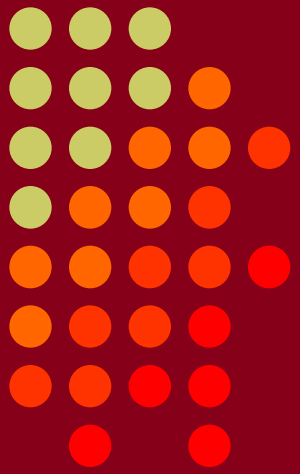
CTU Presents

Techniques to Optimize 6 Meter Contest Performance



Joel Harrison, W5ZN

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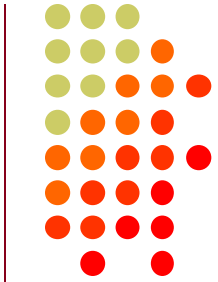
Techniques to Optimize 6 Meter Contest Performance



- Antenna Techniques
- Station Techniques
- Propagation Techniques
- Operating Techniques

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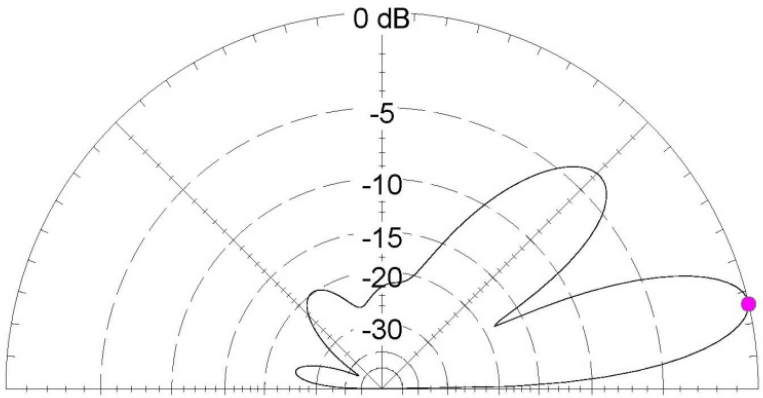
Antenna Techniques

- **What Kind of an Antenna?**
  - **Yagi**
    - **Horizontal polarization**
  - ~~**Vertical**~~
  - ~~**Dipole / Inverted Vee**~~
- **How Many Elements?**
  - **More is better up to a point.**
  - **7 is good**
- **How High Should it Be?**
  - **30 Ft ?**
  - **Let's look at some plots**

Antenna Techniques

Total Field EZNEC+

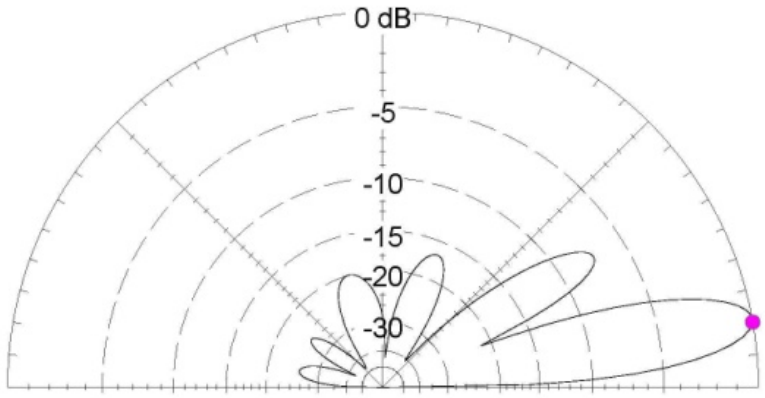


50 MHz - Three Element Yagi 50.1 MHz

Elevation Plot		Cursor Elev	13.0 deg.
Azimuth Angle	0.0 deg.	Gain	13.53 dBi
Outer Ring	13.53 dBi		0.0 dBmax
Slice Max Gain	13.53 dBi @ Elev Angle = 13.0 deg.		
Beamwidth	14.3 deg.; -3dB @ 6.6, 20.9 deg.		
Sidelobe Gain	9.89 dBi @ Elev Angle = 44.0 deg.		
Front/Sidelobe	3.64 dB		

Antenna Techniques

Total Field EZNEC+

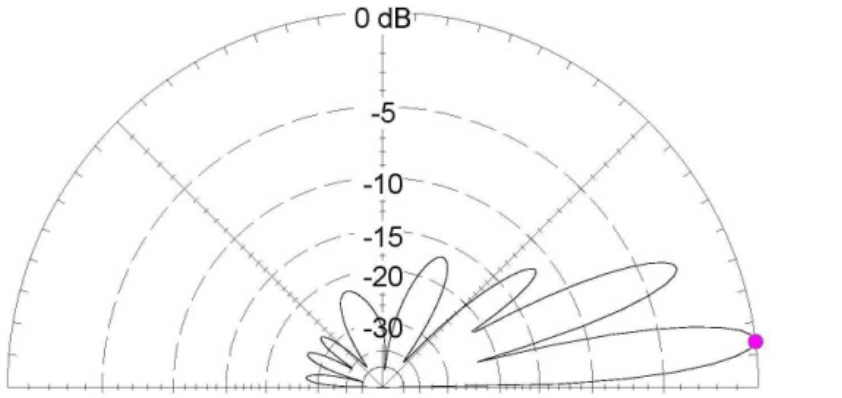


7 Element Yagi @ 25 FT 50.1 MHz

Elevation Plot		Cursor Elev	10.0 deg.
Azimuth Angle	0.0 deg.	Gain	17.98 dBi
Outer Ring	17.98 dBi		0.0 dBmax

Slice Max Gain	17.98 dBi @ Elev Angle = 10.0 deg.
Beamwidth	11.1 deg.; -3dB @ 5.1, 16.2 deg.
Sidelobe Gain	10.86 dBi @ Elev Angle = 32.0 deg.
Front/Sidelobe	7.12 dB

