Using Grounded Structures as Antennas

First Experience Using a Tower as an Antenna

- 50+ years ago loaded the coax going to a TH3 jr beam on a 32 ft tower for fun
- Worked Western Soma on 80 first call with 75 watts!
- Why did it work?

Top Loading a Tower

Table 3

Effective Loading of Common Yagi Antennas

Antenna	*Boom Length (feet)*	*S (area, ft²)*	*Equivalent Loading (feet)*
3L 20	24	768	39
5L 15	26	624	35
4L 15	20	480	31
3L 15	16	384	28
5L 10	24	384	28
4L 10	18	288	24
3L 10	12	192	20
TH7	24	—	40 (estimated)
TH3	14	—	27 (estimated)

- My 32’ tower looked like a 60’ pole!

Shunt Feeding a Tower

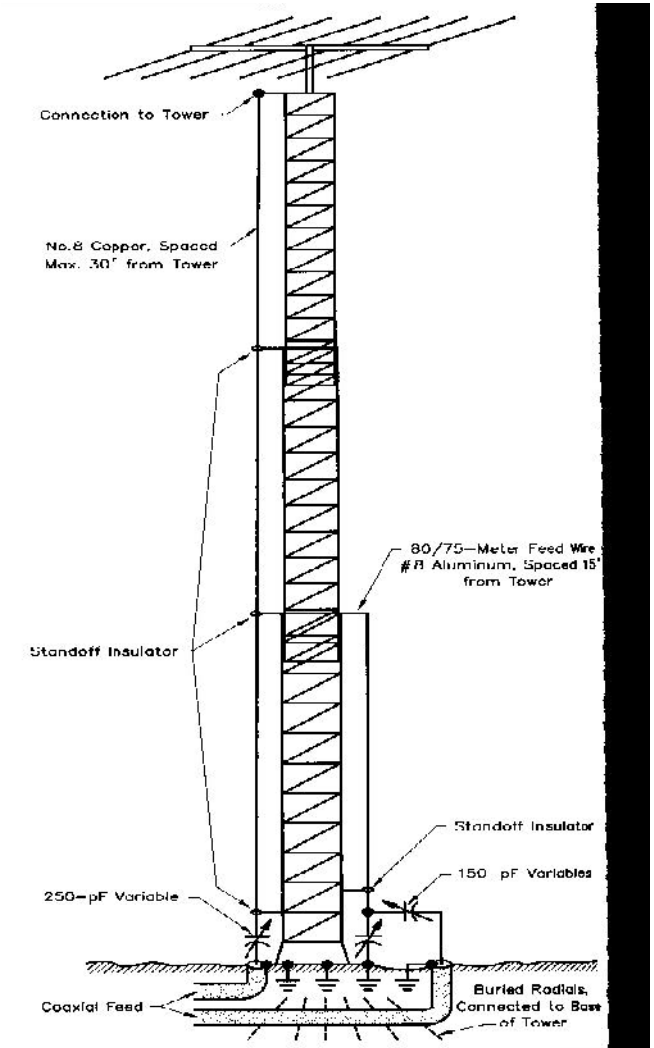
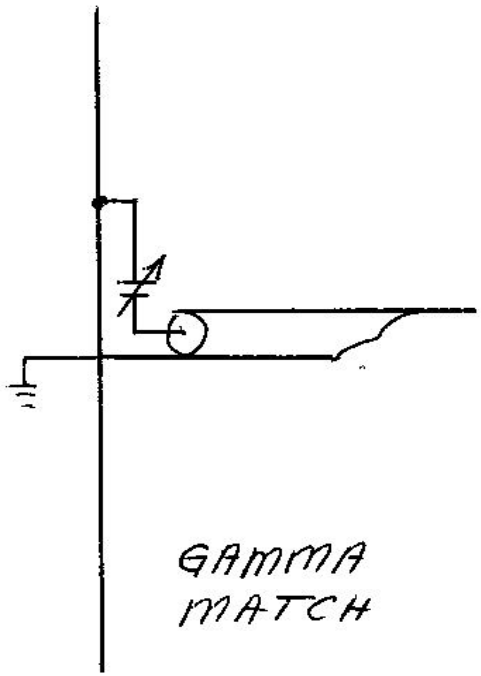
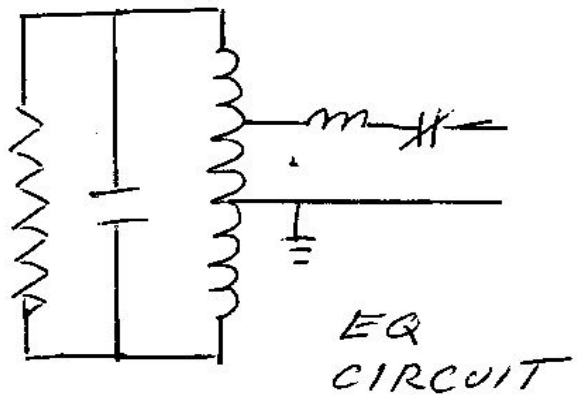


