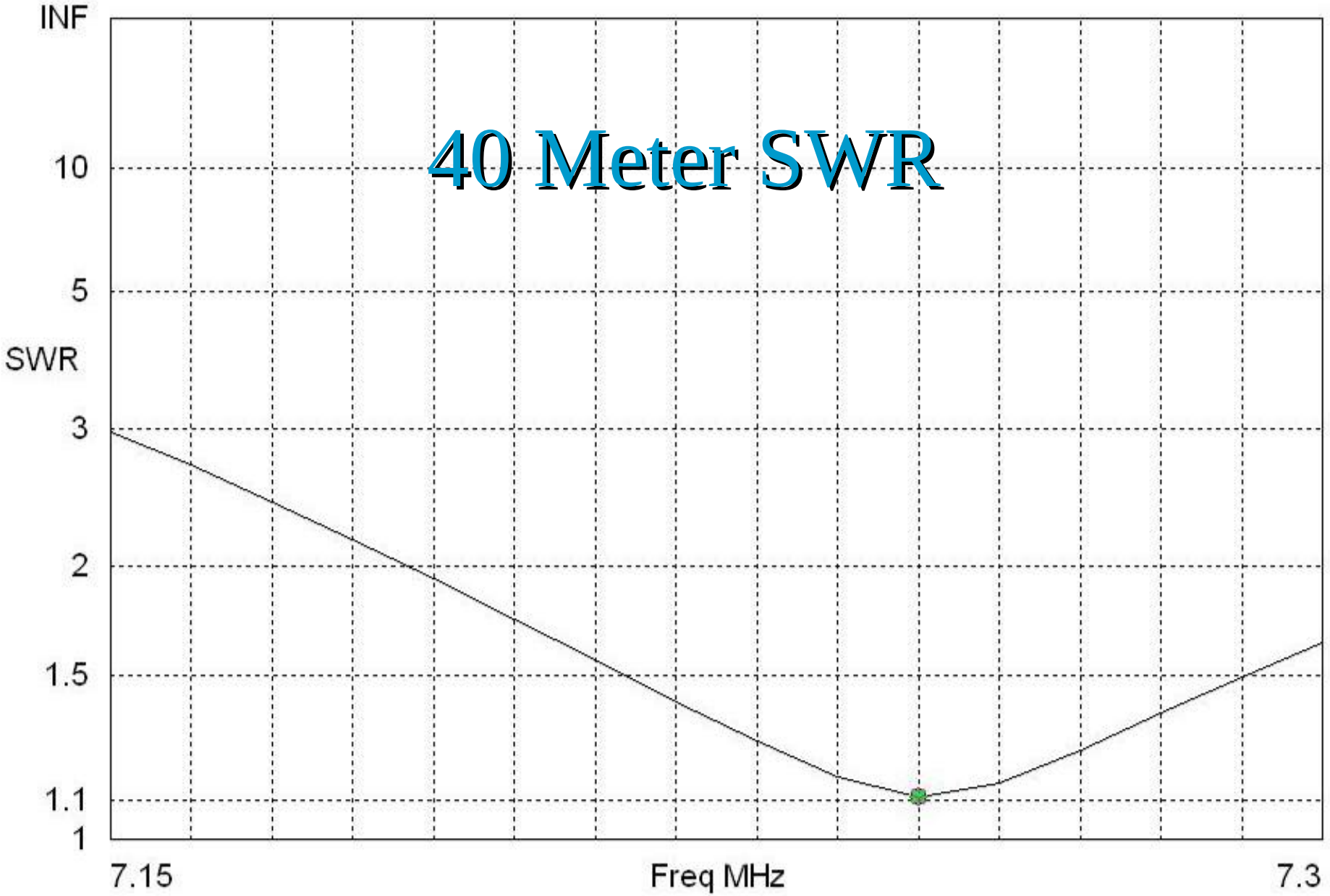
75 Meter Vertical Pattern

EZNEC+



75 Meter Current Flow

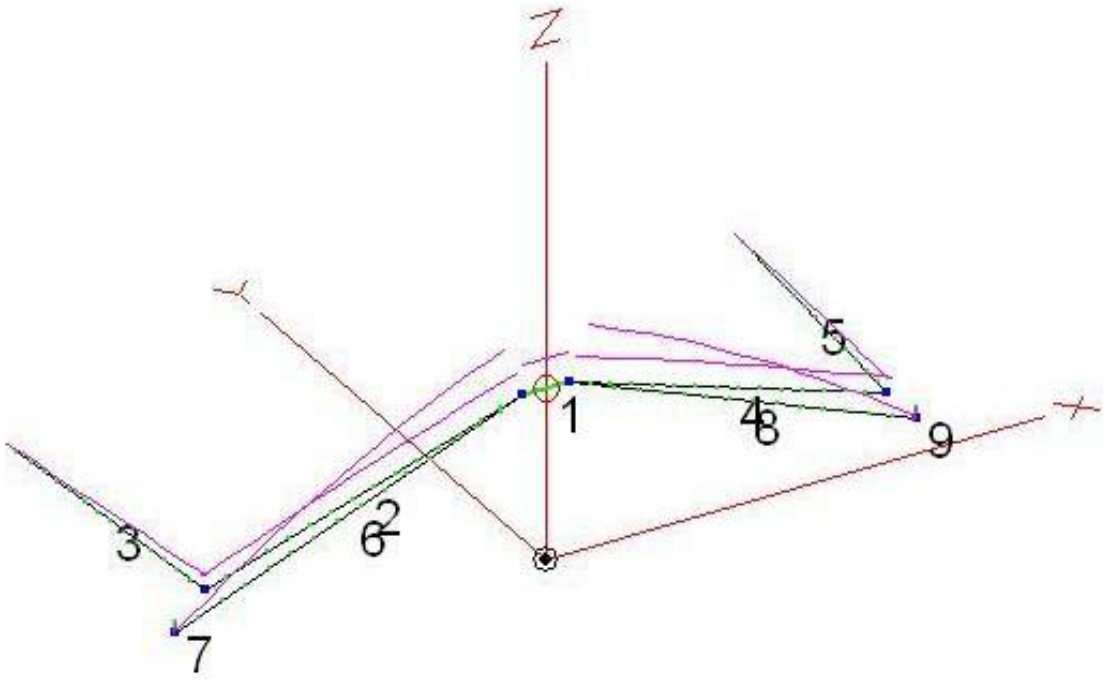
40 Meter SWR



Freq	7.25 MHz
SWR	1.11
Z	55.26 - j 0.8609 ohms
Refl Coeff	0.05065 at -8.82 deg.

