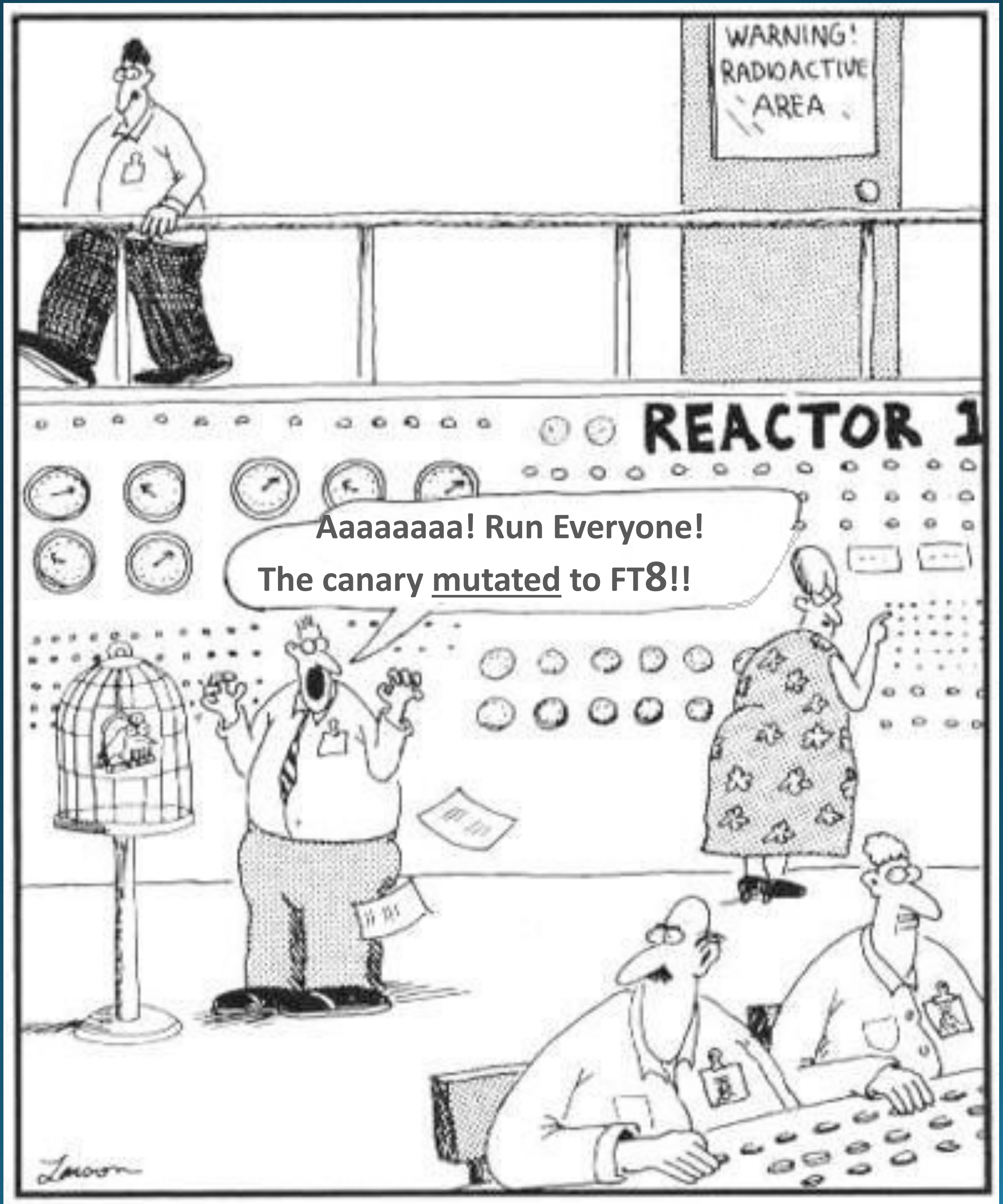

WARNING!
RADIOACTIVE
AREA
REACTOR 1
Aaaaaaaa! Run Everyone!
The canary mutated to FT8!!

We didn't start the fire
It was always burning Since the world's been turning

We didn't start the fire
No we didn't light it But we tried to fight it

Billy Joel - 1989

Effective Utilization of FT8 & MSK 144 for 6 Meter DX & Contesting

Joel Harrison, W5ZN

Six Meter BBQ 2018

Austin, TX

First Some Rules About Rules

- We're not going to discuss or debate DXCC or contest rules. They are what they are….we follow them or change them
- We're not going to debate FT8 as a mode compared to CW, SSB, AM, Spark or two cans on a string
  - We will discuss how to implement it into an effective DX or contest strategy
- FT8 is simply a "Disruptive Technology"!

Disruptive Technology

- Technology that is new and constantly innovating that initially appeals to only a small group
- It disrupts by creating new users and challenging existing technology
- Examples
  - Email & social media transformed the way we communicate
  - Cell phones disrupted the telecom industry
  - Notebook computers & tablets created a mobile workforce
  - FT8 has transformed amateur digital communications

The "JT" Software Suite

- Is a FREE open source software
- Continues to evolve and improve (with no upgrade fee!!!)
- Enhanced the amateur radio experience of thousands
- Contains several digital modes
  - FT8, MSK144 and JT65 are the most popular
  - Let's discuss FT8 and MSK144

FT8

- Compared to the other so called *slow modes* (JT-65) FT8 is a few dB less sensitive but allows completion of QSO's four times faster
- Bandwidth is about ¼ of JT65
- Compared with *fast* digital modes FT8 is significantly more sensitive with a smaller bandwidth
- Offers multi-decoding over the full displayed passband

FT8

- T/R sequence is 15 seconds
- Message length is 75 bits + 12 bit CRC
- Modulation is 8-FSK, keying rate equals tone spacing of 6.25 Hz
- Occupied bandwidth is ***50 Hz***

MSK144

- Improved version of original FSK144
- MSK = Minimum Shift Keying
- Message frames of 144 bits & Modulation tone frequencies of 1000 Hz and 2000 Hz with a keying rate of 2000 baud
- http://www.arrl.org/files/file/QEX_Next_Issue/SeptOct2017/FrankeTaylor.pdf

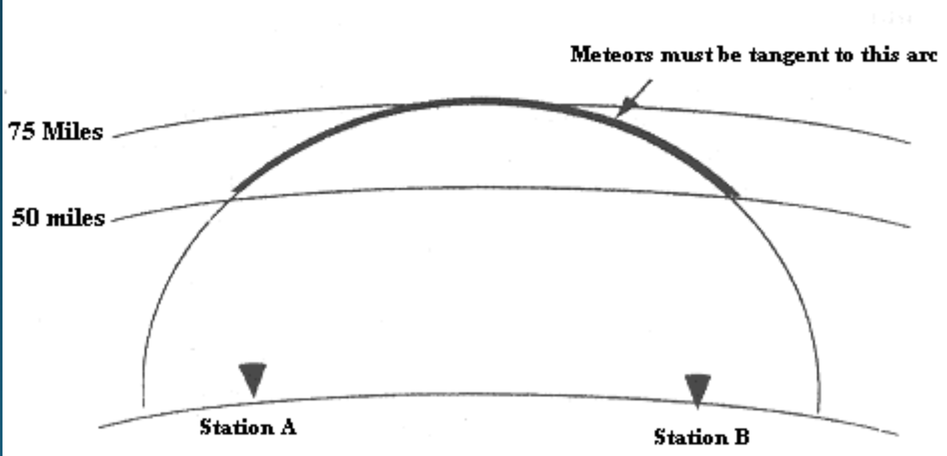
Meteor Scatter

- Meteor scatter is the reflection of radio waves from the ionized trails from meteors & space debris burning up in the upper atmosphere.
- The length of time of the ionization, or burst duration, is related to meteor velocity. An increase in relative velocity results in longer ionization times.
- Excellent for 6 meters & QSOs up to about 1,400 miles are possible and common
- Very Predictable Paths - Best times between midnight & approx. 9 AM

What Causes a "Meteor" Event?

- The earth is bombarded by a constant stream of small particles, that burn up and ionize a column of atoms in the E region at approximately 60 miles above the surface of the earth.

Reflection will occur when the trail is oriented as shown



What Causes a “Meteor” Event?

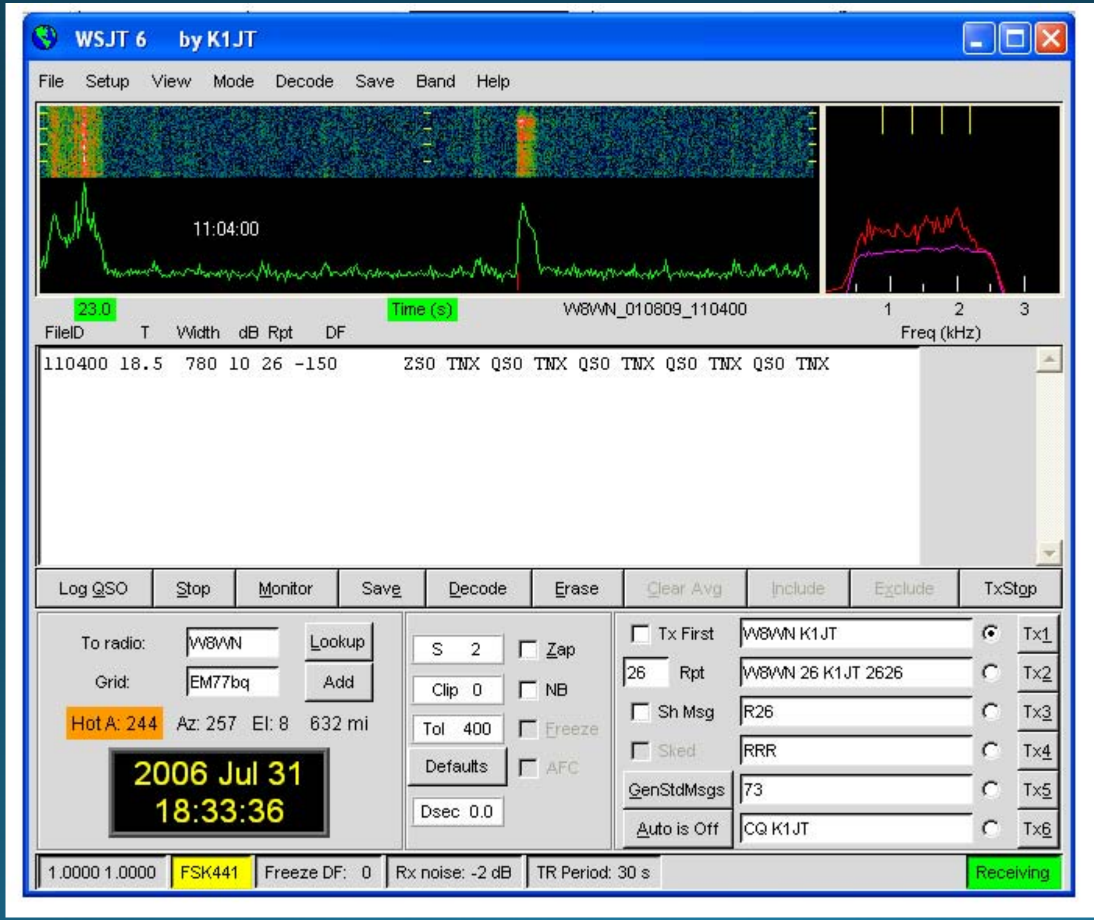
- Most particles entering the earth’s atmosphere are the size of a grain of sand resulting in ionization lasting only a fraction of a second
  - Too short to convey meaningful information via SSB or high speed CW.
- The digital modes of FSK441 and MSK144 were designed to compress a limited amount of information in a packet and transmit that packet in a very short period of time.
  - An MSK144 the information packet has a ***transmission length 0.072 seconds*** and is repeated over and over again during the duration of the selected transmit interval of 5, 10, 15 or 30 seconds.

Meteor Scatter – The "*Old*" Days

- Used SSB with 15 Second sequences
- One station would run 1st & 3rd sequence, other station 2nd & 4th
- K5AND W5ZN K5AND W5ZN K5AND W5ZN
- K5AND W5ZN S2 K5AND W5ZN S2 K5AND W5ZN S2
- Roger S2 Roger S2 Roger S2 Roger S2
- Roger roger roger roger roger roger
- 73 73 73 73 73 73 73 73 73 73 73 73 73

Meteor Scatter – Coming of Age!