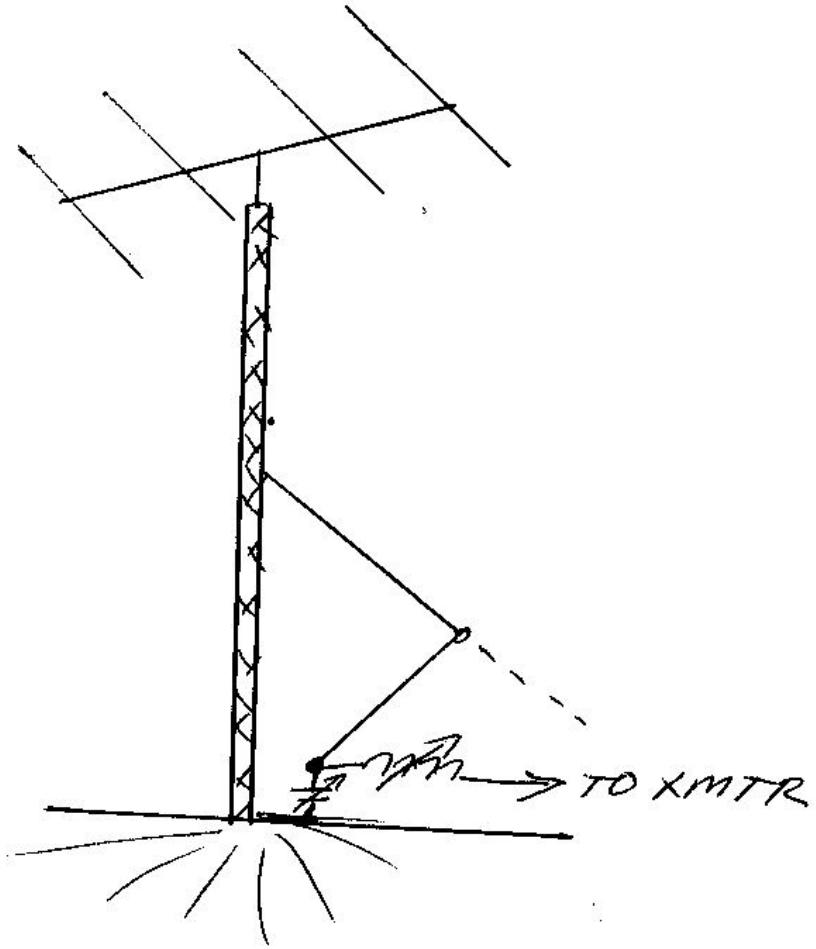
Fig 40—Principal details of the shunt-fed tower at W5RTQ (now K6SE). The 1.8-MHz feed, left side, connects to the to of the tower through a horizontal arm of 1-inch diameter aluminum tubing. The other arms have standoff insulators at their outer ends, made of 1-foot lengths of plastic water pipe. The connection for 3.5-4 MHz, right, is made similarly at 28 feet, but two variable capacitors are used to permit adjustment of matching with large changes in frequency.