Source #	1
Z0	50 ohms

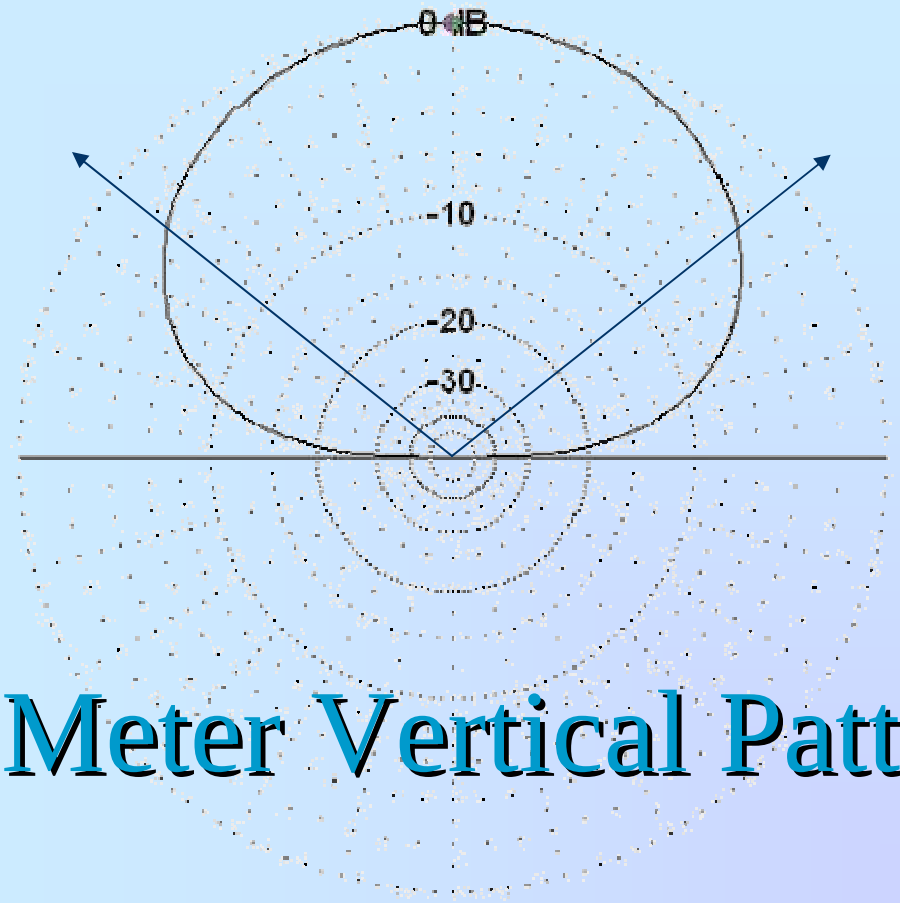
EZNEC+



40 Meter Current Flow

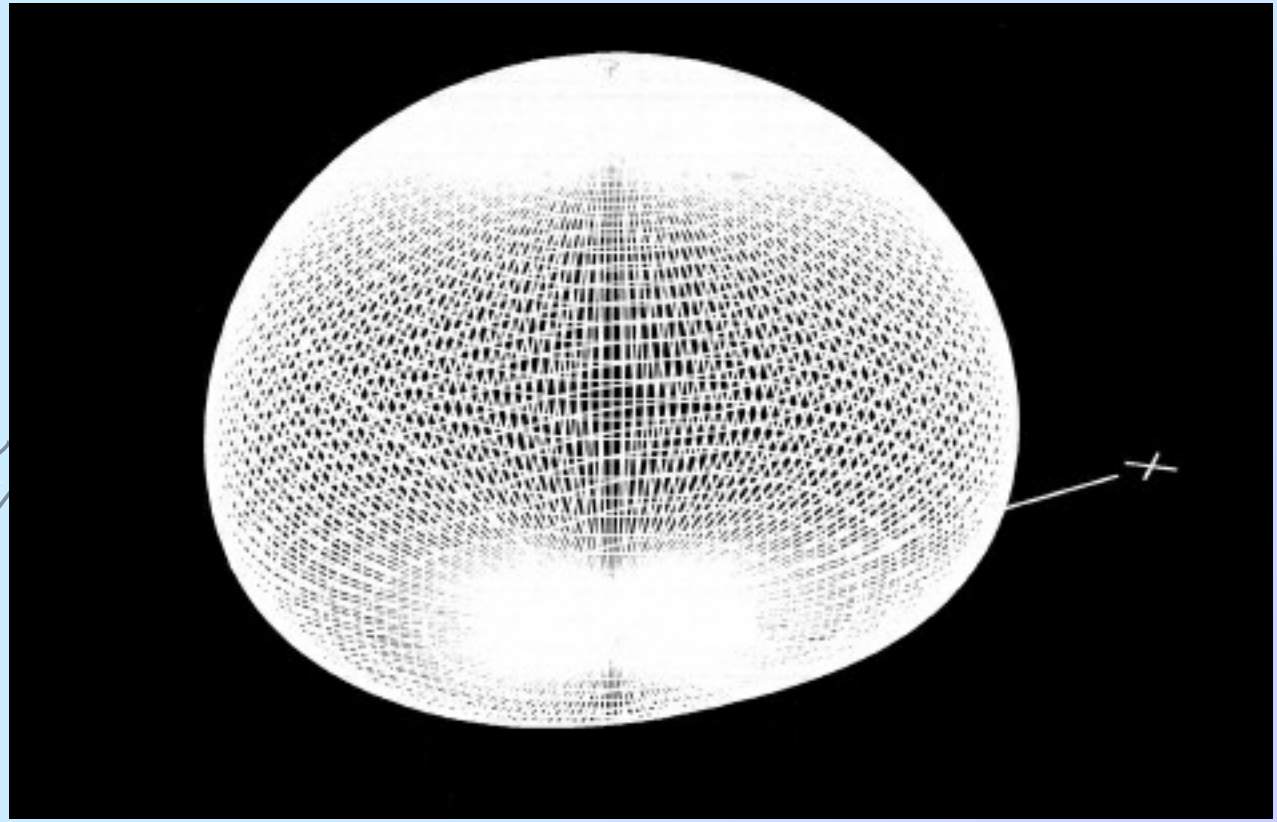
Bandwidth 40 Meters

- 7190 – 2:1
- 7250 – dip
- 7370 – 2:1



40 Meter Vertical Pattern

Omni Pattern



Depth of Current Penetration

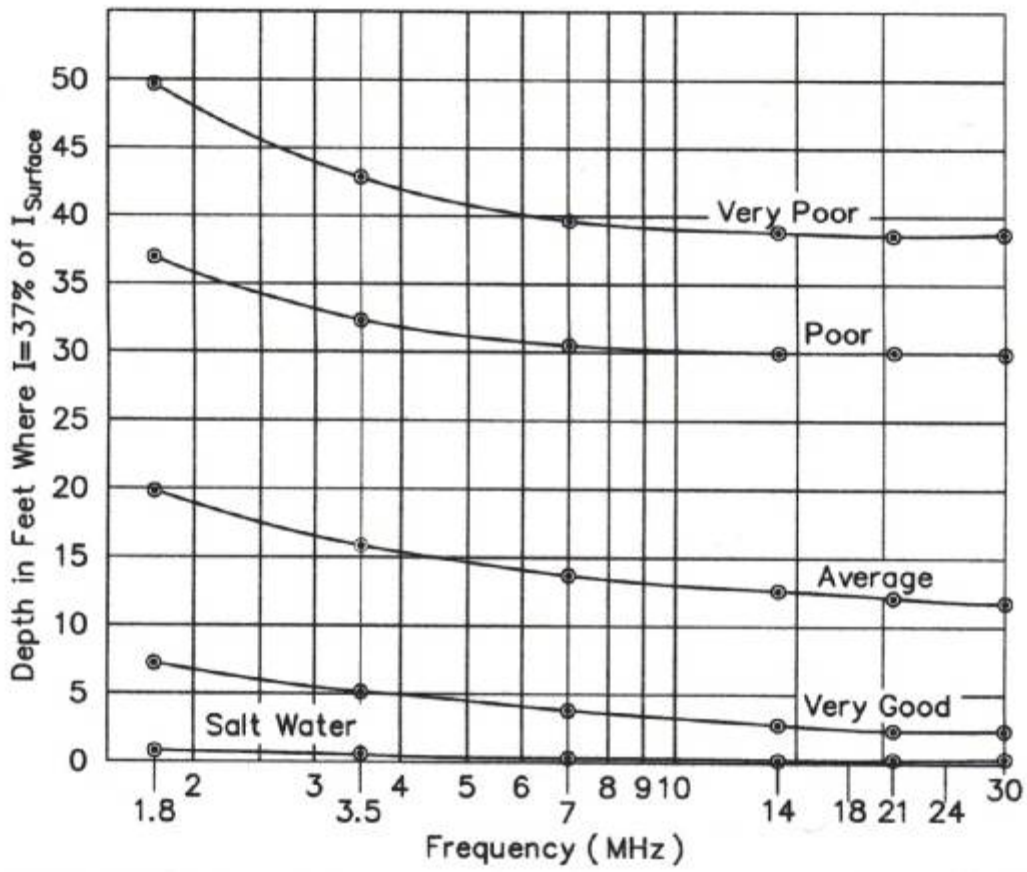


Fig 11—Depths at which the current density is 37% of that at the surface for different qualities of earth over the 1.8- to 30-MHz frequency range. The depth for fresh water, not plotted, is 156 feet and almost independent of frequency below 30 MHz. See text and Table 2 for ground constants.

