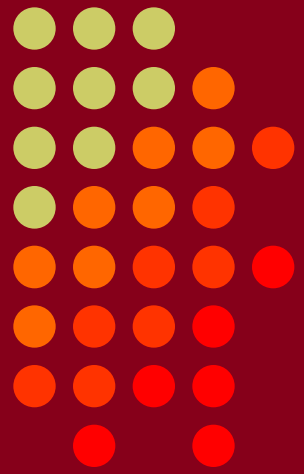
CTU Presents

Utilizing Digital Modes FT8 and MSK144 for Competitive Advantage in VHF Contests

Joel Harrison, W5ZN



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Before We Talk “Digital” Let’s Review VHF Contests

- **Available Contests**
- **Available Modes**
- **Propagation Techniques**

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Available Contests

- ARRL VHF
  - January
  - June
  - September
- CQ VHF
  - July
- Sprints

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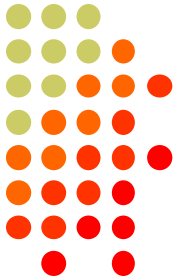
Differences from HF Contests

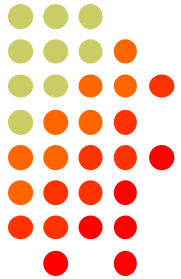


- **Any Mode is Allowed**
  - **Exception**
    - **ARRL Contest FM Only category**
- **You can self spot & make skeds**
  - *Absolutely NO QSO information*

Propagation Techniques

- Sporadic “E”
- Meteor Scatter – “MS”
- Tropo
- Moonbounce - EME

Meteor Scatter



- Meteor scatter is the reflection of radio waves from the ionized trails from meteors burning up in the upper atmosphere.
- Meteors (space debris) 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

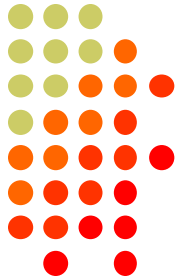
Meteor Scatter

- The earth is bombarded by a constant stream of small particles, remnants of comets that when entering the earth's atmosphere can ionize a column of atoms in the E region at approximately 100km (~60 miles) above the surface of the earth which can reflect radio waves in the VHF region of the spectrum

Meteor Scatter

- There are seasonal variations in the number of sporadic meteors
  - Relative rate increases noticeably in May, peaking in July and August then tailing off into October and November.
- There is also an hourly variation in the relative rate of meteors peaking
  - around dawn local time with the minimum late afternoon before the ramp up begins again late evening.
  - The hourly relative rate is due to the fact that the earth's rotation is head on so to speak in the morning into the path of the particles and therefore there is an increase in the relative velocity of a particle entering the earth's atmosphere.