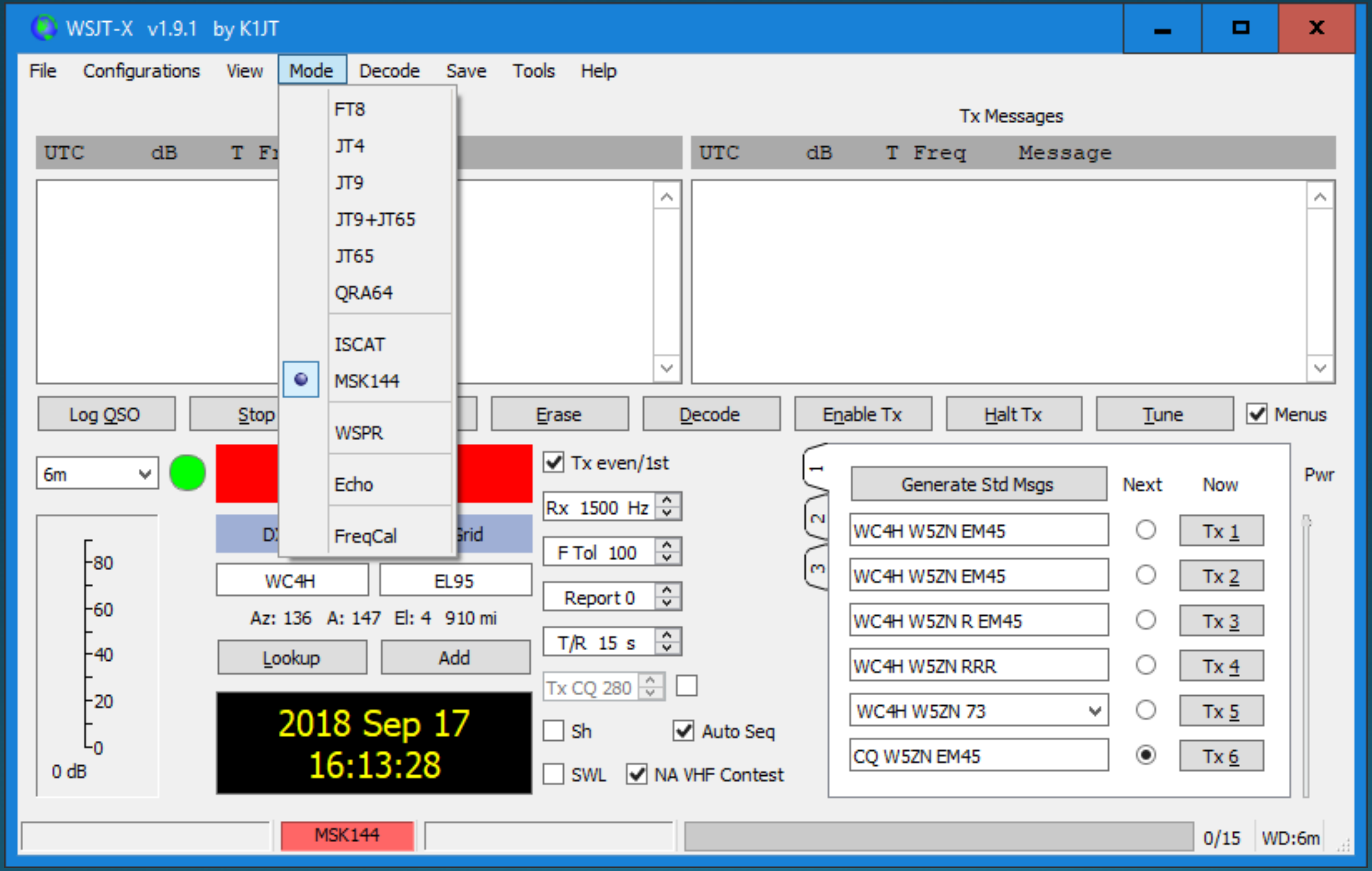
Original JT "FSK441" MS Mode



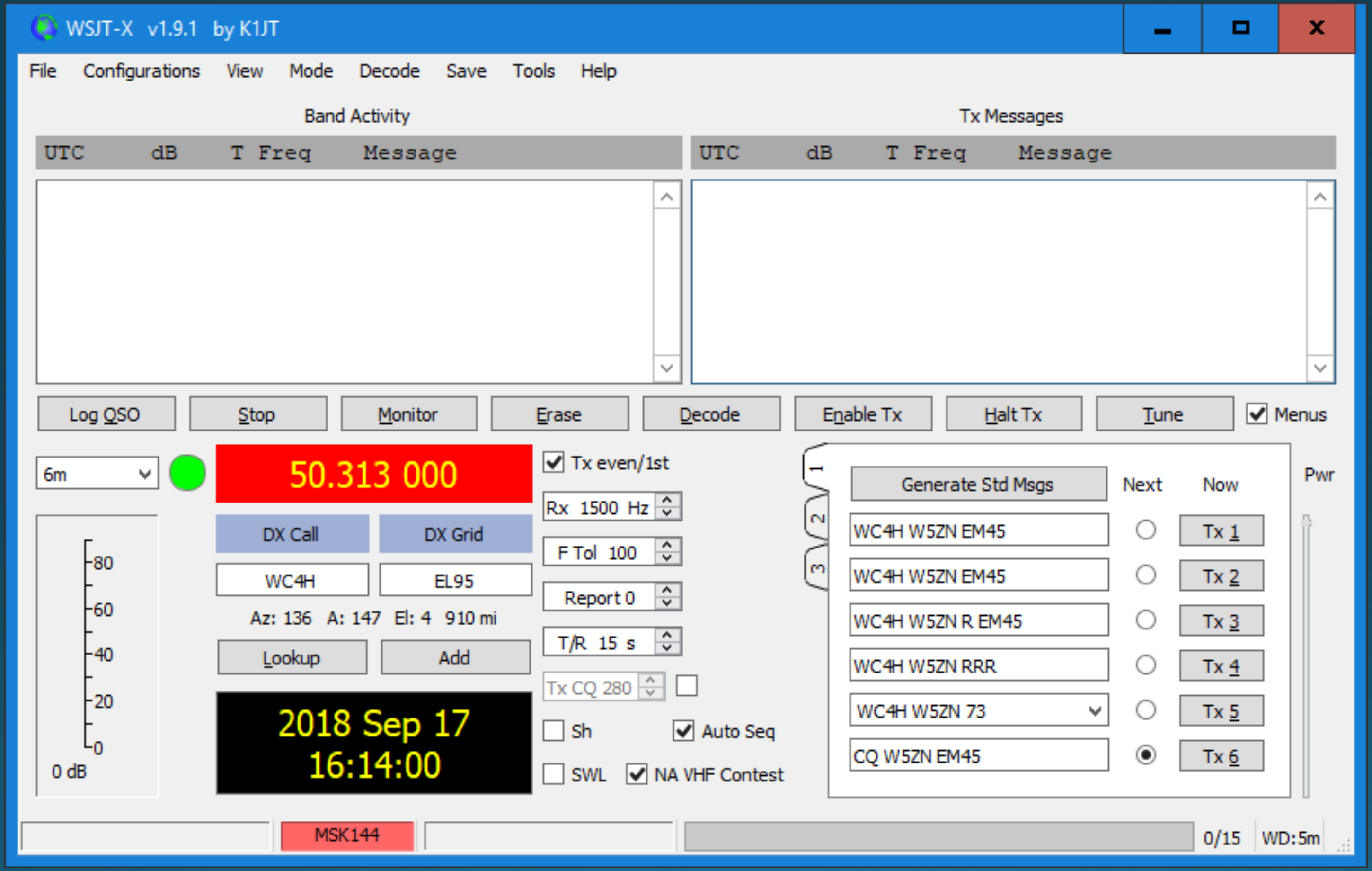
Meteor Scatter – Coming of Age!

- Focused toward contest style operation that include:
  - a machine human interface that facilitates rapid population of QSO specific information
  - shorter TX and RX periods than FSK441
  - auto sequencing that reduces human error and improves operator efficiency important considerations during contest operation