Feed Point Impedance vs. Height

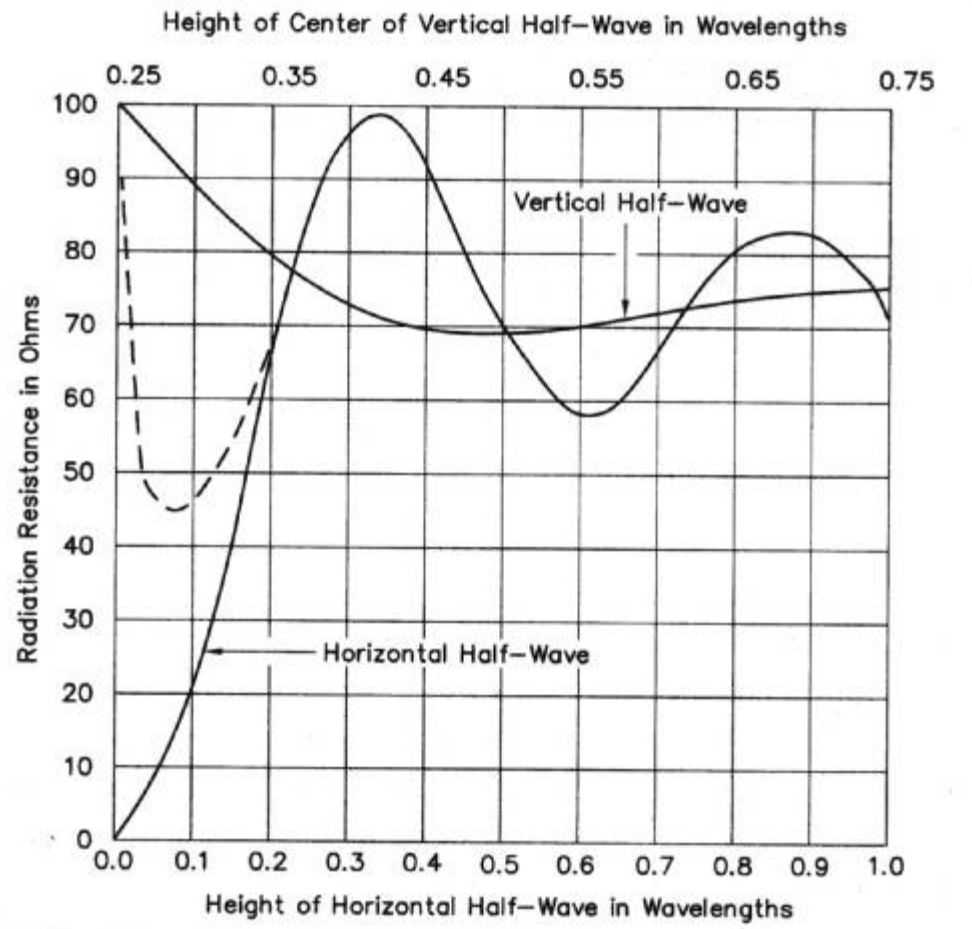


Fig 1—Variation in radiation resistance of vertical and horizontal half-wave antennas at various heights above flat ground. Solid lines are for perfectly conducting ground; the broken line is the radiation resistance of horizontal half-wave antennas at low heights over real ground.

How It Went Together

- Materials
- Construction
- Modifications

Parts List

- 1 Center insulator
- 1 1.5” PVC Slip coupler
- 2 or 3 Hose clamps
- 14 ga. Insulated wire
- 1 10’ TV mast
- 1 5’ TV mast
- Tie wraps as desired
- 1 Fence stake
- Coax to the shack

Feed point is at 15’