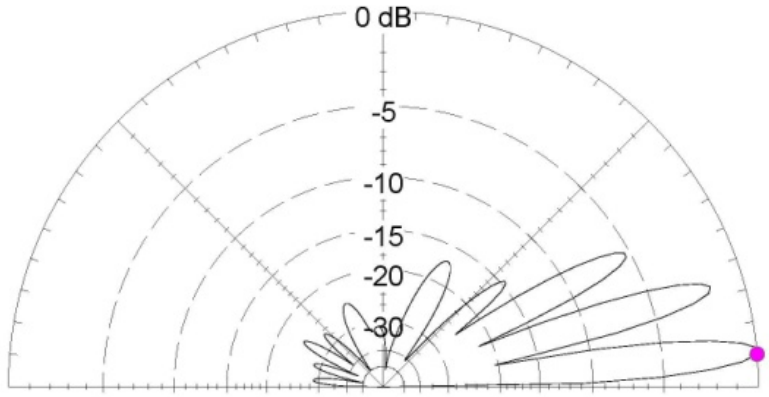
Antenna Techniques



Elevation Plot		Cursor Elev	7.0 deg.
Azimuth Angle	0.0 deg.	Gain	18.42 dBi
Outer Ring	18.42 dBi		0.0 dBmax
Slice Max Gain	18.42 dBi @ Elev Angle = 7.0 deg.		
Beamwidth	7.4 deg.; -3dB @ 3.6, 11.0 deg.		
Sidelobe Gain	15.52 dBi @ Elev Angle = 22.0 deg.		
Front/Sidelobe	2.9 dB		

Antenna Techniques

Total Field EZNEC+

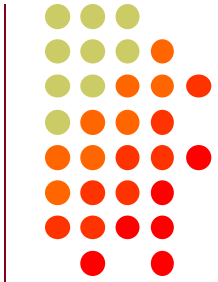


7 Element Yagi @ 50 FT 50.1 MHz

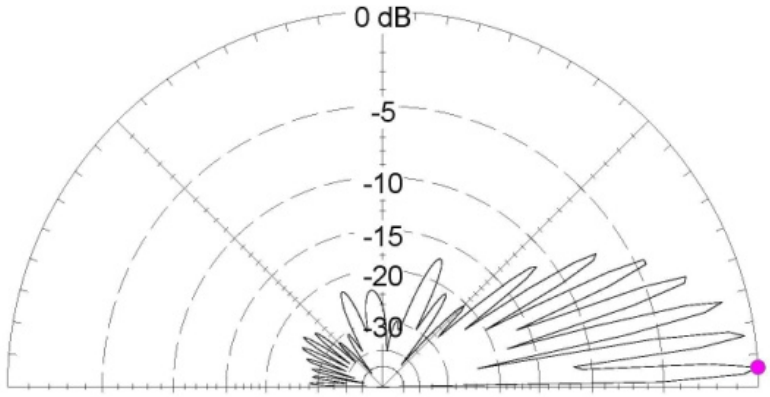
Elevation Plot		Cursor Elev	5.0 deg.
Azimuth Angle	0.0 deg.	Gain	18.53 dBi
Outer Ring	18.53 dBi		0.0 dBmax

Slice Max Gain	18.53 dBi @ Elev Angle = 5.0 deg.
Beamwidth	5.6 deg.; -3dB @ 2.7, 8.3 deg.
Sidelobe Gain	16.95 dBi @ Elev Angle = 17.0 deg.
Front/Sidelobe	1.58 dB

Antenna Techniques



Total Field EZNEC+



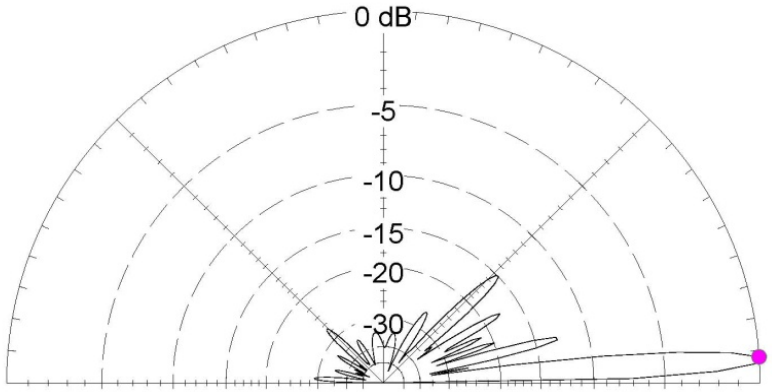
7 Element Yagi @ 100 FT 50.1 MHz

Elevation Plot		Cursor Elev	3.0 deg.
Azimuth Angle	0.0 deg.	Gain	18.72 dBi
Outer Ring	18.72 dBi		0.0 dBmax

Slice Max Gain	18.72 dBi @ Elev Angle = 3.0 deg.
Beamwidth	2.6 deg.; -3dB @ 1.5, 4.1 deg.
Sidelobe Gain	18.23 dBi @ Elev Angle = 8.0 deg.
Front/Sidelobe	0.49 dB

Antenna Techniques

Total Field EZNEC+

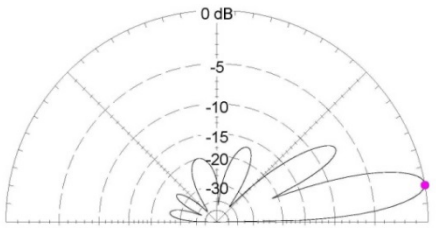


7x7x7x7 Array 50.1 MHz

Elevation Plot		Cursor Elev	4.0 deg.
Azimuth Angle	0.0 deg.	Gain	22.84 dBi
Outer Ring	22.84 dBi		0.0 dBmax
Slice Max Gain	22.84 dBi @ Elev Angle = 4.0 deg.		
Beamwidth	3.8 deg.; -3dB @ 1.8, 5.6 deg.		
Sidelobe Gain	10.1 dBi @ Elev Angle = 14.0 deg.		
Front/Sidelobe	12.74 dB		

Antenna Techniques

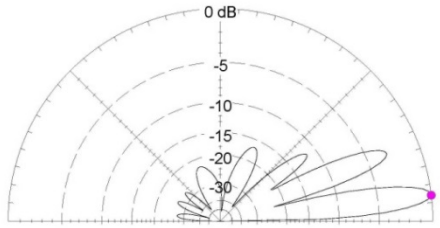
Total Field EZNEC+



7 Element Yagi @ 25 FT 50.1 MHz

Elevation Plot		Cursor Elev	10.0 deg.
Azimuth Angle	0.0 deg.	Gain	17.98 dBi
Outer Ring	17.98 dBi		0.0 dBmax
Slice Max Gain	17.98 dBi @ Elev Angle = 10.0 deg.		
Beamwidth	11.1 deg.; -3dB @ 5.1, 16.2 deg.		
Sidelobe Gain	10.86 dBi @ Elev Angle = 32.0 deg.		
Front/Sidelobe	7.12 dB		

