DXCC Honor Roll in One Solar Cycle

A Little Pistol Adventure

KY6R – Rich Holoch

IDXC 2013

DX Academy

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Dedication

- I would like to thank Tom, N6BT and Dean, N6BV for their unwavering support and help with my education with all things antennas
- I would like to thank Jack, K6JEB, and Peter, W6DEI for their friendship and camaraderie - helping me put up my antennas and letting me try my Pacificon presentations at East Bay Amateur Radio Club (EBARC) meetings. Big thanks to ALL members of EBARC!
- I would like to thank Dr. Robert Schmieder, KK6EK for teaching me how large scale DX-peditions are organized
- I would like to thank Paul Howes, WA6GYY for more than 10 years of friendship, kind words and the best Antenna Forum on the planet, and the NCDXC/SCDXC for inviting me to present at the best DX Convention, the IDXC
- I would especially like to thank my wife, Kat, who supports my ham radio insanity

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K-Line: Elecraft K3, P3, KPA-500, KAT500. (TS-590s Backup)

I have been a Database Designer, DBA and Programmer since 1981 and currently work for macys.com in San Francisco.
I was the 130th employee at Oracle, 30th at Gupta and 470th at PeopleSoft.

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My DXCC Standings

- I made Honor Roll (Mixed) on January 1, 2013
- My final QSO was with SV2ASP/A
- The first 300 were made with 200 watts or less and wire antennas
- I have 8BDXCC and am almost at the 2000 level in the Challenge
- Now working on 160M DXCC and I am up to 50 entities

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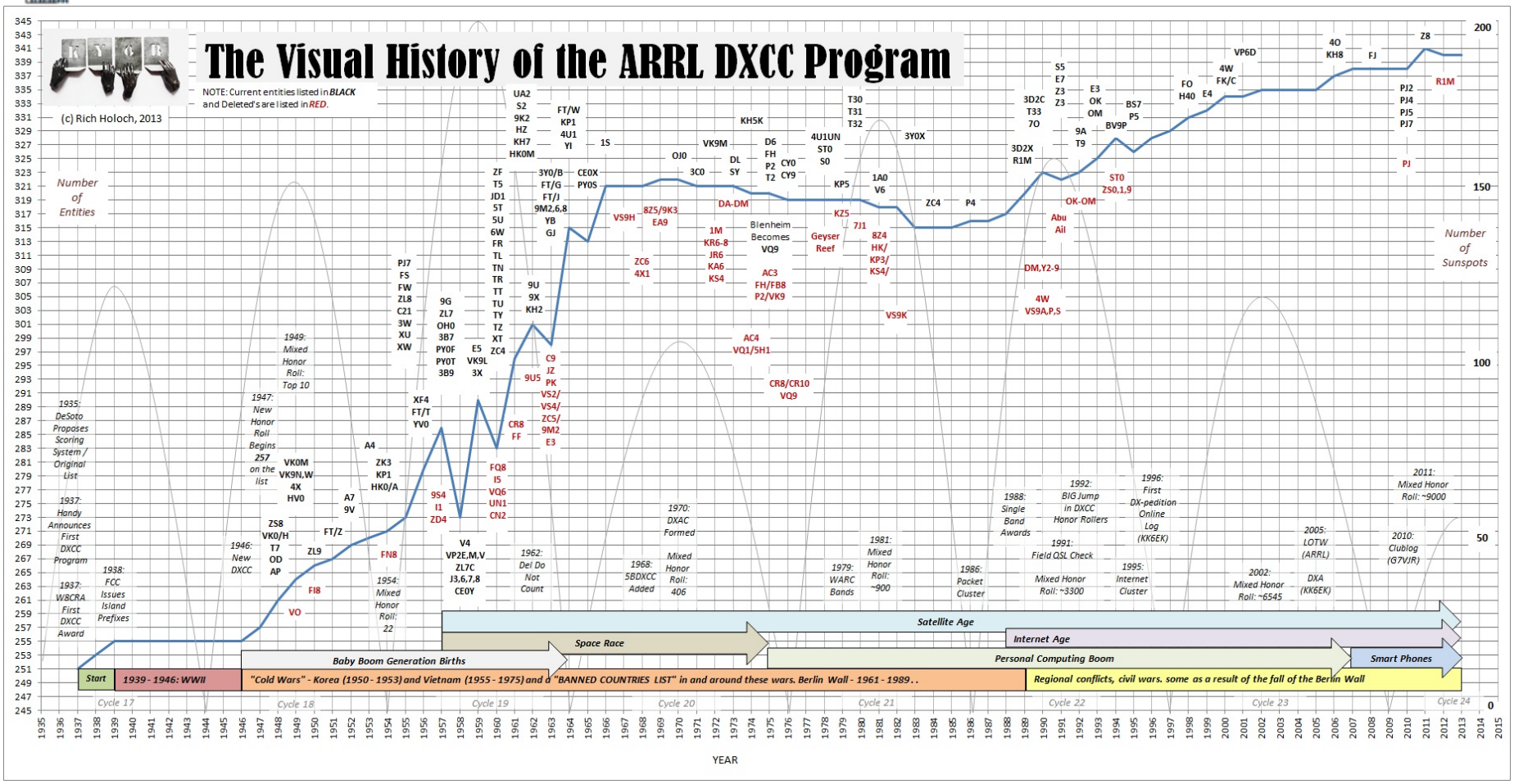

You can download a nice PDF of this diagram at http://dxccsleuth.wordpress.com/ and scroll down in the blog. If you print it on large A3 paper, it looks great!

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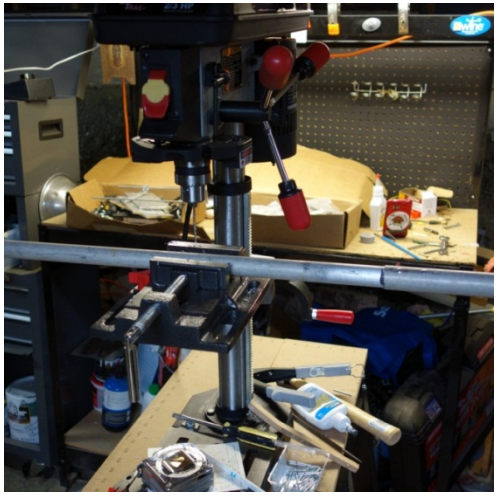
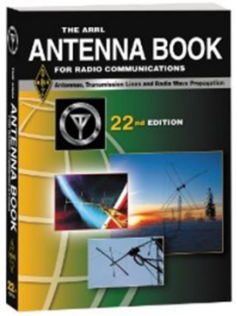
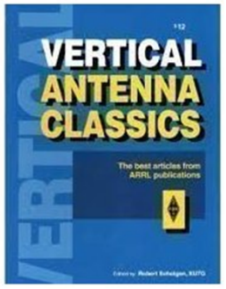
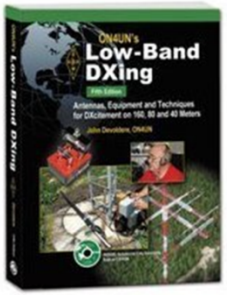
Tools of the Trade

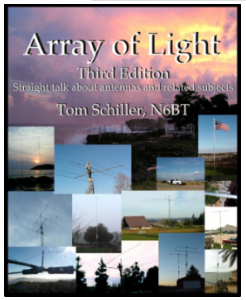


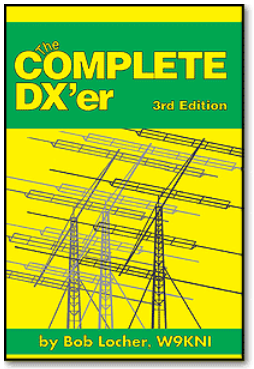
Drill Press and Pop Riveter

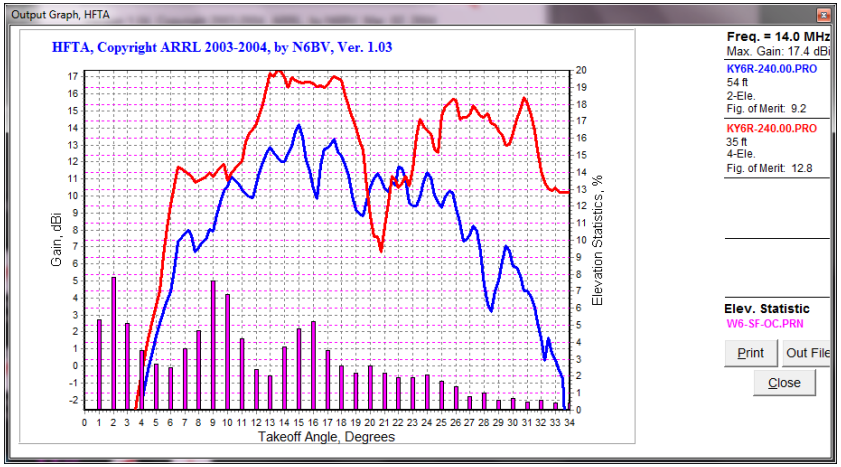




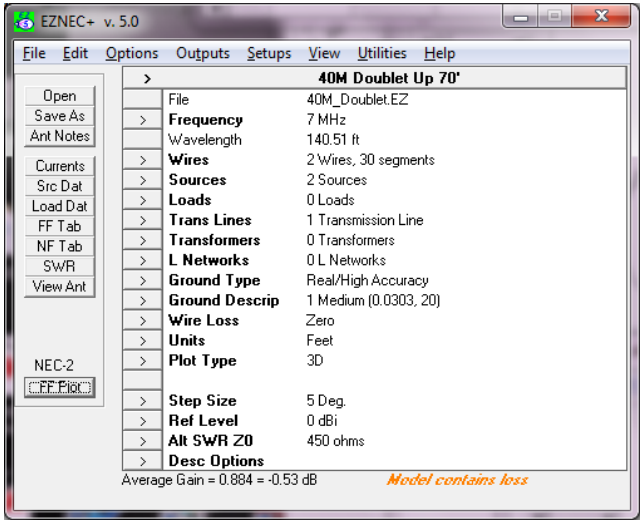








Superimposes an EZNec like antenna model over your terrain. Used to get a more real world view of how your antennas perform at your QTH.



Lets you design and optimize antennas given their real world dimensions (i.e. “taper schedule”)

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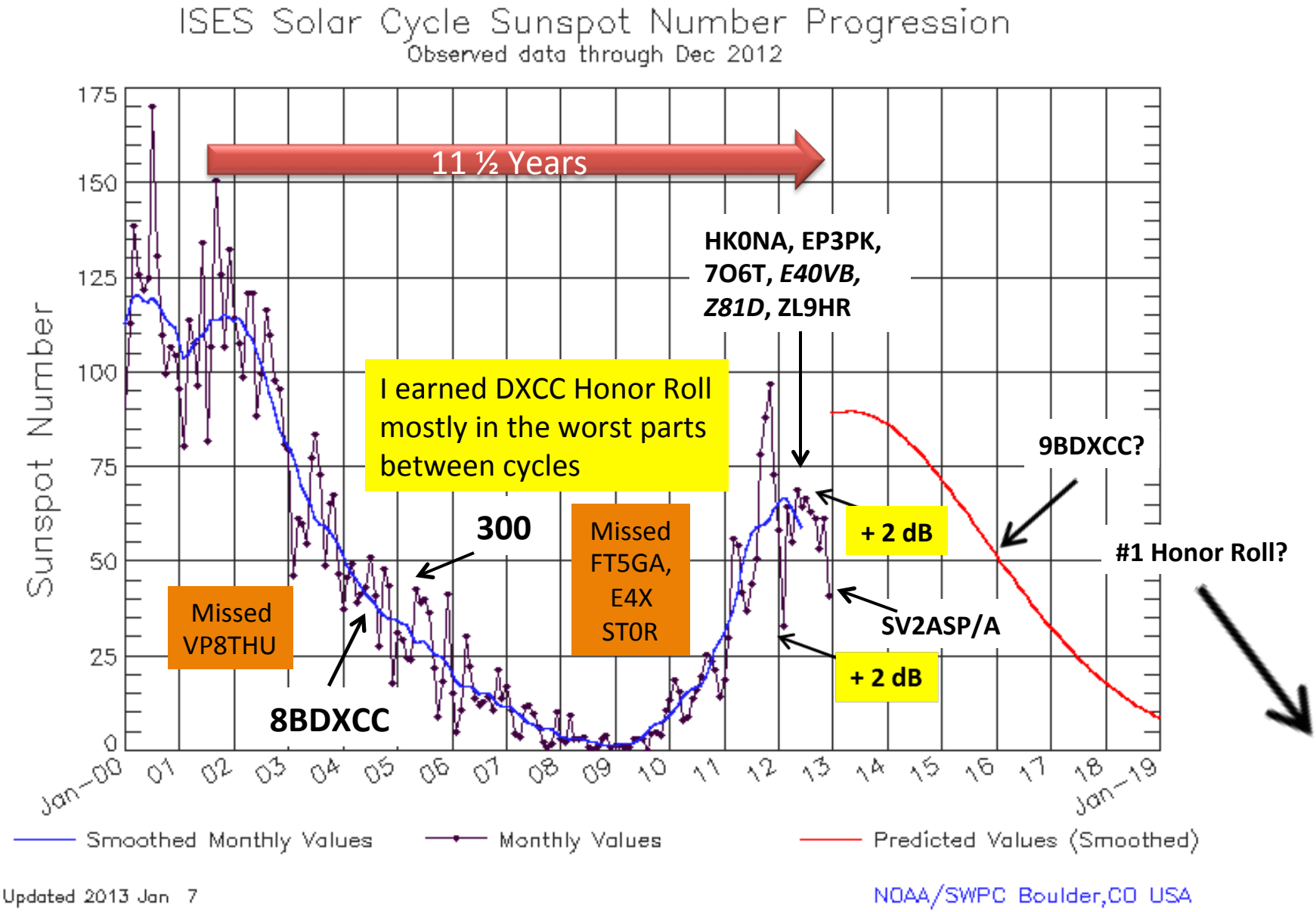
Solar Cycles 23 and 24



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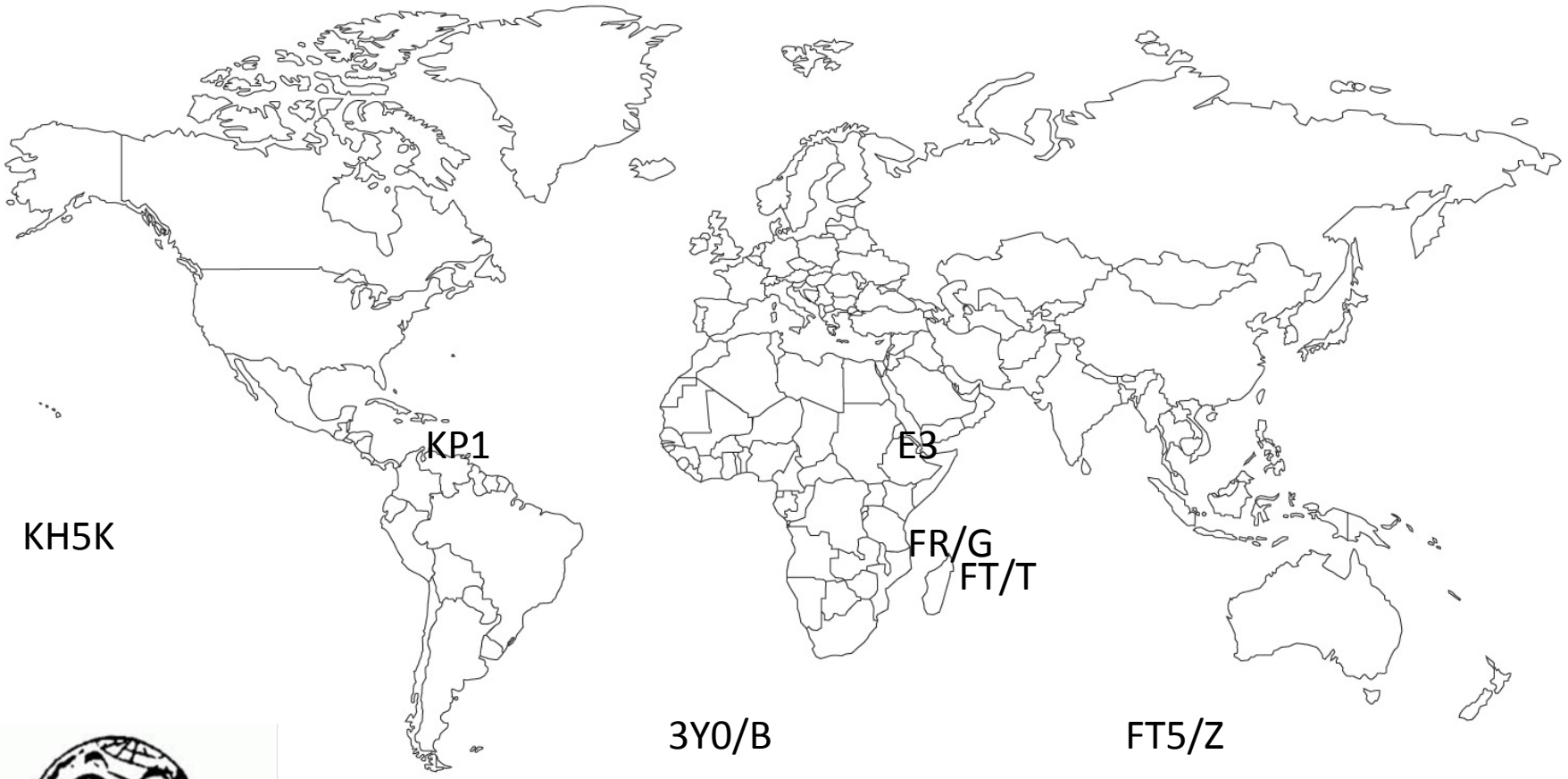
What I Need for DXCC HR #1



"Tell them to go activate what I need!"

Azimuthal View – Centered on KY6R

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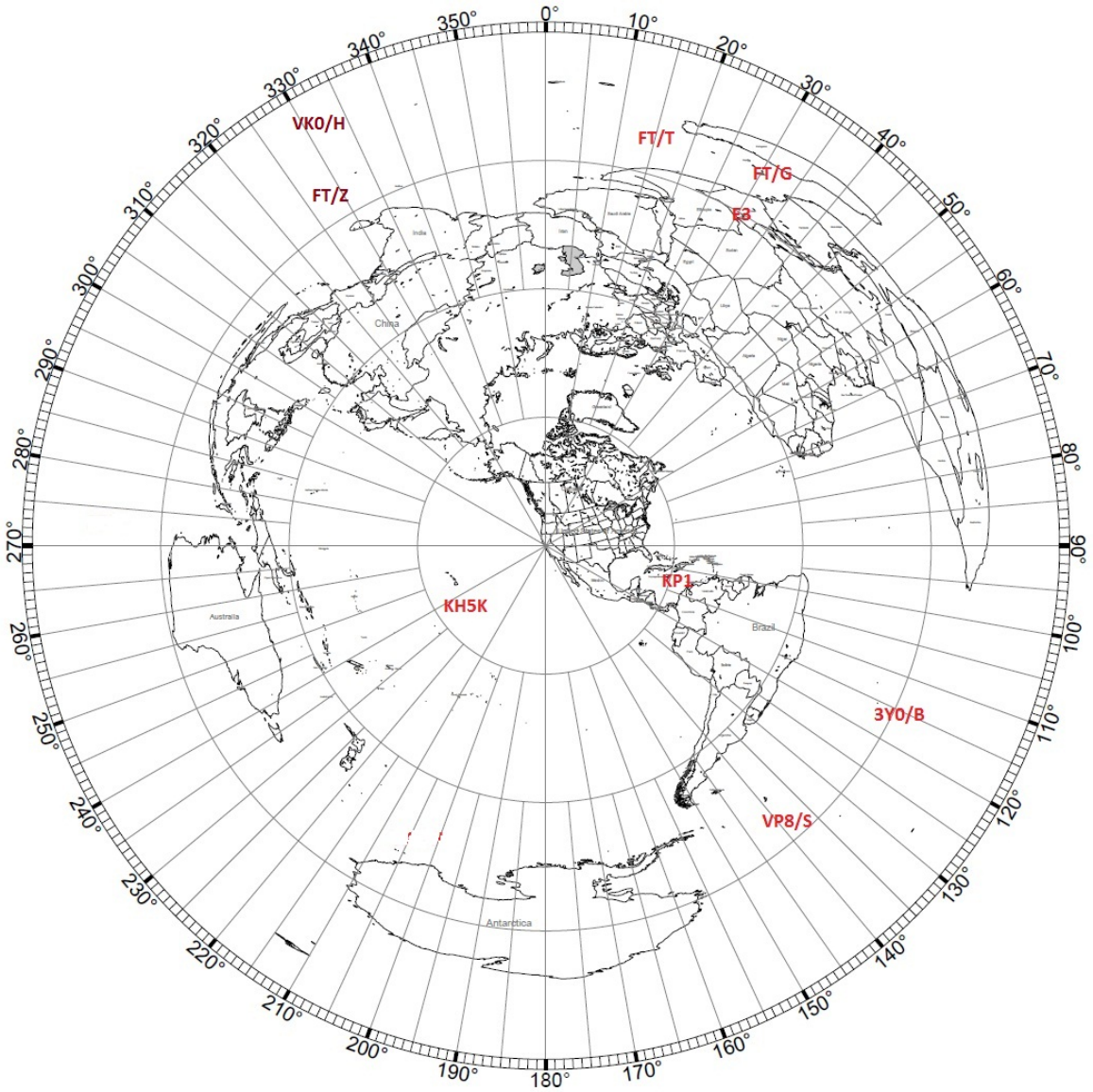
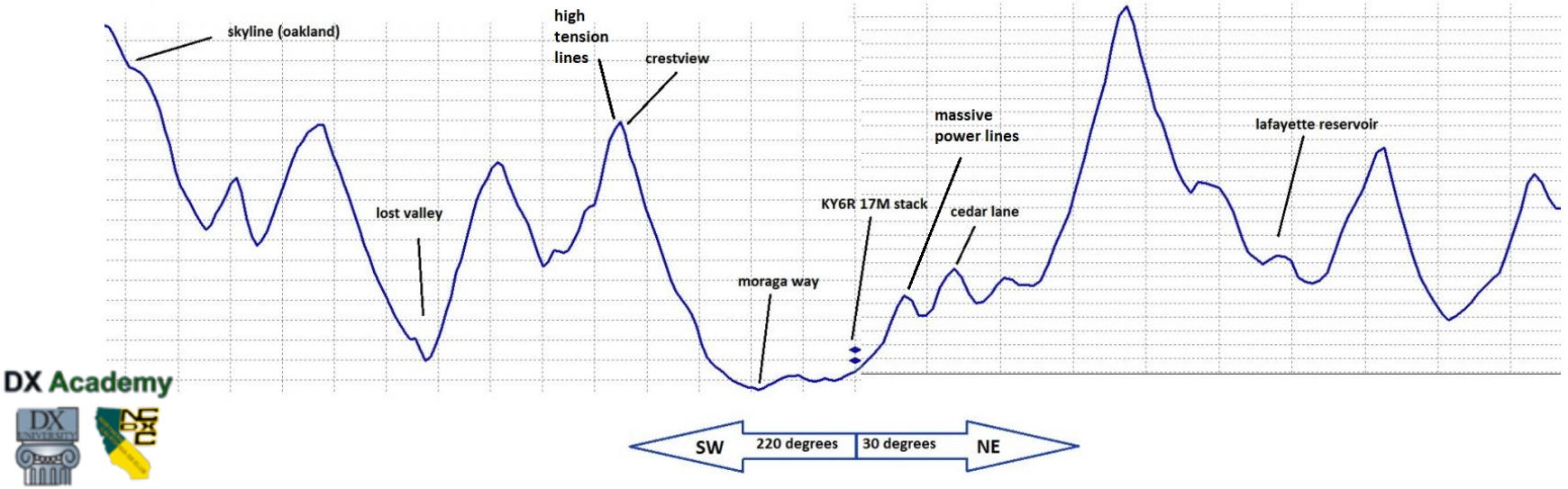


My QTH

Shunts signals below 11 degrees

Shunts signals below 18 degrees



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Best DX Advice I Have Ever Received

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- From Dean Straw, N6BV's Pacificon 2011 Antenna Forum Presentation: "How Does My Little Gun Compare to a Superstation?":

  "In a pileup, even 1 or 2 dB can make a difference in getting through"

- From Tom, N6BT's Book "Array of Light":
  Page 19 – ***"I have concluded that 2 dB represents a level which can be heard and and accounts for another "layer" of stations that can be worked"***

The KY6R “2 dB Rule”

- If I can squeeze 2 dB out of any antenna on any band, then its worth doing. This means reducing loss in the case of a low-band vertical
- If I can drop my TOA by 2 degrees on any band, then its worth doing (as long as I still clear my hills)

HFTA + EZNec = Toolbox

- HFTA and EZNec are the two tools needed to assess the 2 dB and 2 degree rules
- I have successfully followed these rules and used these tools starting in late 2011 to achieve 100% success in every ATNO that I have gone after
- I went from 325 to 331 (that count toward DXCC) within the span of one year (2012)

My HFTA “Epiphany” . . .