End of 75M wires are 6’ above ground
End of 40M wires are 4’ above ground

Element Lengths

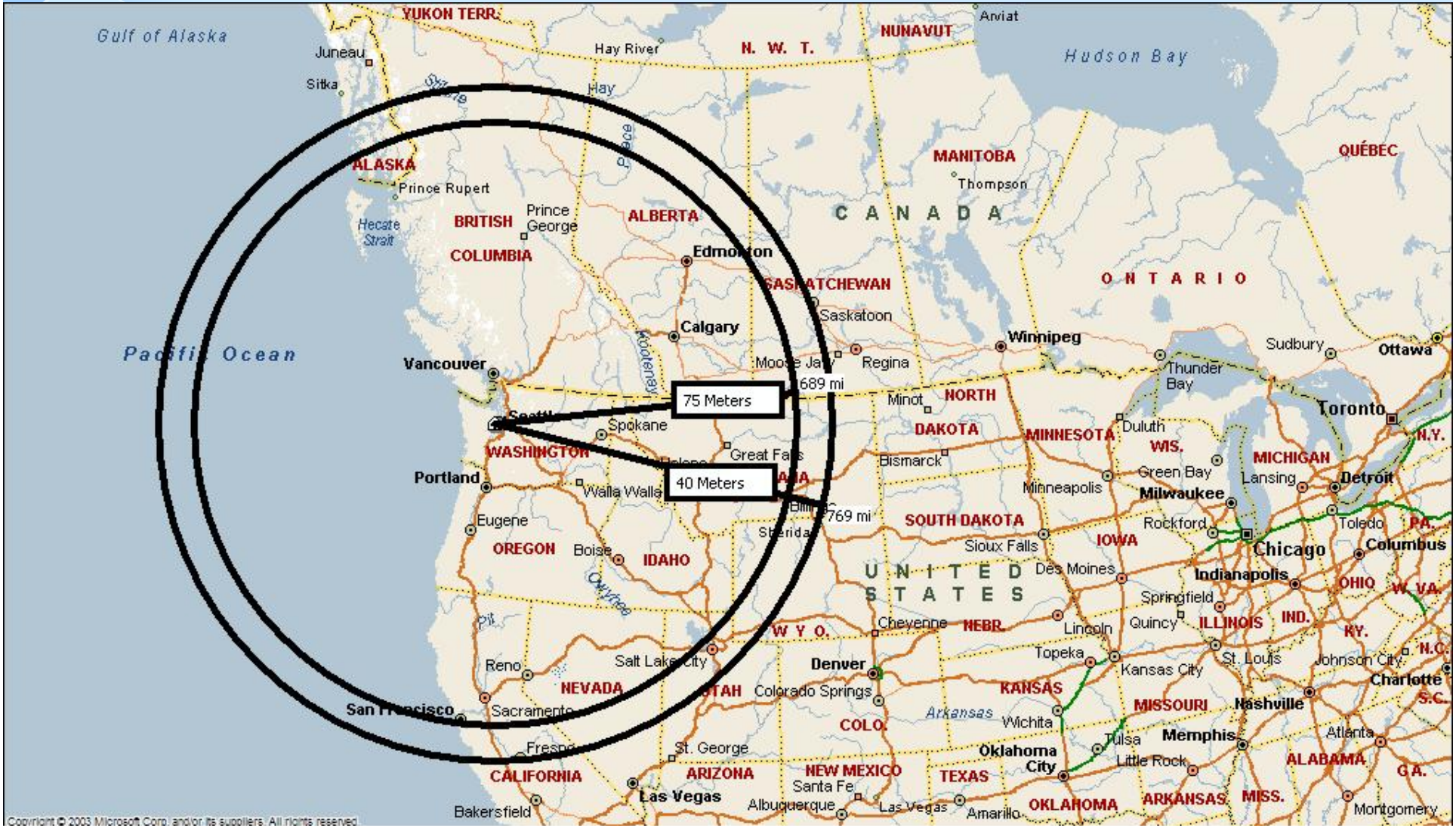
- 75 Mtr legs = 57 ft
- 40 Mtr legs = 39 ft

- Prune these lengths to meet your ground conditions

Beamwidth

- 75 Mtrs 41 deg. To 139 deg.
- 40 Mtrs 39 deg. To 141 deg.

Night Time Ionosphere (300 mi.)



Hints & tips

- Solder wires at the feed point
- Solder feed point pigtail to all other wires
- Coax should be perpendicular to the antenna

Hints & tips (cont.)

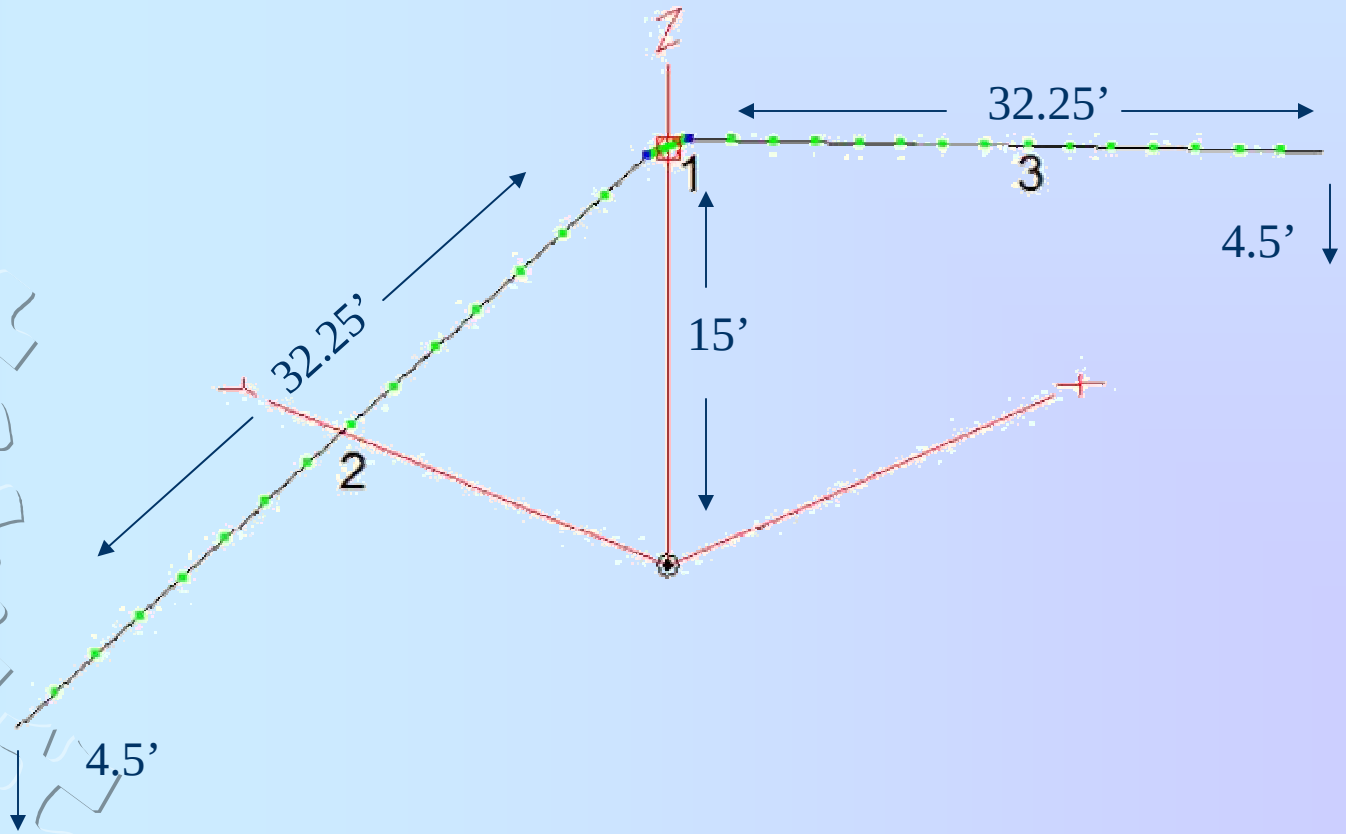
- Ground conditions will drive element lengths
- Wet vs.. dry
- Use an antenna analyzer!!!
- Tune 75M first, then 40M
- Minimize the catenaries in the wires but not too tight – the wire will stretch
- Maintain the spacing between the 75 & 40M elements