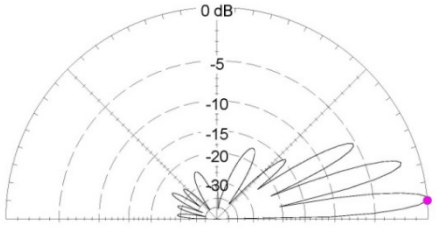
Total Field EZNEC+



7 Element Yagi @ 37.5 FT 50.1 MHz

Elevation Plot		Cursor Elev	7.0 deg.
Azimuth Angle	0.0 deg.	Gain	18.42 dBi
Outer Ring	18.42 dBi		0.0 dBmax
Slice Max Gain	18.42 dBi @ Elev Angle = 7.0 deg.		
Beamwidth	7.4 deg.; -3dB @ 3.6, 11.0 deg.		
Sidelobe Gain	15.52 dBi @ Elev Angle = 22.0 deg.		
Front/Sidelobe	2.9 dB		

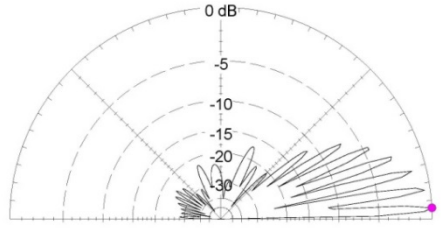
Total Field EZNEC+



7 Element Yagi @ 50 FT 50.1 MHz

Elevation Plot		Cursor Elev	5.0 deg.
Azimuth Angle	0.0 deg.	Gain	18.53 dBi
Outer Ring	18.53 dBi		0.0 dBmax
Slice Max Gain	18.53 dBi @ Elev Angle = 5.0 deg.		
Beamwidth	5.6 deg.; -3dB @ 2.7, 8.3 deg.		
Sidelobe Gain	16.95 dBi @ Elev Angle = 17.0 deg.		
Front/Sidelobe	1.58 dB		

Total Field EZNEC+



7 Element Yagi @ 100 FT 50.1 MHz

Elevation Plot		Cursor Elev	3.0 deg.
Azimuth Angle	0.0 deg.	Gain	18.72 dBi
Outer Ring	18.72 dBi		0.0 dBmax
Slice Max Gain	18.72 dBi @ Elev Angle = 3.0 deg.		
Beamwidth	2.6 deg.; -3dB @ 1.5, 4.1 deg.		
Sidelobe Gain	18.23 dBi @ Elev Angle = 8.0 deg.		
Front/Sidelobe	0.49 dB		

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Antenna Techniques

- **What is the best height for my antenna?**
  - You will always have dead zones and nulls regardless of height
  - Get your antennas as high as you reasonable can
- **How Many Antennas do I need?**
  - **Really depends on where you live**

Antenna Techniques

QTH in Maine / Northeast USA

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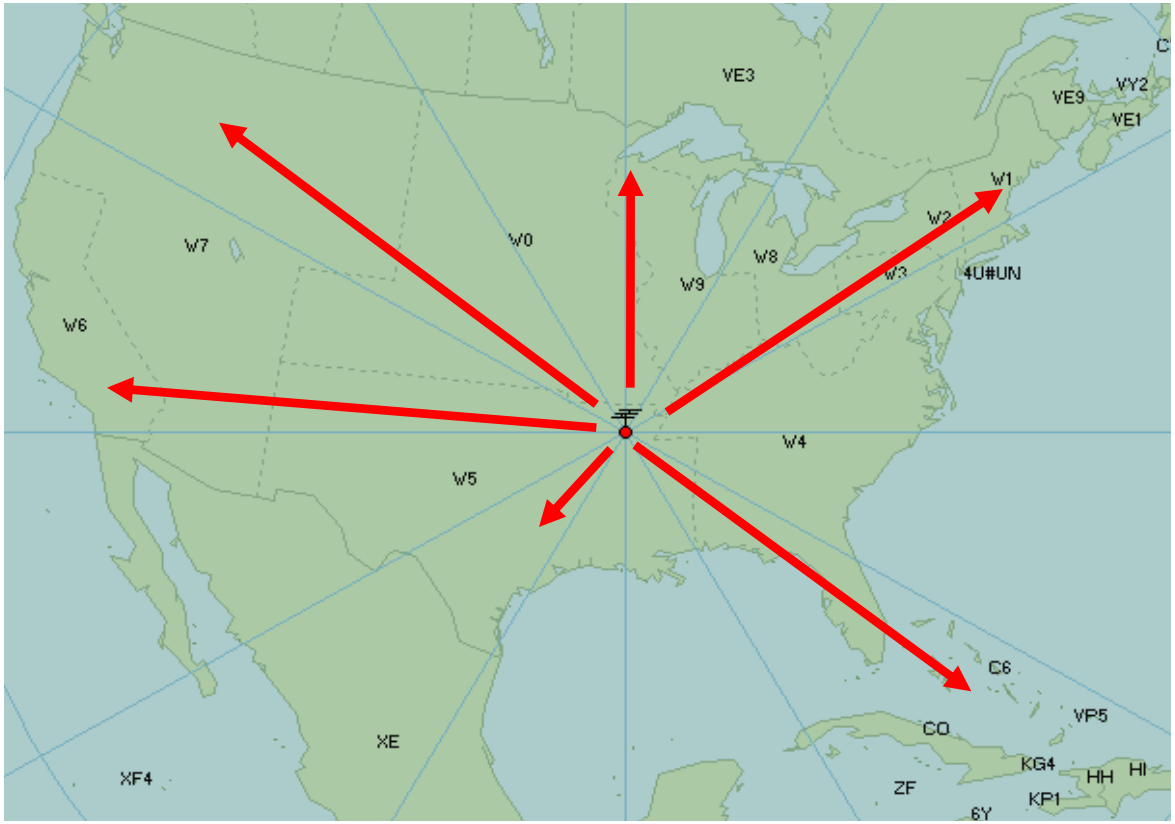
Antenna Techniques

QTH in Mid USA



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Antenna Techniques

How can you quickly change antenna direction??