Meteor Scatter



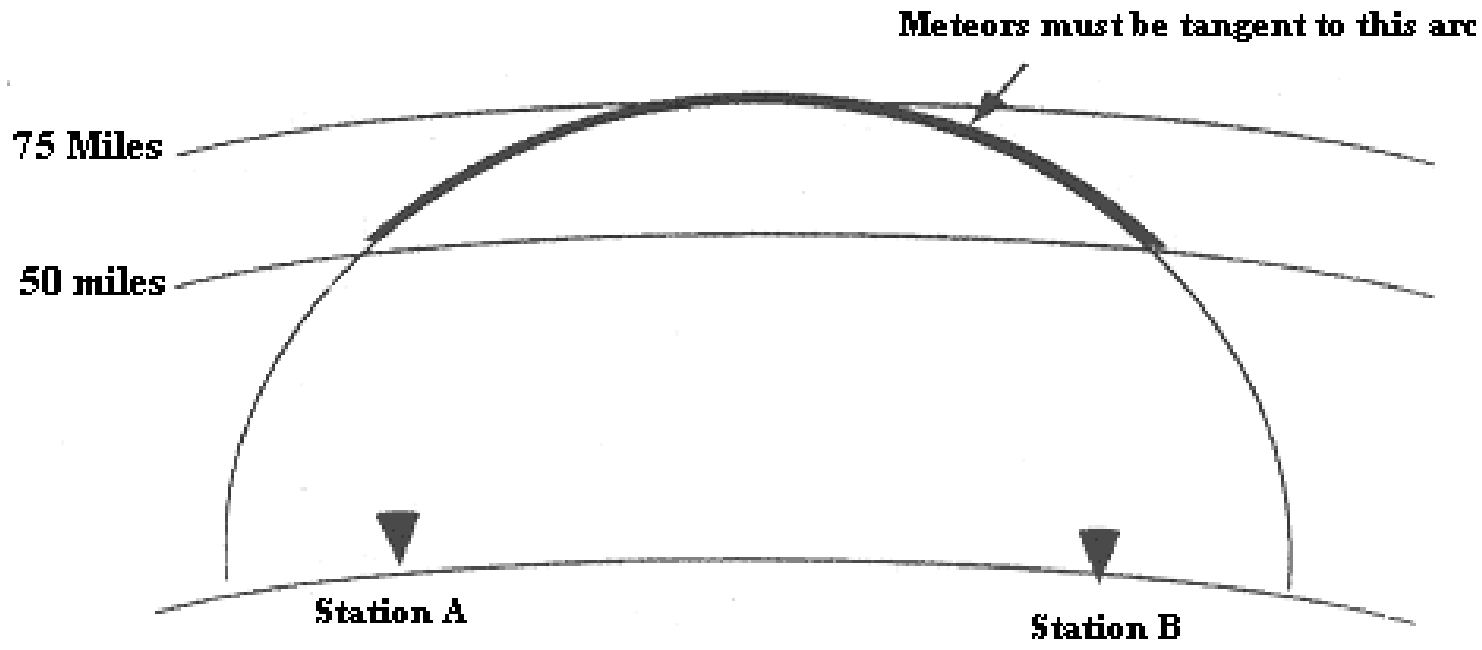
- The length of time of the ionization, or burst duration, is related to meteor velocity and increase in relative velocity results in longer ionization times.

Meteor Scatter

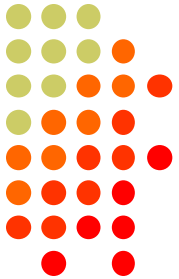
- Most particles entering the earth's atmosphere are the size of a grain of sand resulting in ionization lasting only a fraction of a second
  - much too short to convey any meaningful information using SSB or even high speed CW.
- The digital modes of FSK441 and MSK144 were designed to compress a limited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

Meteor Scatter

Reflection will occur when the trail is oriented as shown

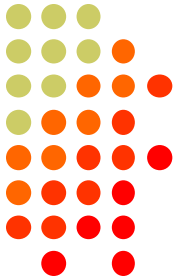


Meteor Scatter



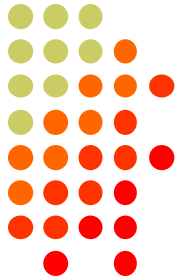
- **Excellent for 50 MHz**
- **Very Predictable Paths**
  - Best times between midnight & approx 9 AM
  - Peak during “showers” – Anytime with high speed procedures like ***WSJT***

Meteor Scatter



- **Very Good for 144 MHz**
- **Very Predictable Paths**
  - Best times between midnight & approx 9 AM
  - Peak during “showers” – Anytime with high speed procedures like ***WSJT***