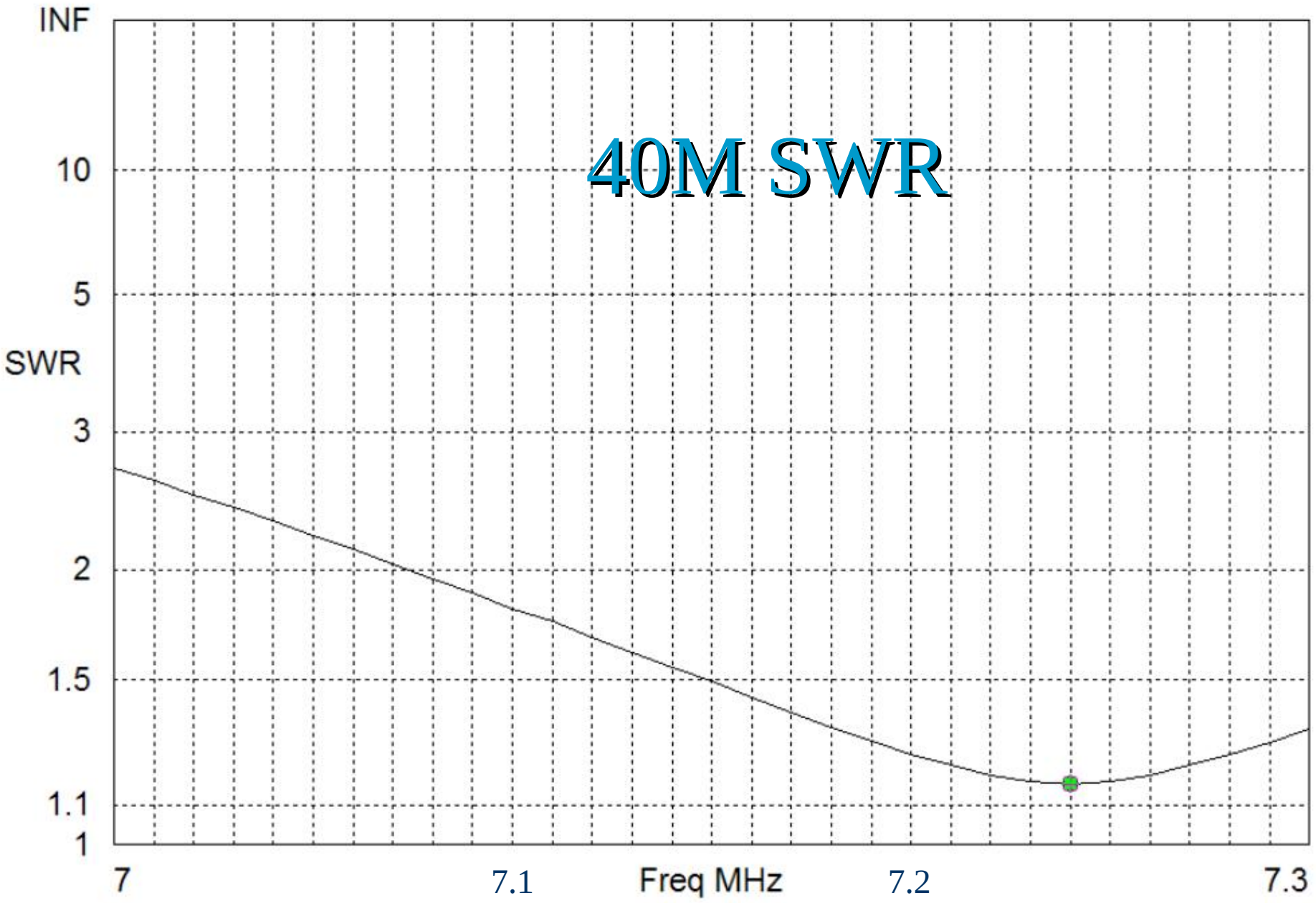
Too big?