The Gamma Match





My Typical Setup



Problems

- Tuning was quite sharp
- Concerned about tuner losses
- Wanted to try a pure gamma match
  - To save time….. Model it

Main [V5.8.2] (F2)

File Edit Settings Calculate Window Show Run Help

Filename	SHUNT FEED TOWER GAMMA MAT(	Frequency	3.5 Mhz
		Wavelength	85.66 mtr
Voltage	4701 + j 0 V	Current	0.21 - j 5.02 A
Impedance	39.6 + j 935	Series comp.	48.65 pF
Parallel form	2.e4 // j 936	Parallel comp.	48.57 pF
S.W.R.50	443	Input power	1000 W
Efficiency	100 %	Structure loss	0 W
Radiat-eff.	18.27 %	Network loss	0 W
RDF [dB]	5.94	Radiat-power	1000 W

Environment

GROUND PLANE SPECIFIED.
WHERE WIRE ENDS TOUCH GROUND, CURRENT WILL BE INTERPOLATED TO IMAGE IN GROUND PL
FINITE GROUND. SOMMERFELD SOLUTION

Comment

step 5 5

Geometry (F3)

Show View Validate Currents Far-field Near-field Segm. Plot

SHUNT FEED TOWER GAMMA MATCH.out 3.5 MHz

Elev. : 10 Axis : 20 ft Azi. : 170

Pattern (F4)

Show Far field Near field Compare OpenPF Plot

Tot-gain [dBi] Vertical plane

3.5 MHz

90 Z 75 60 45 30 15 0 XY -15 -30 -45 -60 -75 -90 -105 -120 -135 -150 -165 180

0 -3 -6 -10 -15 -20 -30 -40 -50

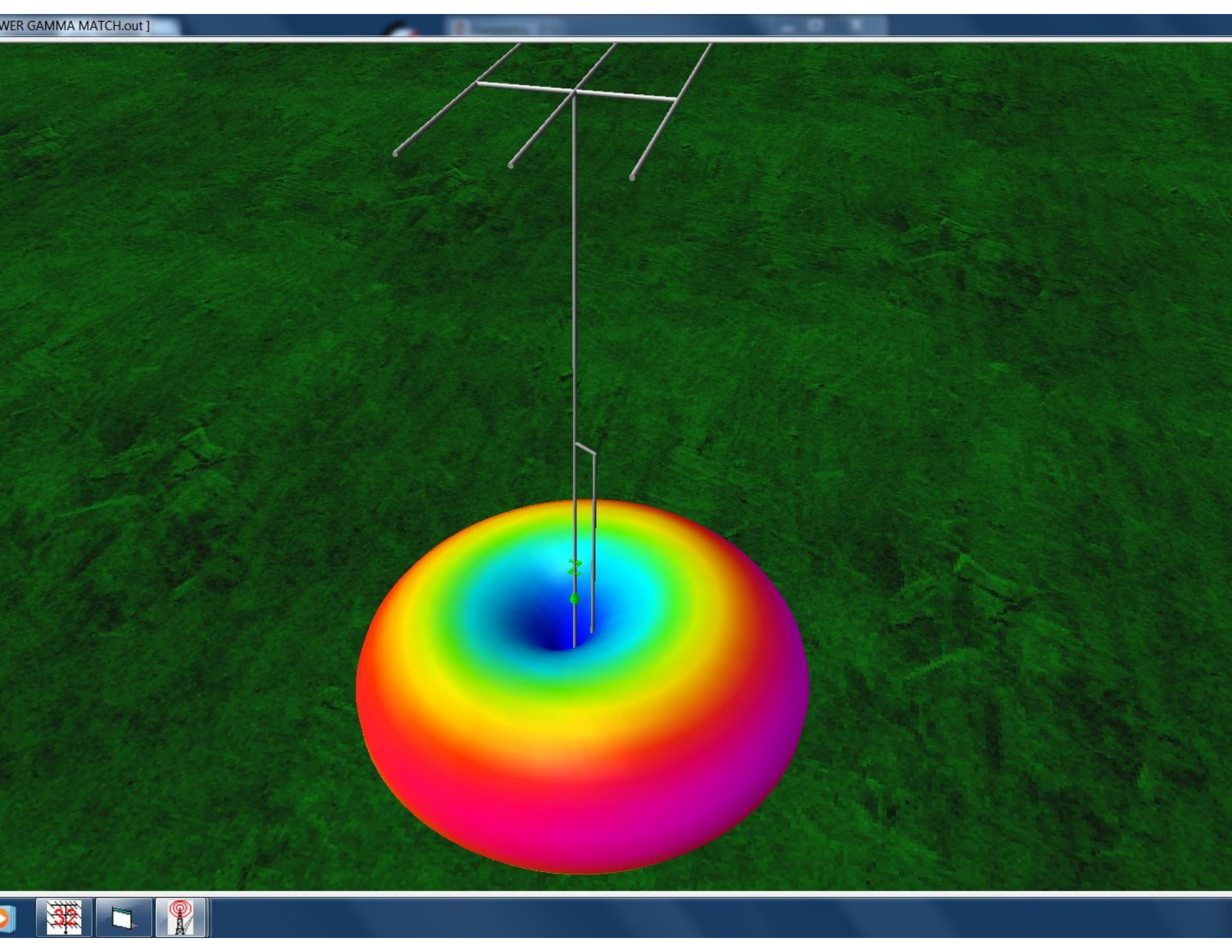
SHUNT FEED TOWER GAMMA MATCH.out -999 < dBi < -1.4