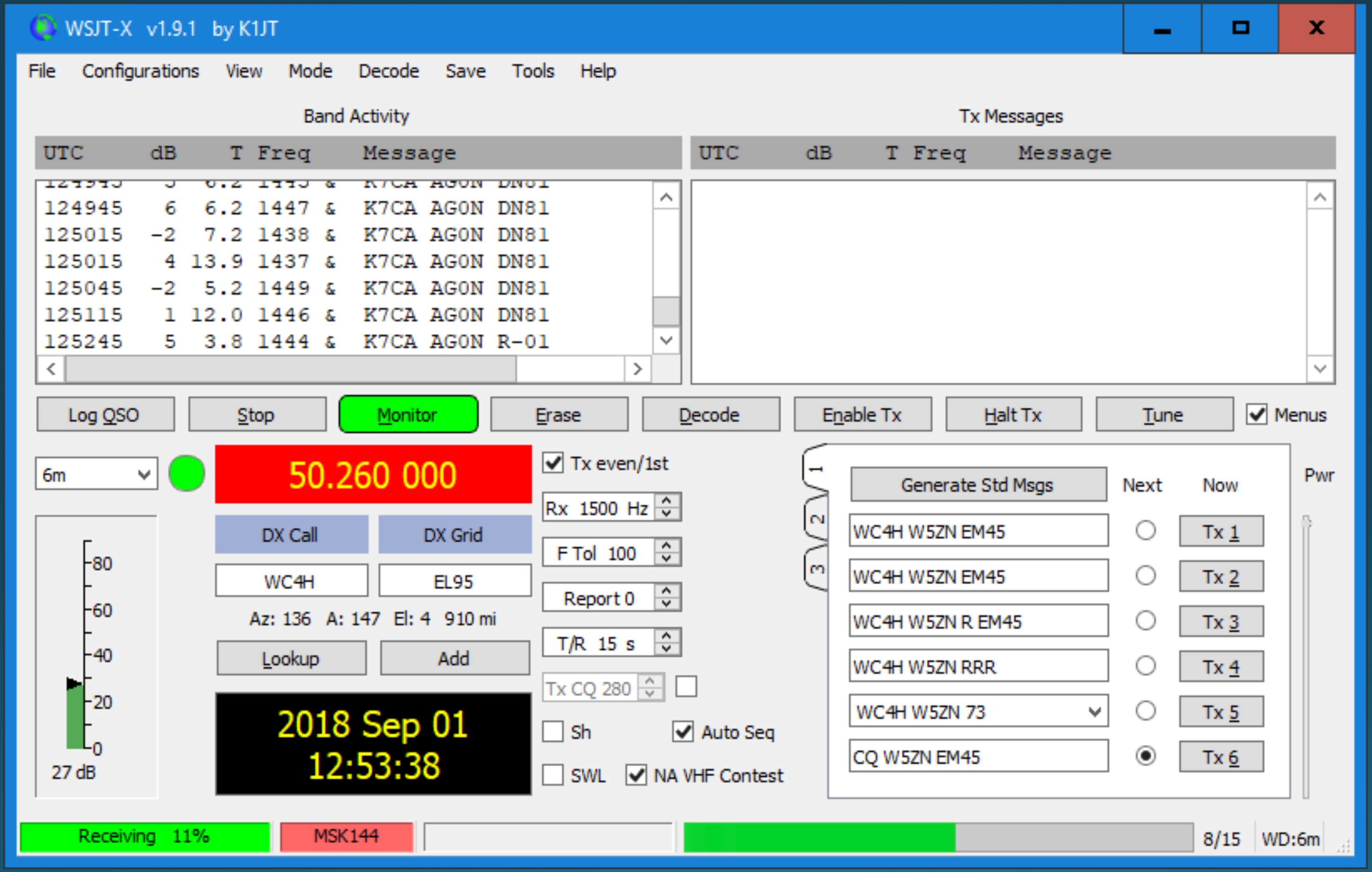
The New “JT” Software Suite



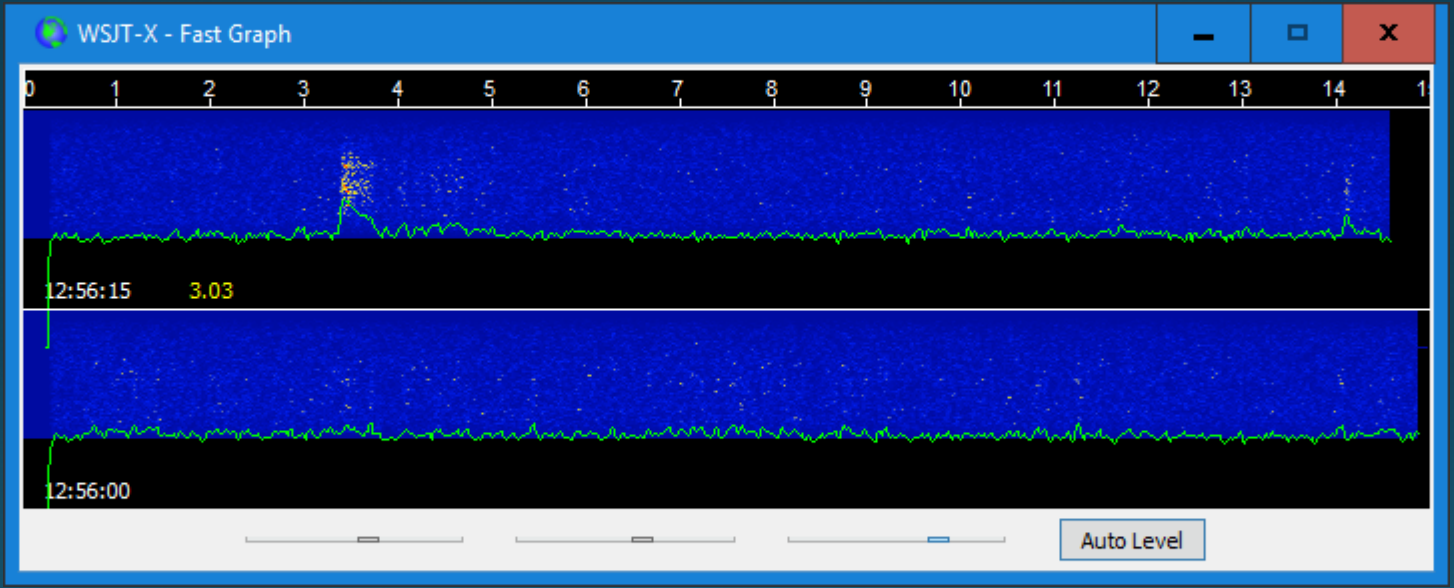
The New "JT" Software Suite



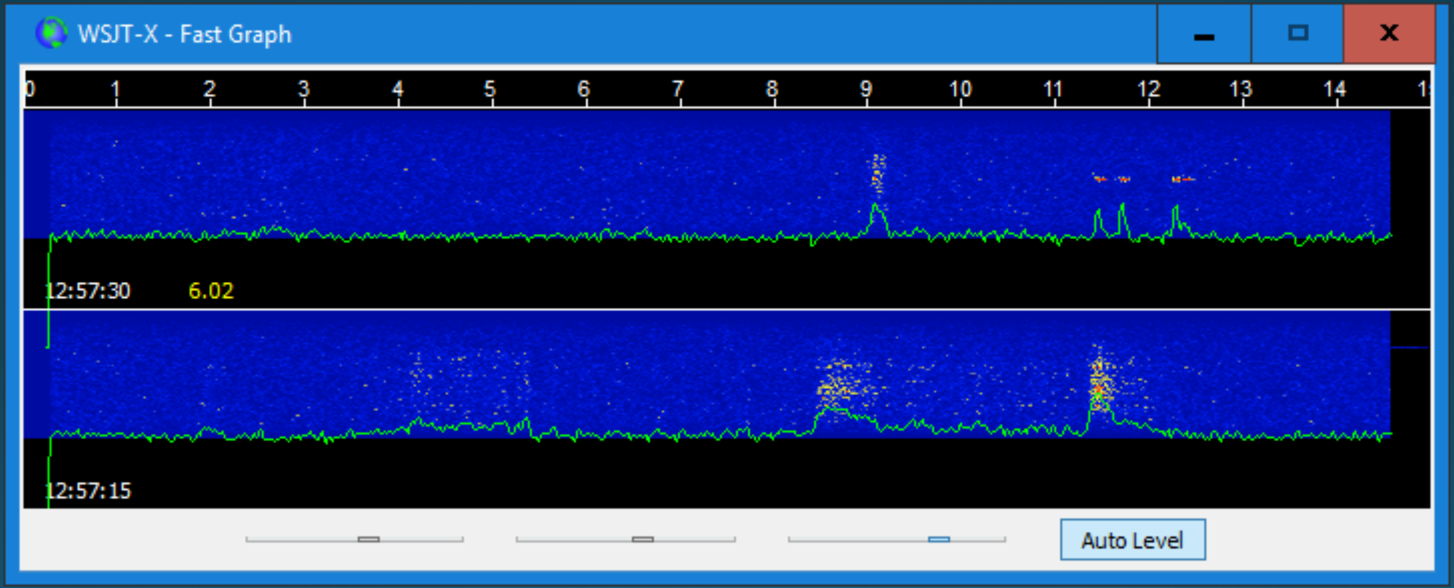
The New “JT” Software Suite



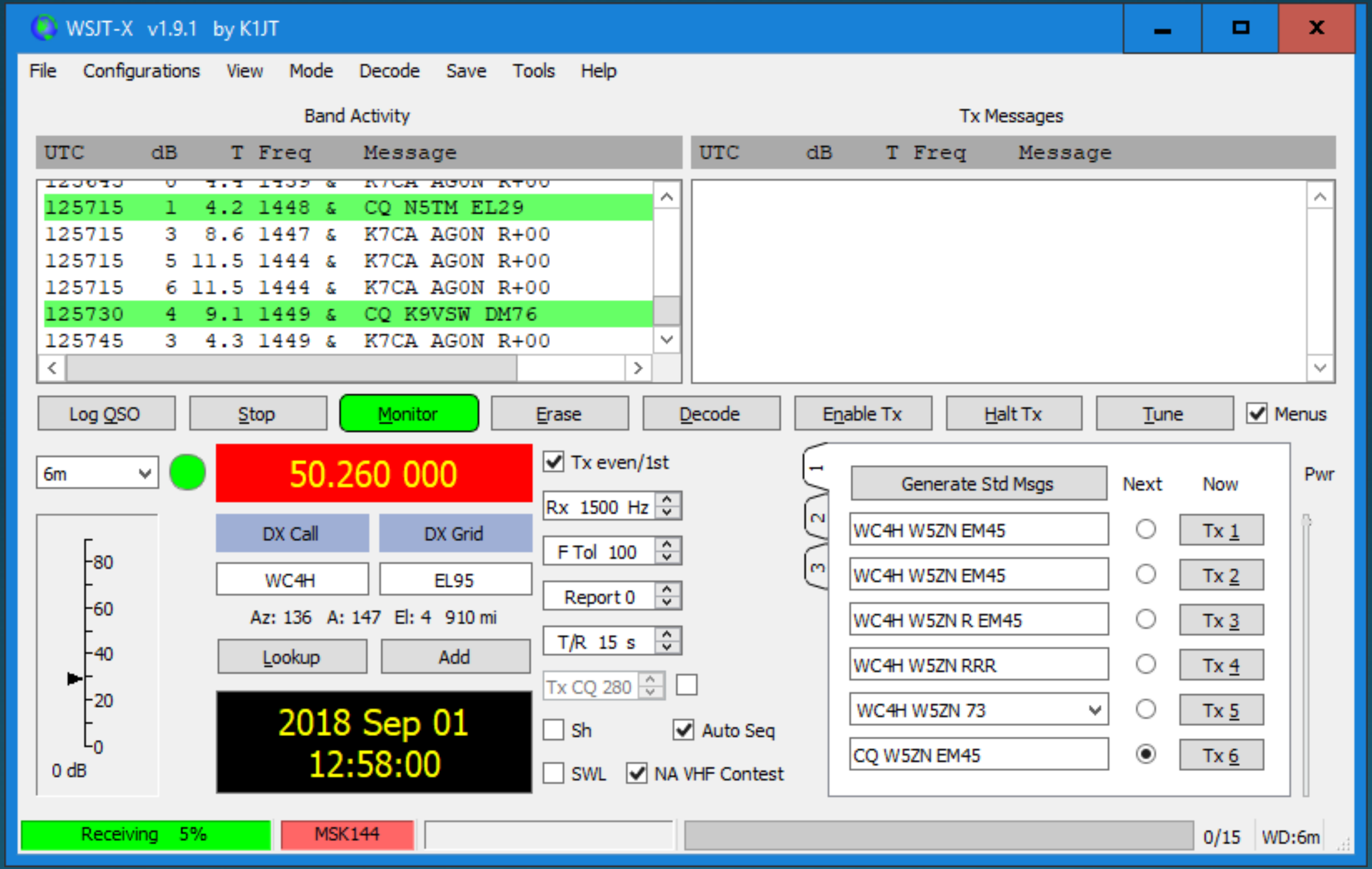
MSK144 "Fast Graph"



MSK144 “Fast Graph”

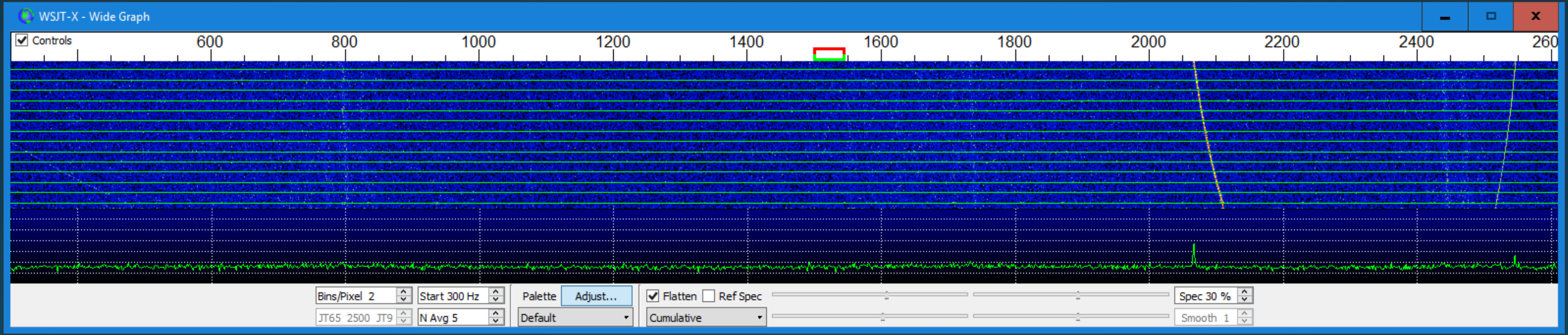


MSK144

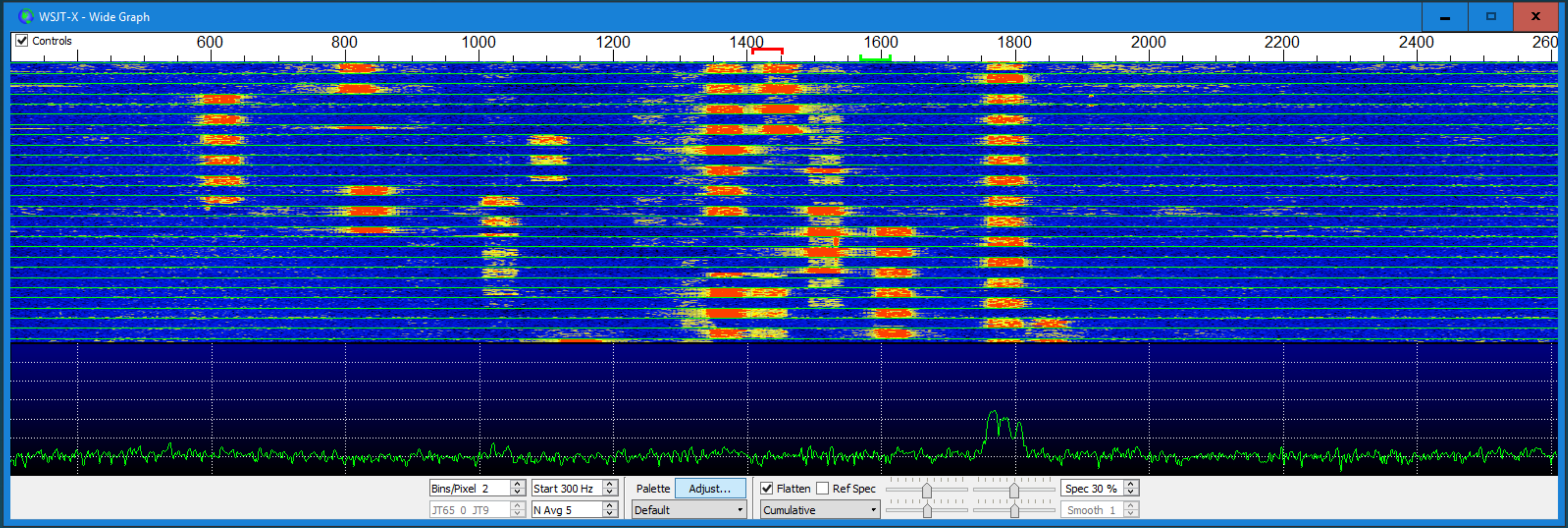


WSJT-X v1.9.1 by K1JT
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB T Freq Message
125715 1 4.2 1448 & CQ N5TM EL29
125715 3 8.6 1447 & K7CA AG0N R+00
125715 5 11.5 1444 & K7CA AG0N R+00
125715 6 11.5 1444 & K7CA AG0N R+00
125730 4 9.1 1449 & CQ K9VSW DM76
125745 3 4.3 1449 & K7CA AG0N R+00
Tx Messages
UTC dB T Freq Message
Log QSO
Stop
Monitor
Erase
Decode
Enable Tx
Halt Tx
Tune
Menus
6m
50.260 000
DX Call
DX Grid
WC4H
EL95
Az: 136 A: 147 El: 4 910 mi
Lookup
Add
2018 Sep 01
12:58:00
Tx even/1st
Rx 1500 Hz
F Tol 100
Report 0
T/R 15 s
Tx CQ 280
Sh
Auto Seq
SWL
NA VHF Contest
Generate Std Msgs
Next
Now
Pwr
WC4H W5ZN EM45
Tx 1
WC4H W5ZN EM45
Tx 2
WC4H W5ZN R EM45
Tx 3
WC4H W5ZN RRR
Tx 4
WC4H W5ZN 73
Tx 5
CQ W5ZN EM45
Tx 6
80
60
40
20
0
0 dB
Receiving 5%
MSK144
0/15
WD:6m

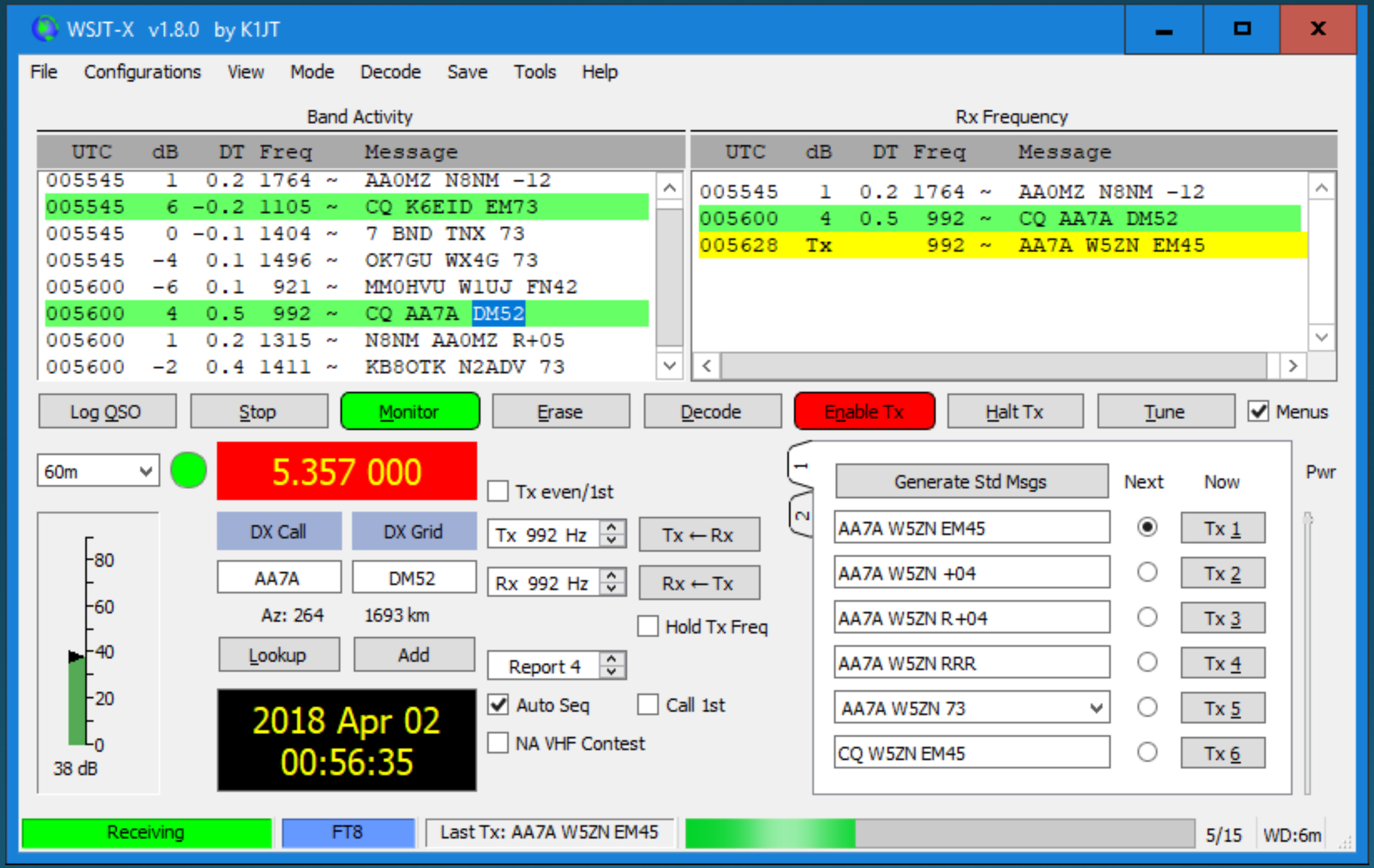
FT8's "Wide Graph"