If that doesn’t work for you,

try this

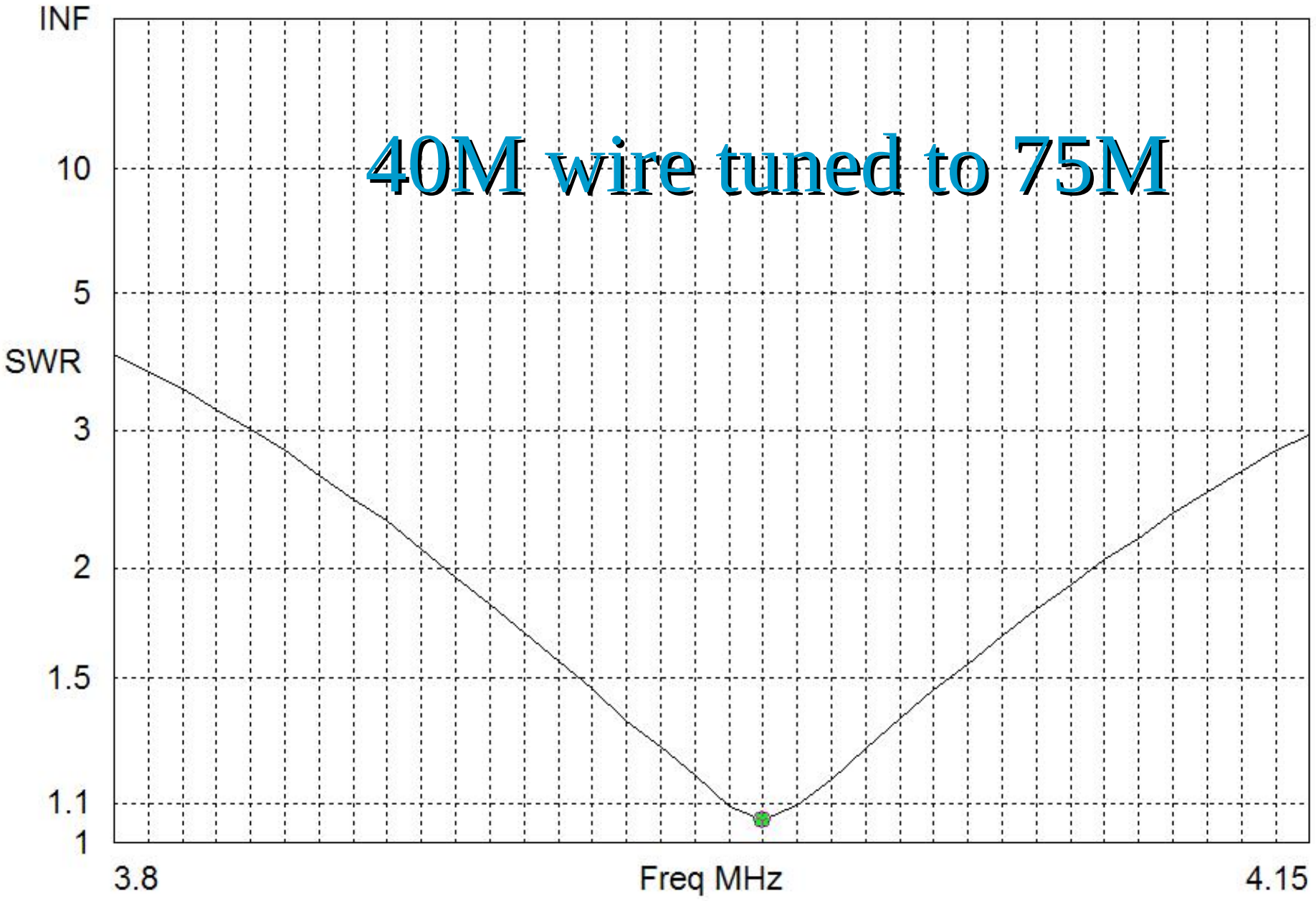
40M wire Tunable on 75M



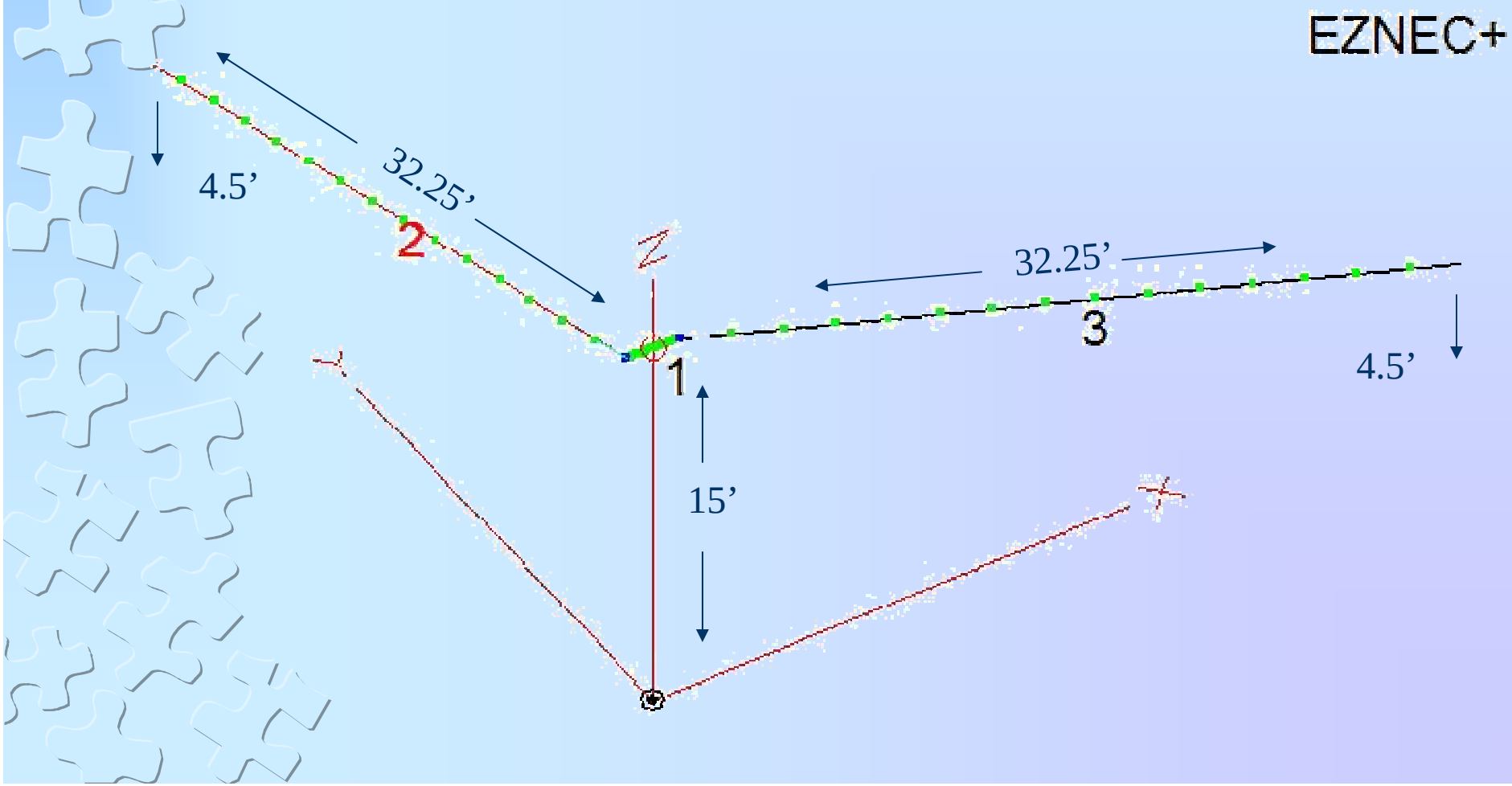


Freq 7.24 MHz
SWR 1.16
Z 57.88 - j 0.5715 ohms
Refl Coeff 0.07322 at -3.85 deg.

Source # 1
Z0 50 ohms


40M wire tuned to 75M
INF
10
5
SWR
3
2
1.5
1.1
1
3.8
Freq MHz
4.15
Freq 3.99 MHz
SWR 1.057
Z 47.32 - j 0.2223 ohms