MSK144 & FT8 Digital Modes

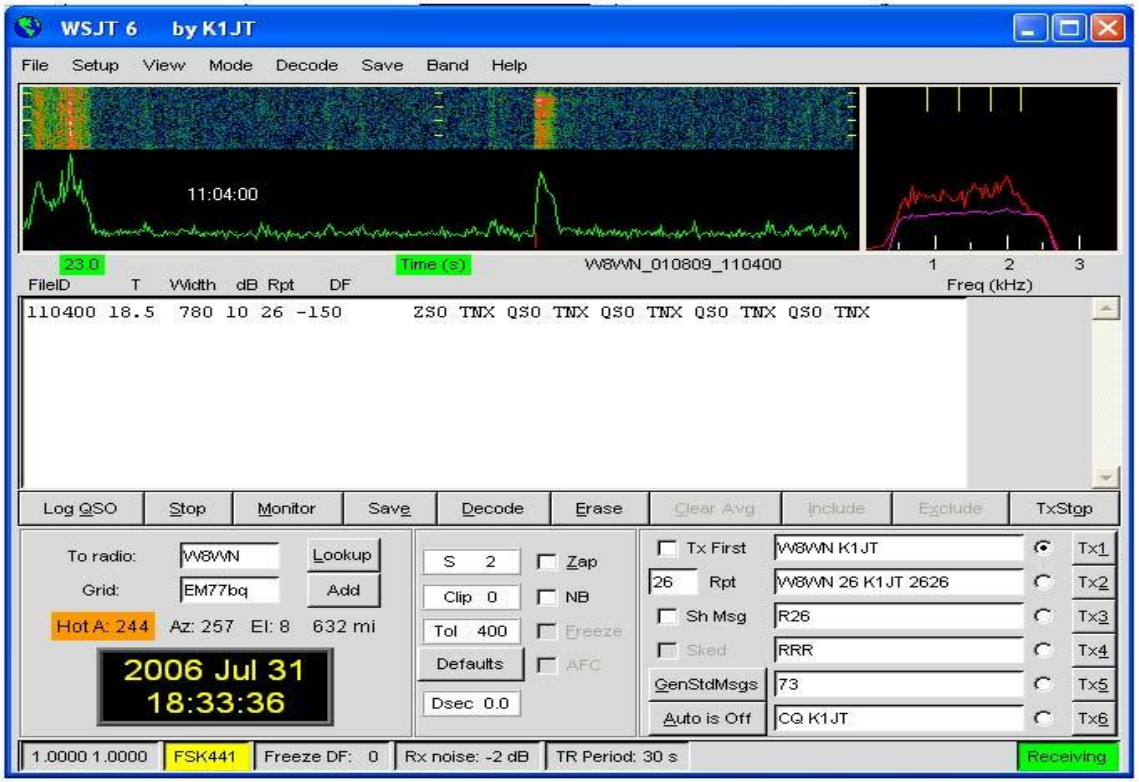


- **Weak Signal Communication by K1JT (WSJT) offers specific digital protocols optimized for EME and meteor scatter at VHF/UHF**

- **Free open-source programs in the WSJT-x Suite. Normal usage requires only a standard SSB transceiver and a personal computer with soundcard.**

Meteor Scatter

Original JT “FSK441” MS Mode



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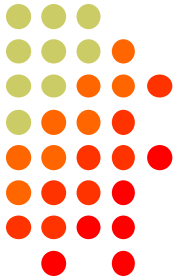
Meteor Scatter – MSK144

- **New Mode introduced in WSJT-X**
  - Officially released in January 2017
  - Contains 8 new modes
  - **MFSK441 Mode**
    - **Calling frequencies 50.280**
    - **Many new features**