Antenna, or a stack of smaller antennas in a fixed direction allow fast direction change without waiting for a rotor to turn.

Station Techniques

- Radio
- Preamp
- Interconnecting cables
- Noise

Station Techniques

- Radio
  - All new radios include 6 meters
  - Good dynamic range, roofing filters essential
- Preamp
- Interconnecting cables
- Noise

Station Techniques

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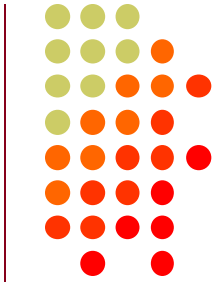
Station Techniques



- **Radio**
  - All new radios include 6 meters
  - Good dynamic range, roofing filters essential
- **Preamp**
  - Will improve weak sigs when band is dead but can cause problems in presence of strong stations
- **Interconnecting cables**
  - Ensure solid connections
  - Avoid cheap phono connectors & cable
- **Noise**

Station Techniques

Noise! The Grim Reaper of noise is *not* your friend!!

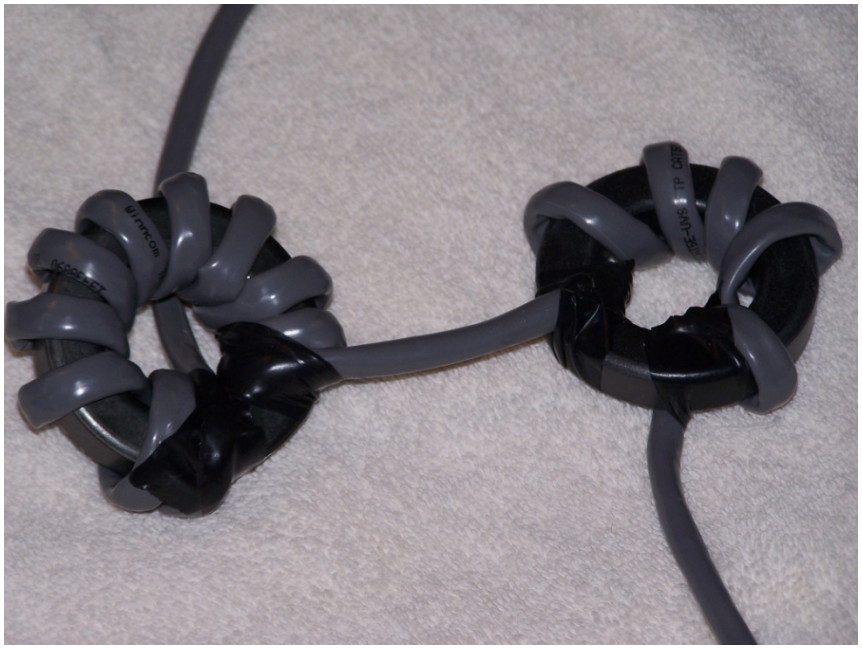
- Sky Noise
- Atmospheric Noise
- Line Noise
- Other man-made noise

Station Techniques

- **Internet Routers can be a significant noise source at 50 MHz that will populate the band, especially the DX Window**
  - Multiple carriers of relatively constant amplitude but with modulation (Birdies)
    - 50.044, 50.058, 50.105, 50.120, 50.148, 50.166
  - Broadband trash
- ***Get your own station "clean" first!***

Station Techniques

Internet Router noise can be significantly reduced or eliminated.



Also utilize shielded CAT5 cable and connectors

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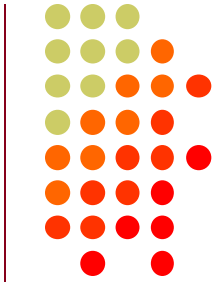
Station Techniques



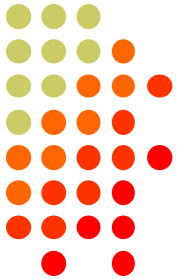
- **Some Actual Results**
  - All “birdies” are gone
  - Noise floor dropped 8 dBm !!!
- **More technical info:**
  - A Ham’s Guide to RFI, Ferrites, Baluns and Audio Interfacing - Jim Brown, K9YC
    - http://audiosystemsgroup.com