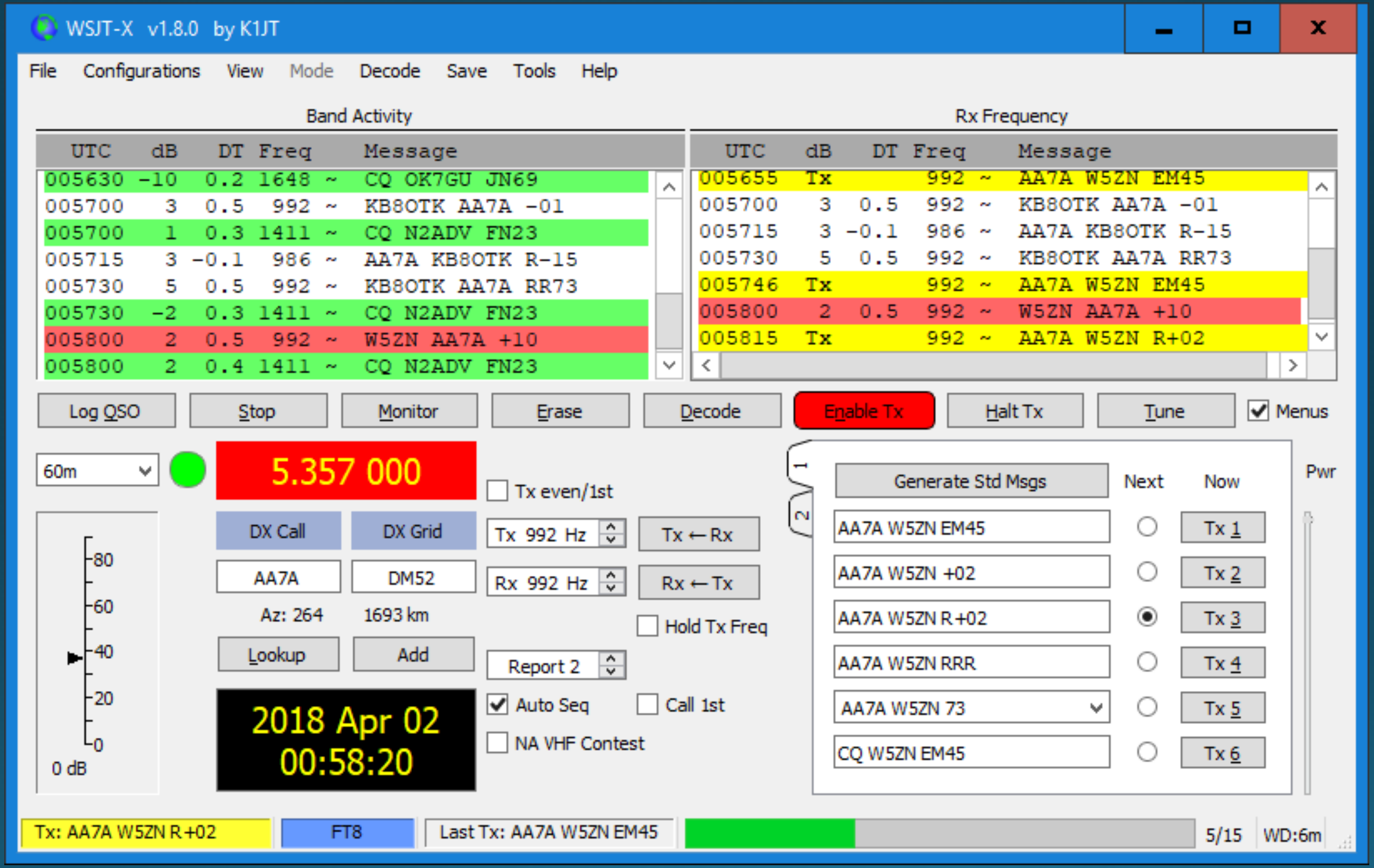
FT8's "Wide Graph"



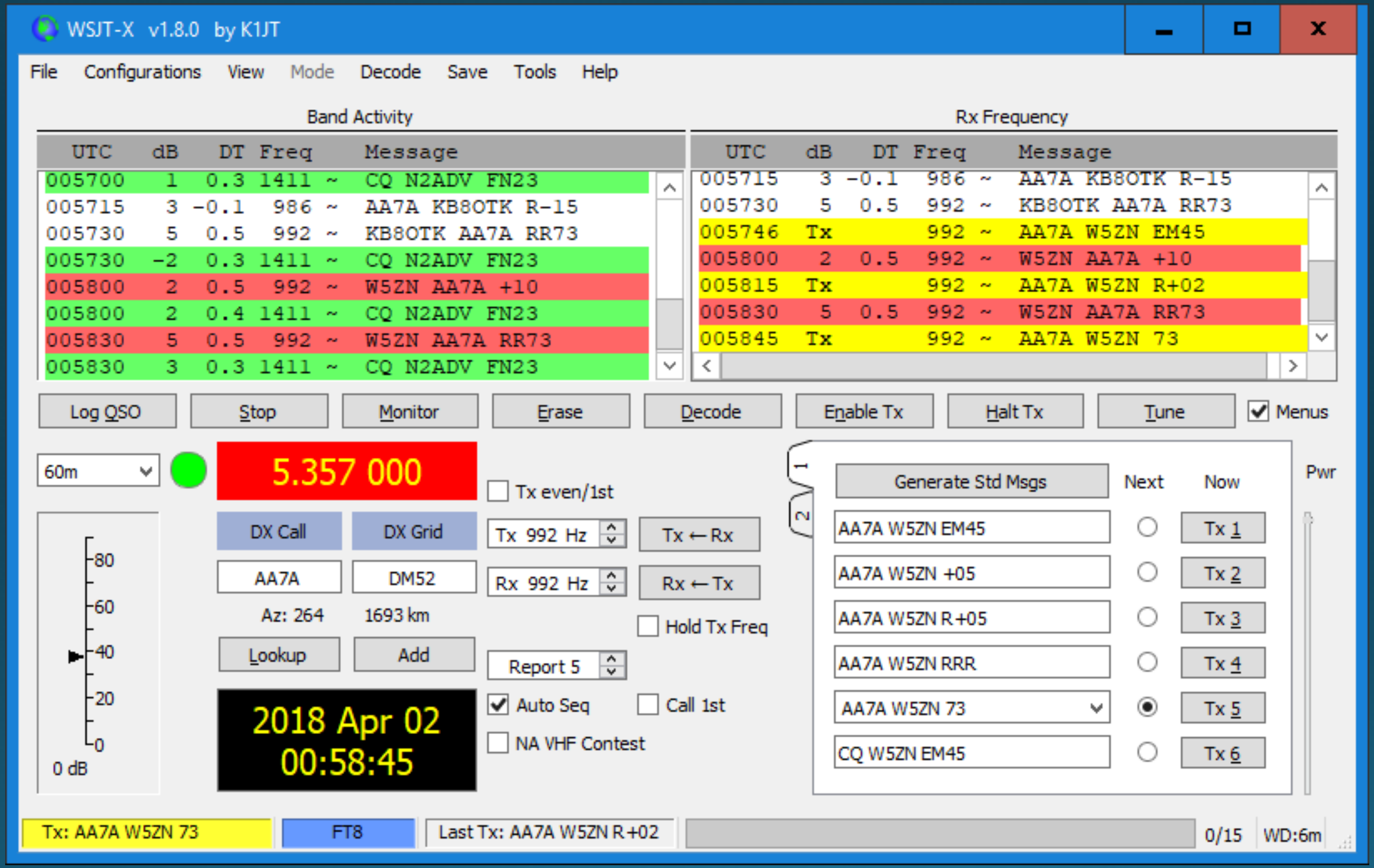
FT8 Decoded Signals



FT8 Decoded Signals



FT8 Decoded Signals



6 Meter Applications

- Working DX on 6 meters
  - 4X, 9K2, S01, Tons of EU, JA, BY, HL
- VHF Contests
  - New stations are now on 6 meters - 12 in Arkansas alone
  - SO2R for 6 meters?

Single Operator 2 Radio

- Used for several years in HF contesting
- Some VHF contest multi-ops utilize two radios on one band
- Only a few Single Ops utilize it for VHF contesting on one band
  - Obviously a VHF operator must use more than one radio
- Basic principle is very simple:
  - Use one radio as a "run" radio to call CQ
  - Use a second radio to search for multipliers
- Not applicable to 144 MHz and up
- 50 MHz presents a golden opportunity for this technique

Single Operator 2 Radio

Single Operator 2 Radio

- Remember during VHF contests we can utilize any mode
  - Exception – FM Only category
- On 50 MHz we must now monitor a wide frequency range
  - CW starting at 50.080 MHz
  - SSB at 50.110 (50.125) MHz and up to above 50.200 MHz
  - And now FT8 at 50.313 MHz

First Some Basics

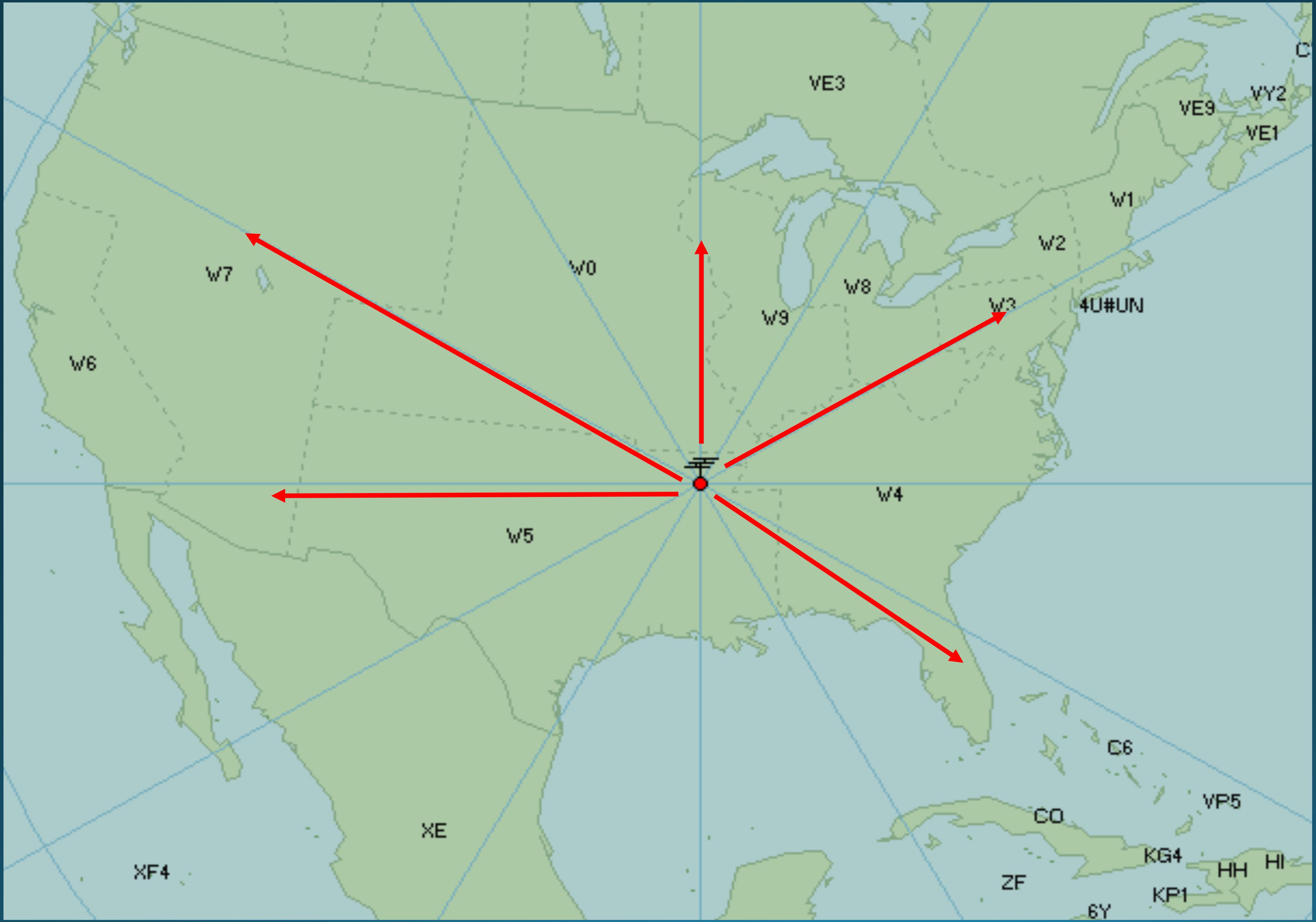
- “2 Radio is just that, 2 radios
  - Don’t have to be the same make/model, just need to cover 6 meters
- You will need a separate antenna
  - Or a way to feed your antenna system to two radios with proper interlocks
- Antennas is a topic within itself however some review is warranted

6 Meter Antenna Basics

- Become familiar with the various propagation modes you will experience in a VHF contest
  - We'll focus on Sporadic E here
- The old amateur wives tale is "BIGGER and HIGHER is BETTER!!"
  - How do you know???
- An effective 6 meter antenna for Sporadic E only needs to be around 25 to 40 feet high, with 35 feet optimum for single hop E out to around 1,000 miles or so.
- 35 feet places the antenna around 1.5λ above the ground