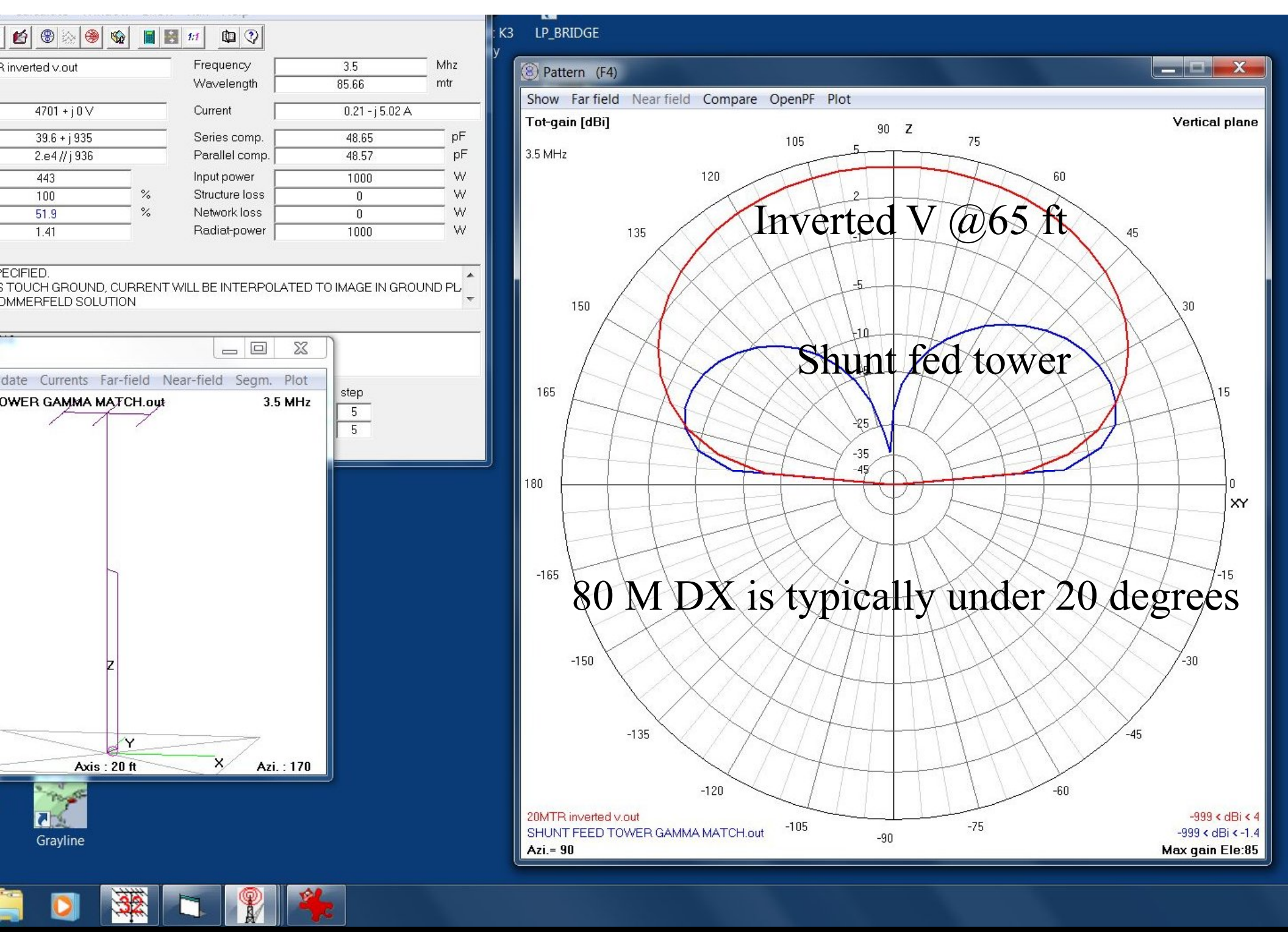
Azi.= 90 Max gain Ele:25

LP_BRIDGE

PowerSDR-IF Stage v1.19...