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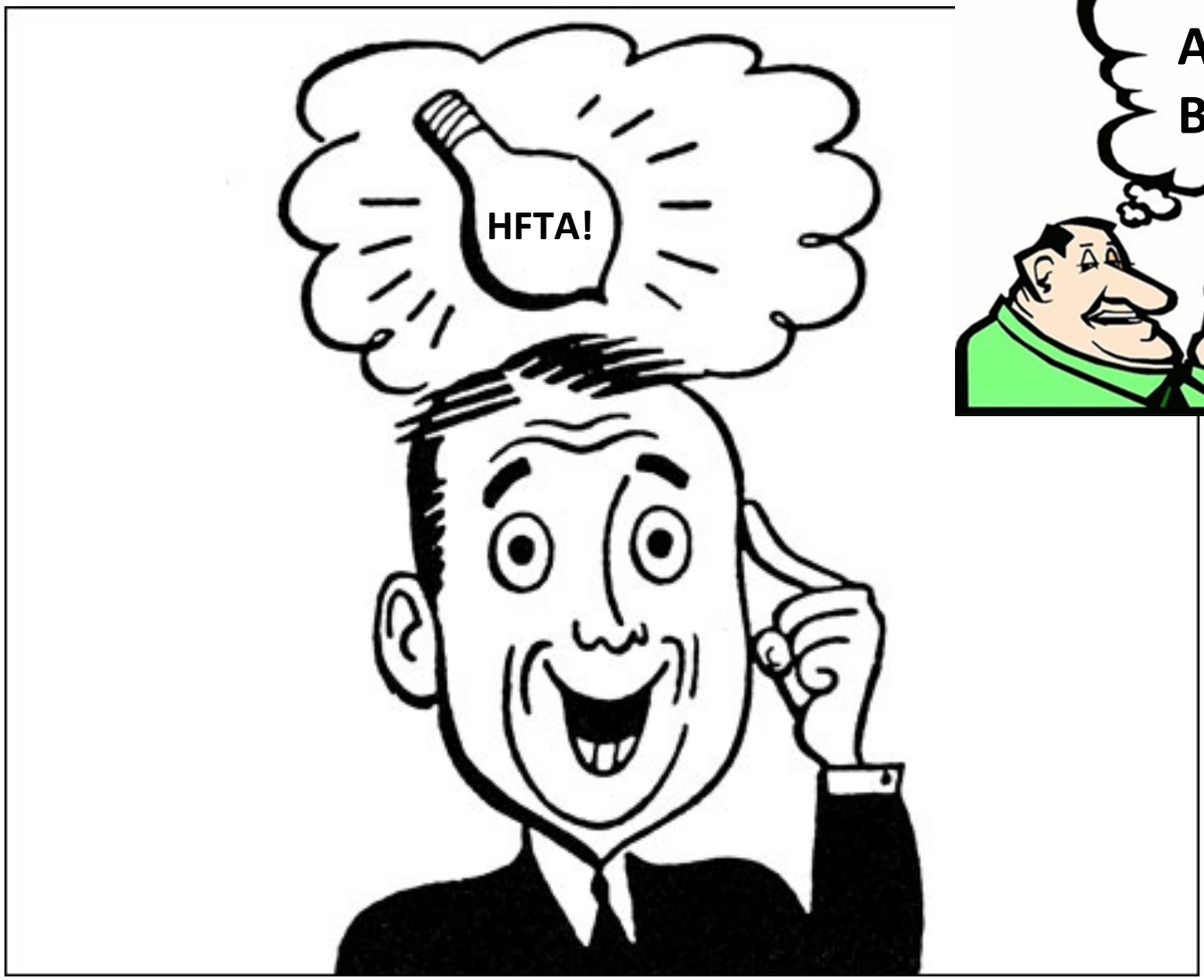

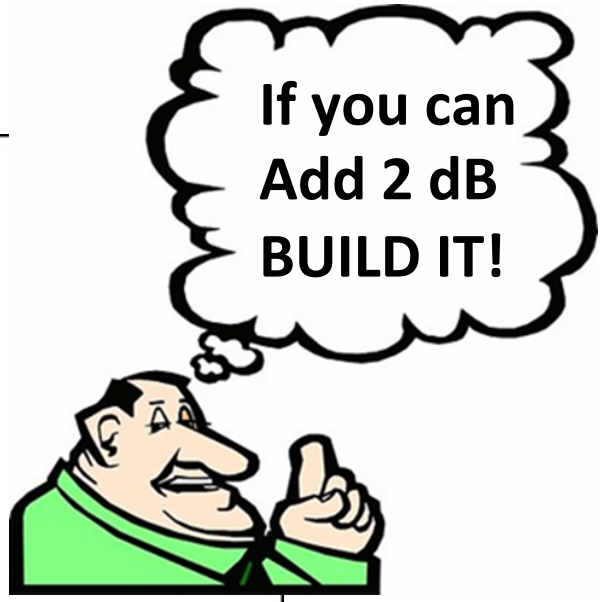

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Why HFTA?

- EZNec is great, but assumes flat ground
- HFTA superimposes horizontal antenna models over your actual terrain
- HFTA lets you know if there is any way you can eek out more gain in your antenna system

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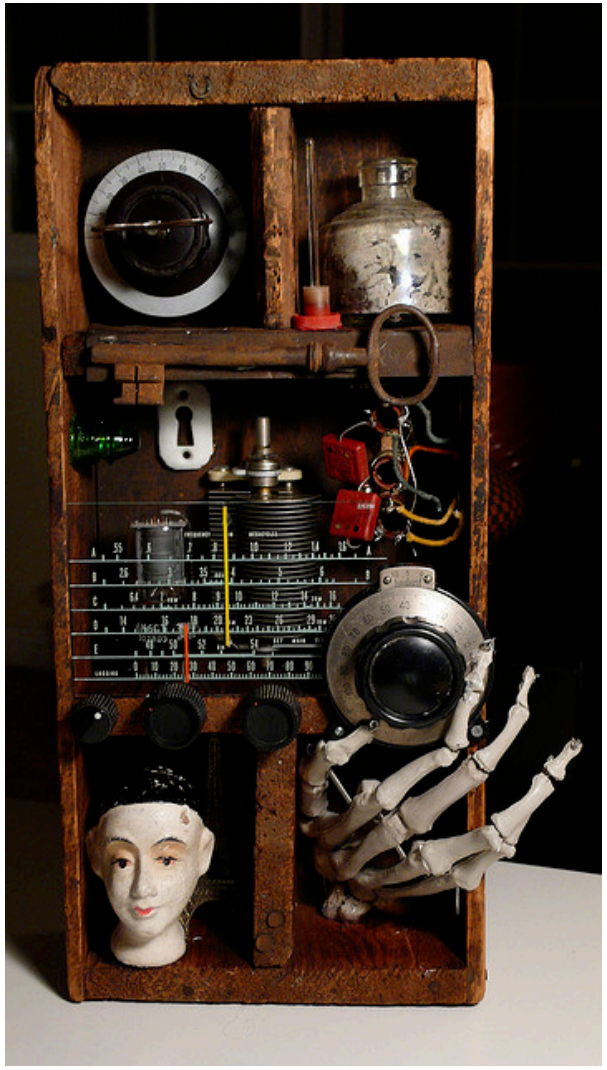
Background – Late 2011



From 2009 – 2011 I Hit a Terrible Wall

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- Hills, Hills and More Hills!
  - SP ME / AF suffers most
  - Low TOA needed at bottom of cycle
  - Nearby hills diffracts low TOA signals
  - No (or very low) sun spots – weak F2
  - I have worked stations in the same areas before – but either with higher SSN's and smaller pileups, and sometimes LP

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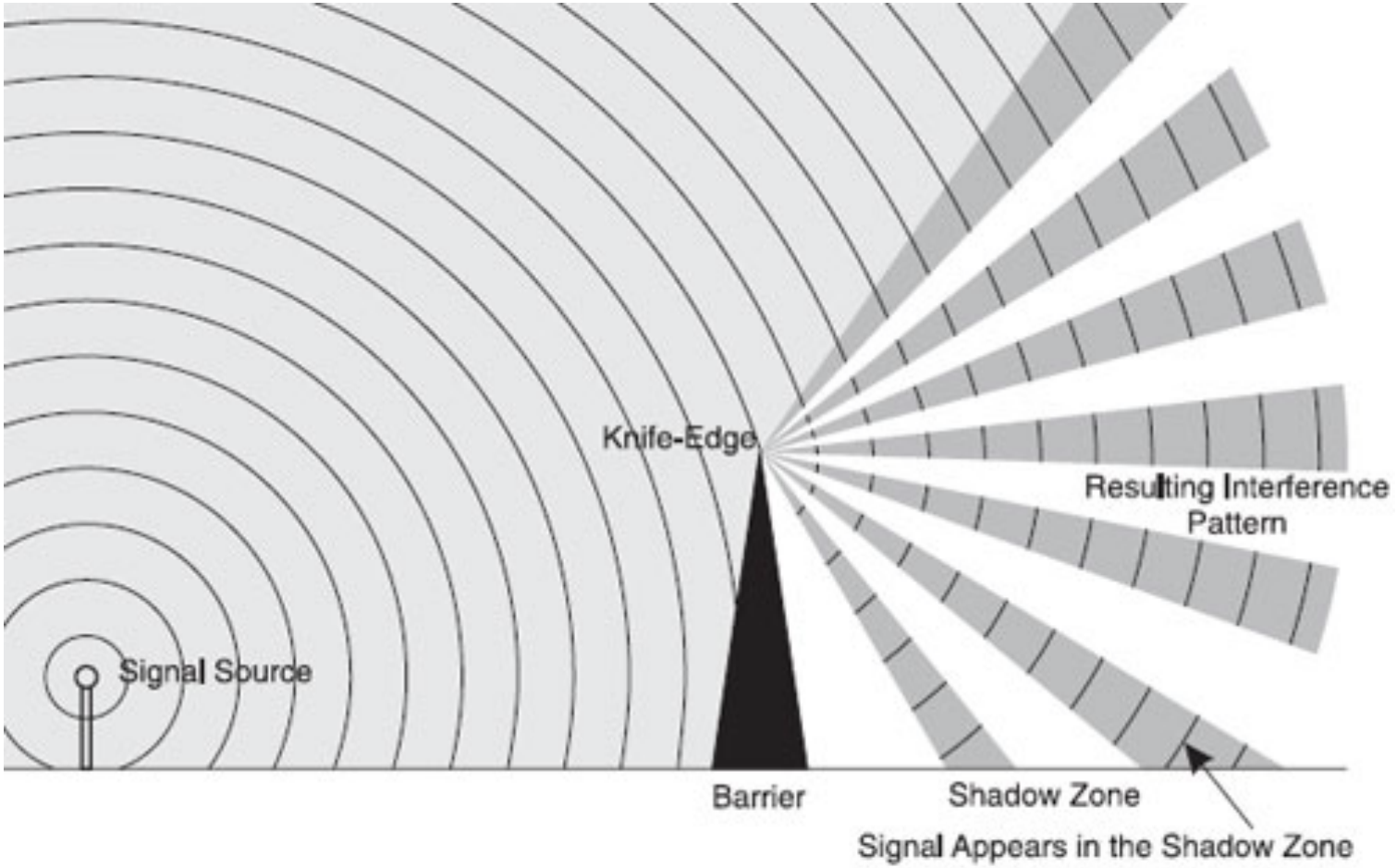
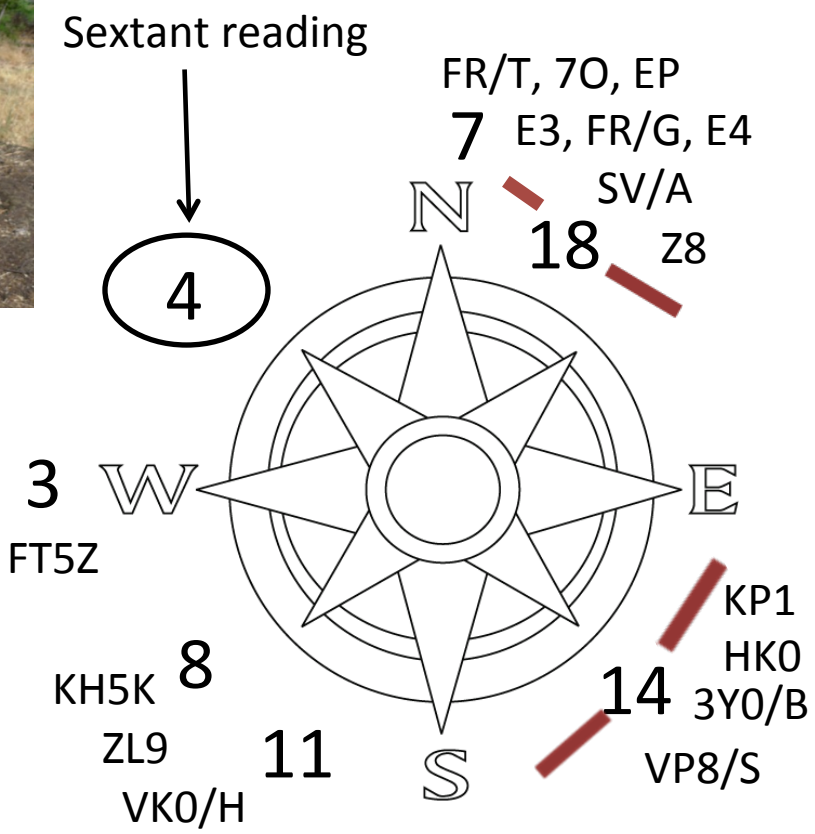
Theory #1: Knife Edge Diffraction?



I actually posted on a forum asking if anyone knew about “selective propagation “. Then I came to my senses and realized this is science – not séance.

The $12 KY6R Sextant (Inclinometer)



N by NE

These are readings from the street which is about 15’ above the bottom of the tower base or 30’ below the top.
This test proves that HFTA is correct.

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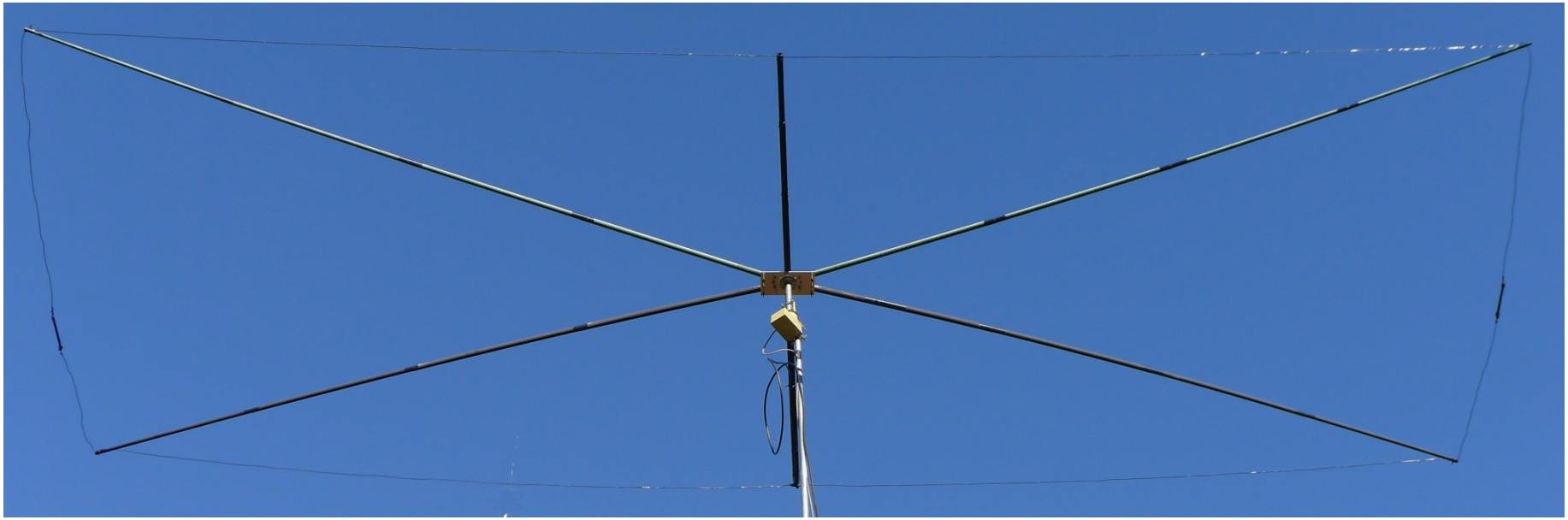
My Old High Band HF Antenna



Missing ST0R motivated me to replace wire 20M Moxon (3 dBd gain and 24 dB F/B, up 30') with:

⇒ The A3S - gives me about 2 dBd more gain on 20/15/10M

⇒ The Nested 17/12M Monoband Yagi - gave me 3 dBd more gain

⇒ The new height of the A3S and Moxon greatly lowers the TOA

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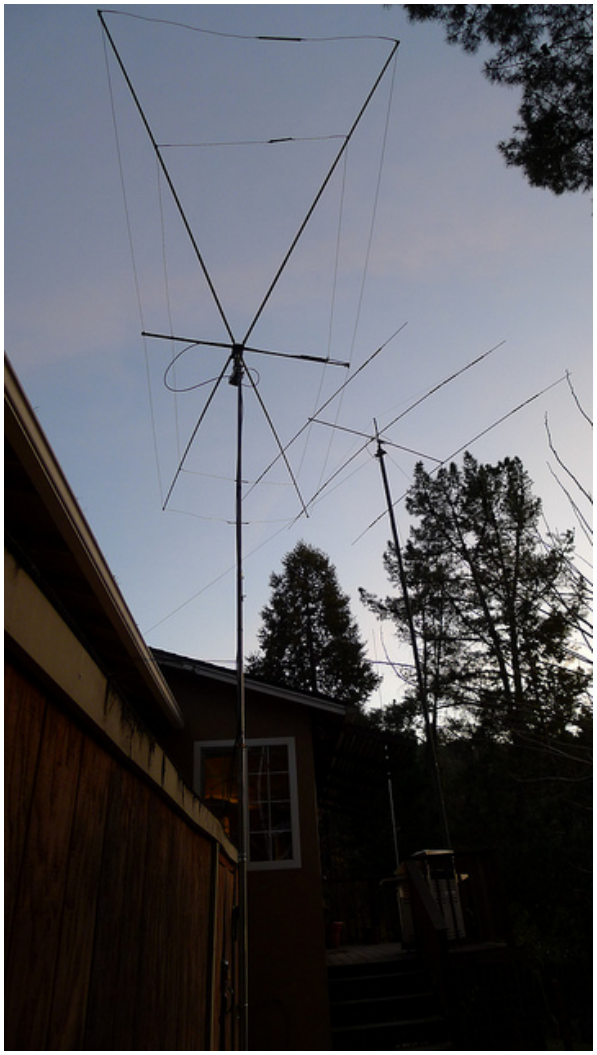
Testing an Assumption

- If I were to buy a portable / semi permanent Military Surplus Mast System (AB-952 or AB-577) what would be the best height?
- How does it compare to my A3S that is up 30'?
- How does it compare to what I had before (20M Moxon up 30')
- Will it be worth investing $800?