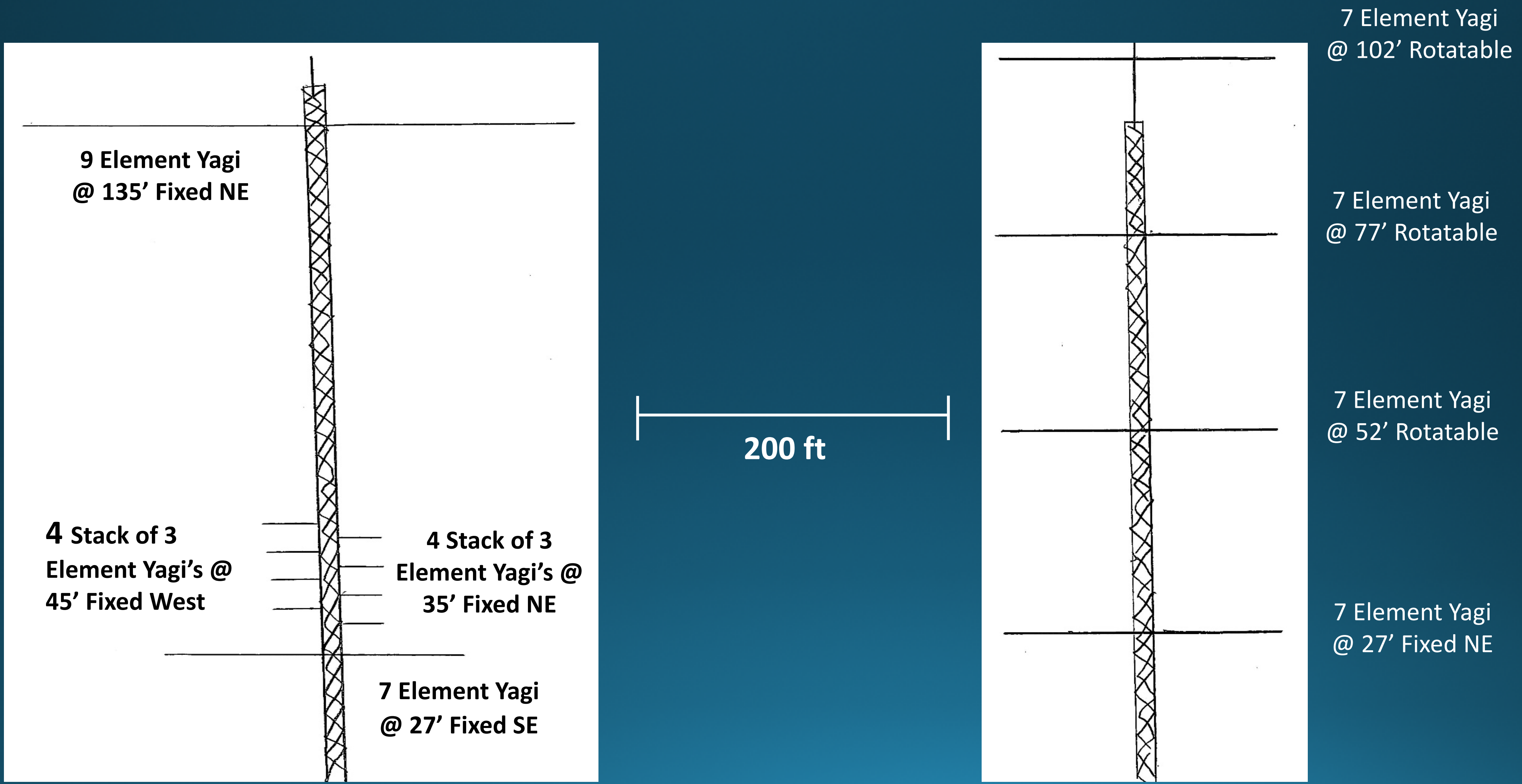
6 Meter Antenna Basics

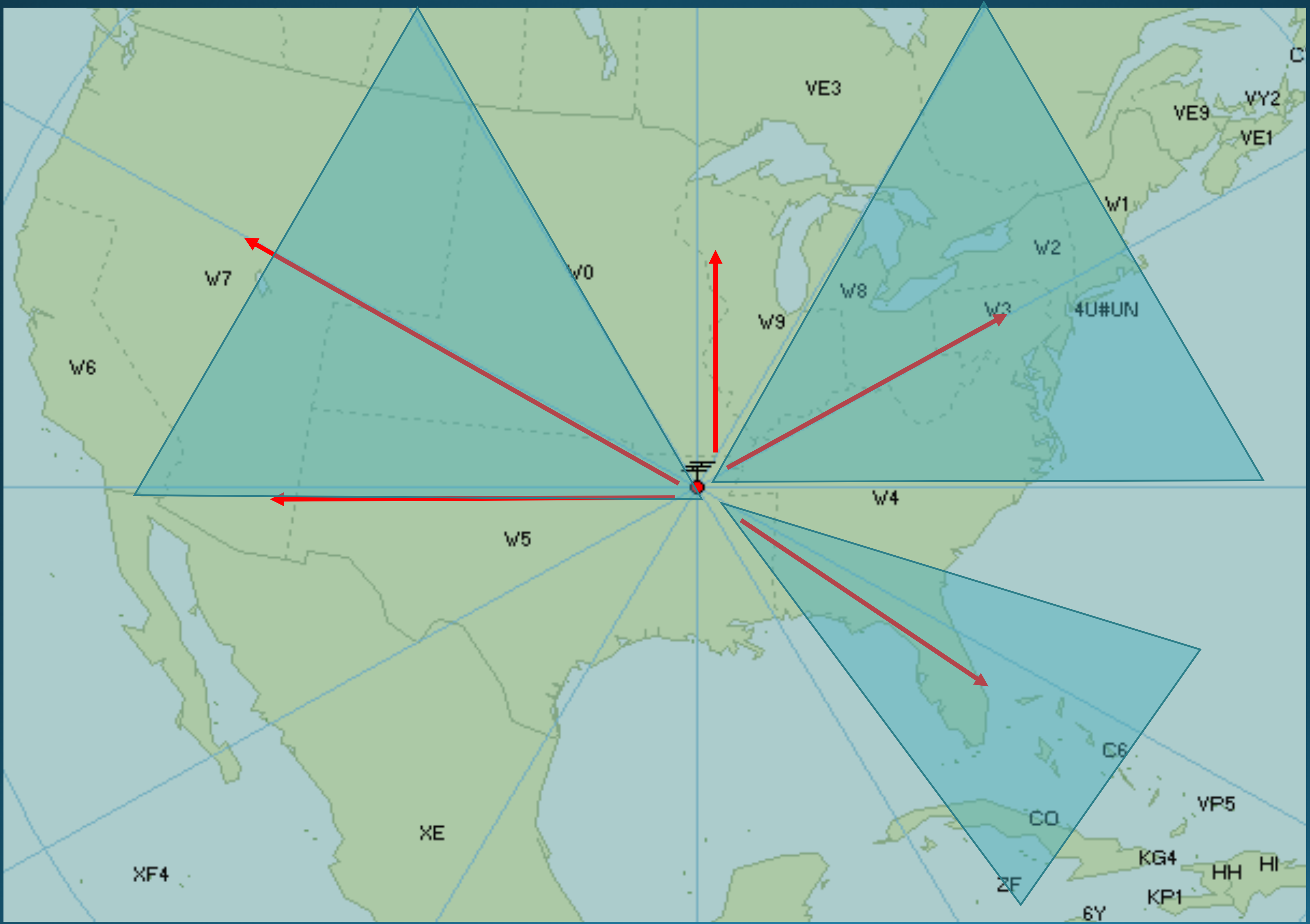
- You do NOT need a monster antenna with a 50 foot boom.
  - While you will have more gain you will have a very narrow beamwidth
- You will achieve outstanding results with a small Yagi at low height
- Better, use four 3 element antennas spaced around 10-12 feet and stacked vertically centered around 35 feet fixed toward a high QSO direction
  - Provides almost 70 degree E Plane beamwidth



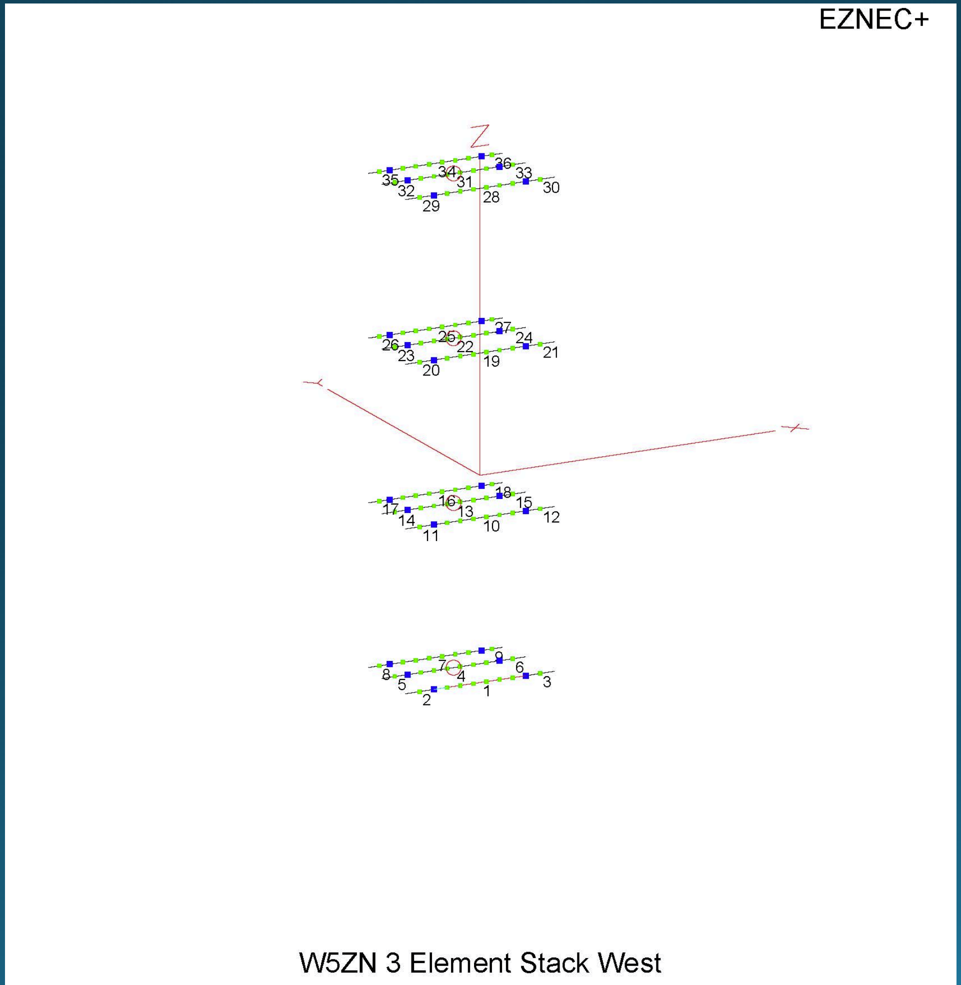
VE3
VY2
VE9
VE1
W1
W2
W7
W0
W8
W3
4U#UN
W9
W6
W4
W5
C6
VP5
CO
KG4
HH
HI
XE
XF4
ZF
KP1
6Y