4nec2 Build Grayline


WER GAMMA MATCH.out]
Z

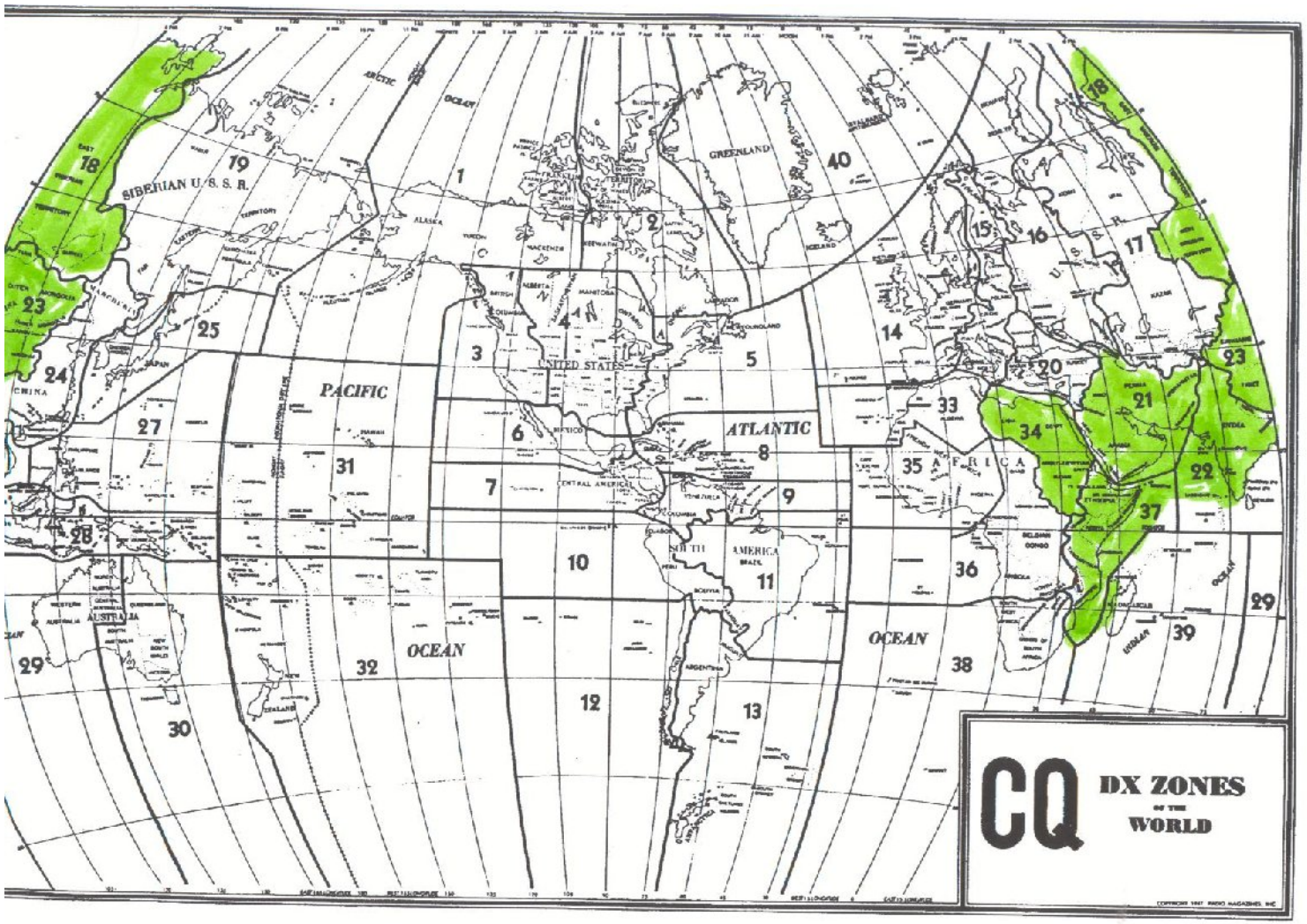

K3
LP_BRIDGE
R inverted v.out
Frequency 3.5 Mhz
Wavelength 85.66 mtr
4701 + j 0 V
Current 0.21 - j 5.02 A
39.6 + j 935
Series comp. 48.65 pF
2.e4 // j 936
Parallel comp. 48.57 pF
443
Input power 1000 W
100 %
Structure loss 0 W
51.9 %
Network loss 0 W
1.41
Radiat-power 1000 W
PECIFIED.
S TOUCH GROUND, CURRENT WILL BE INTERPOLATED TO IMAGE IN GROUND PL
OMMERFELD SOLUTION
date Currents Far-field Near-field Segm. Plot
OWER GAMMA MATCH.out
3.5 MHz
step
5
5
Z
Y
X
Axis : 20 ft
Azi. : 170
Grayline
Pattern (F4)
Show Far field Near field Compare OpenPF Plot
Tot-gain [dBi]
Vertical plane
3.5 MHz
90 Z
105
75
120
60
135
45
150
30
165
15
180
0
XY
-165
-15
-150
-30
-135
-45
-120
-60
-105
-75
-90
5
2
-1
-5
-10
-25
-35
-45
Inverted V @65 ft
Shunt fed tower
80 M DX is typically under 20 degrees
20MTR inverted v.out
SHUNT FEED TOWER GAMMA MATCH.out
Azi.= 90
-999 < dBi < 4
-999 < dBi < -1.4
Max gain Ele:85

My Current Setup

Does it Work?