Station Techniques

Noise – Recap

- Clean up your own station
- Address line noise issues
- Use Bandpass Filters

Propagation Techniques

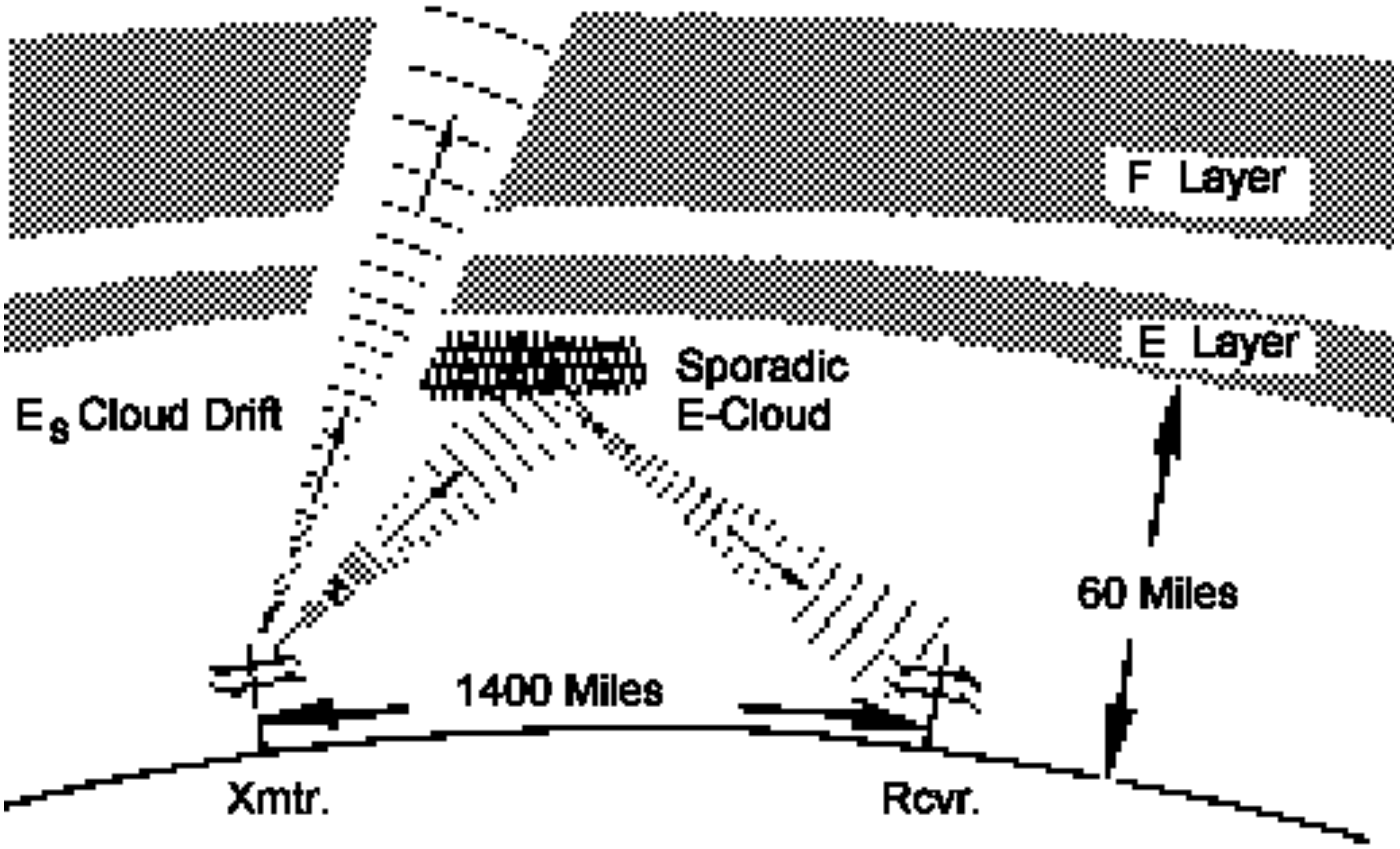


- **Sporadic E – “Es”**
- **Meteor Scatter – “MS”**

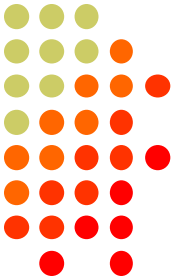
Propagation Techniques

- **Sporadic ionization of the E-Layer**
  - Peaks May–July, Possibly generated by lightning
- **50 & 144 MHz, possibly 222 MHz**
  - Single-hop optimum range 900-1300 miles, maximum range 1350-1500 miles
  - Double-hop optimum range 2000-2600 miles, maximum range 2750-3100 miles
- **Peak time during daylight hours & early evening**

Propagation Techniques



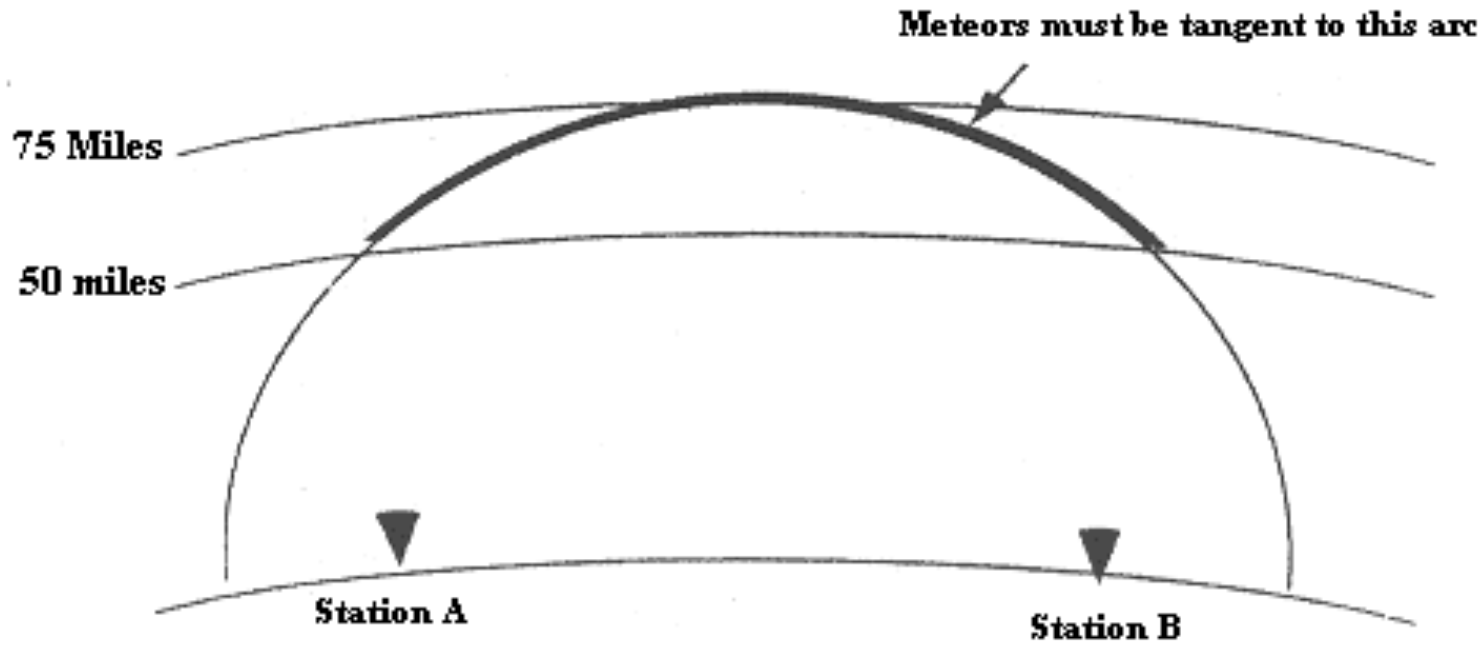
Propagation Techniques



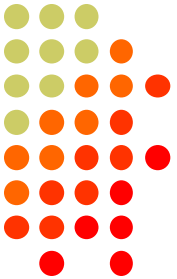
- **Meteor scatter is the reflection of radio waves from the ionized trails from meteors burning up in the upper atmosphere.**
- **Meteors burn up in the upper atmosphere at a height of around 65 miles.**
- **This may be used to make QSOs up to about 1400 miles**