Refl Coeff 0.02764 at -175.13 deg.
Source # 1
Z0 50 ohms

40M wire tunable on 75M in 90 deg. configuration

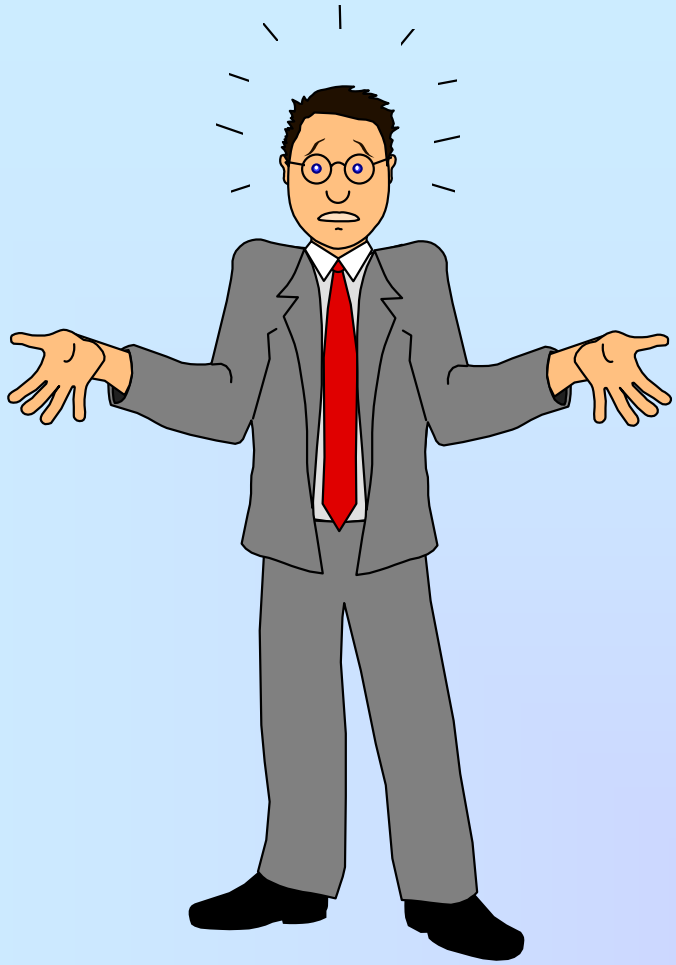


Buddipole

Maximizing the Received Signal

Thanks to Bill Balzarini, KL7BB

for all the drawings!



QUESTIONS?

Questions are welcome

- Contact Tom at tjsand@wavecable.com
- Contact Ed at n7nvp@arrl.org

Thank you!

de Ed & Tom