- 140 countries on 80 during the last 3 winters
- 34 of the 40 CQ Zones

Missing Zones



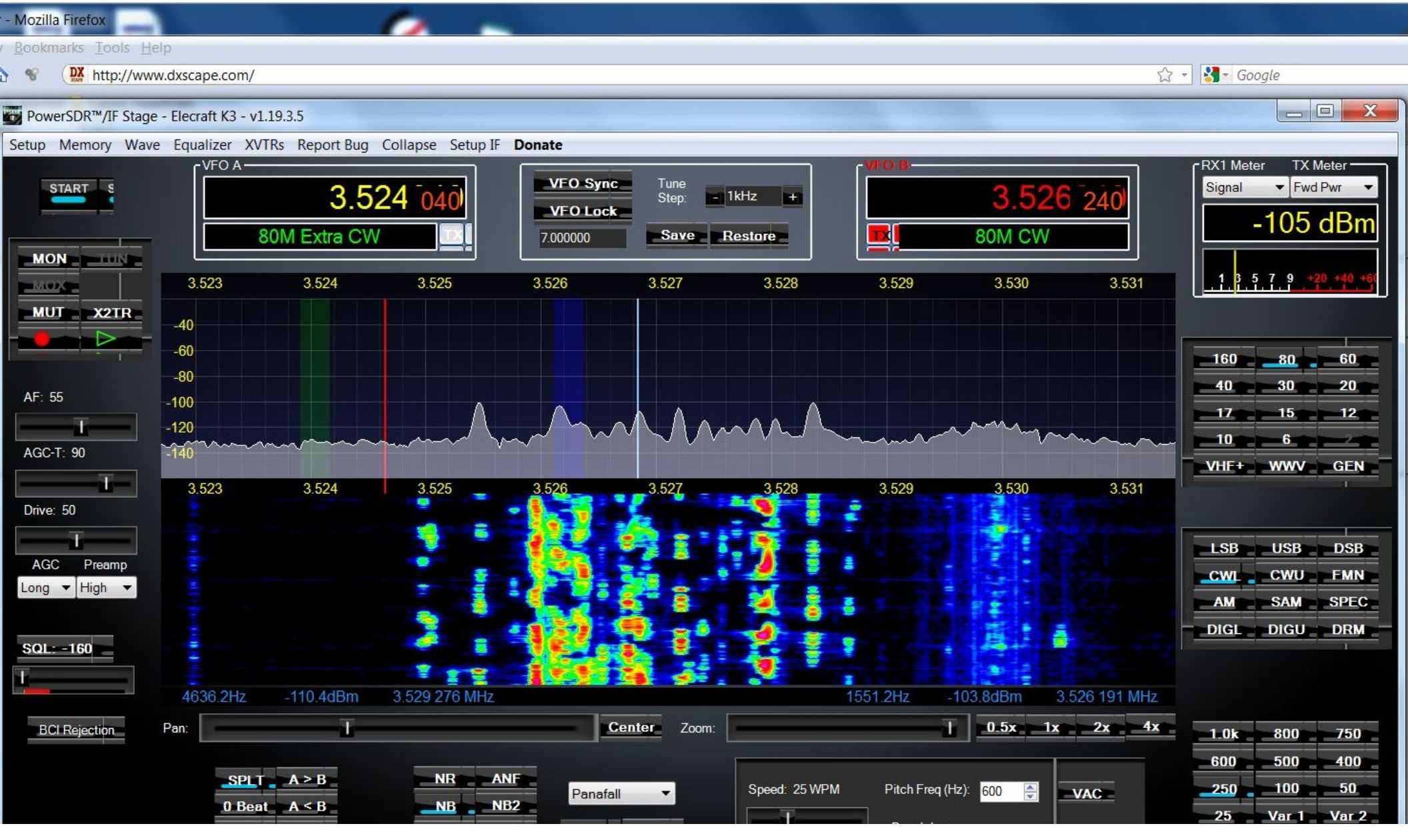
ADDENDUM TO WAZ MAP

All Sakhalin Island and the Russian Kurile Islands are now in Zone 19. Zone 19: Eastern Siberian Zone—UAØ (C, D, F, I, J, K, L, Q, X, Z). Zone 25: Japanese Zone—HL, P5, and JA.—*April 1995*

Comparing the Tower to a V @65 Feet

- Watch the S meter as one switches between the two
- Back off the RF gain to disable the AGC and listen to the difference
- On the air test
- Use a pan adapter that displays signal strength in DBM

Power SDR


- Mozilla Firefox
Bookmarks Tools Help
http://www.dxscape.com/
Google
PowerSDR™/IF Stage - Elecraft K3 - v1.19.3.5
Setup Memory Wave Equalizer XVTRs Report Bug Collapse Setup IF Donate
START
VFO A
3.524 040
80M Extra CW
VFO Sync
VFO Lock
7.000000
Tune Step:
1kHz
Save
Restore
VFO B
3.526 240
80M CW
RX1 Meter
TX Meter
Signal
Fwd Pwr
-105 dBm
MON
TUN
MOX
MUT
X2TR
AF: 55
AGC-T: 90
Drive: 50
AGC
Preamp
Long
High
SQL: -160
BCI Rejection