Propagation Techniques

Reflection will occur when the trail is oriented as shown

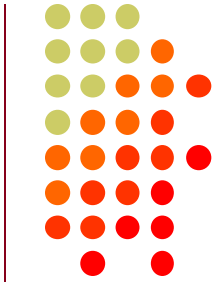


Propagation Techniques



- **Excellent for 50 MHz**
- **Very Predictable Paths**
  - Best times between midnight & approx 9 AM
  - Peak during “showers” – Anytime with high speed procedures like ***WSJT***

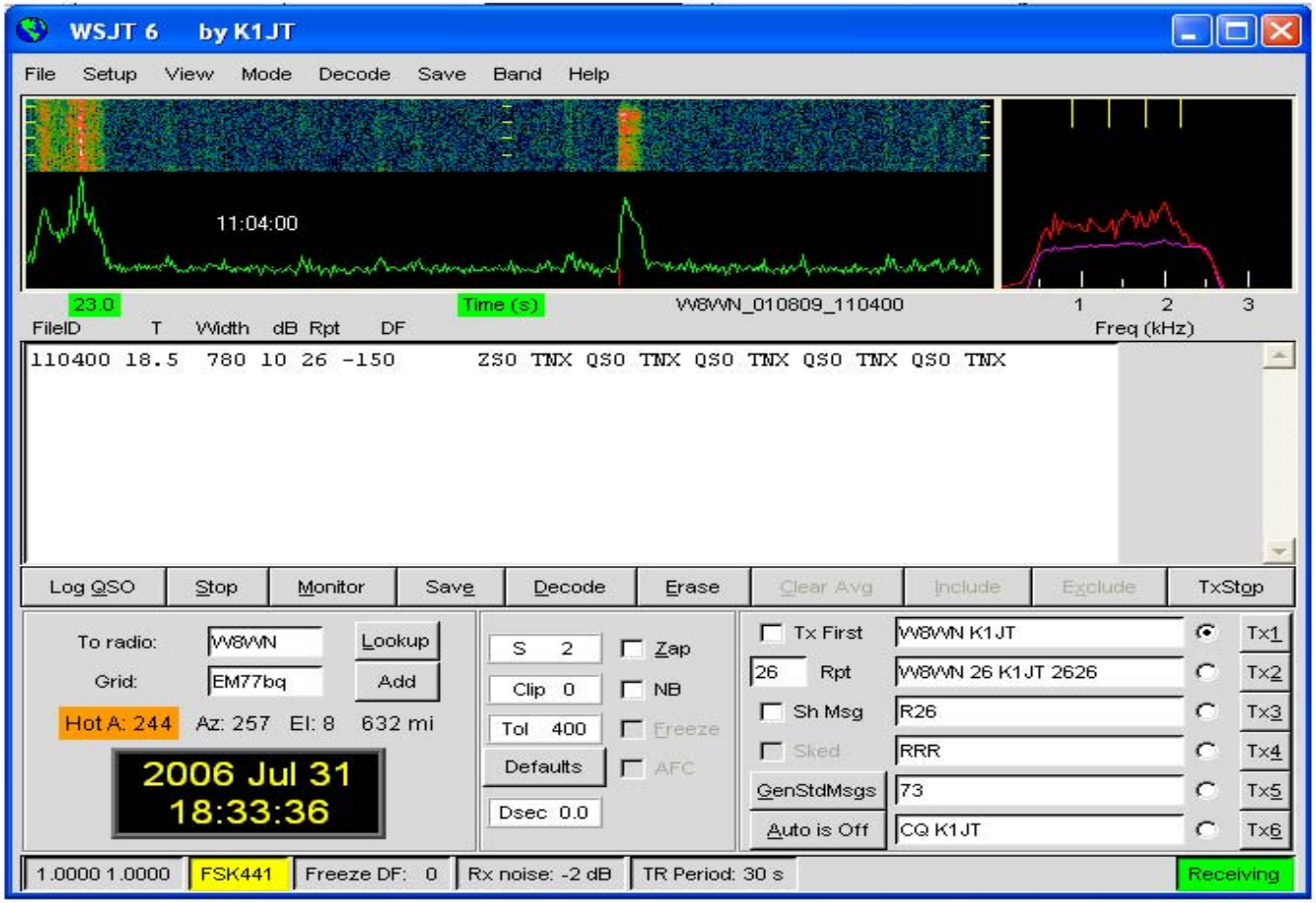
Operating Techniques



K1JT Digital Modes

- **Weak Signal Communication by K1JT (WSJT) offers specific digital protocols optimized for EME and meteor scatter at VHF/UHF**
- **Free open-source programs. Normal usage requires only a standard SSB transceiver and a personal computer with soundcard.**
- **Can Provide Outstanding access to new grid multipliers from moderate stations**

Operating Techniques



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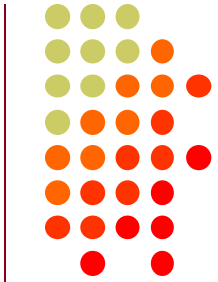
Operating Techniques

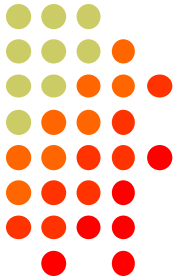


- **FSK441 Mode**
  - **Calling frequencies 50.260**
  - **Single Antenna & 100 W is outstanding**
  - **Antenna is pointed toward station worked**
  - **Run 30 second sequences**
    - **Normally eastern most station runs 1st 30 second period (0-30) and western station runs 2nd 30 second period (31-00).**

Operating Techniques

- **FSK441 Mode (cont)**
  - **Once calls are received stations start sending report**
  - **Stations will be on after 0500z**
  - **Listen on 50.260 in “Monitor” mode for stations calling CQ**
    - **You may hear “CQ W5ZN EM45 U5” or “D10”**
      - **U5 means the CQ station is listening Up 5 KHz**
      - **Call there. When CQ station hears you he will begin transmitting Up 5 KHz.**