Paid $1500 for >2 dBd gain +24 dBd F/B

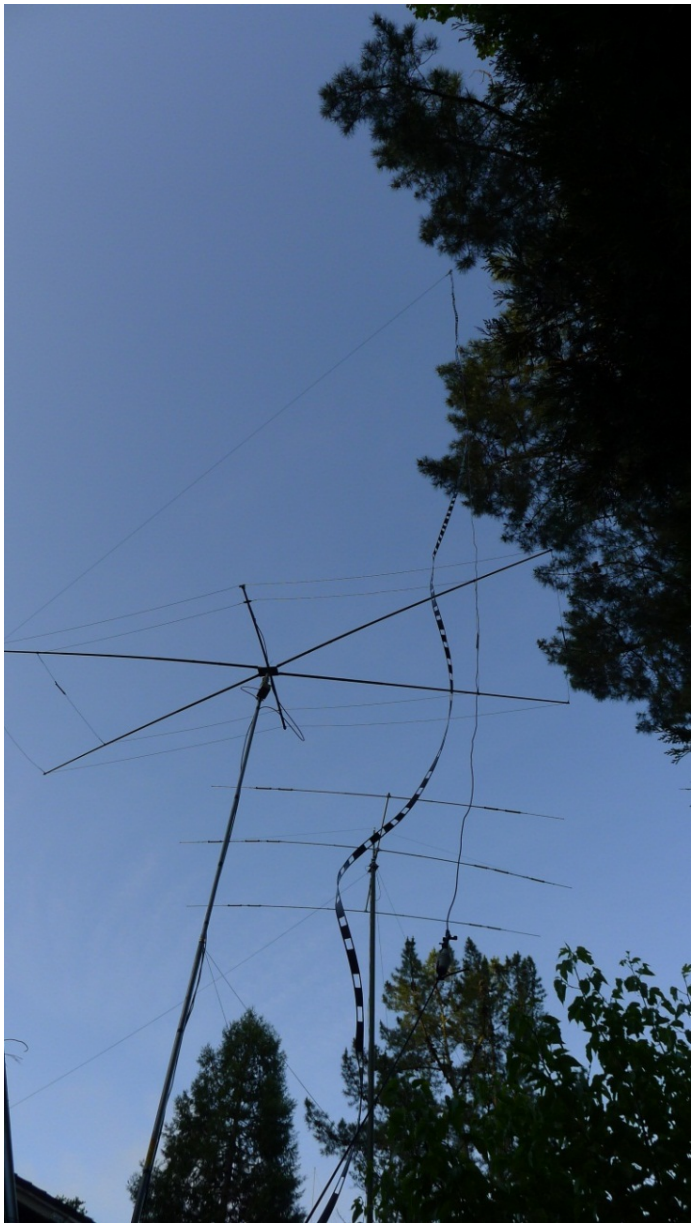
A3S + 30M at 46’ on AB-952
- Replaced 20M Moxon at 30’



17/12M Nested Moxon
- Replaced 20M Moxon at 30’ (which acted as a dipole)

Increased 33’ vertical to 45’ w/six 5’ top hats, added Switchable Base LC’s

K9AY Loops for RX and 40M Half Square



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Full KY6R Honor Roll “Retrospective”

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“Basic” Little Pistol Tips

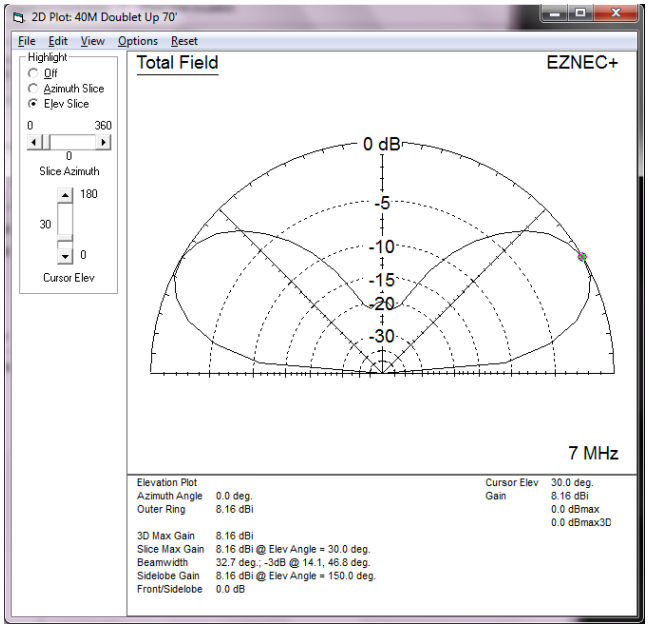
- The antenna is easily the most important “tool” to earn Honor Roll
- Your operating skill is also critical. Listening and knowing how to work split is a must
- You don’t need an amplifier, but it takes a lot of frustration out of the chase
- You need a receiver that has good filtering and which lets you hear the really weak ones
- Live by the cluster, die by the cluster

Favorite Antennas for the First 300 (aka "Before The Wall") . . .

- Ladder line fed doublet up only 35' and used with a tuner
- Bruce Array – opened 40M up in a way that the low doublet couldn't
- I also tried Force-12 Sigma 5 and 40 short hatted vertical dipoles
- Moxon wire beams on Crappie Poles

“Lowly Dipole” – High and in the Clear

Old Dipoles Can Learn New Tricks!



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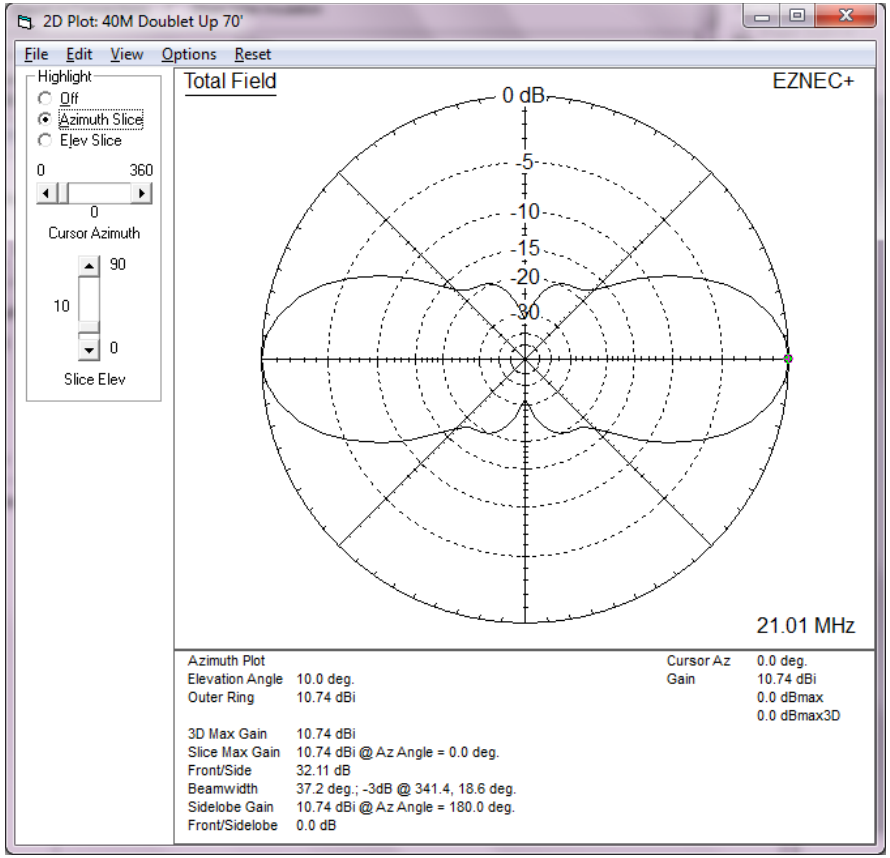
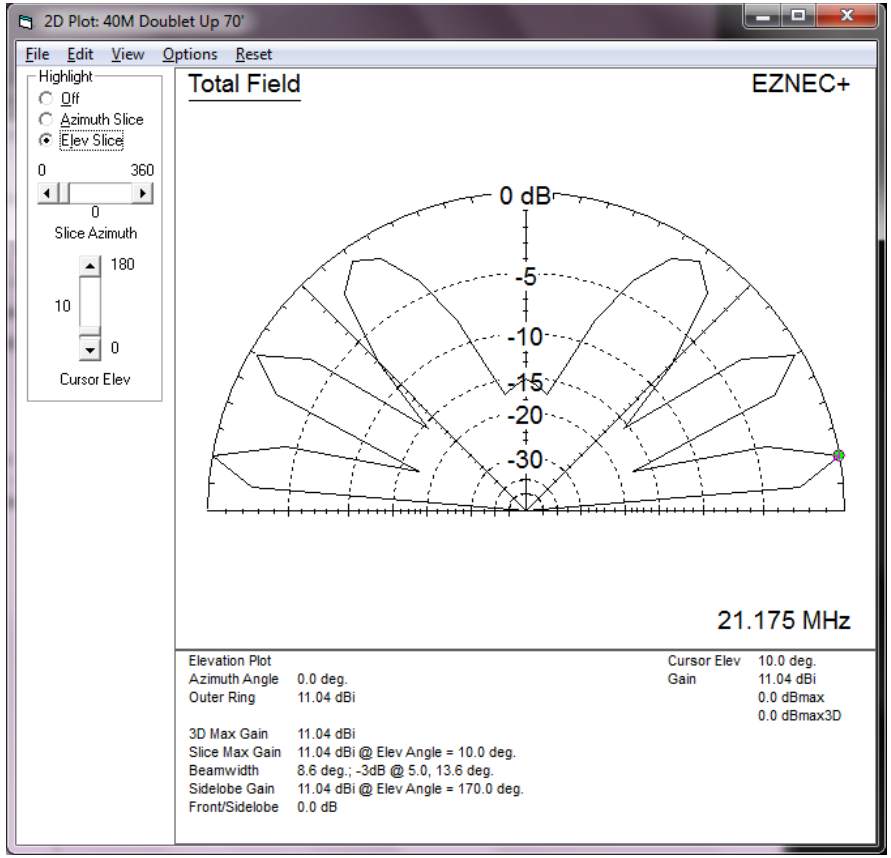
40M Doublet on 15M





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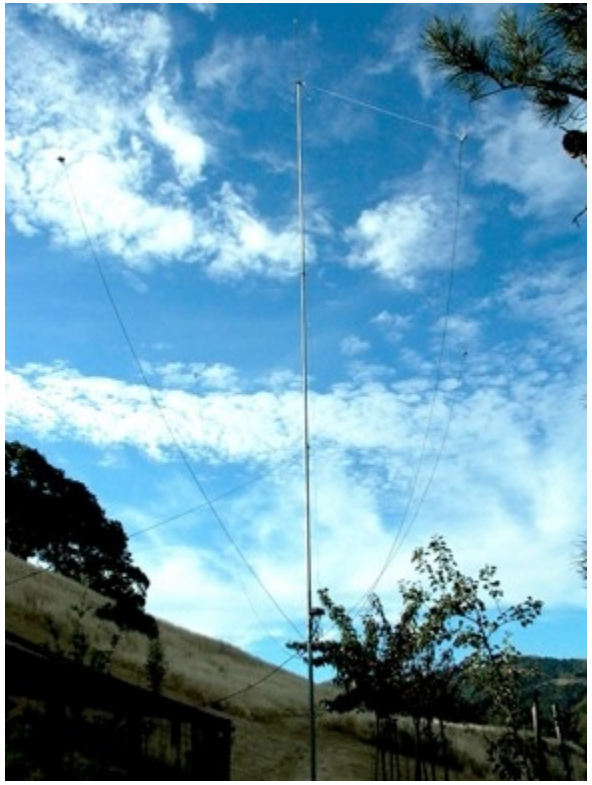
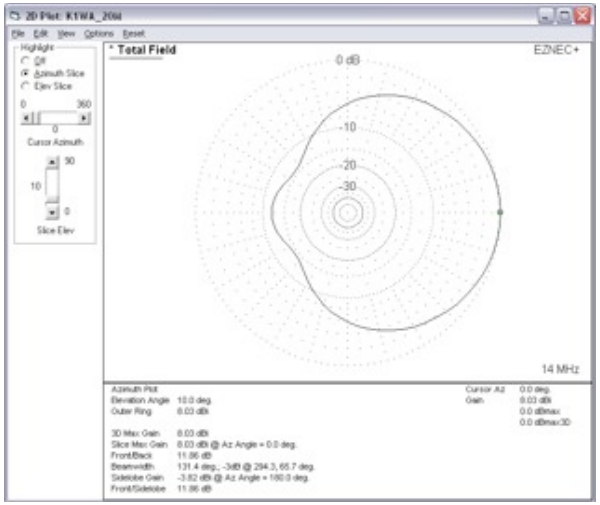
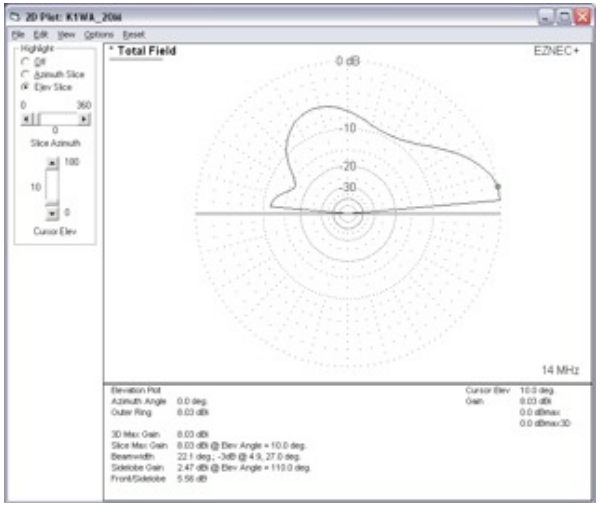
Verticals That Don’t Require Radials



K1WA Array





SHVD - Best Low Band ROI

Iraq, Afghanistan, Syria

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If I Could Only Have One (Stealth) Antenna

+

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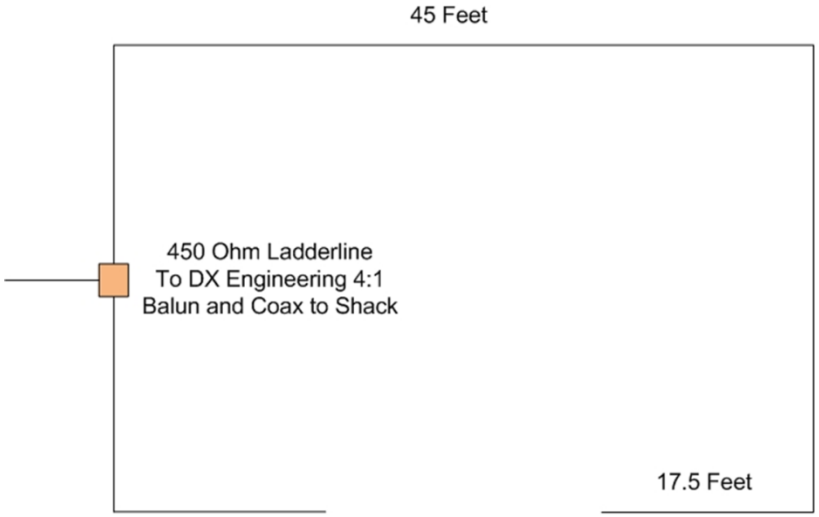
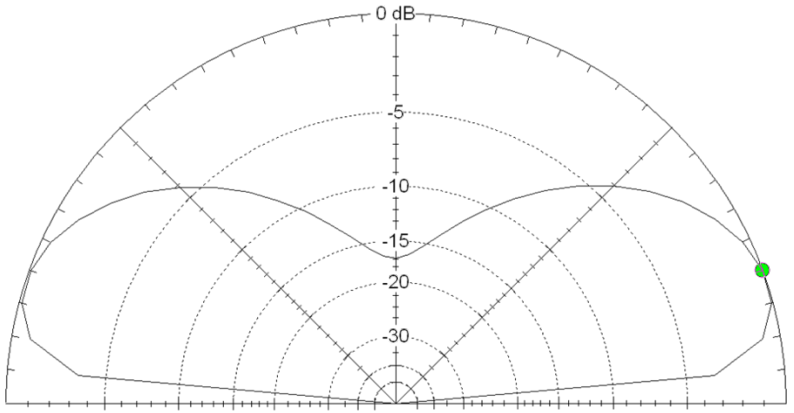
Bruce Array's on the Low Bands



30 Feet



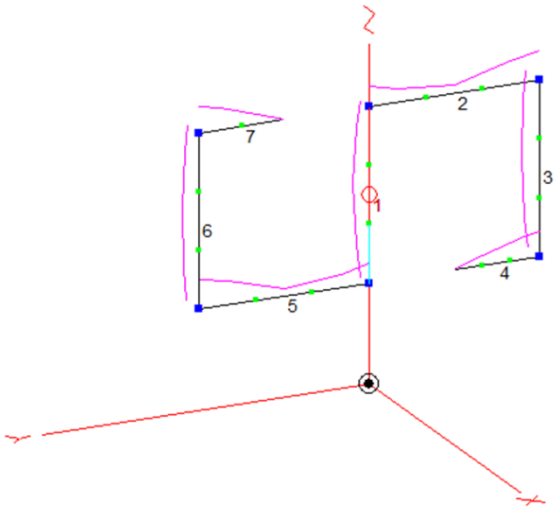
7 MHz

Elevation Plot
Azimuth Angle 265.0 deg.
Outer Ring 3.78 dBi

3D Max Gain 3.78 dBi
Slice Max Gain 3.78 dBi @ Elev Angle = 20.0 deg.
Beamwidth 34.9 deg.; -3dB @ 5.7, 40.6 deg.
Sidelobe Gain 3.72 dBi @ Elev Angle = 160.0 deg.
Front/Sidelobe 0.06 dB

Cursor Elev 20.0 deg.
Gain 3.78 dBi
0.0 dBmax
0.0 dBmax3D

140 Feet #12 AWG Wire – Full Wavelength on 40M
10 Feet off the ground



160M – My 9th DXCC Band

- I use a Cushcraft MA160V with 64 50’ radials for transmit
- The antenna is only 36’ tall
- I added a Ten Tec variable capacitor at the base - which doubles the usable bandwidth to 80 khz

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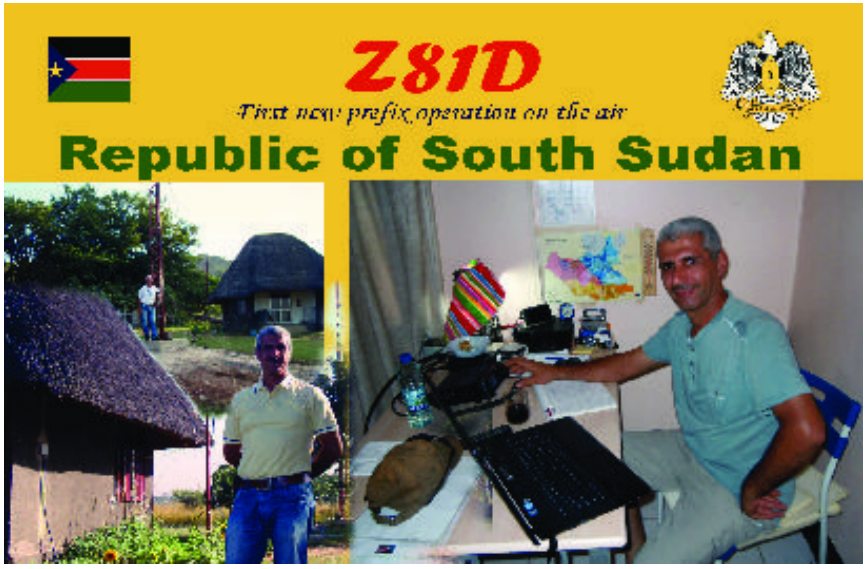
Cushcraft A3S – Great ROI



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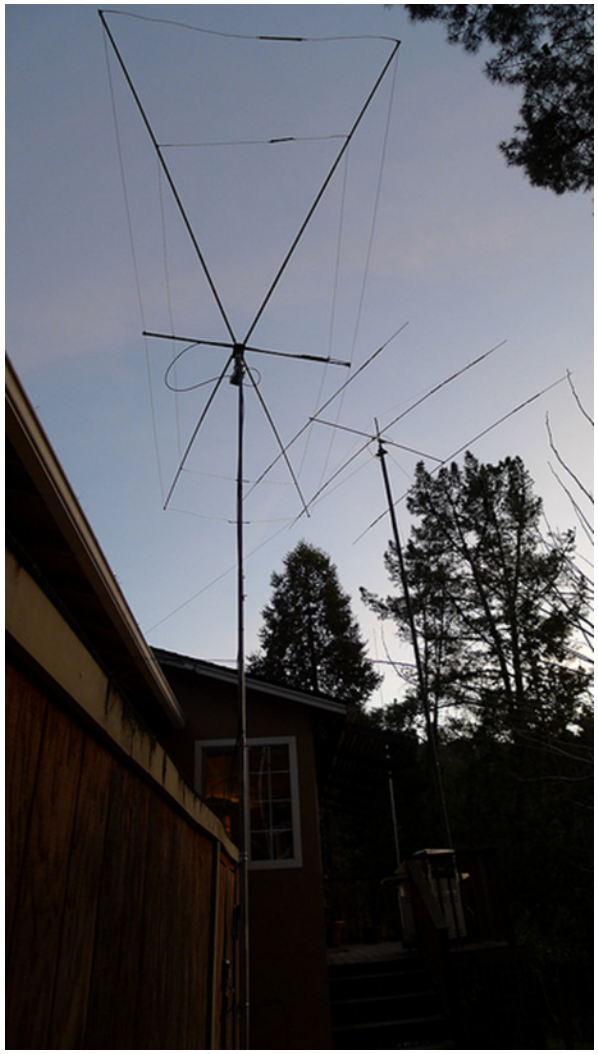
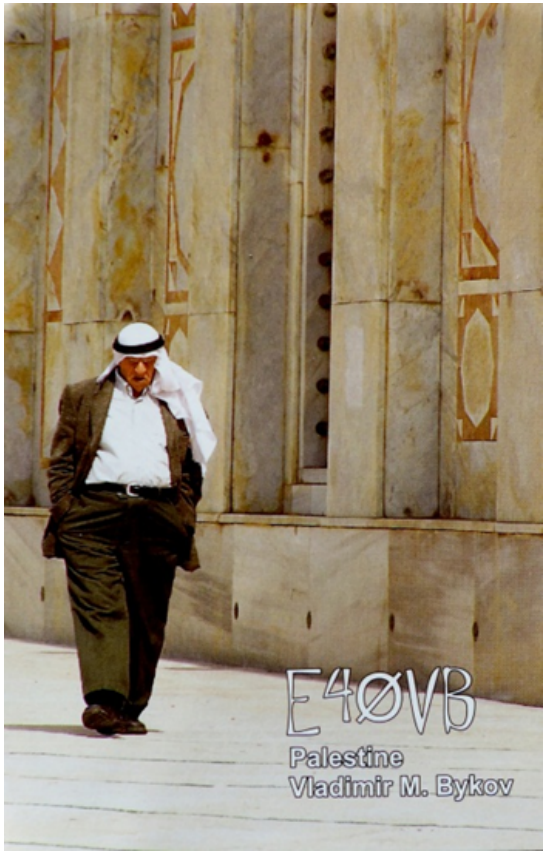
Nested Moxon – Best High Band ROI





"Yes, I worked you. Your signal was probably the weakest of any I have worked. Propagation was outstanding. Even NE5EE on his screwdriver antenna in SF was louder than you." - Paul, N6PSE

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My Annual 2 dBd "Quest"

- Can I improve my antenna gain by 2 dBd? (on the high bands)
- Can I drop the TOA by a couple of degrees?
- What are the bands with the highest probability that I should consider for the height of Sunspot Cycle 24 – for those left that I need for an ATNO?
- Last year I improved by 2 dBd across the board - by going from a Moxon to the A3S on 20 – 15 – 10 and from a dipole to a nested Moxon on 17 – 12M

There is not much gain left to squeeze out of my QTH . . .