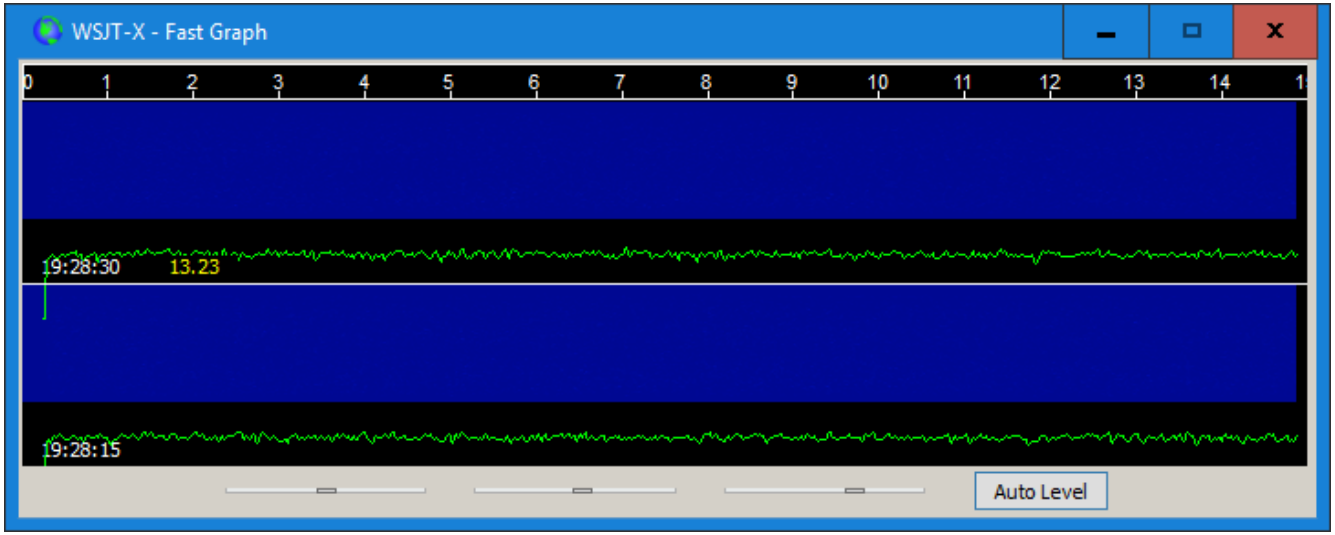
Meteor Scatter – MSK144



- Focussed 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

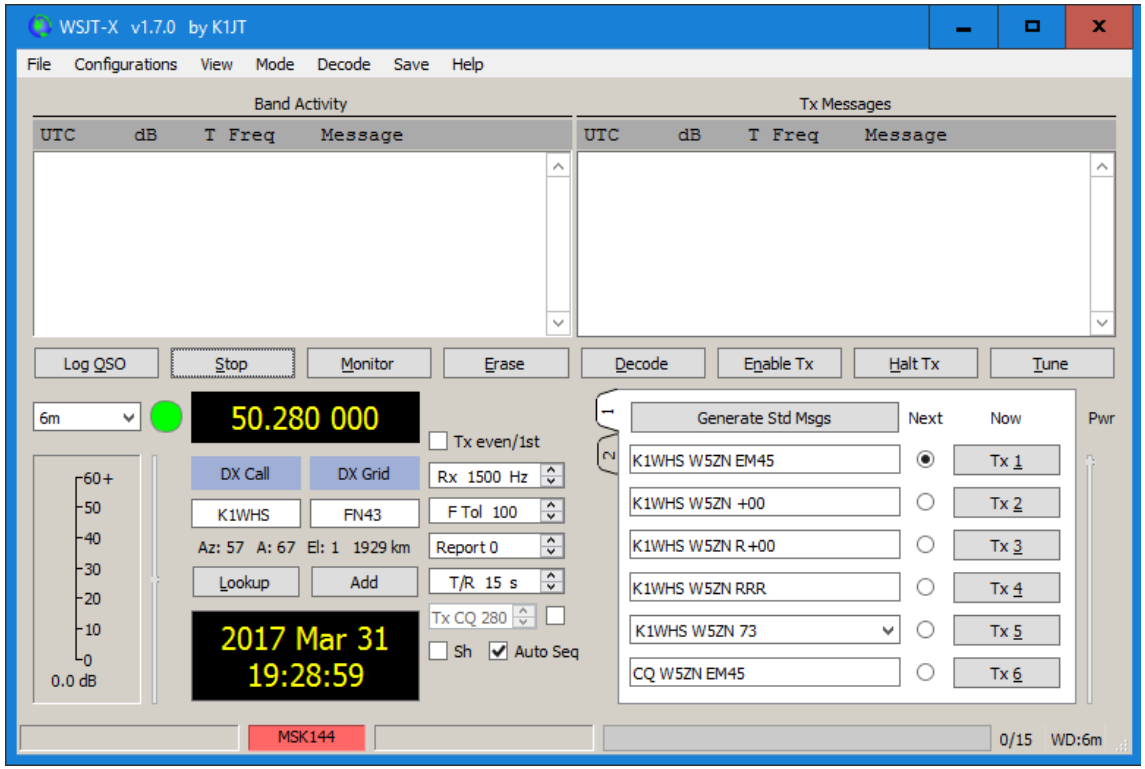
Meteor Scatter – MSK144

Graph still exists but in a separate window called “Fast Graph”



Meteor Scatter – MSK144

MSK144 Window is different from previous FSK441 Window”