Pan:
Center
Zoom:
0.5x
1x
2x
4x
160
80
60
40
30
20
17
15
12
10
6
VHF+
WWV
GEN
LSB
USB
DSB
CWL
CWU
FMN
AM
SAM
SPEC
DIGL
DIGU
DRM
3.523
3.524
3.525
3.526
3.527
3.528
3.529
3.530
3.531
-40
-60
-80
-100
-120
-140
4636.2Hz
-110.4dBm
3.529 276 MHz
1551.2Hz
-103.8dBm
3.526 191 MHz
SPLT
A > B
0 Beat
A < B
NR
ANF
NB
NB2
Panafall
Speed: 25 WPM
Pitch Freq (Hz):
600
VAC
1.0k
800
750
600
500
400
250
100
50
25
Var 1
Var 2

Results

- Generally DX is 3 DB stronger on the tower
  - This varies from no improvement to +12 DB
  - Exception: the Caribbean is typically better on the V
- State side is the same or up to 12 to 18 DB stronger on the V

Conclusions

- Don’t be afraid to load up various objects!
- Use an antenna tuner when necessary
- Don’t jump to conclusions
  - Many nights the V was much better than the tower

Next?

- Receive only antennas
- Using the guy wires as an elevated radial system
- Improving the ground
  - The ground system is not as critical with antennas greater than 1/4 wave length
- Try the tower on 160