W5ZN 50 MHz Antennas

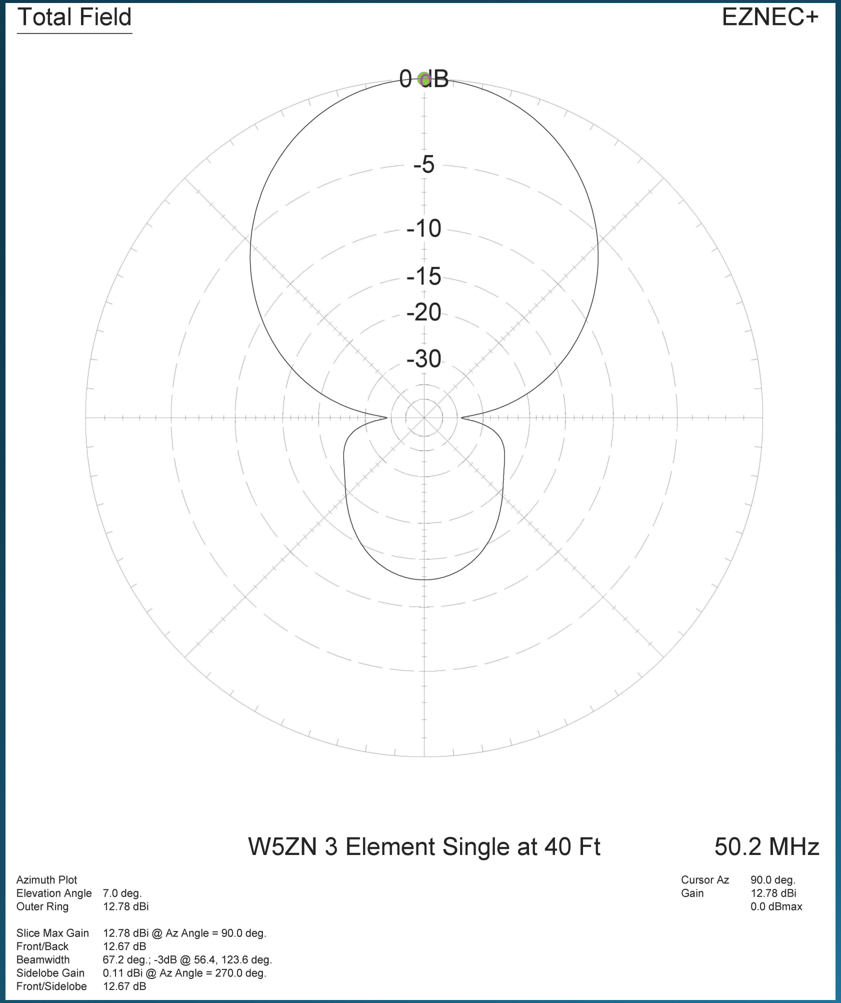


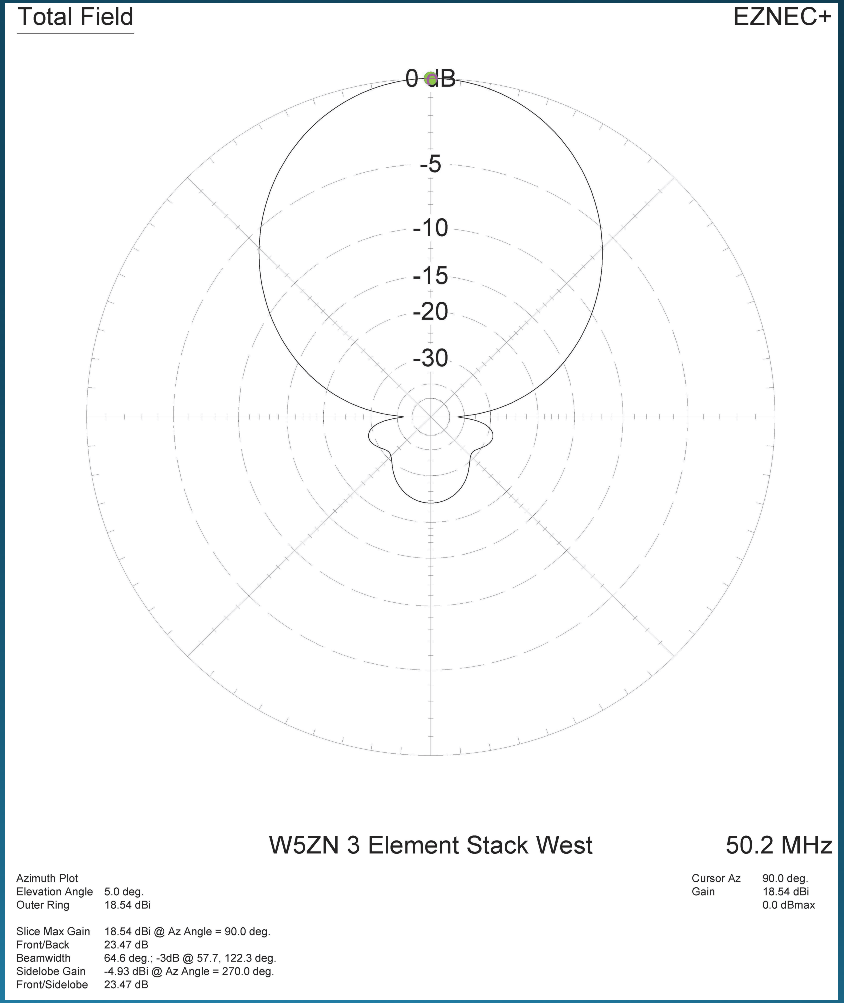

VE3
VE9
VY2
VE1
W1
W2
W0
W7
W8
W9
W3
4U#UN
W6
W4
W5
C6
VP5
CO
KG4
HH
HI
XE
XF4
ZF
KP1
6Y

Stack of Four 3 element Yagi's

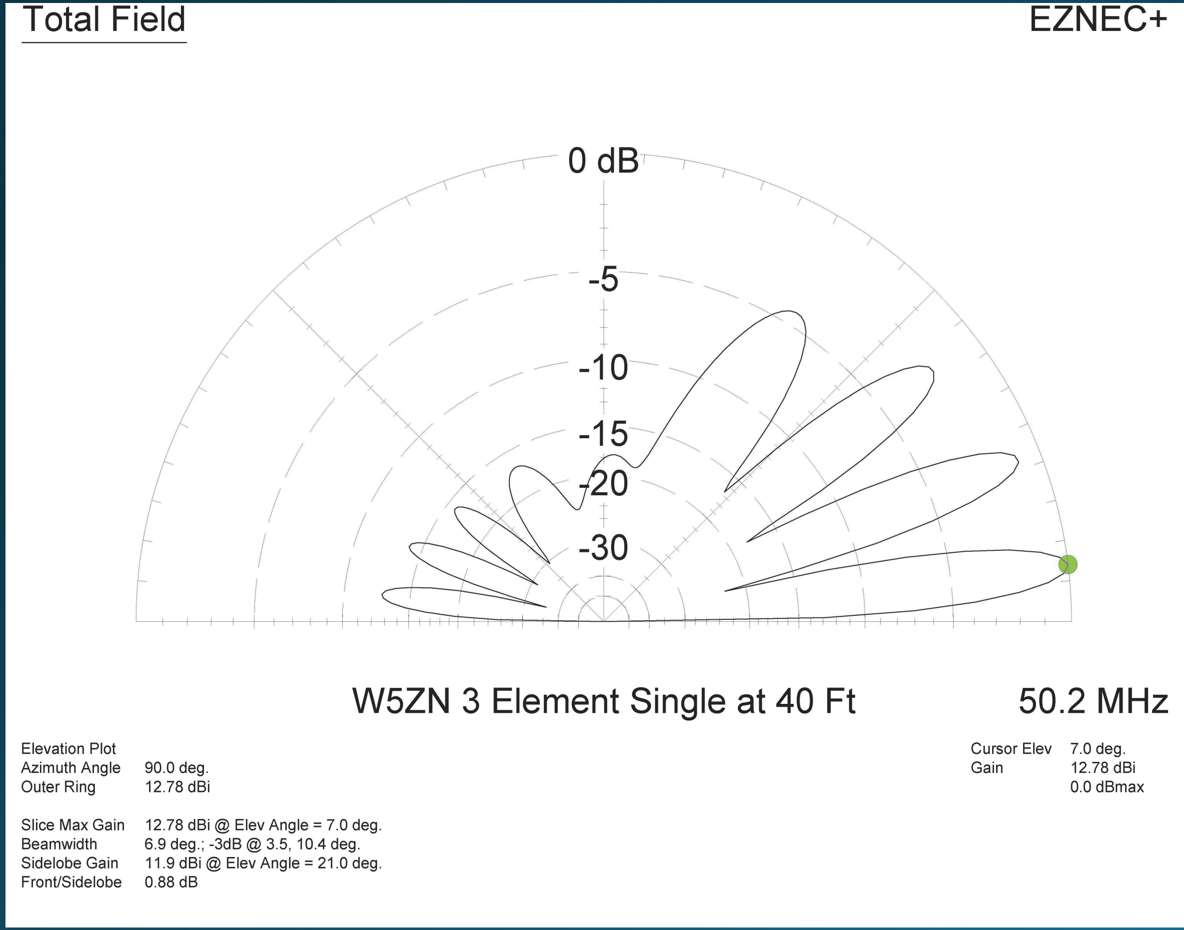


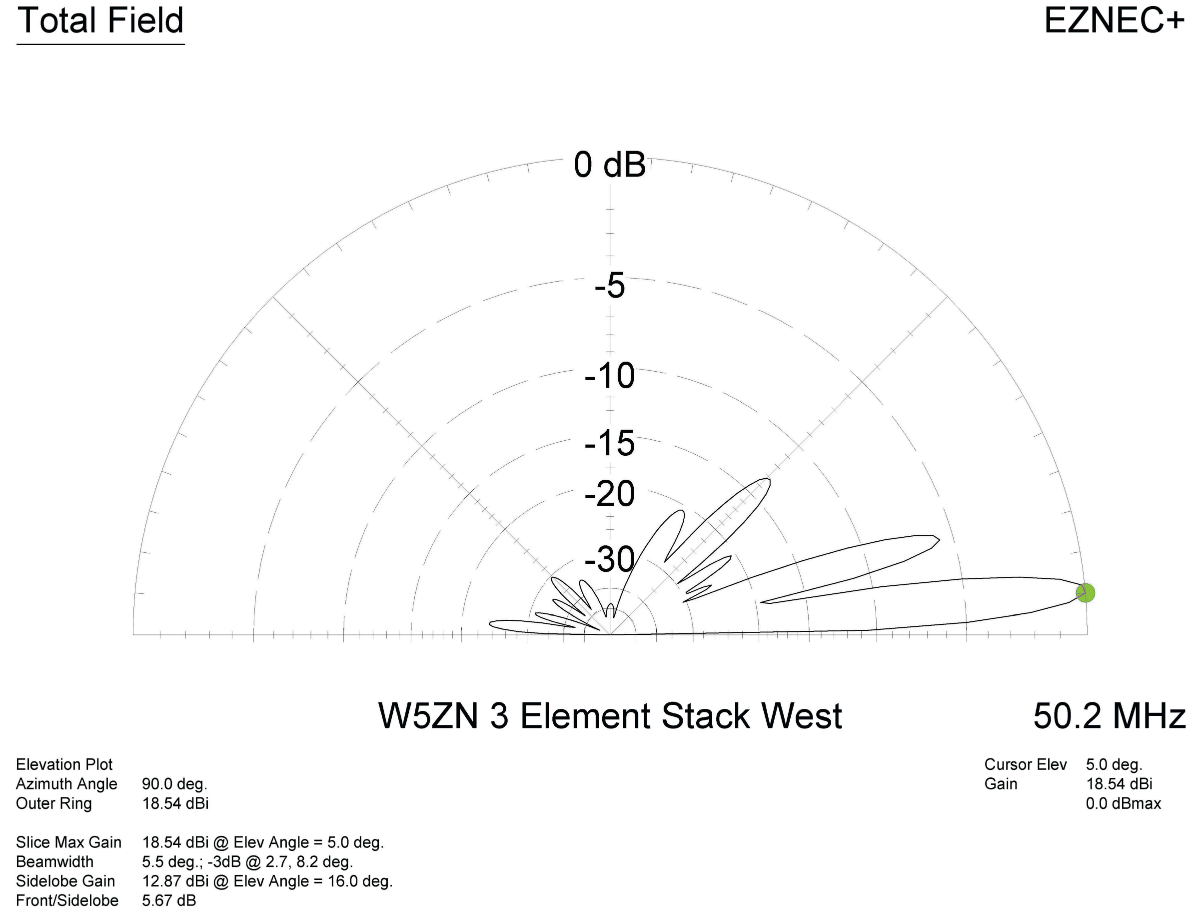
Single 3 element Yagi





Stack of Four 3 element Yagi's





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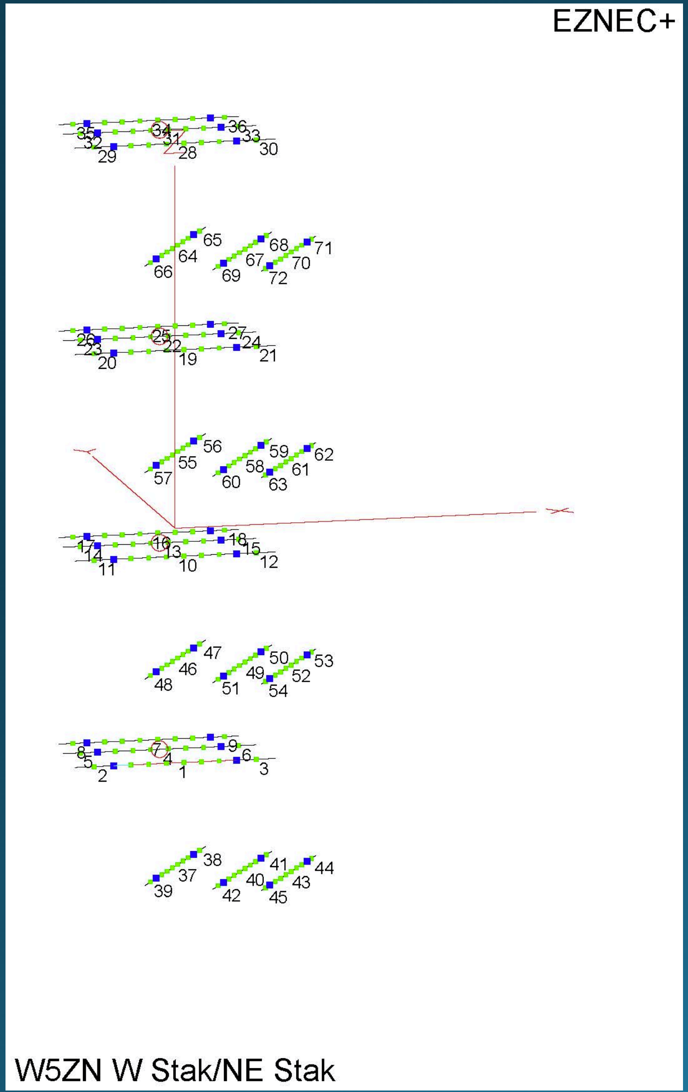