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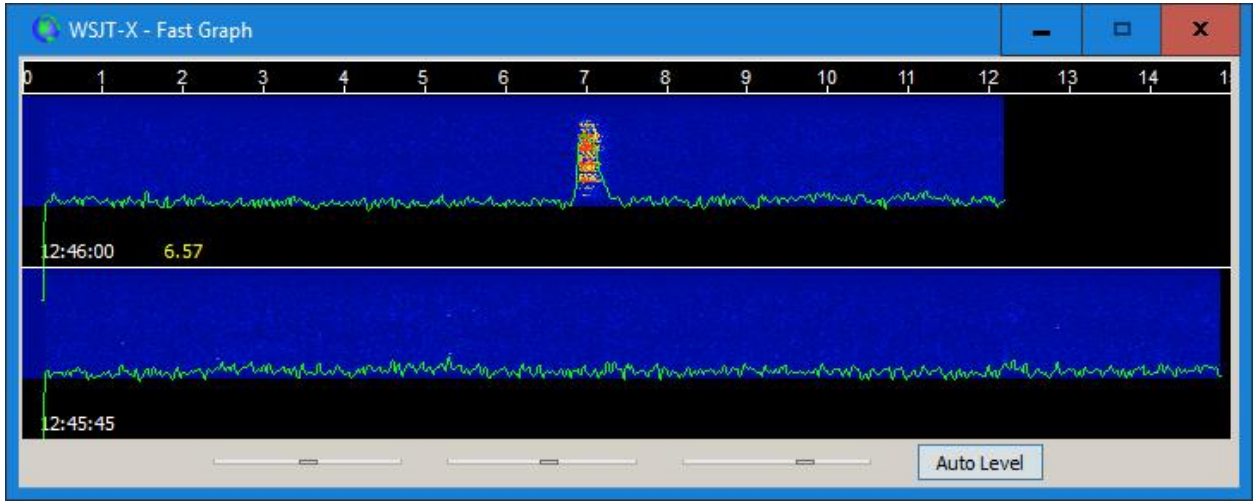
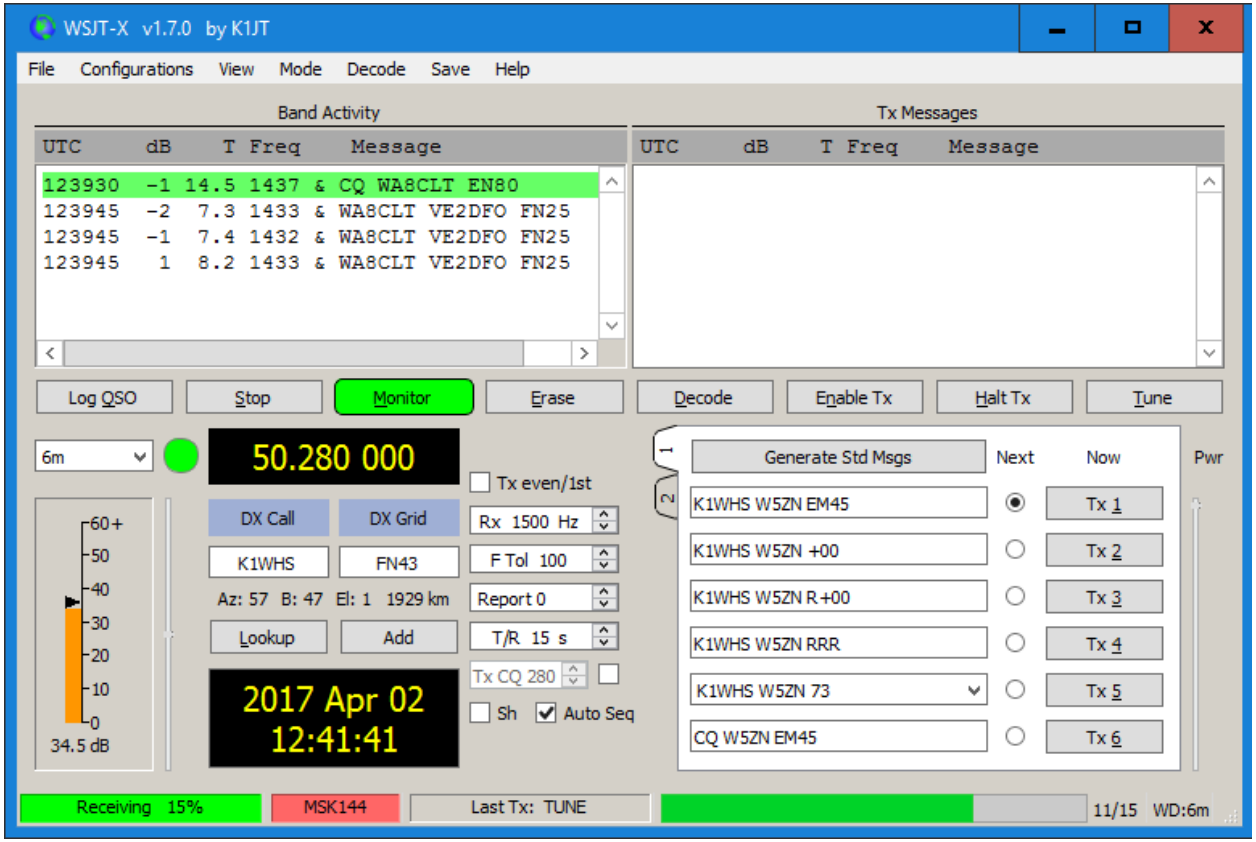
Meteor Scatter – MSK144