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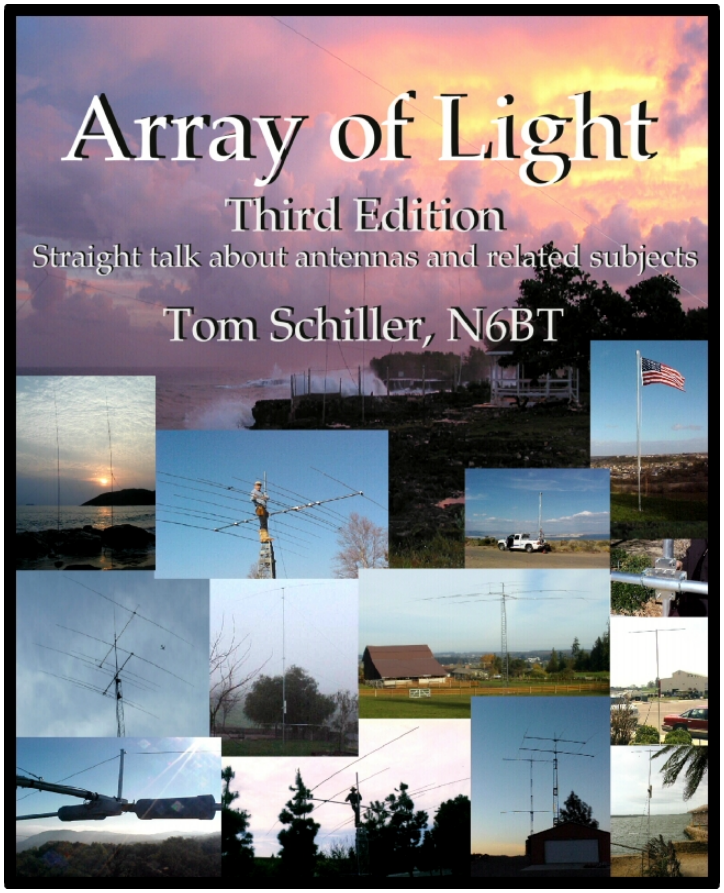
Enter “Array of Light”, by Tom, N6BT

I met Tom at Pacificon 2012 and I bought his fantastic “Array of Light” book.

I finally learned how my A3S really performed. It was a real eye opener!



I learned about “proximity”, how cell drivers are designed and the gain you get from height over ground.

I had modeled and cut the aluminum for a 24’ 4 element direct feed “OWA” yagi for 20M.

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I Purchased Two Old Yagi's For $325

Wilson M520 5 element 20M on 40' 3" boom

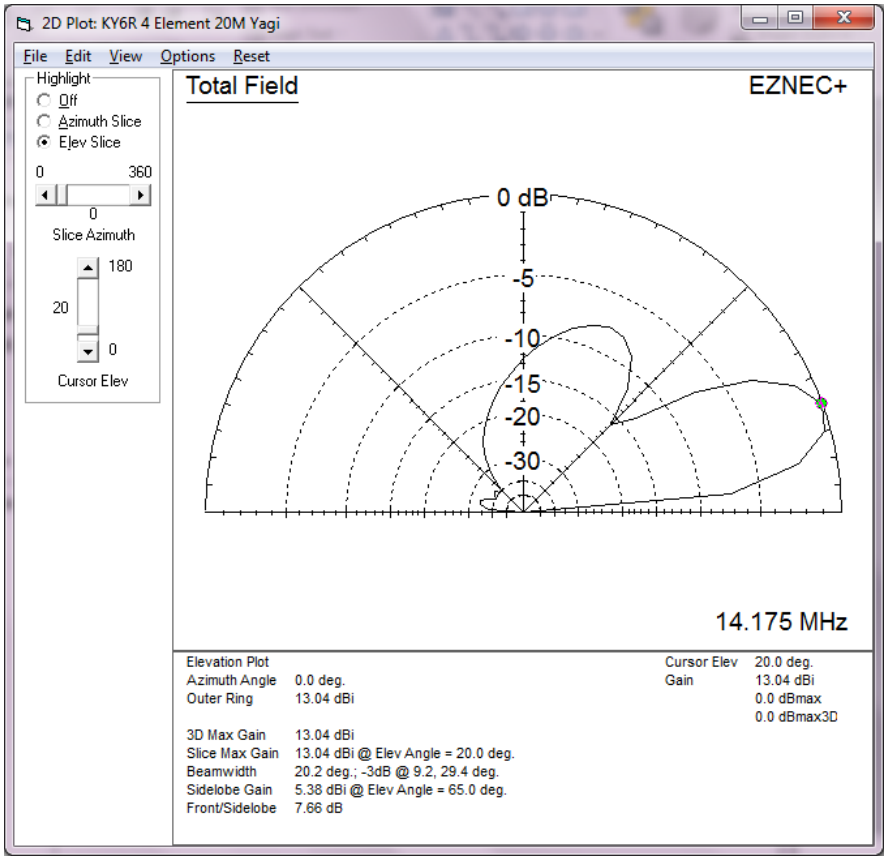
I bought two of Carl, AI6V's old antennas from his "antenna graveyard" up in Nevada City.

KLM 5 element 10M yagi on 27' boom

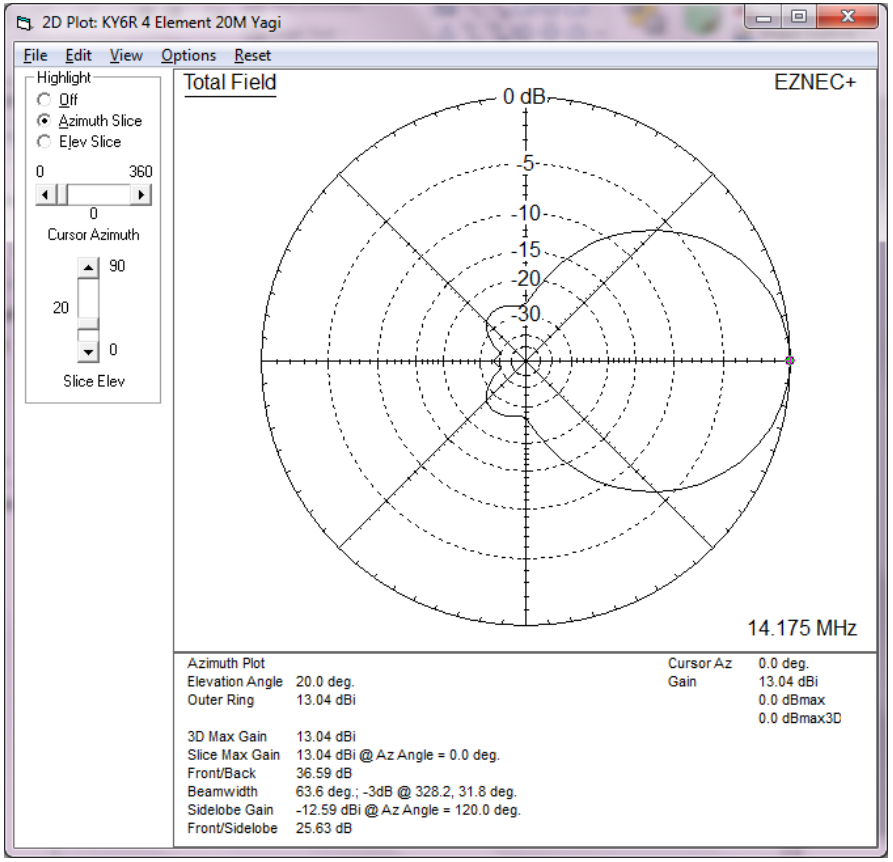
And a Force-12 C3 for $150 . . . .

The 4 Element 20M Idea (24’ Boom)

This Antenna is Featured in “Array of Light”, and I wanted to see if it made sense to have one really “serious” antenna with a lot more gain than what I had – even if just on one band – 20M being the “money band”



13 dBi Gain!



36 dB Front to Back!

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But What About My Tower?

- My AB-952 Military Mast with the A3S at 45’
- The 24’ 20M 4 element yagi would be way too top heavy
- Tom suggested a stack of 2 element mono banders

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Finally Dropped the 20M Idea

(I "did the math")

- My AB-952 can go up to 55'
- 492/f = half wave stacking distance 492/18.1 = 27'
- 55' was not enough for a 20M 2X2 Stack
- But its perfect for a 17M stack (27 + 27 = 54')
- Must use "Armstrong Rotator" though . .

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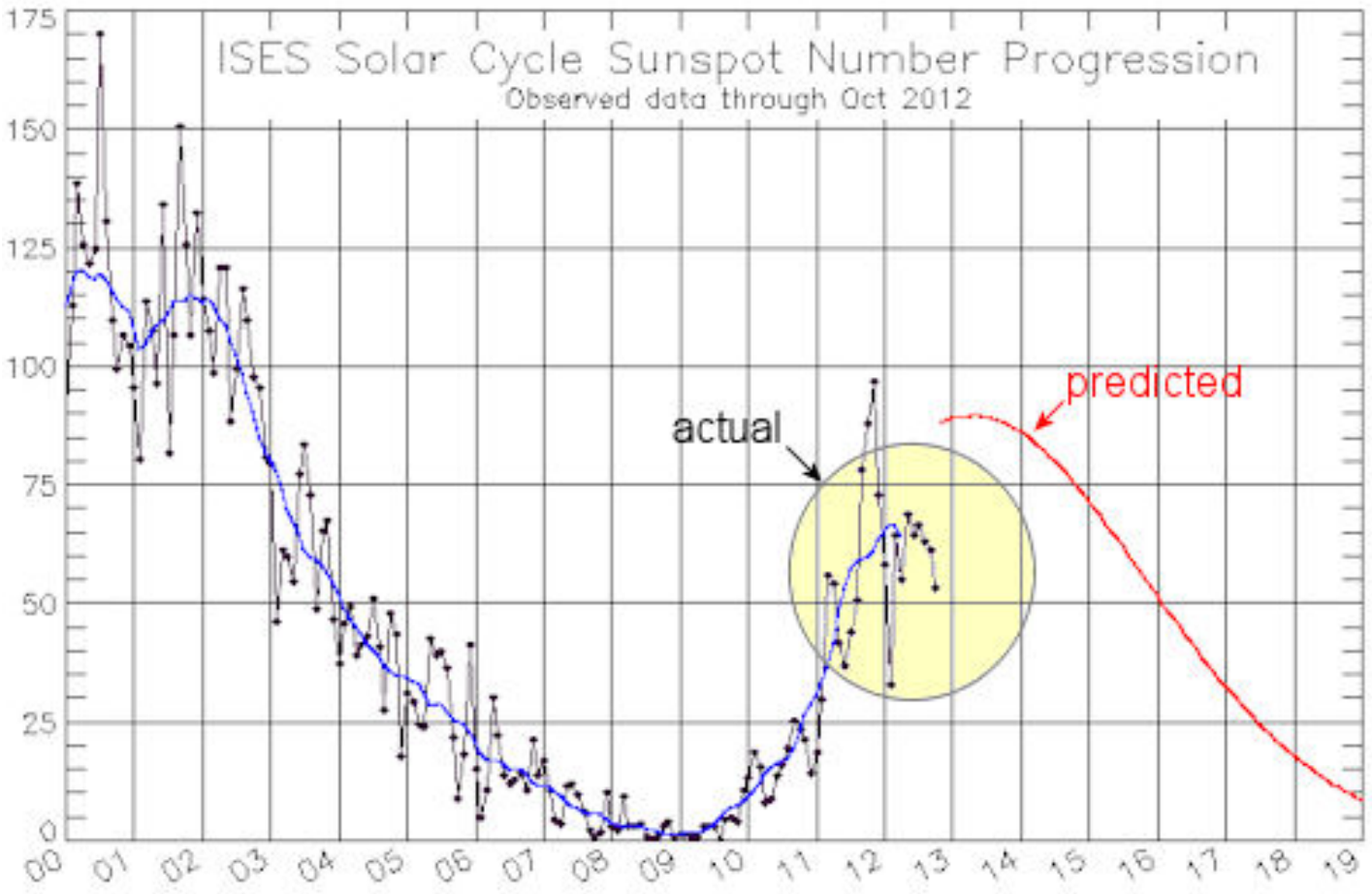
17 Meters = Good Choice



I am not a contester, and 17M seems to be a great strategic choice for this ***very*** weak cycle

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My 17 Meter “2X2” Stack

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Why a stack?

- Very good gain
- Low TOA
- Flexibility – switch for best angle / null
- Compressed lobes
- Broad banded
- “Models well”, but more importantly, on air it works well on the other bands (with a tuner)

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Tried a 17/12M duo bander

PRO: Compact and fairly light weight
CON: Still too top heavy on my tower

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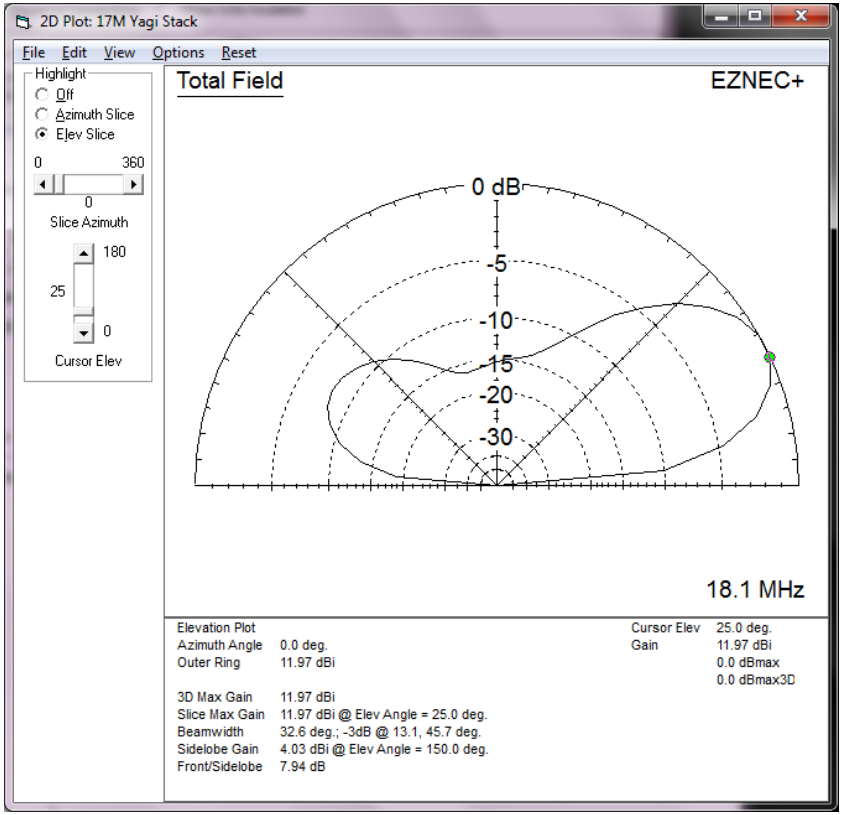
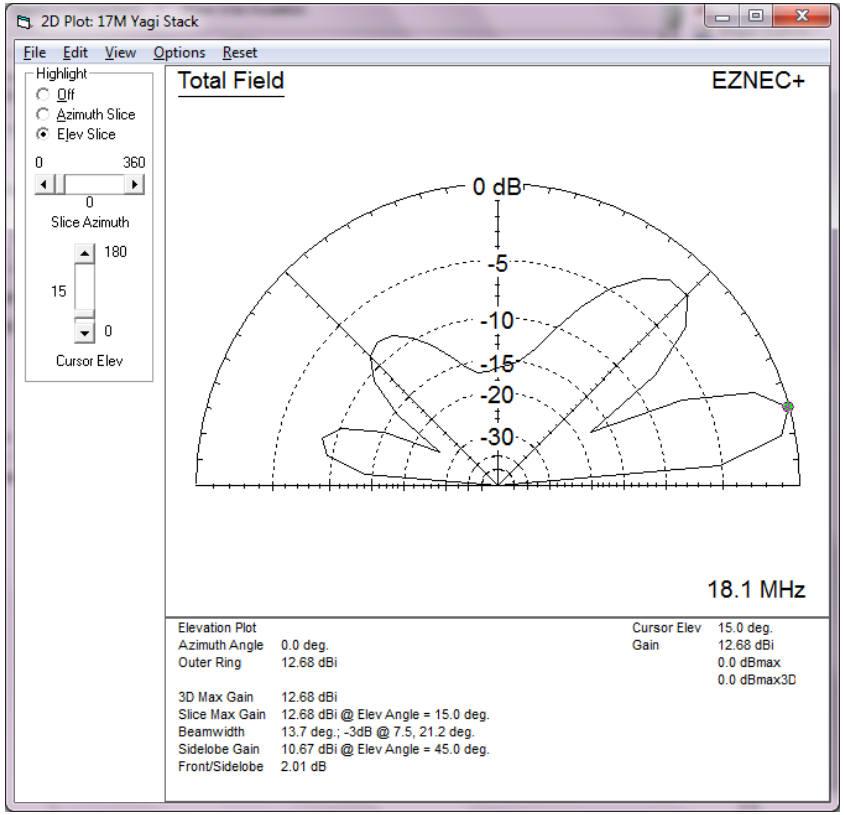
Single 17M Yagi's

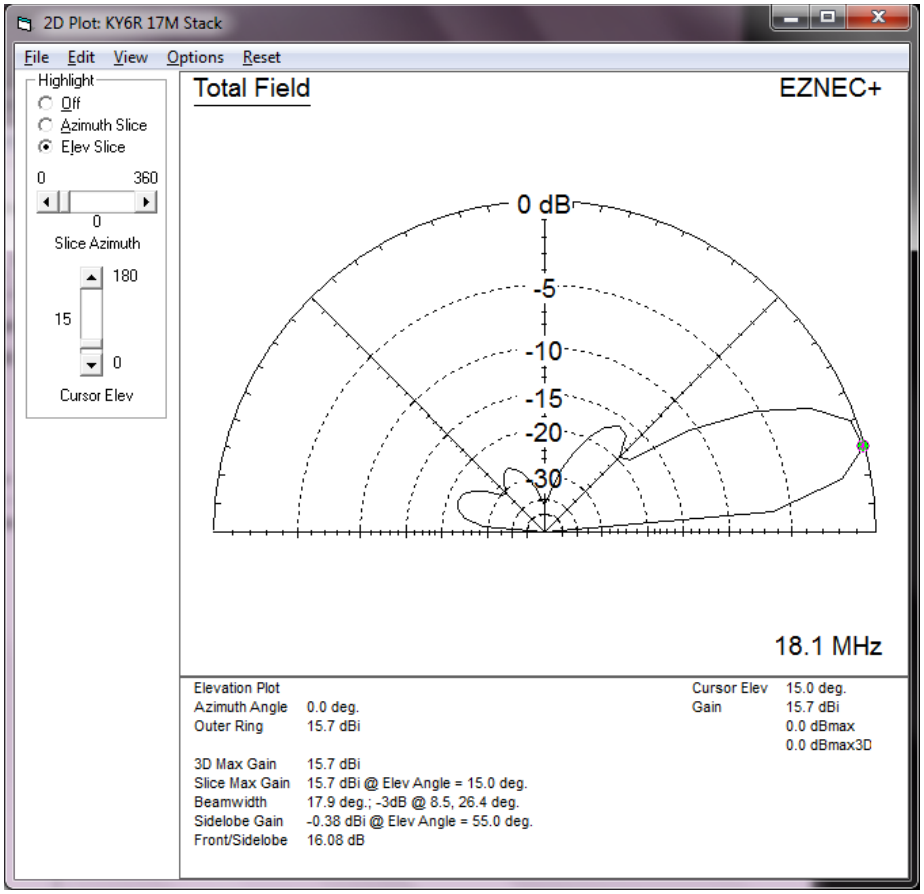


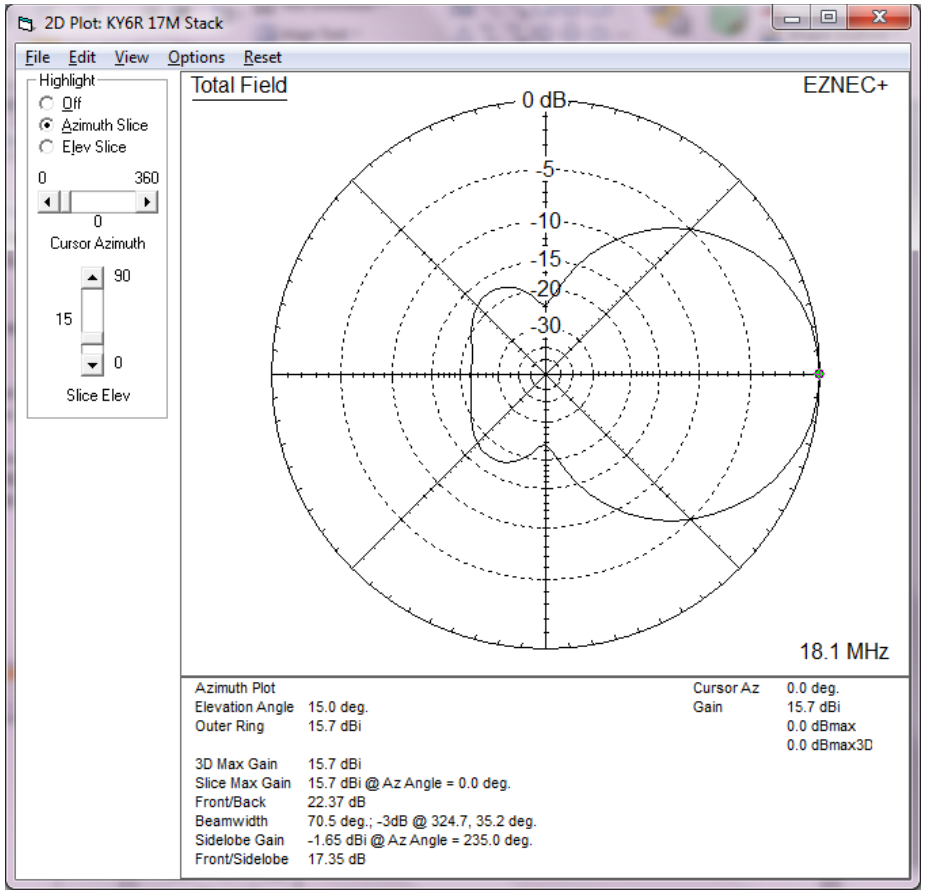


At 27' – ~ 12 dBi

At 54' – ~12.7 dBi

What about a 2x2 17M Yagi Stack?