Operating Techniques



- **Download Free Software at:**

  http://physics.princeton.edu/pulsar/K1JT/wsjt.html

  Download User's Guide at:

  http://physics.princeton.edu/pulsar/K1JT/WSJT_User_600.pdf

Operating Techniques

- **How to monitor for an unpredictable band opening:**
  - Radio with Panadapter
  - CW Skimmer
  - ON4KST Region 2 - 50 MHz Chat
  - DX Sherlock
    - Based on Cluster spots & shows paths
  - DX Cluster

Operating Techniques

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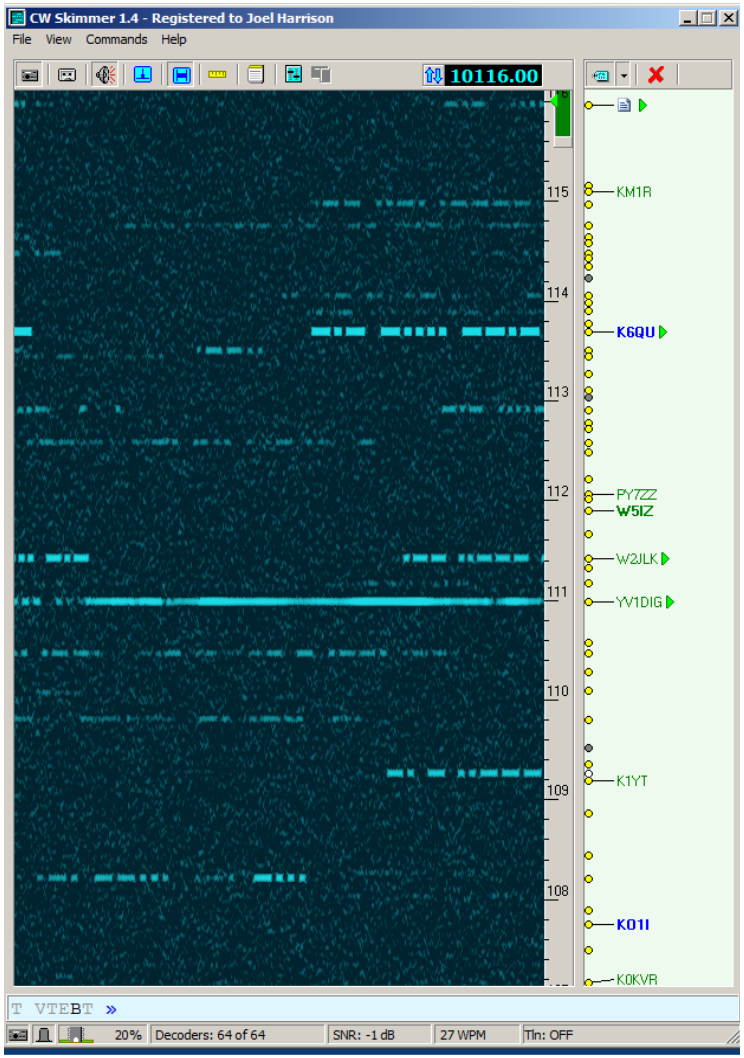
Operating Techniques

CW Skimmer allows you to see CW stations on the band



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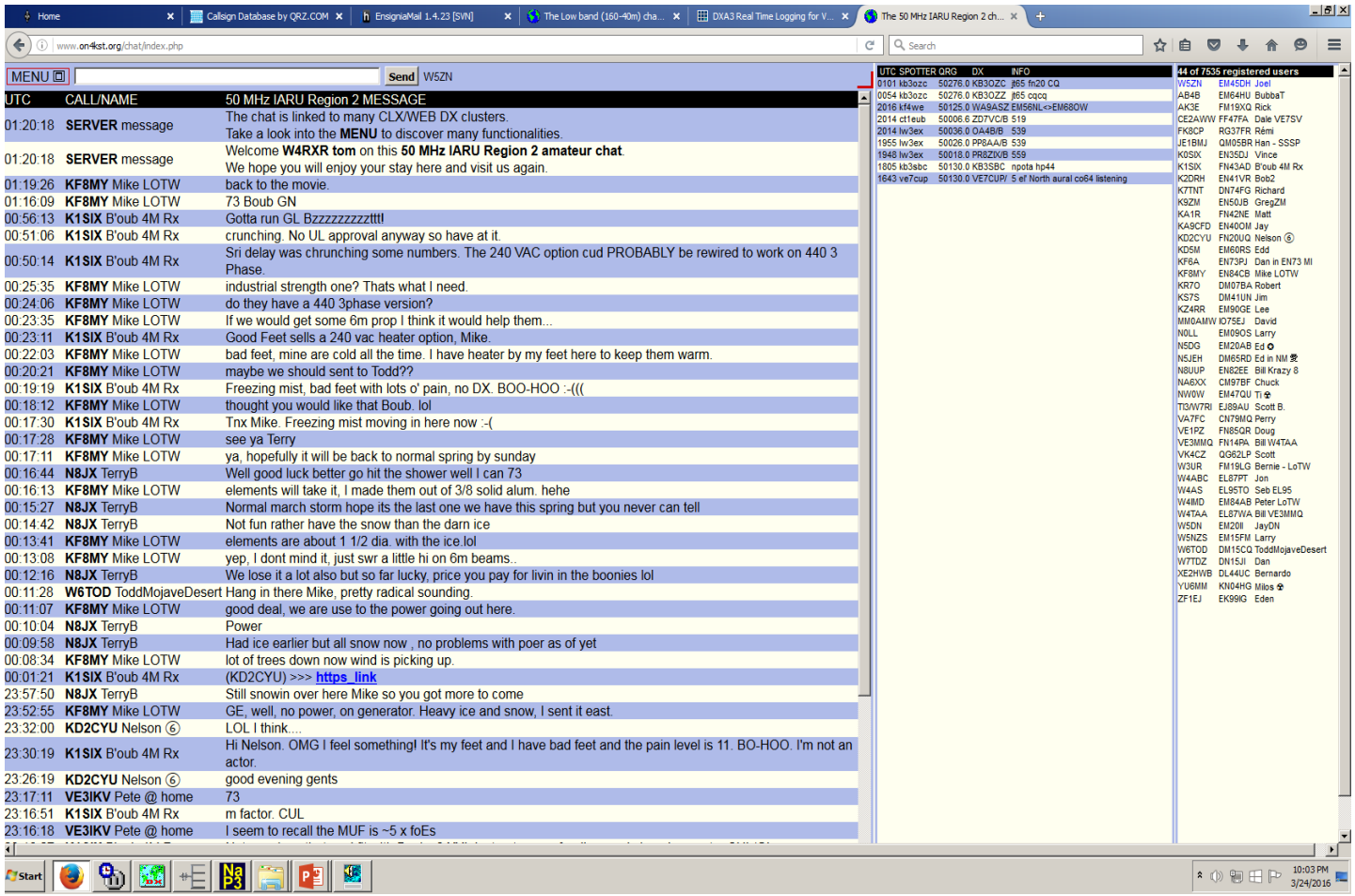
Operating Techniques