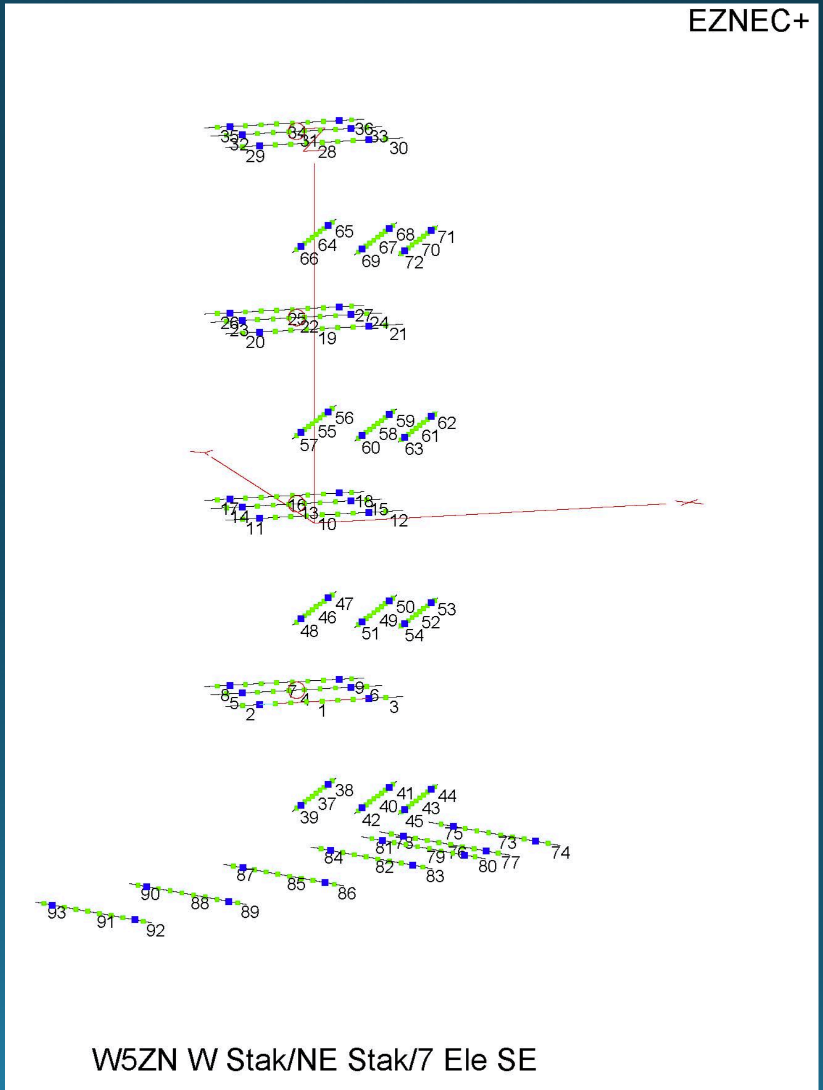
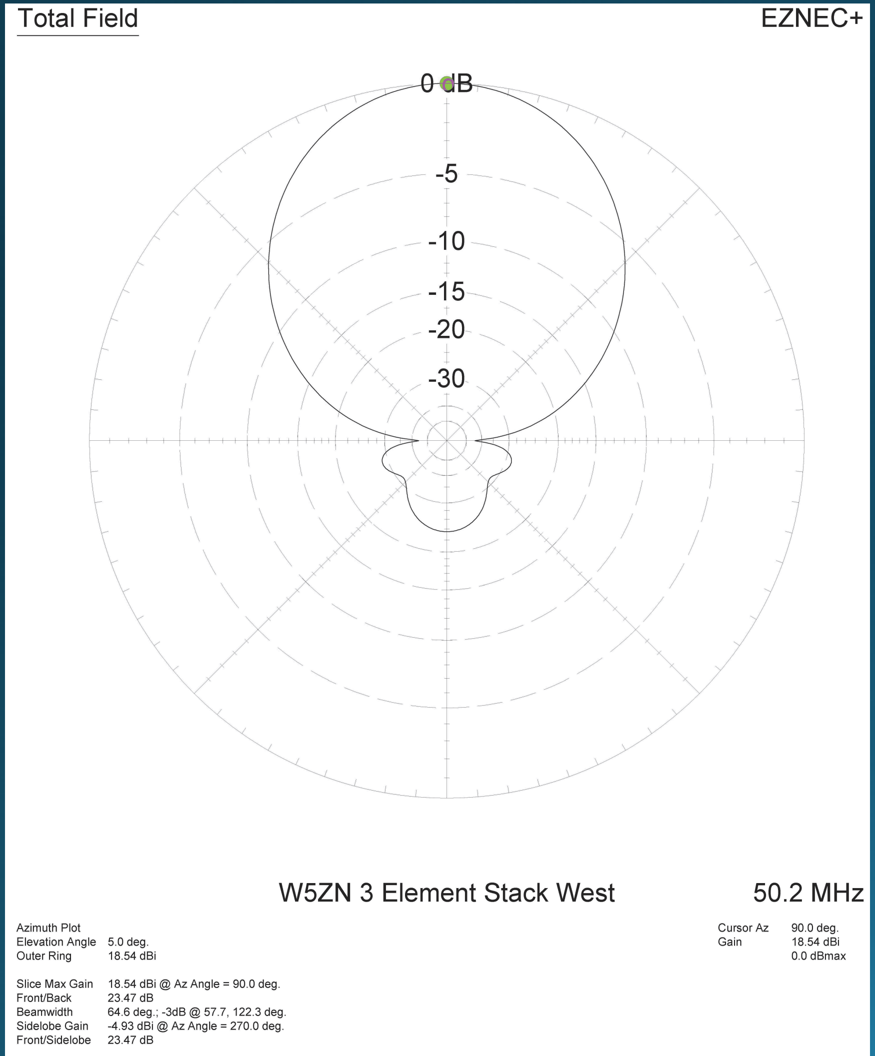
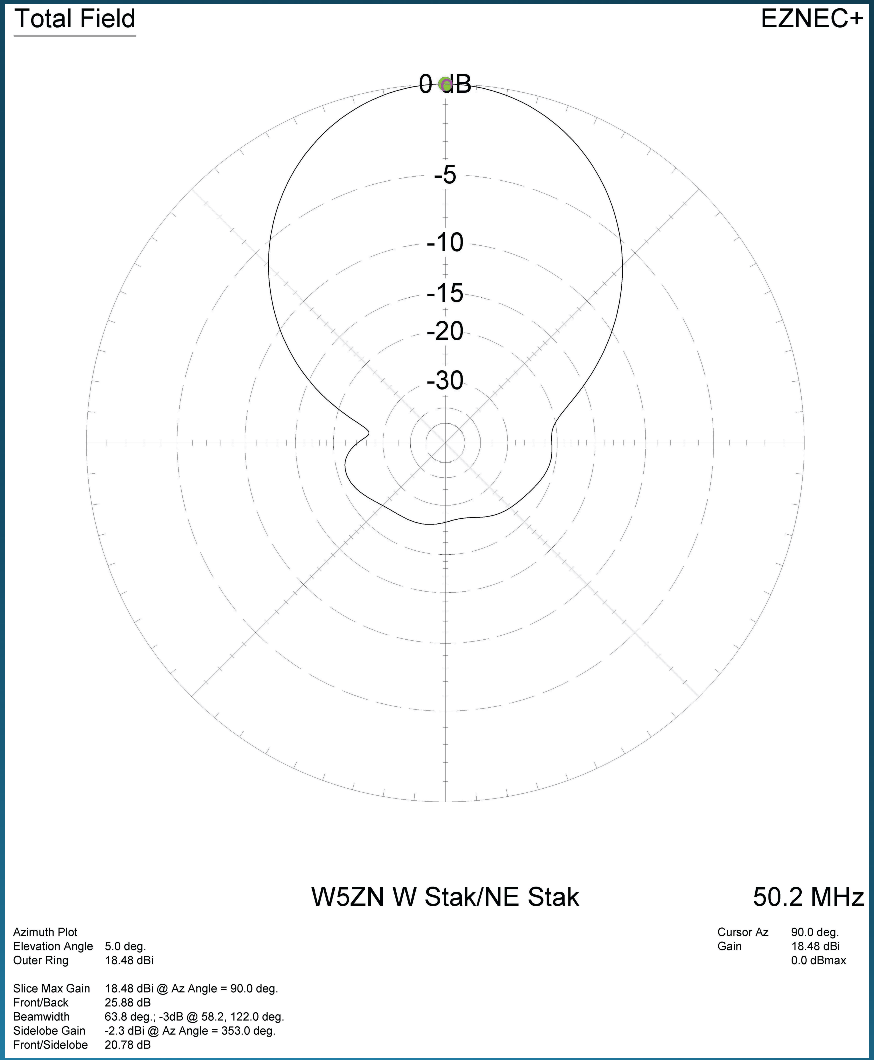




Stack of Four 3 element Yagi's





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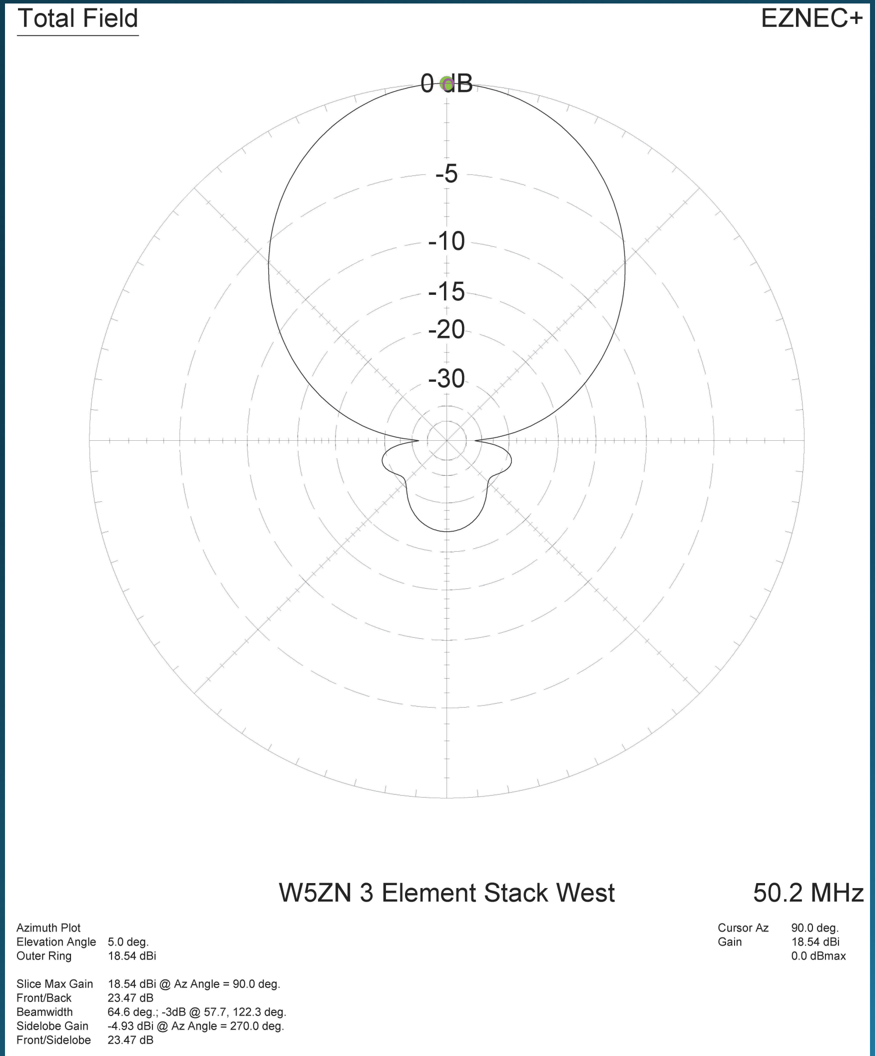

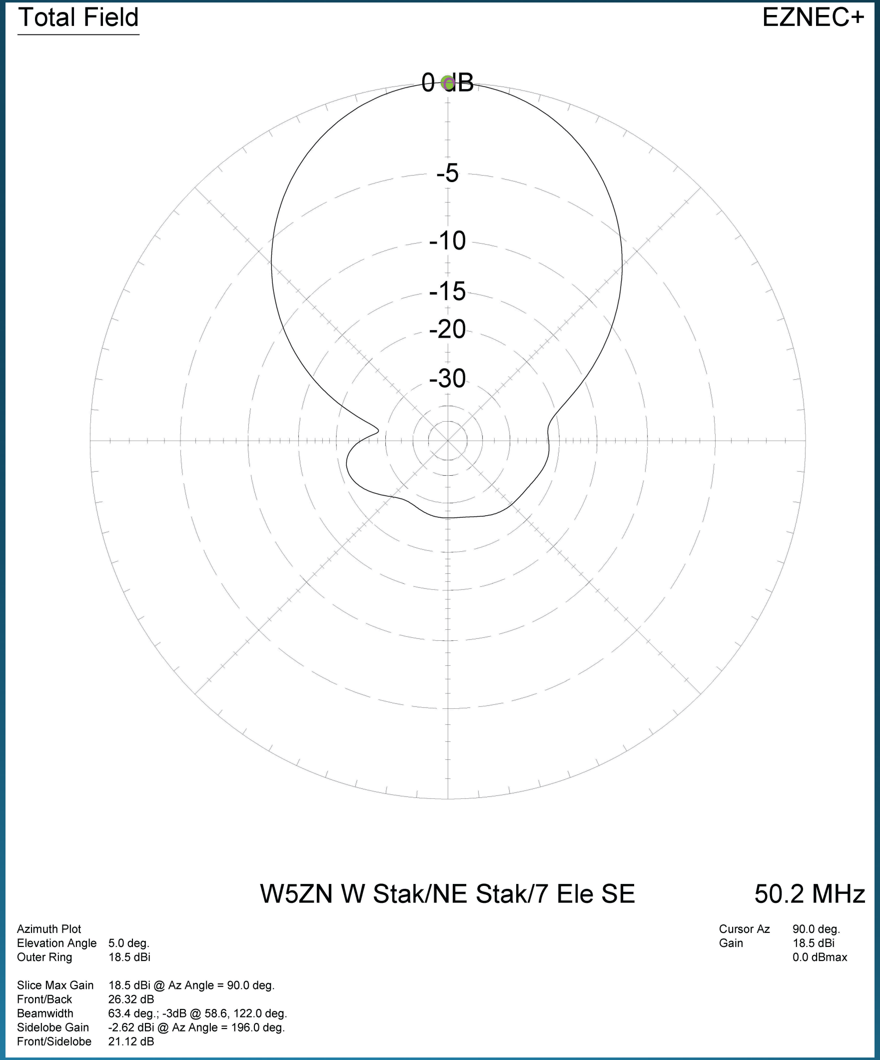

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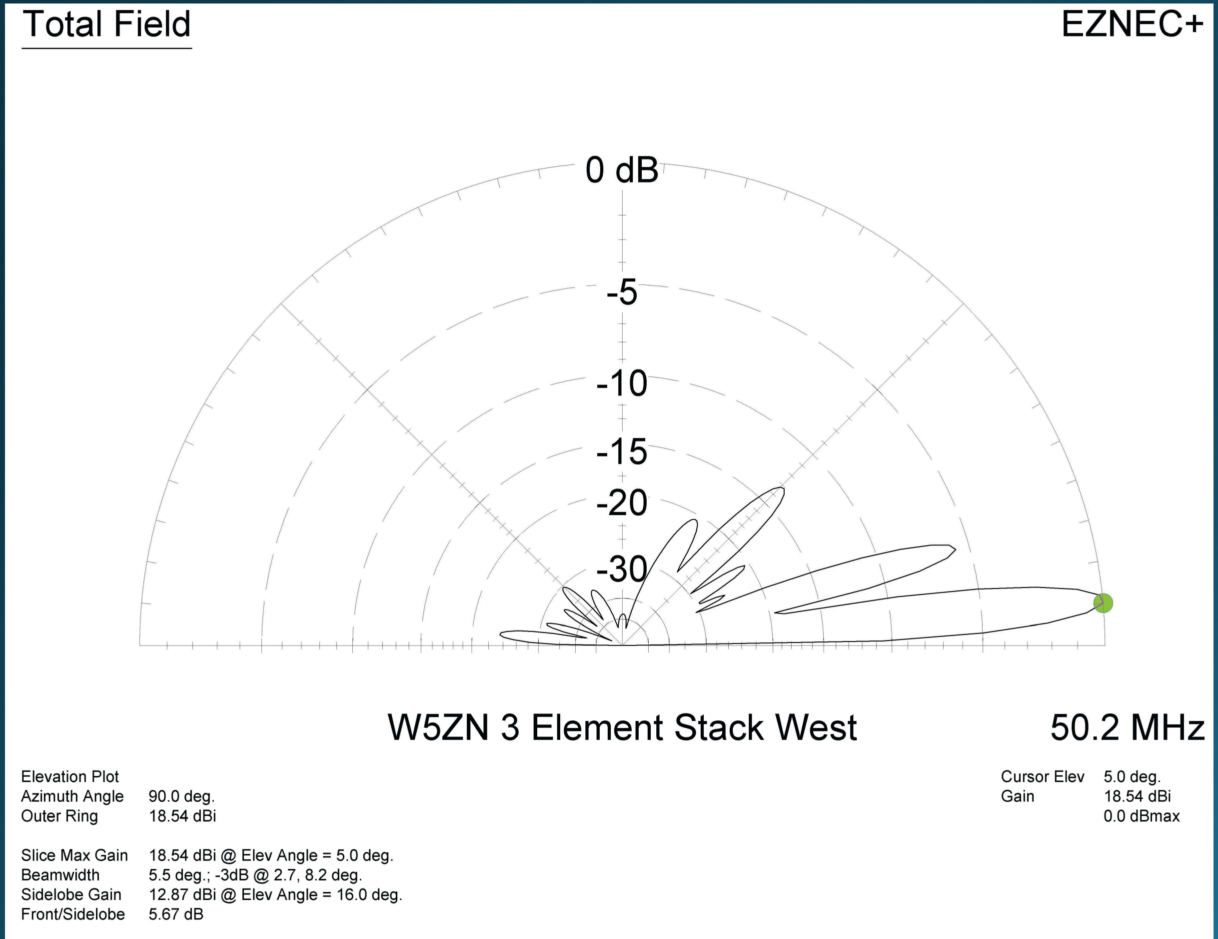