15.7 dBi, Excellent TOA

22.4 dB F/B

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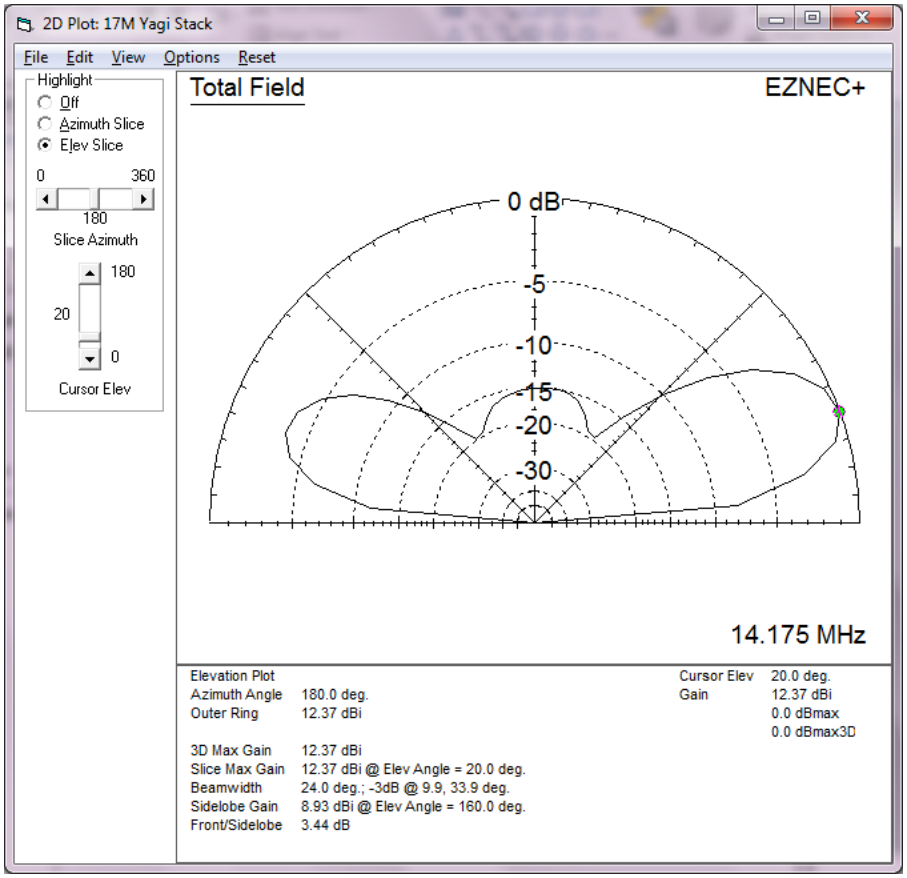
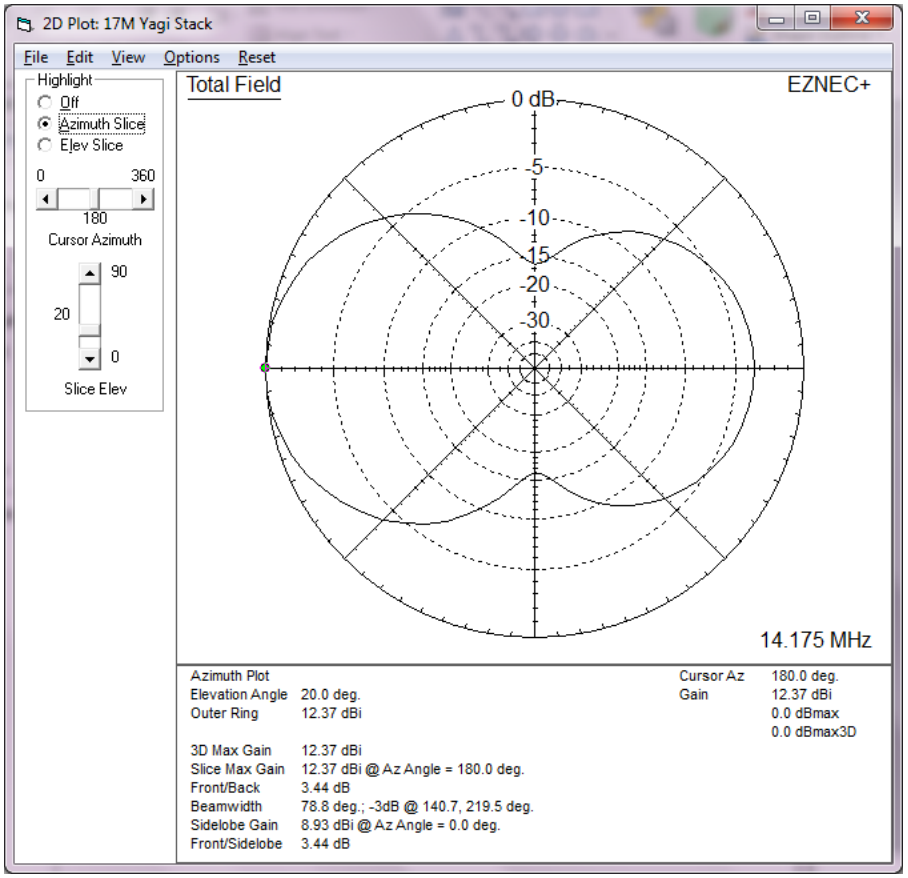
The Same Stack on 20M





12.4 dBi in reverse direction, Good TOA

Insignificant F/B

Has the characteristics of an Extended Double Zepp

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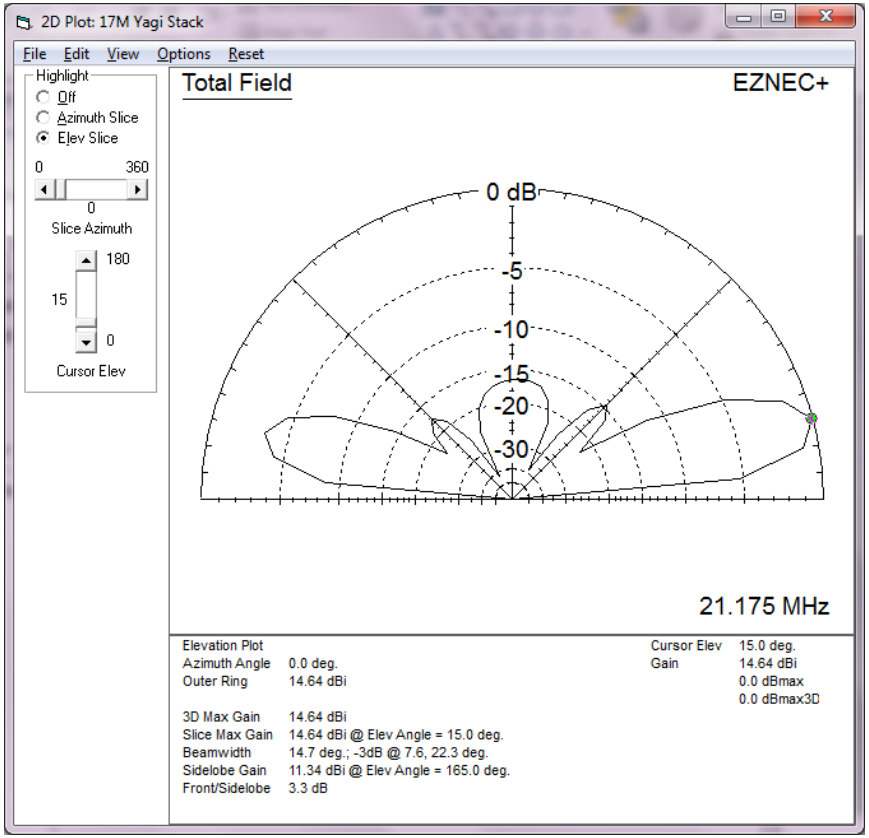
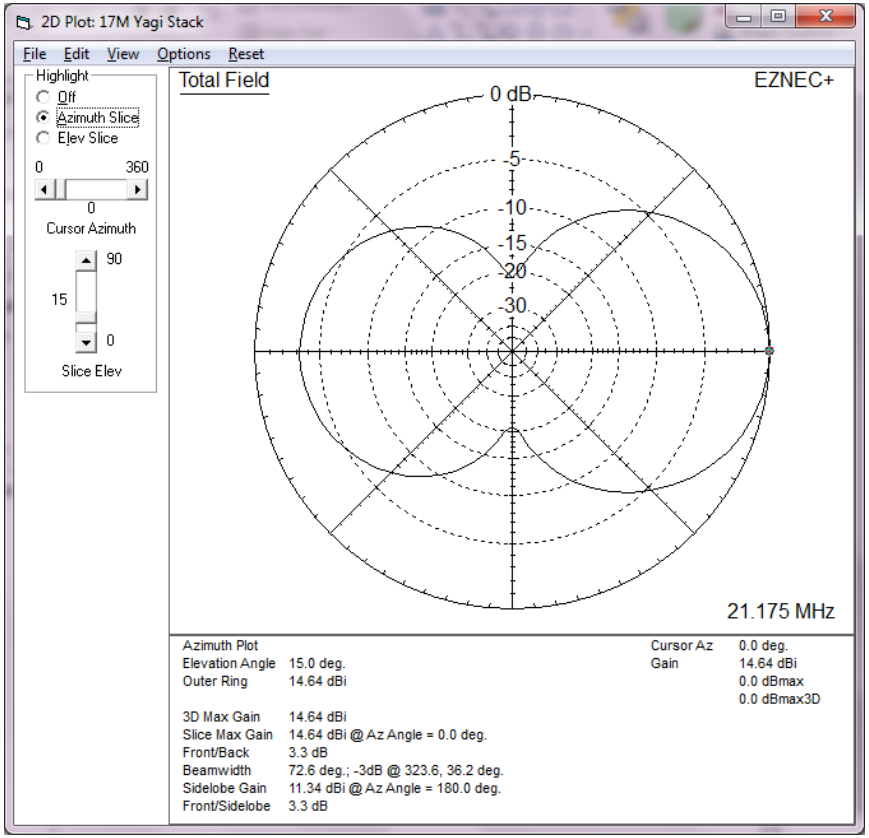
The Stack on 15M





14.6 dBi gain, Excellent TOA

Insignificant F/B

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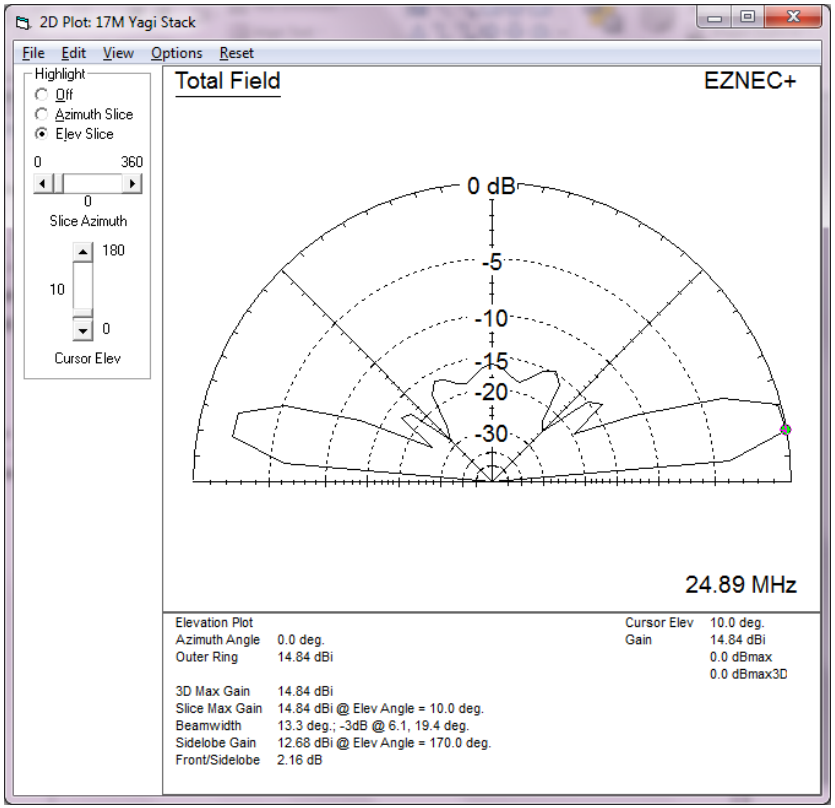
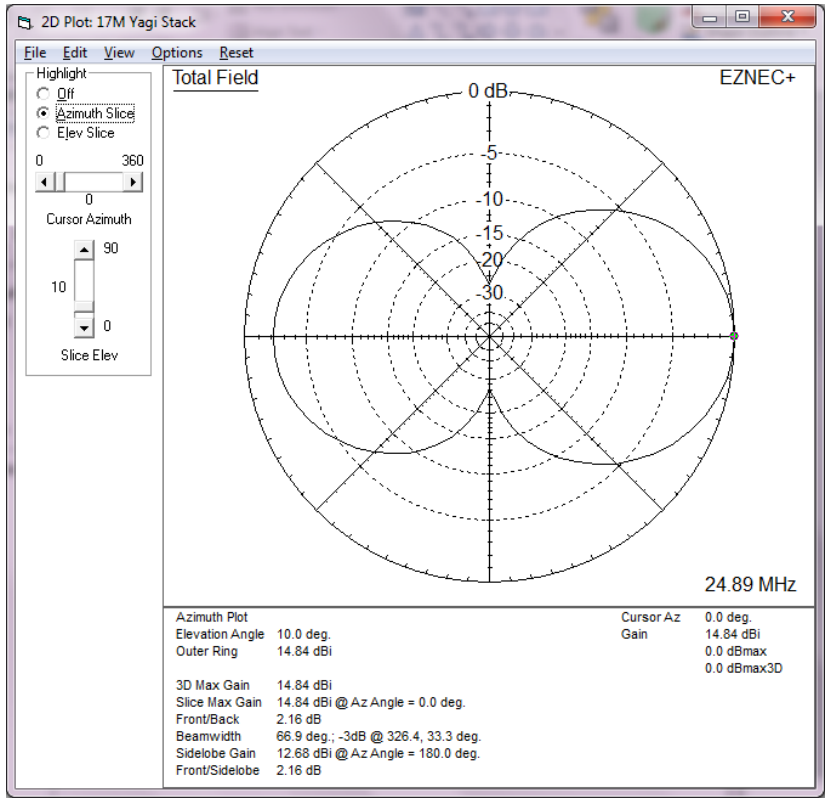
The Stack on 12M



14.8 dBi gain, Superb TOA



Insignificant F/B

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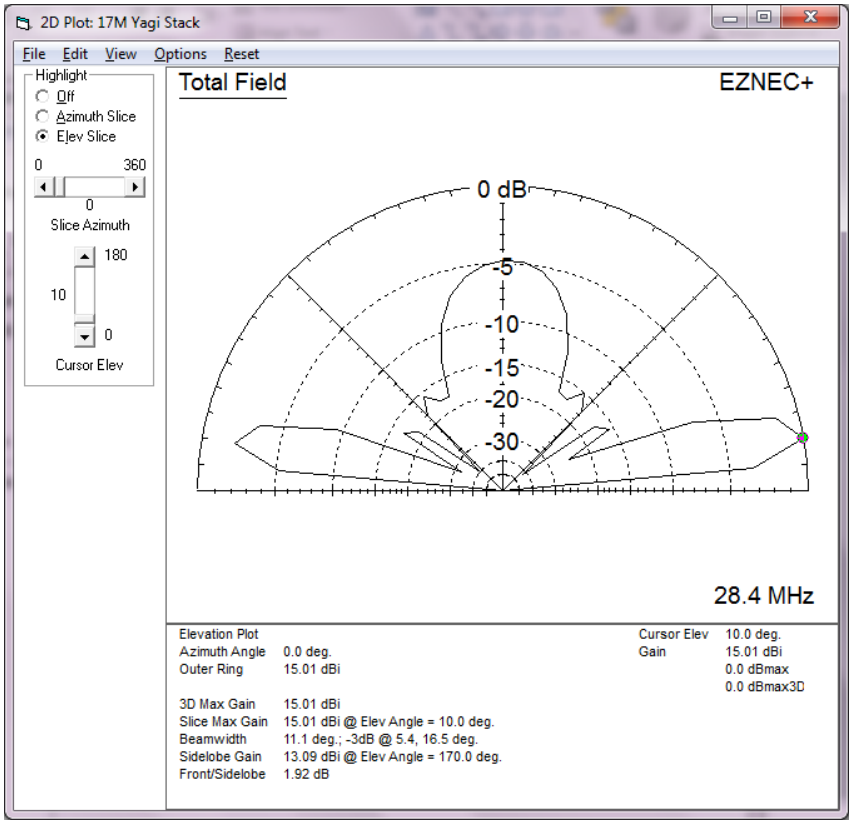
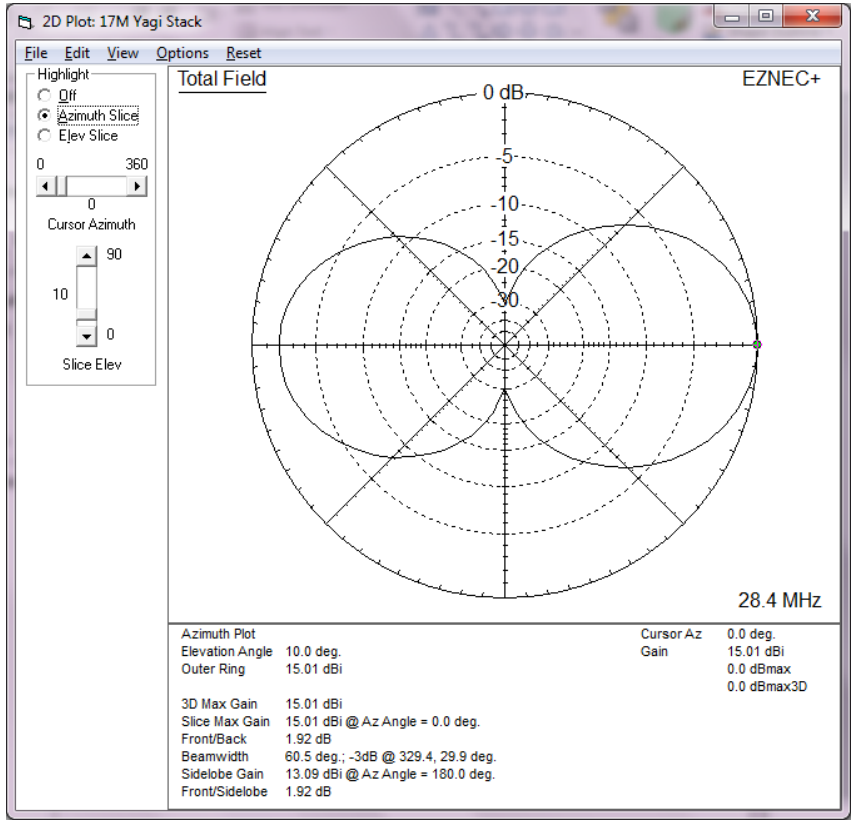
The Stack on 10M





Good gain – but with big ugly lobe.
Superb TOA

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Array Solutions Stackmatch II

ARRAY SOLUTIONS

StackMatch II Controller

Does a great job of phasing and “flattening” the SWR of the two yagis in a stack

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Does it Pass The 2 dBd Test?

BAND	ANTENNA	PASS?	DIFFERENCE
20M	A3S (2 dB) with trap loss and spacing	Yes	+2 dB [*]
17M	Nested Moxon (4 dB)	Yes	+3 dB
15M	A3S (3 dB) with trap loss and spacing	Yes	+2 dB [*]
12M	Nested Moxon (4 dB)	Yes	+2 dB
10M	A3S (4 dB) with trap loss	Yes	+2 dB [*]

Spec for spec, it passes the test. Lets look at the stack (real world) given my terrain in HFTA.

[*] The A3S has less gain than its published Specification – by at least 2 dB, maybe 3 dB. Its hard to tell exactly how much less, but minimizing loss is the name of the game.