http://www.on4kst.org/chat/index.php

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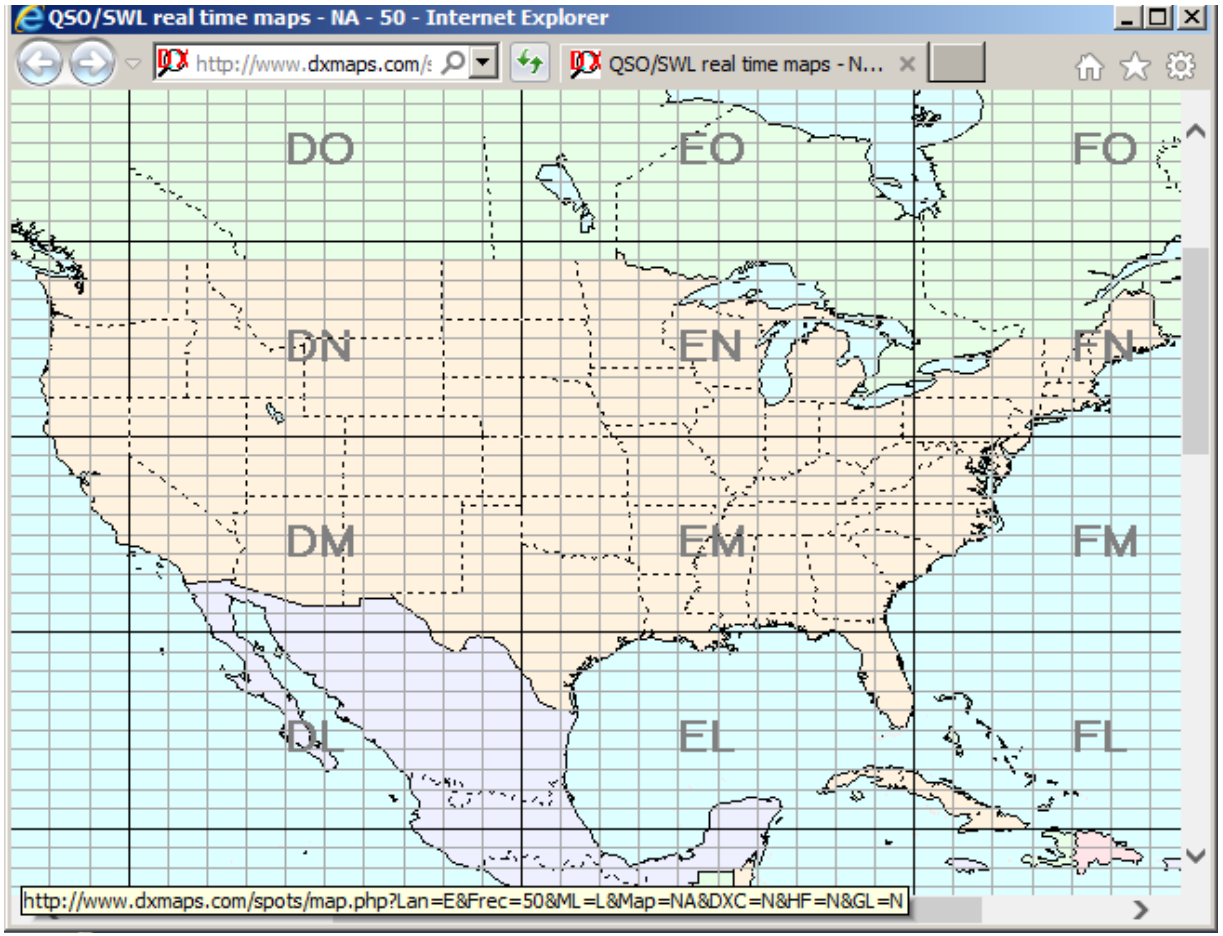
Operating Techniques

DX Sherlock will display open paths between stations



http://www.dxmaps.com/spots/map.php?Map=NA

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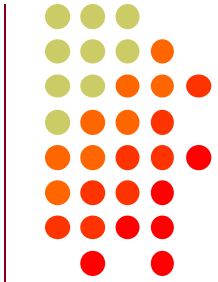
Operating Techniques

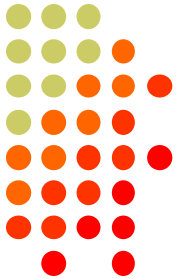
- **READ THE RULES!!!!!!!!!!!!**
  - Different contests have different rules. Some allow assistance for single op and some don't. Do NOT assume they are all the same!
- **The band will not be open continuously or with any certainty**
  - Monitor & Listen!
  - Monitor & Listen some more!!

Important Techniques



- **The Same Principles for HF Apply to VHF**
  - Tower & Electrical Safety
  - Station Ergonomics
  - Physical Fitness
  - **ETHICS !!!**
    - A system of moral values and motivation based on right and wrong
      - "The rules are black and white, we make them gray!"
        K5ZD, CTU Dayton 2009

Where to Learn the Techniques



- VHF Conferences & Microwave Update
  - Central States VHF Society (CSVHFS)
  - Northeast Weak Signal Society (NEWS)
  - Southeast VHF Society (SEVHFS)
  - Western States Weak Signal Society (WSWSS)
  - Microwave Update Conference
  - Not “traditional” hamfests
  - Publish proceedings (compilation of technical papers)