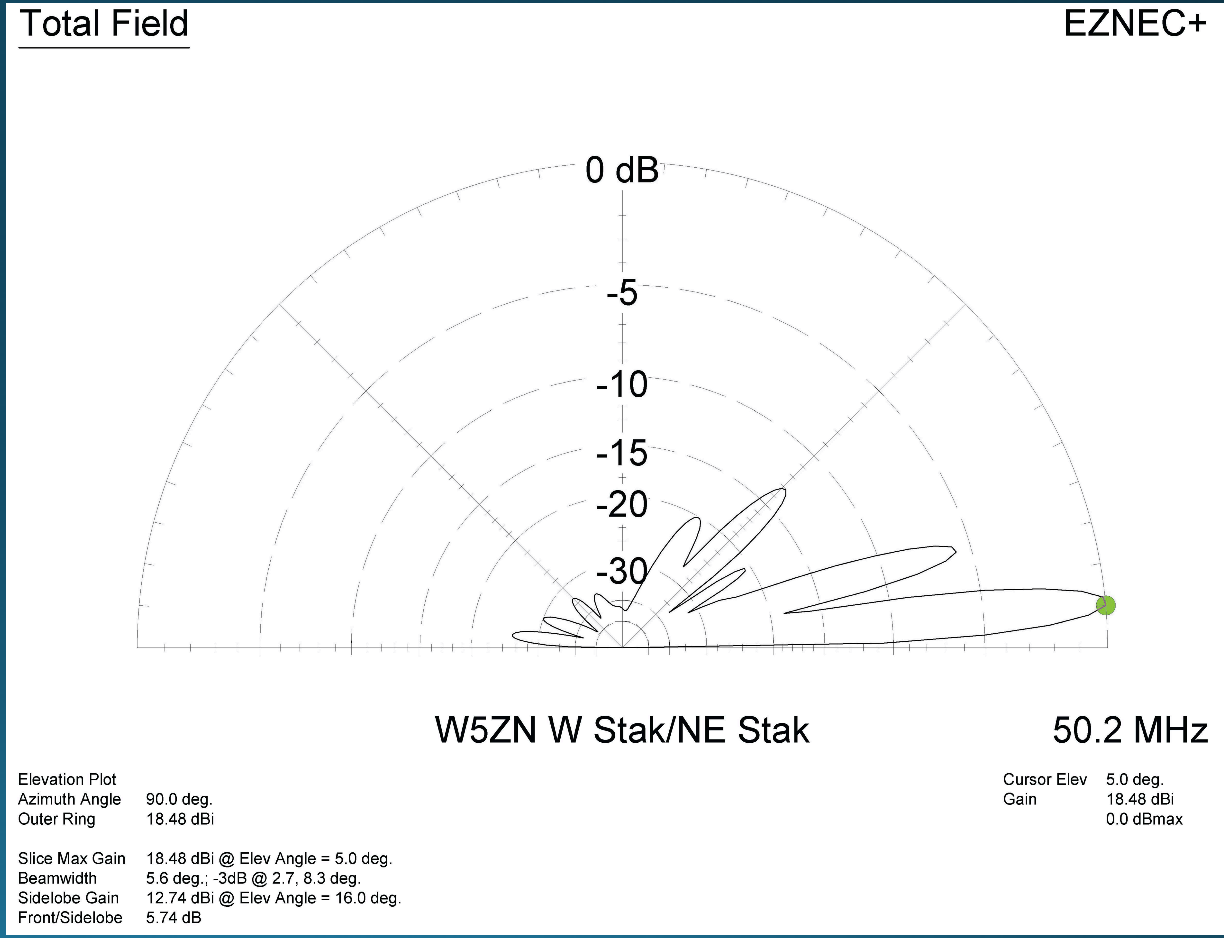

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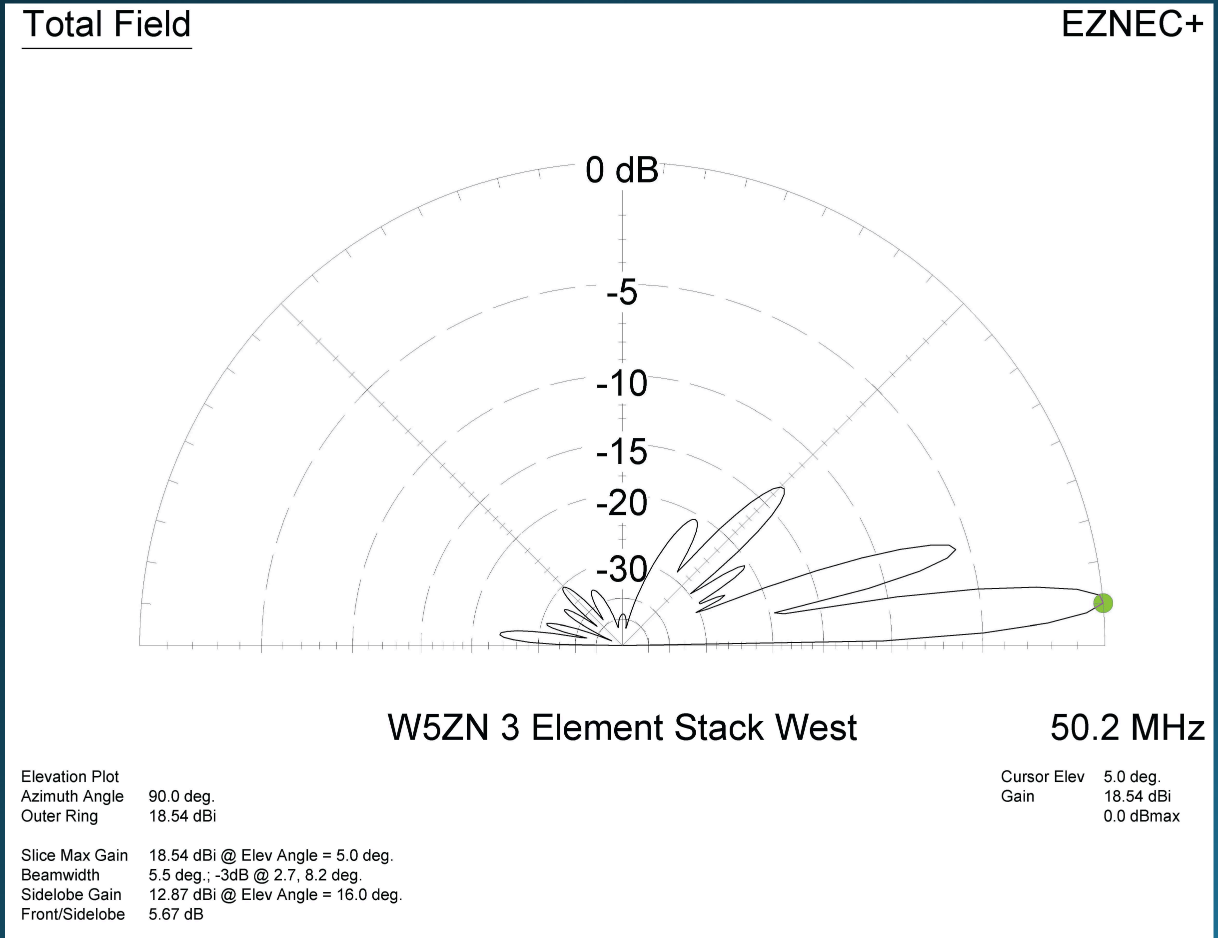

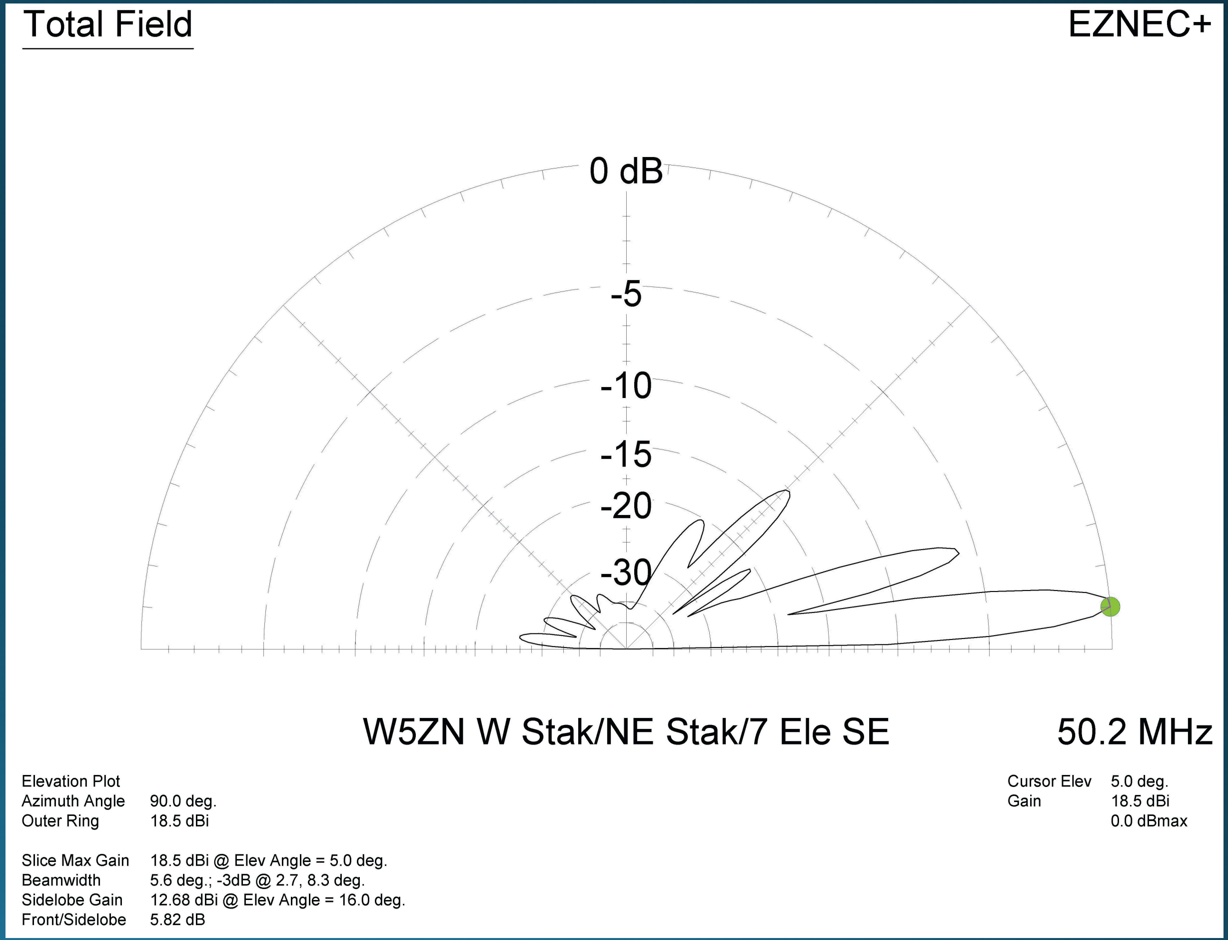

The SO2R Technique for 6 Meters

- Dedicate one radio as your main run radio in the CW and SSB portion of the band
  - Utilize this radio effectively and continually during your time on 6 meters and make as many Q's as possible
- Use the second radio to monitor 50.313 MHz (or 50.323 for EU).
  - During times when you decode a CQ from a station you have not worked stop CQ'ing on the "run" radio and work the station on the second radio
- **WARNING CAUTION STOP IT!!!!**
  - Do not, repeat NOT leave a good strong run on SSB or CW
  - You will simply miss many more QSO opportunities on SSB & CW

The SO2R Technique for 6 Meters

- If there is no FT8 activity on 50.313 then use the second radio to scan the SSB/CW portion for new multipliers
- Sometime during the night Sporadic E and other modes will die
- Stations will move to meteor scatter on 50.260 MHz
  - Move your run radio here while maintaining the second on 50.313

2018 June VHF Contest

W5ZN worked the following on 6 meters:

Mode	QSO's	Grids
SSB	662	106
CW	5	5
FT8	67	48
Total	734	159

The SO2R Technique for 6 Meters

Practice your technique *__BEFORE__* the contest

You will create a disaster if you don't and most likely blow up something

W5ZN's FT8 Contest Conclusions

- **FT8 is an excellent addition to your contest mode arsenal**
- **Several new stations are on the band as a result of FT8**
  - **More QSO's and/or Multipliers!!**
- **FT8 is *not* a primary mode to focus your contest effort on**

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