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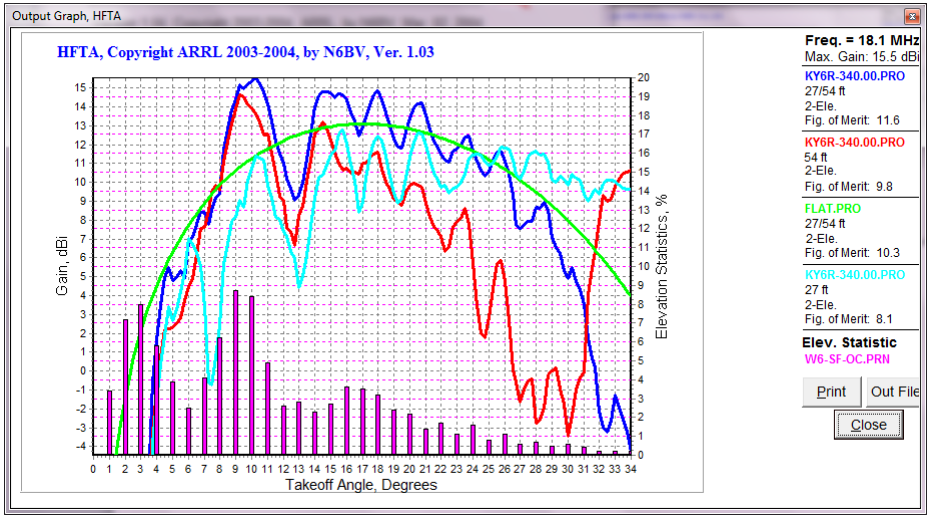
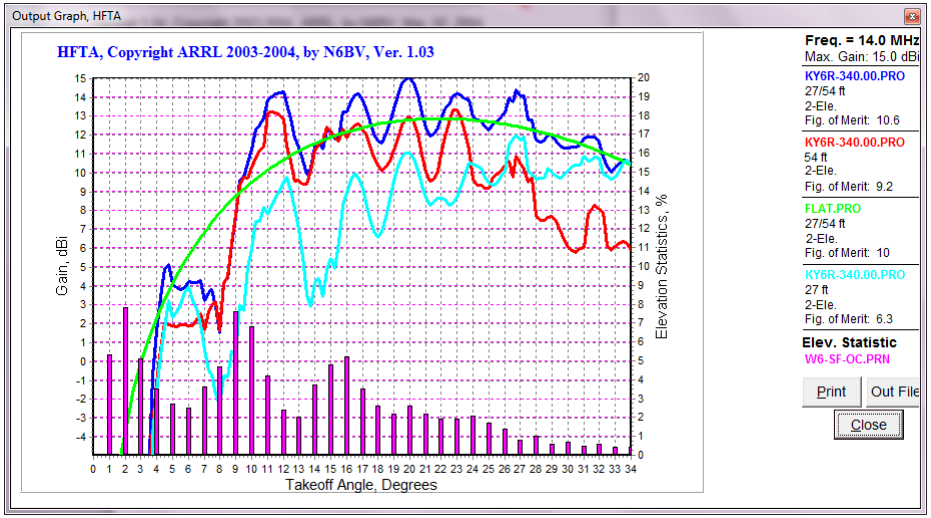
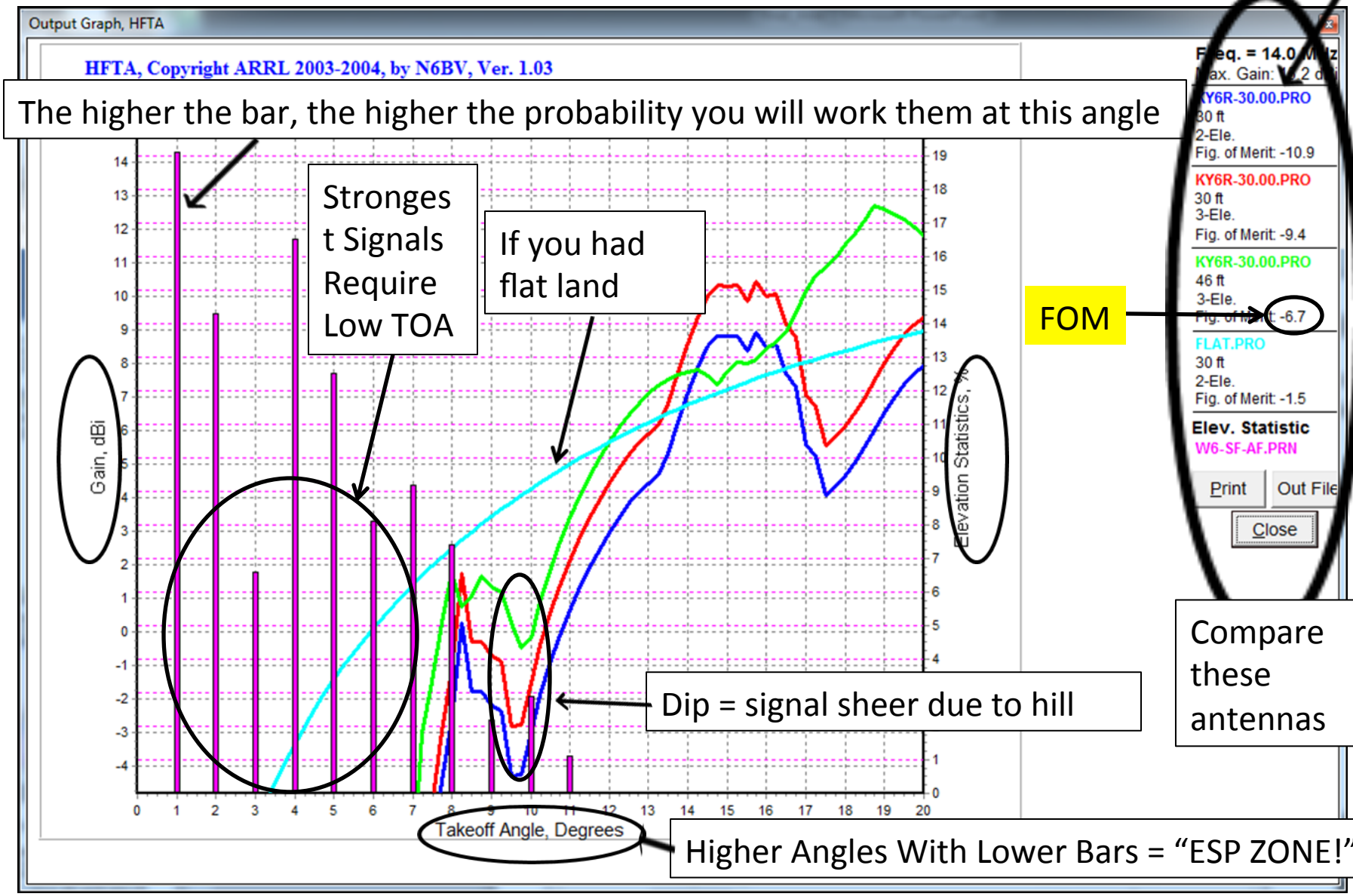
A 15 dB Difference!





- I consistently get reports that just the top yagi in the stack is 15 dB better than both switched in
- This happens on both 17M as well as 20M
- Its not quite as apparent on receive
- There are a few paths where the lower antenna was noticeably better (VU at West Coast night time greyline on 20M)

How to Read an HFTA Chart



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HFTA “Figure of Merit”

- “A weighted statistical average computed by multiplying the gain at each angle by the statistical percentage that the band is open at that angle. The products for all angles are averaged to compute the Figure of Merit, which is calibrated in dBi” – source = ARRL Antenna Book Addendum

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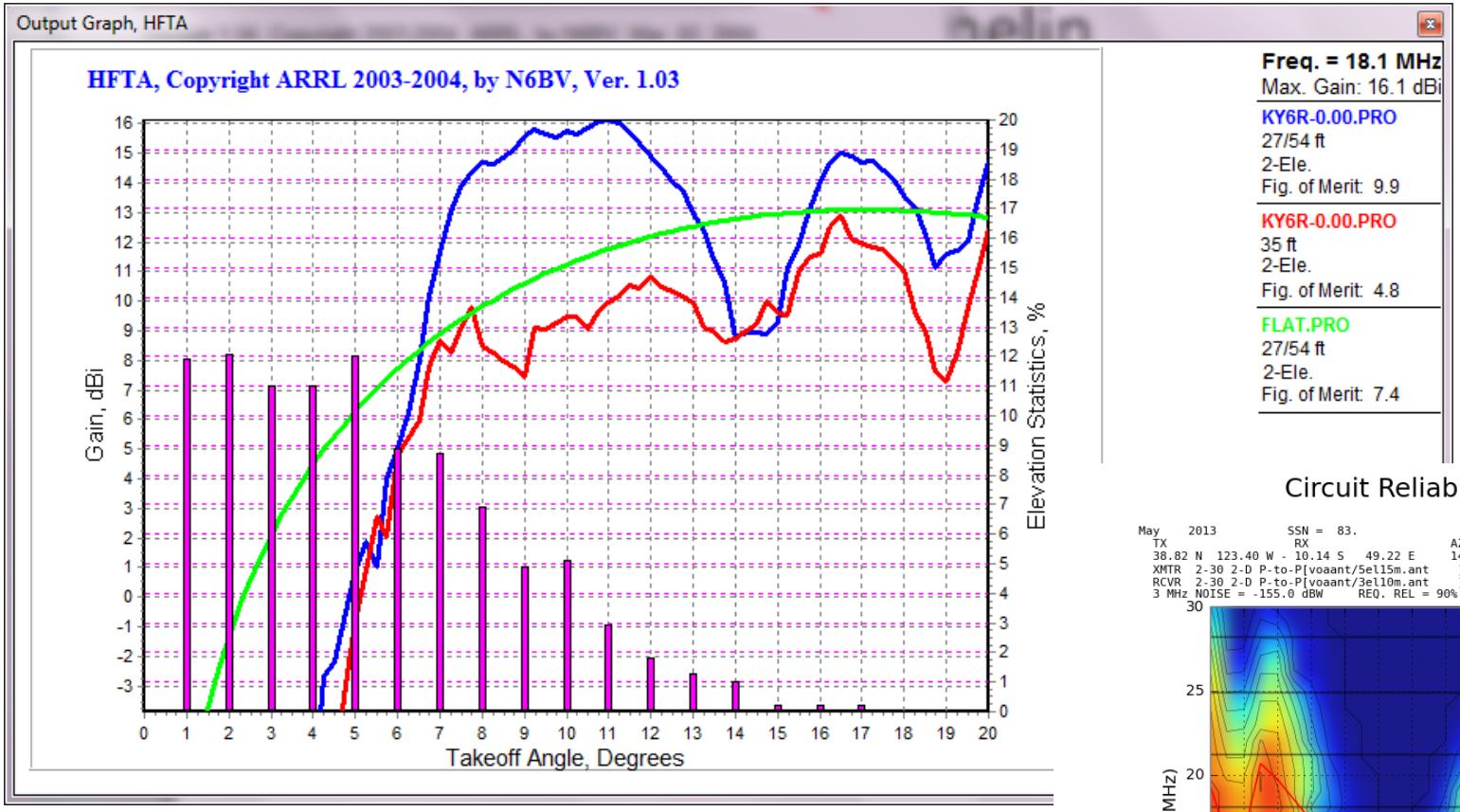
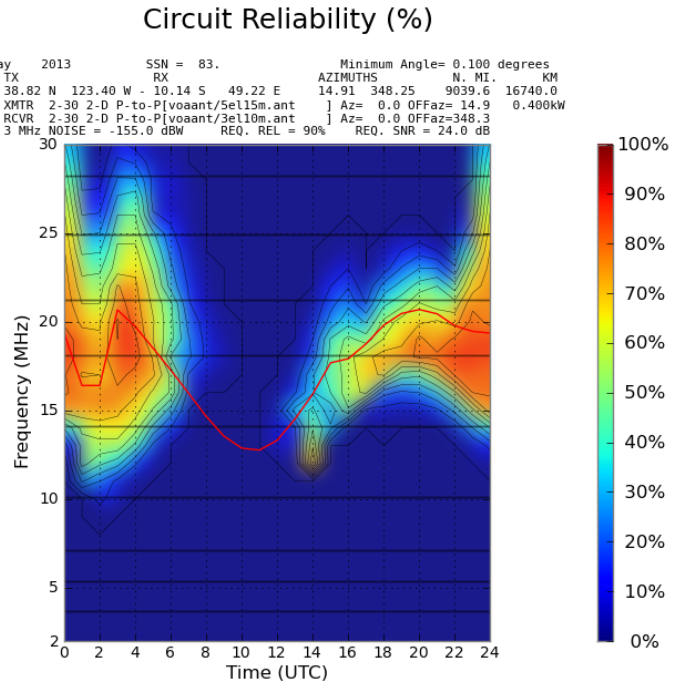
FT5/T - Tromelin

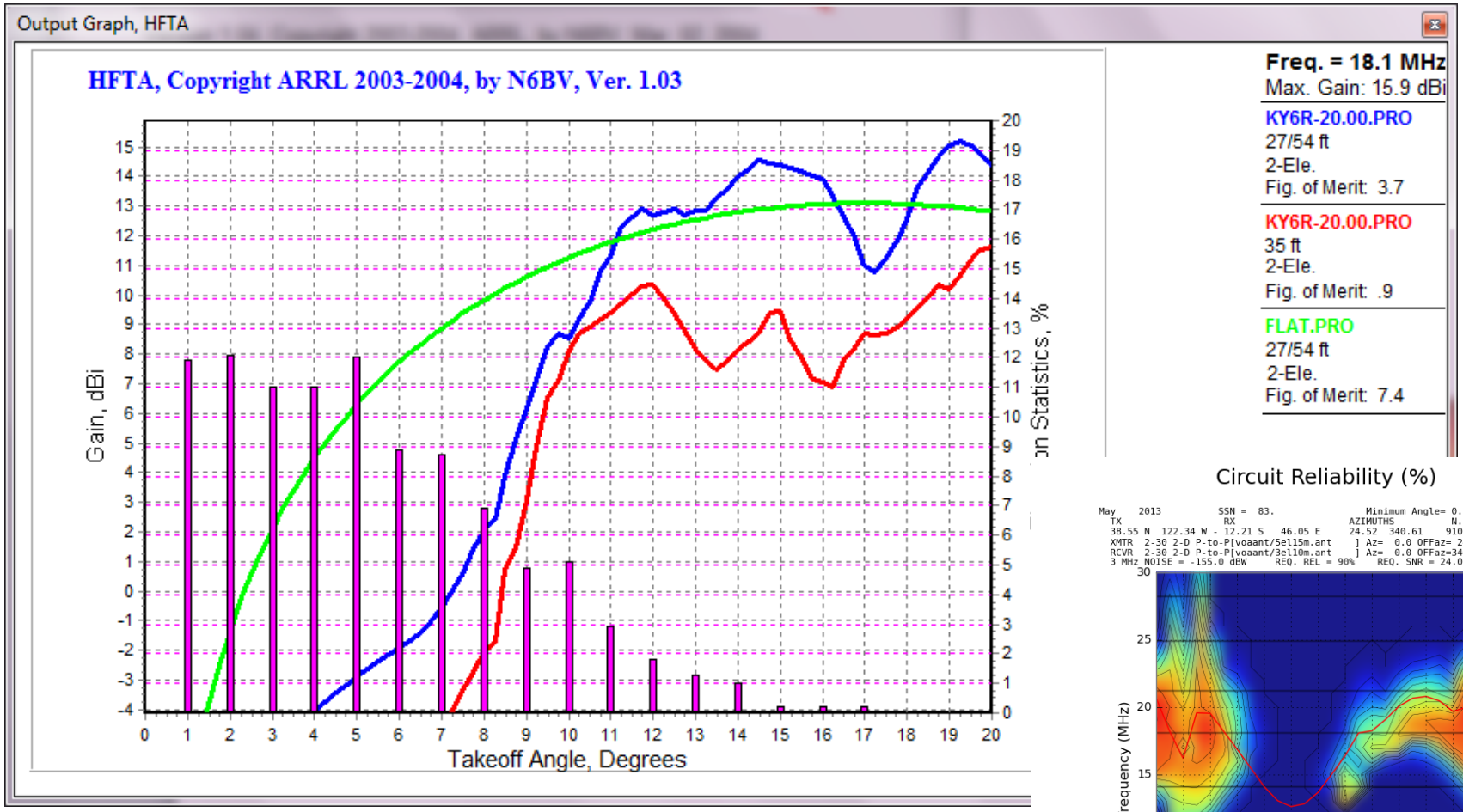


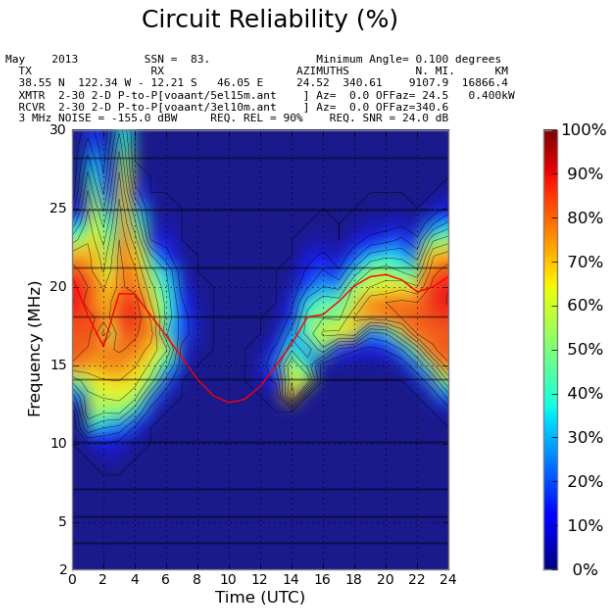


The Stack has 4.6 dB more gain than my old Nested Moxon. The TOA is about the same. The stack will be a big improvement.

May 2013 - 17m predicted best

E3 – Eritrea and FT5/G - Glorioso





The Stack has 2.8 dB more gain than my Nested Moxon. The TOA is 2 degrees lower and will make a big difference.

May 2013 - 17m predicted best

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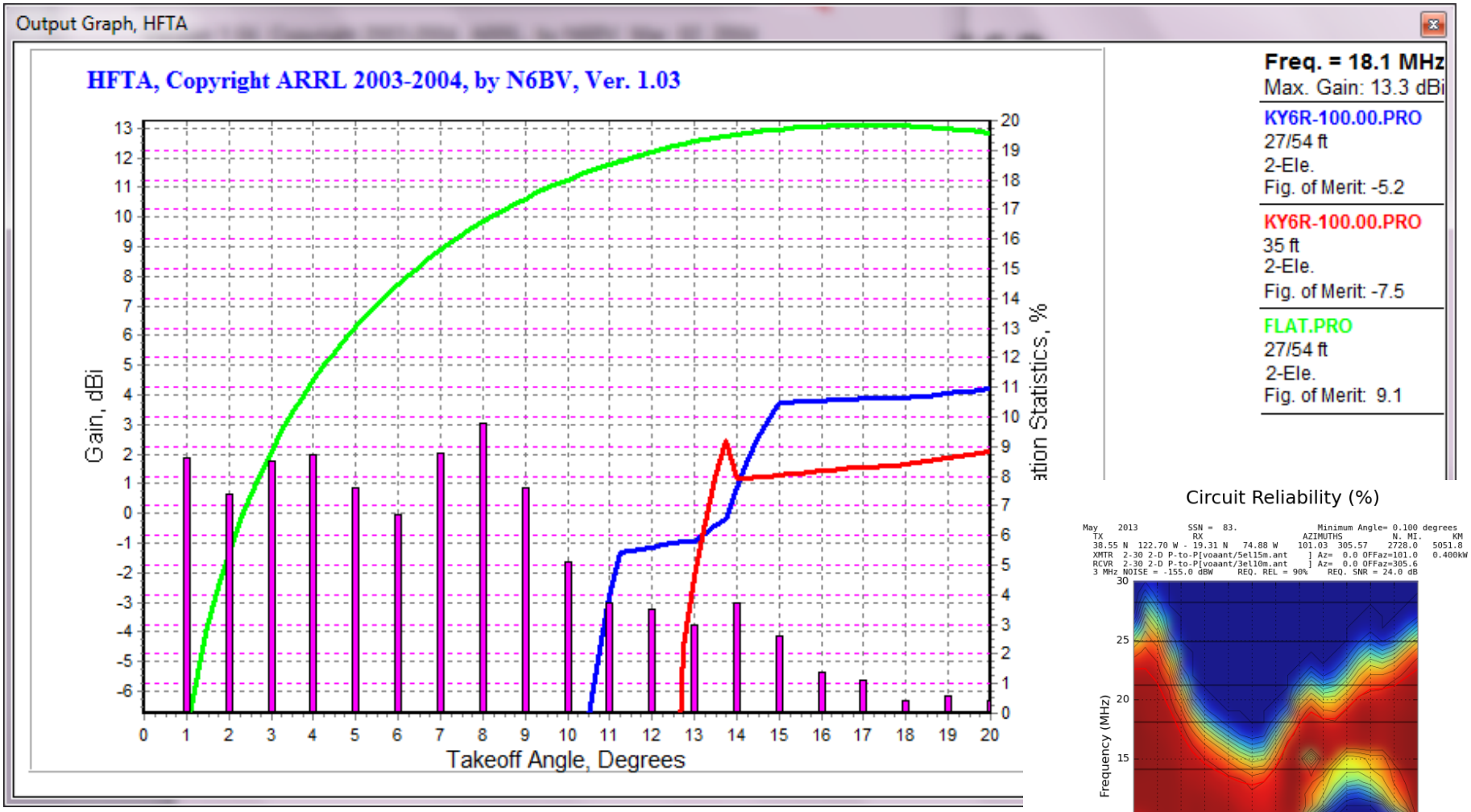
KP1 - Navassa



The higher yagi in the Stack has 2.3 dB more gain than my Nested Moxon. The TOA is 2 degrees lower and will make a big difference.

May 2013 – 20+17M best

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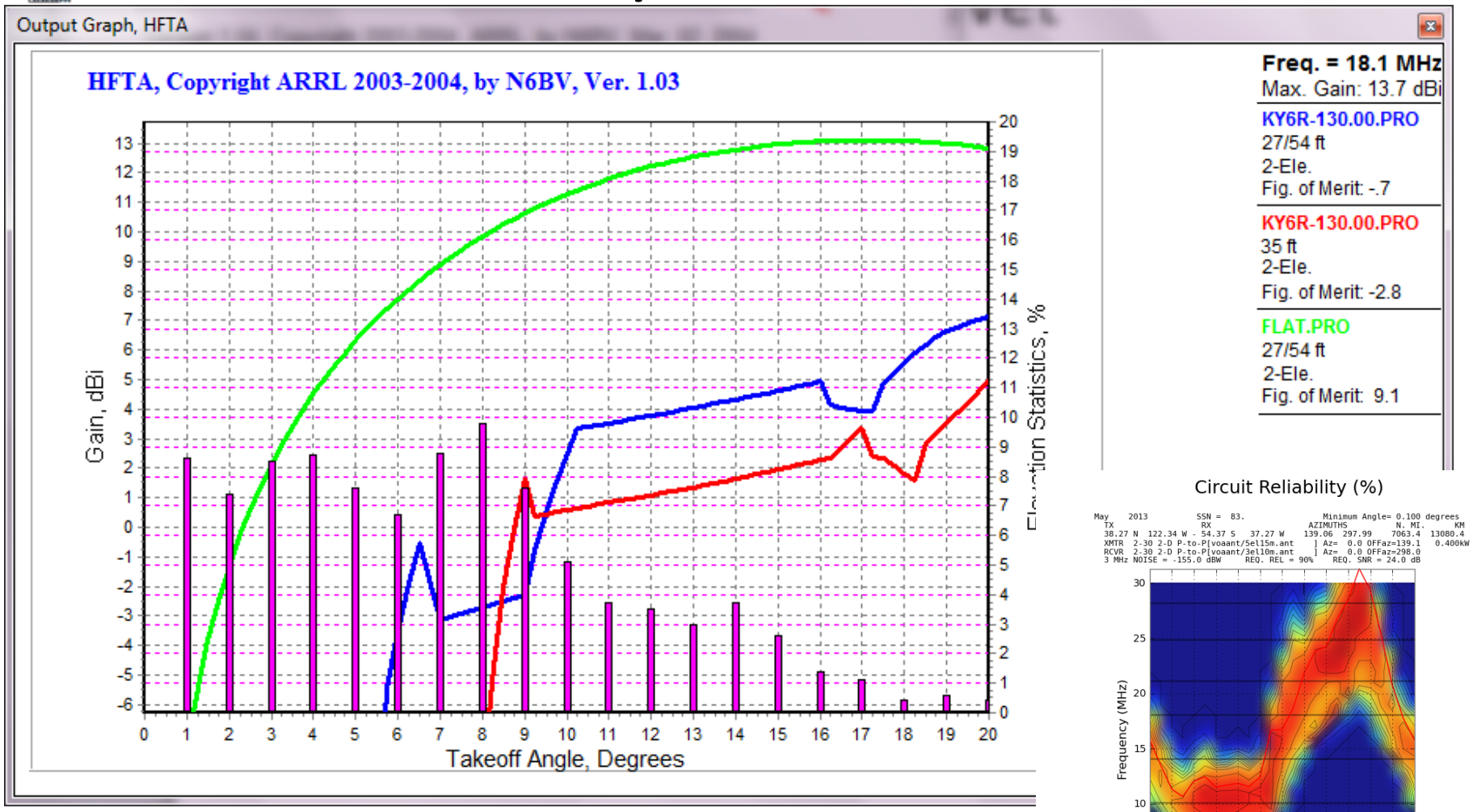
3Y0/B - Bouvet



The higher yagi in the Stack has 2.1 dB more gain than my Nested Moxon. The TOA is 2 degrees lower and will make a big difference.

May 2013 – 30/15/17/12M best

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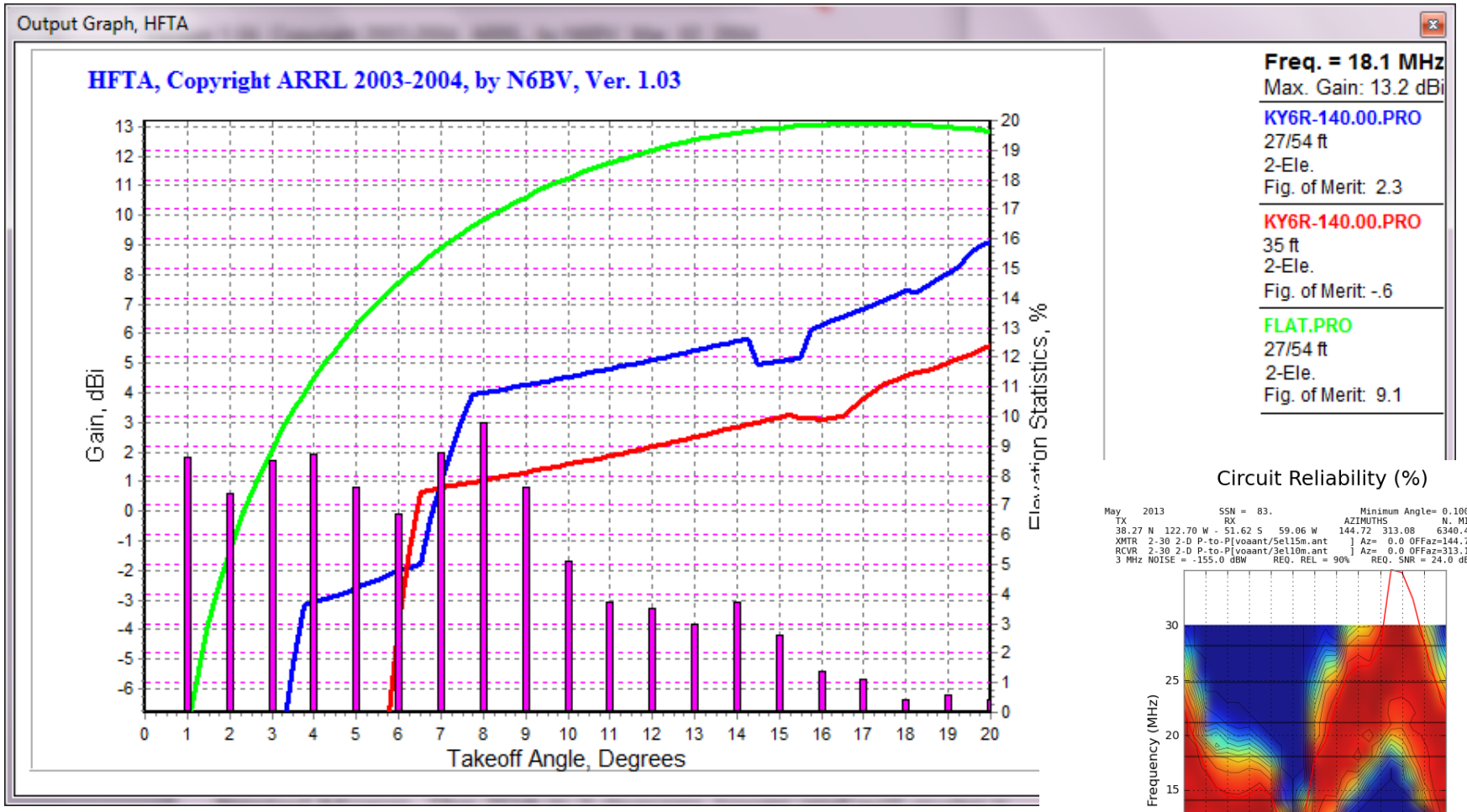
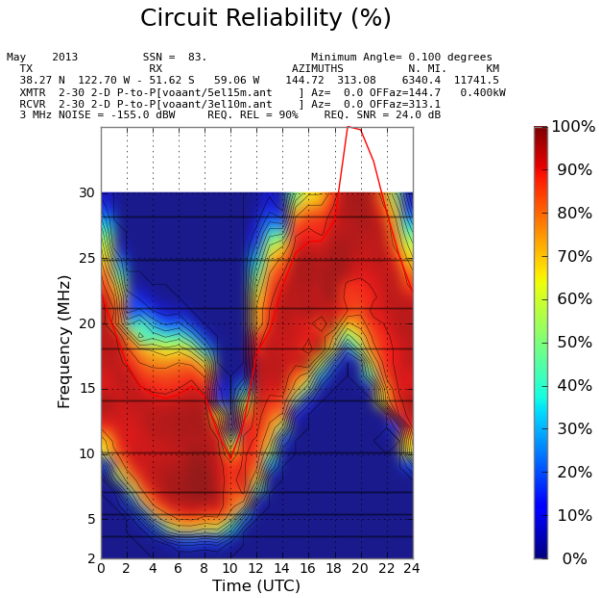
VP8/S – South Sandwich

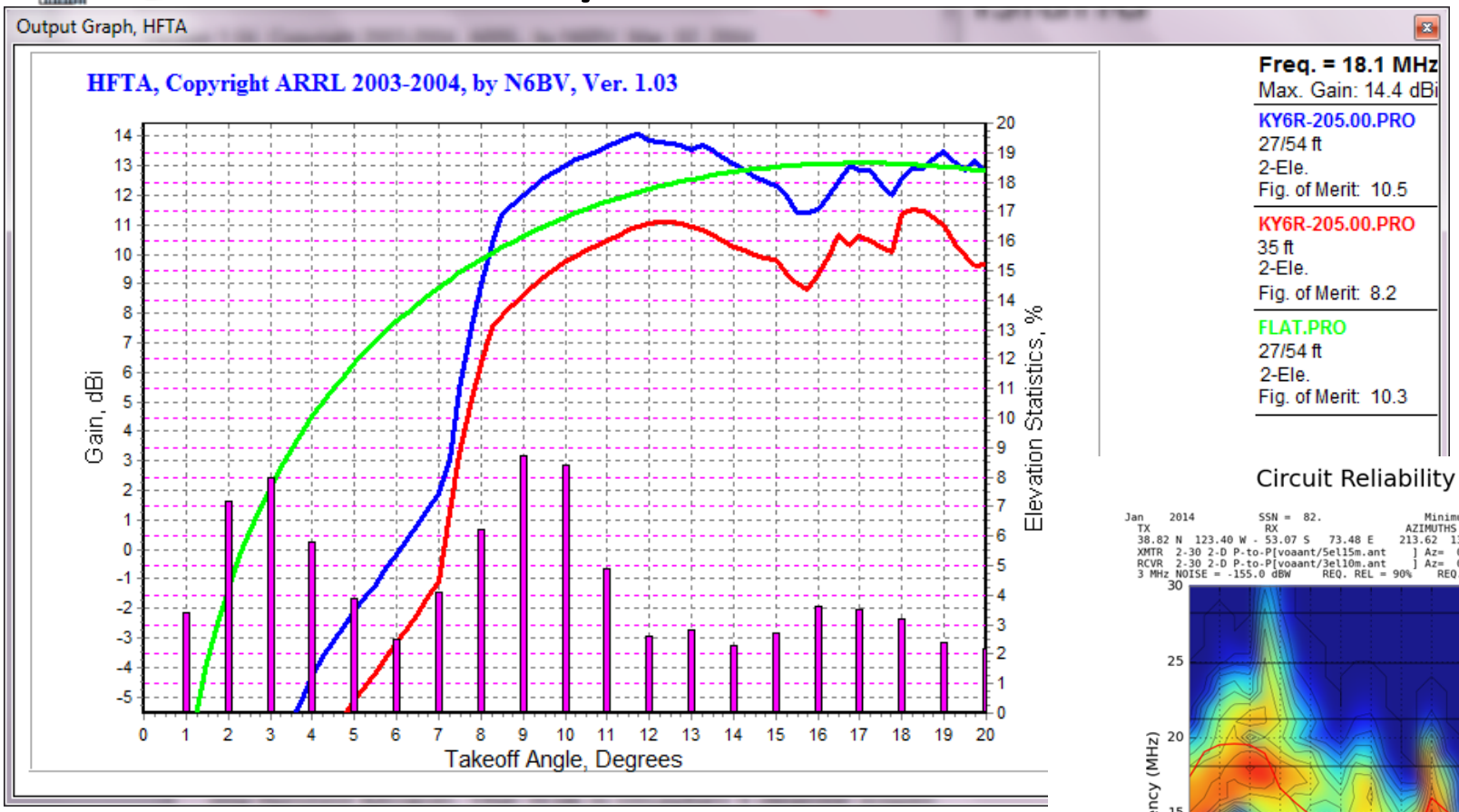


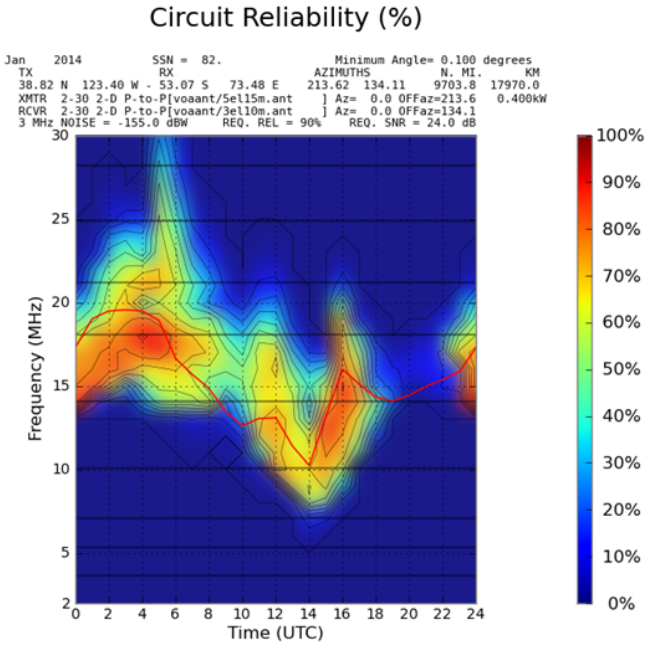


The higher yagi in the Stack has 1.7 dB more gain than my Nested Moxon. The TOA is 3 degrees lower and will make a noticeable difference.

May 2013 – 30/20/17/12M best

VK0/H – Heard Island

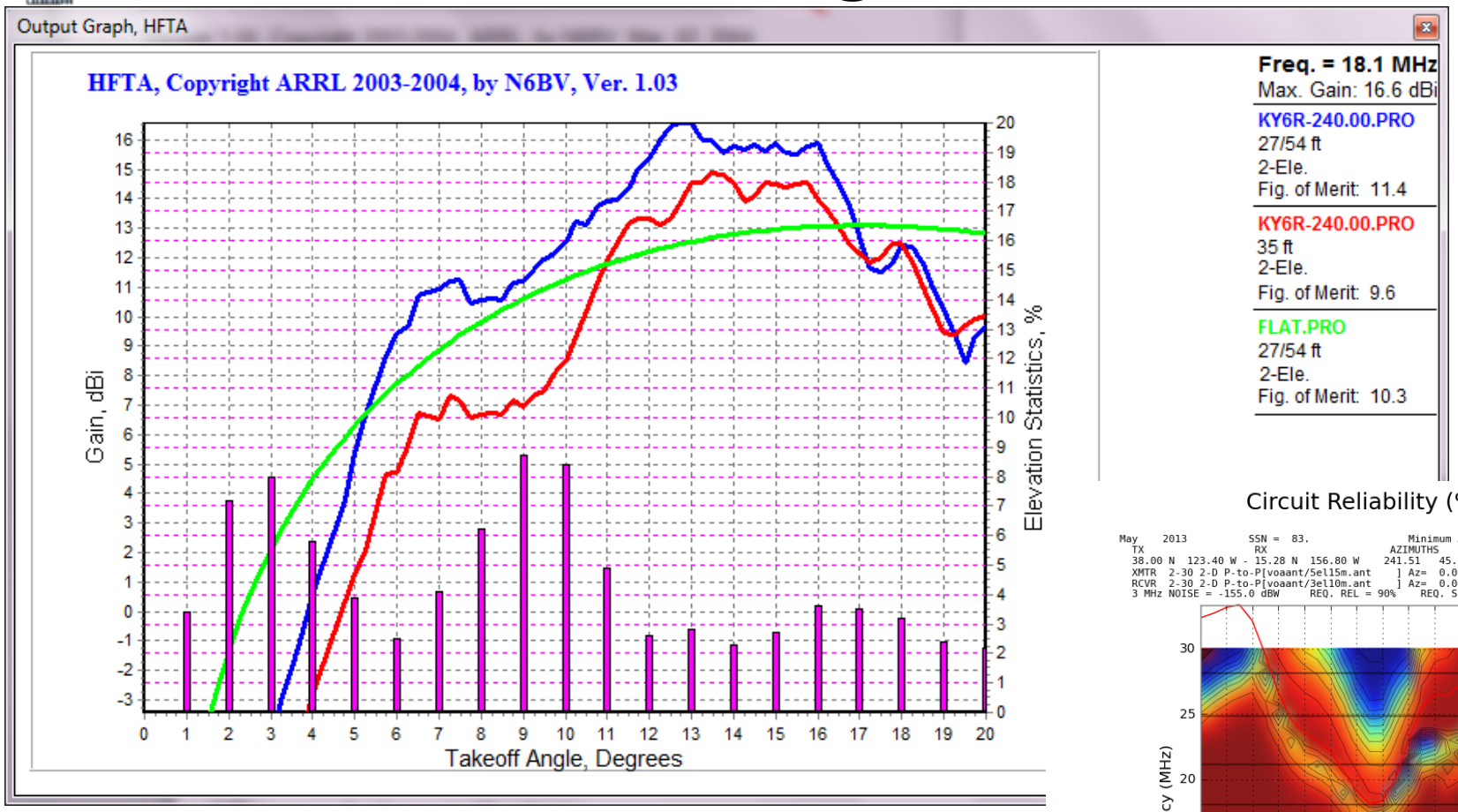


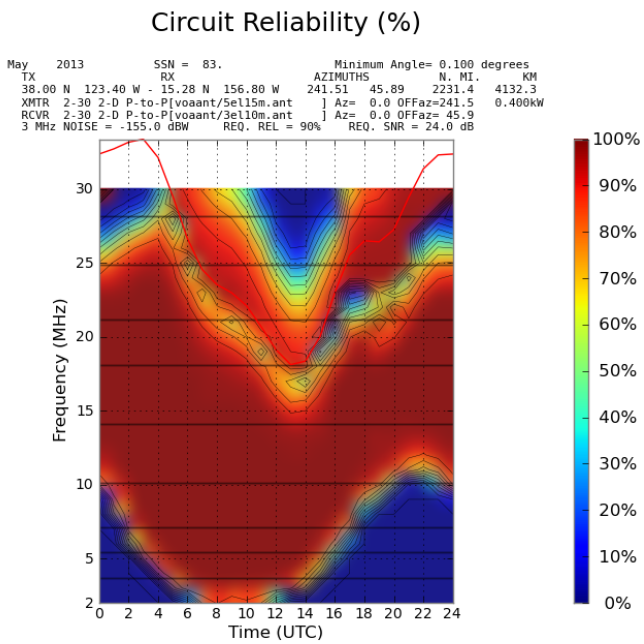


The higher yagi in the Stack has 2.3 dB more gain than my Nested Moxon. The TOA is (maybe) 1 degree lower. The stack will be a good improvement.

May 2013 – 17M best

KH5K – Kingman Reef

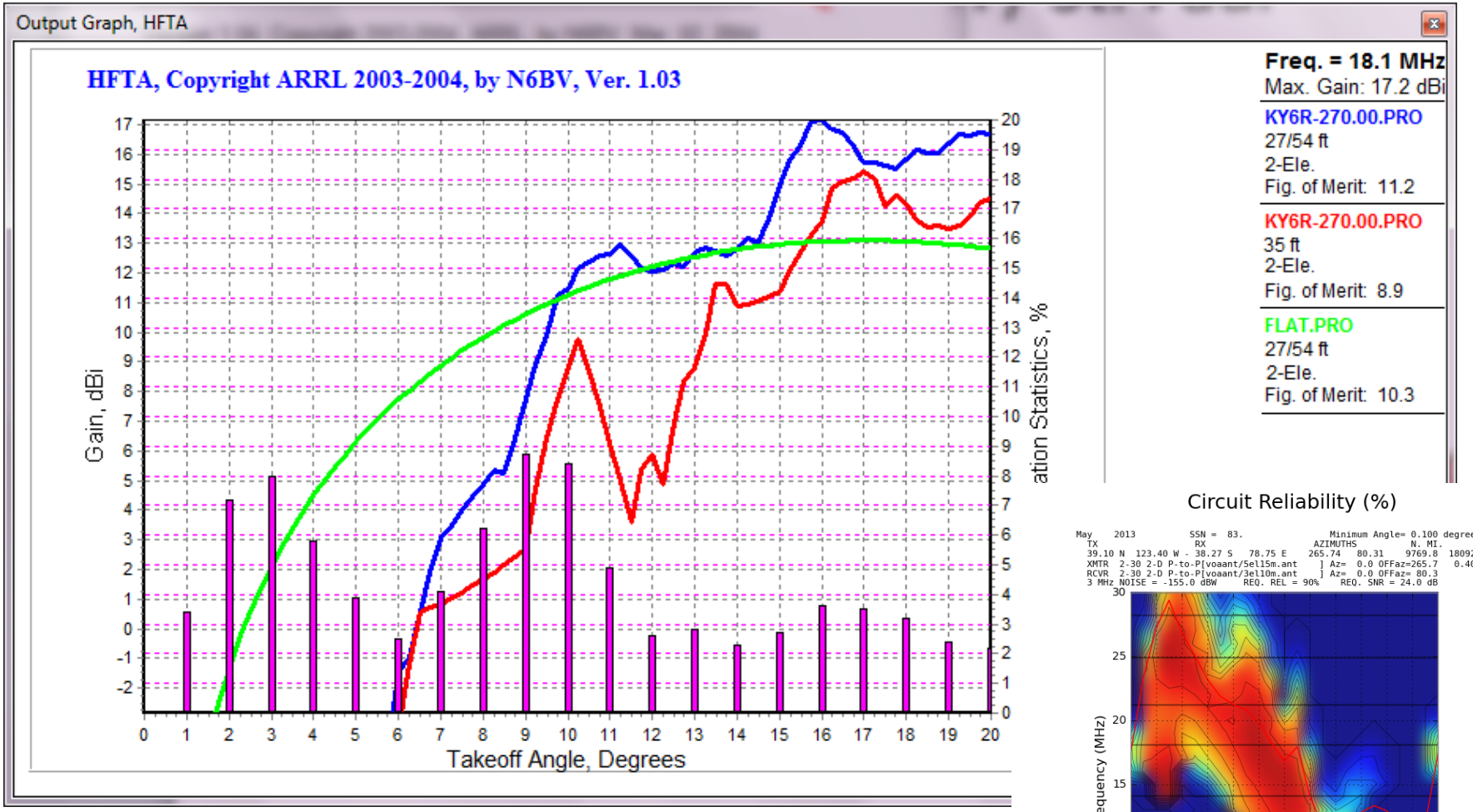


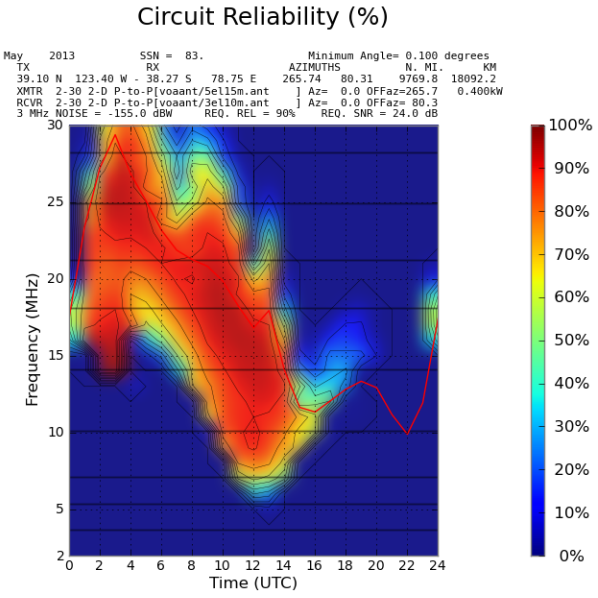


The higher yagi in the Stack has 1.8 dB more gain than my Nested Moxon. The TOA is the same. The stack will be better – not sure if it will be a big difference though.

May 2013 – 30/20/17M best

FT5/Z – Amsterdam / St. Paul





The higher yagi in the Stack has 2.3 dB more gain than my Nested Moxon. The TOA is the same. The stack should make a difference that is noticeable.

May 2013 – 17/15M best

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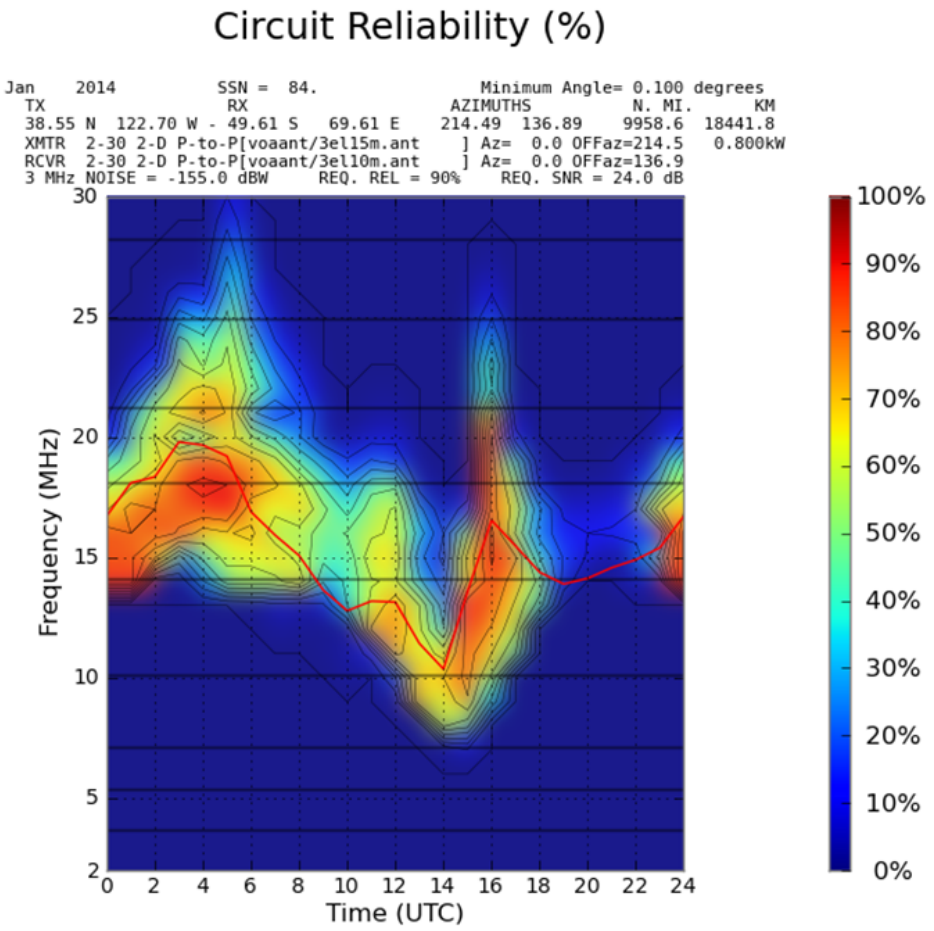
Heard Island - January 2014



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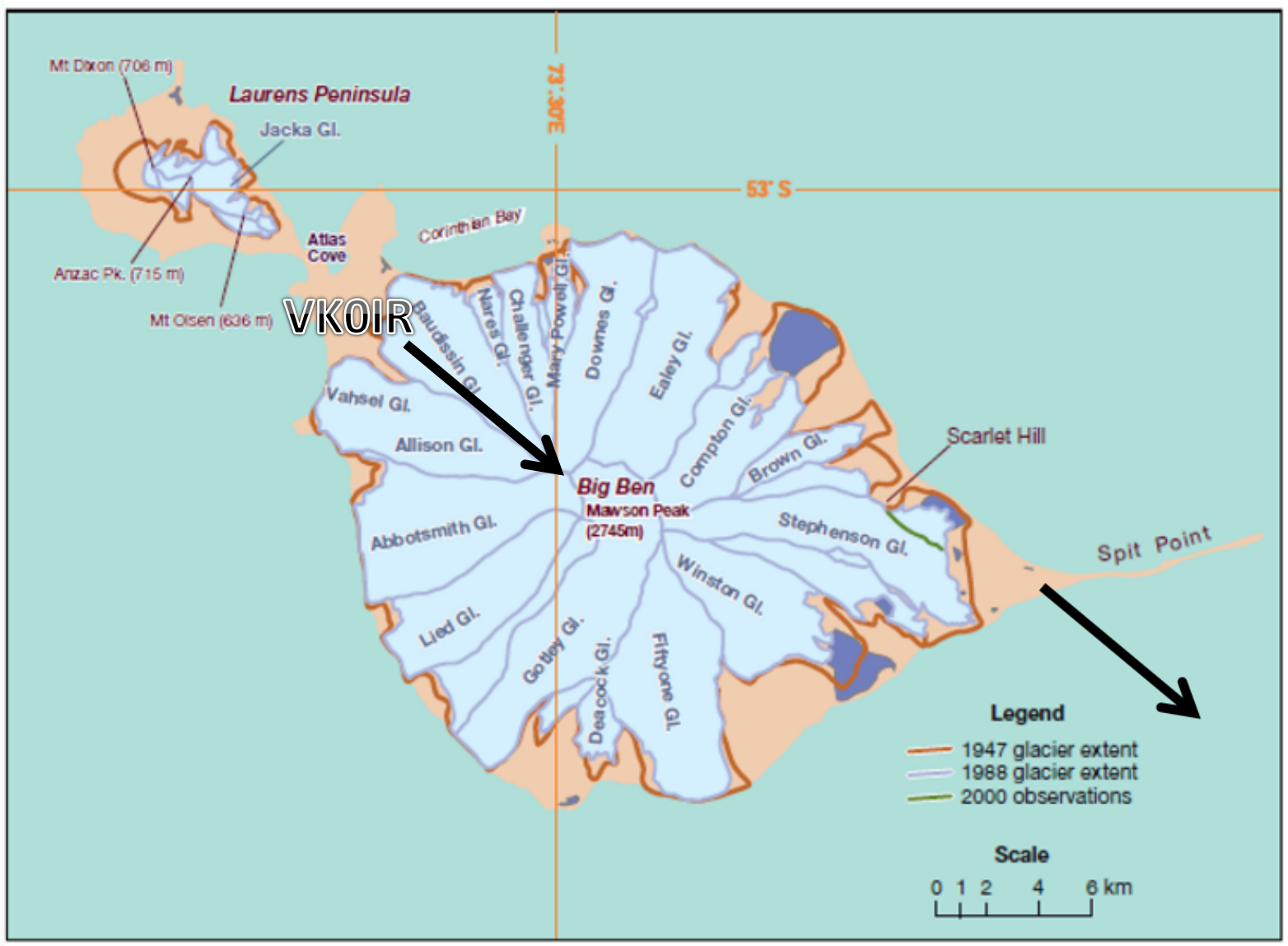
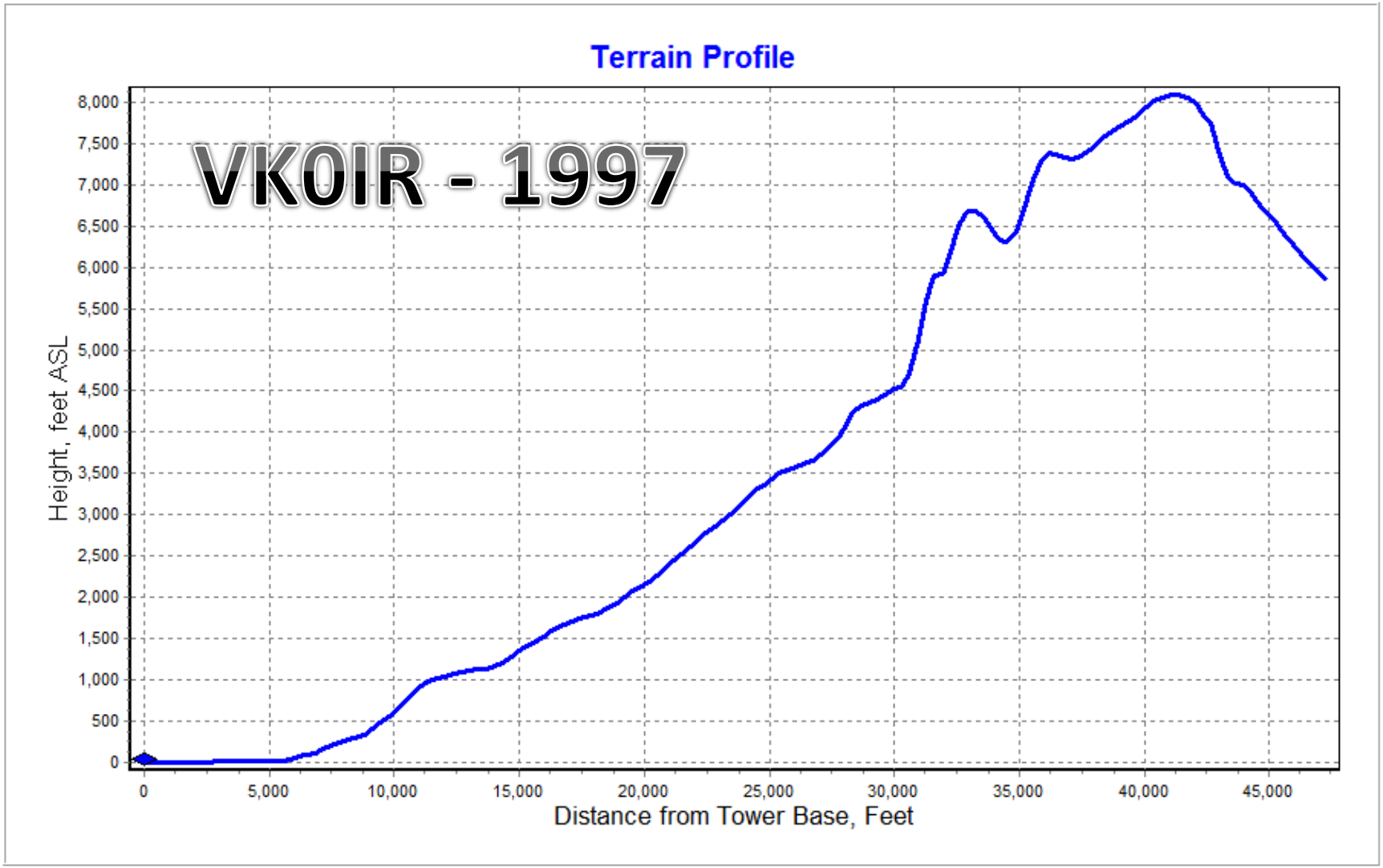
From VK0/H to KY6R = 138°



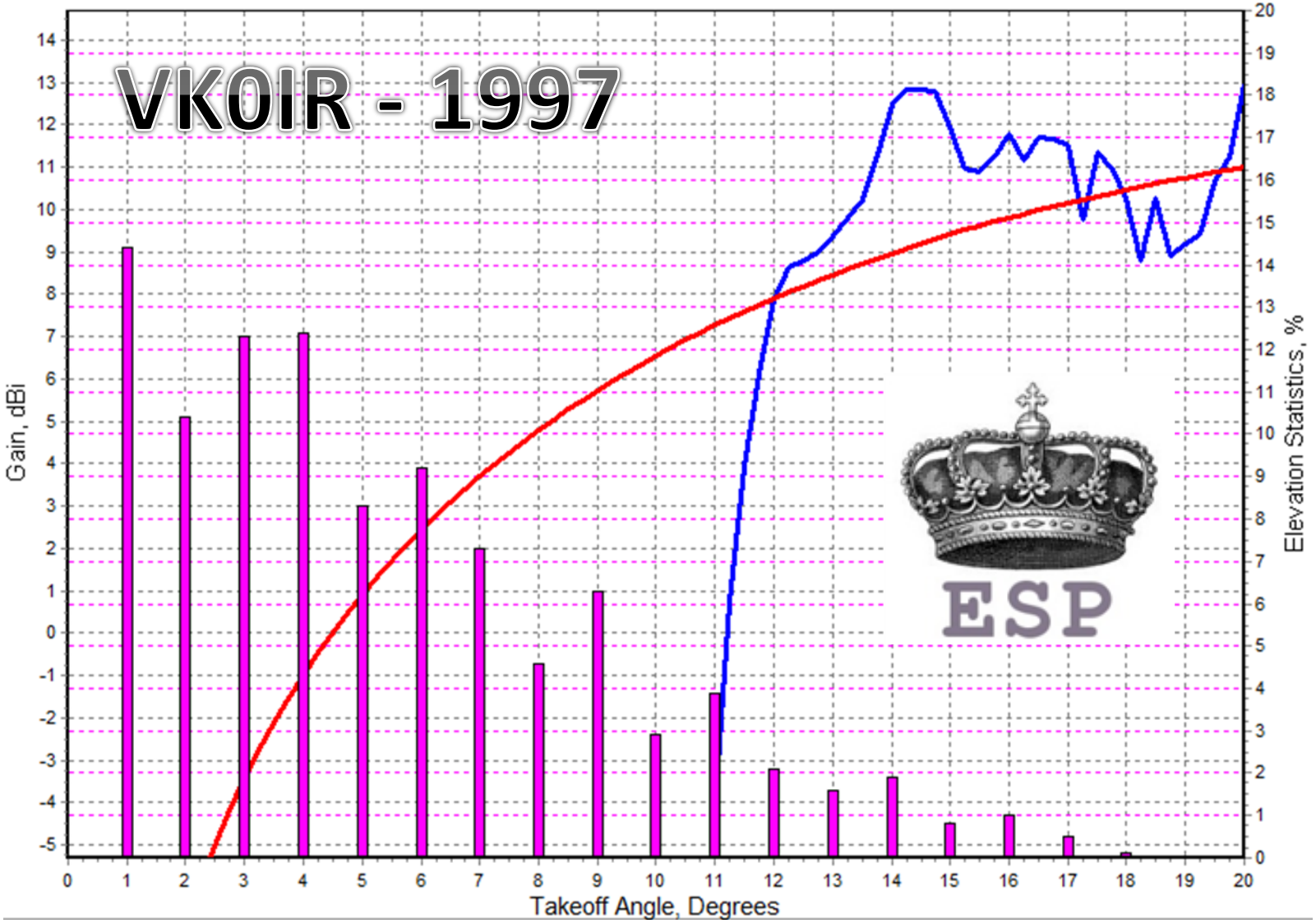
ANDREW RUDDELL

From “Atlas Cove” to KY6R = 138º



HFTA Data and Analysis provided by Dean Straw, N6BV

From “Atlas Cove” to KY6R = 138°



HFTA Data and Analysis provided by Dean Straw, N6BV

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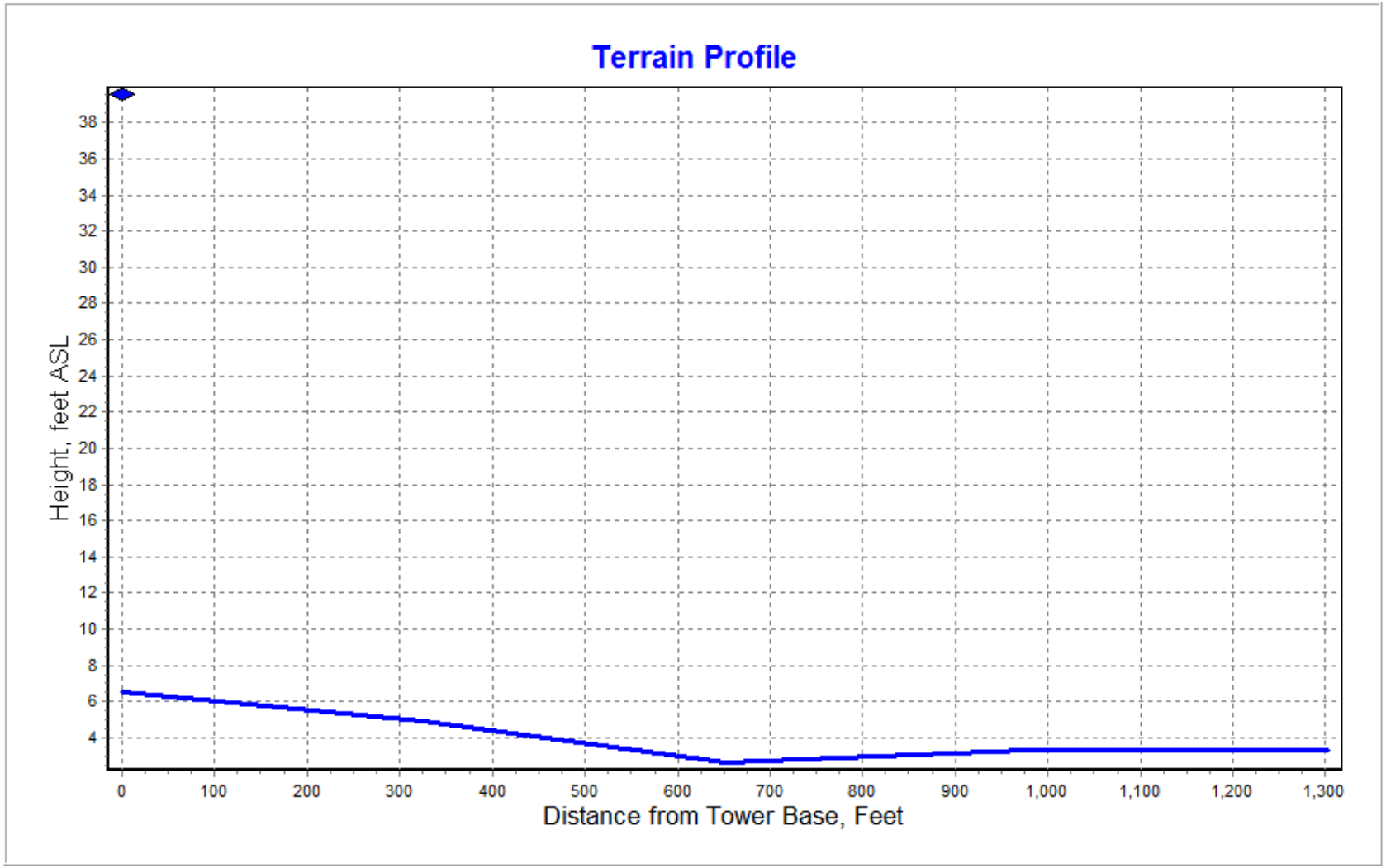
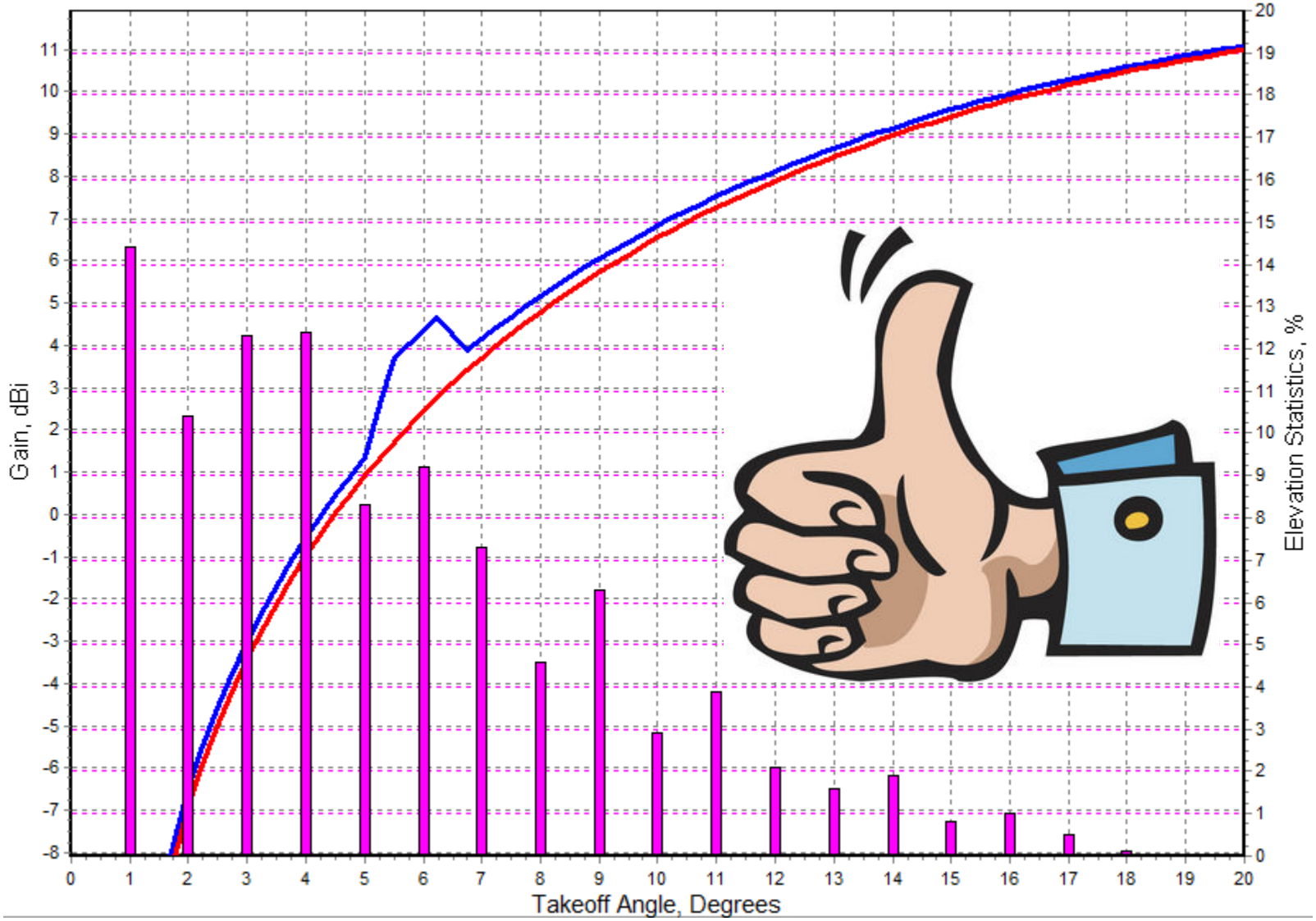
From “Spit Point” to KY6R = 138°



HFTA Data and Analysis provided by Dean Straw, N6BV

From “Spit Point” to KY6R = 138^{o}



HFTA Data and Analysis provided by Dean Straw, N6BV

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It Was Well Worth It

- To squeeze any more performance out – I would either:
  - Need to move to a hilltop or flat location
  - Put up a 70’ fixed tower
  - Improve my low band antennas – but this is really not possible on my tiny low lying lot
  - Drive a mobile rig next to salt water or to a mountain top (?)

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References

- http://eastbayarc.org/pdf/final-mile.pdf
  for an updated copy of this presentation
- http://dxccsleuth.wordpress.com/
  for a history of DXCC entities
- http://ky6r.wordpress.com/
  for a blog related to my “Pilot” communications
- Twitter = @KY6R, Skype is KY6R--
- My information on QRZ.COM is up to date