Signal bursts still appear in the “Fast Graph”



Meteor Scatter – MSK144



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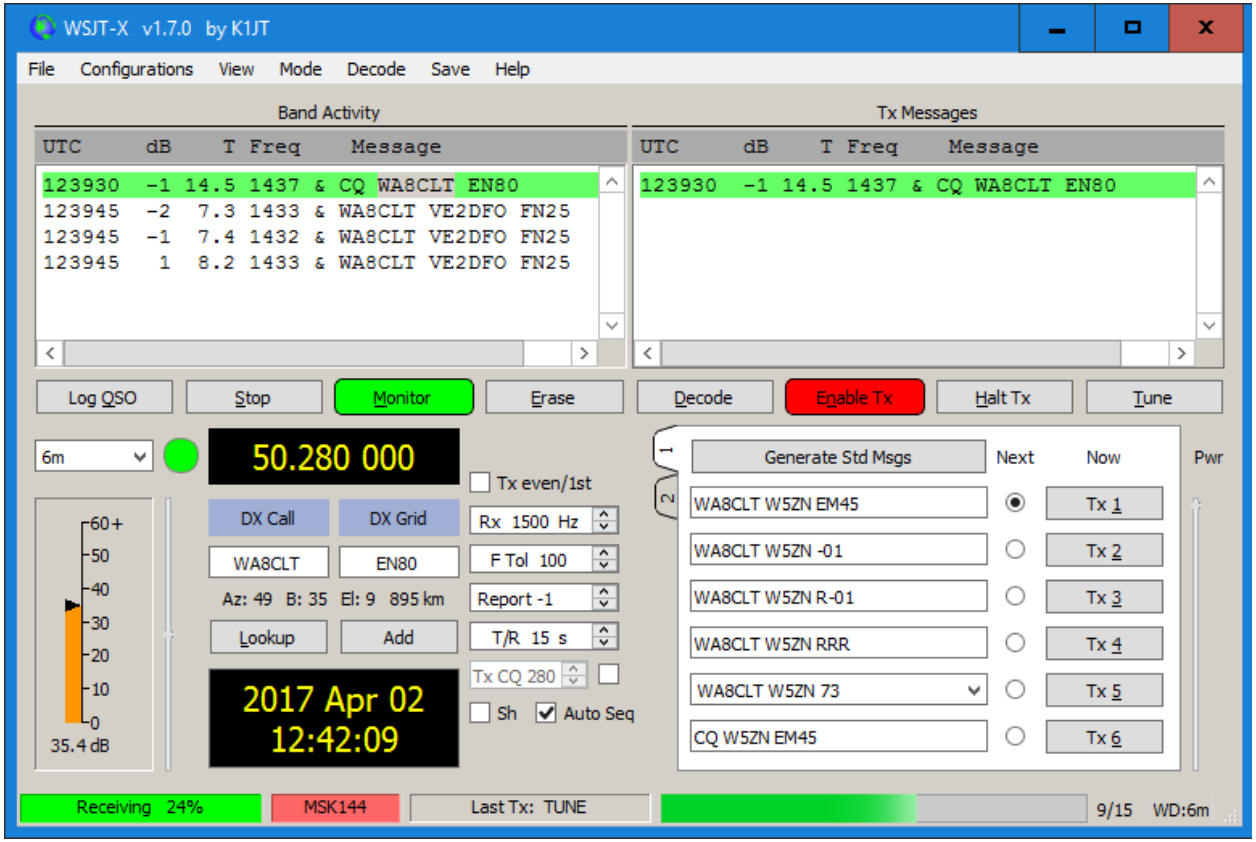

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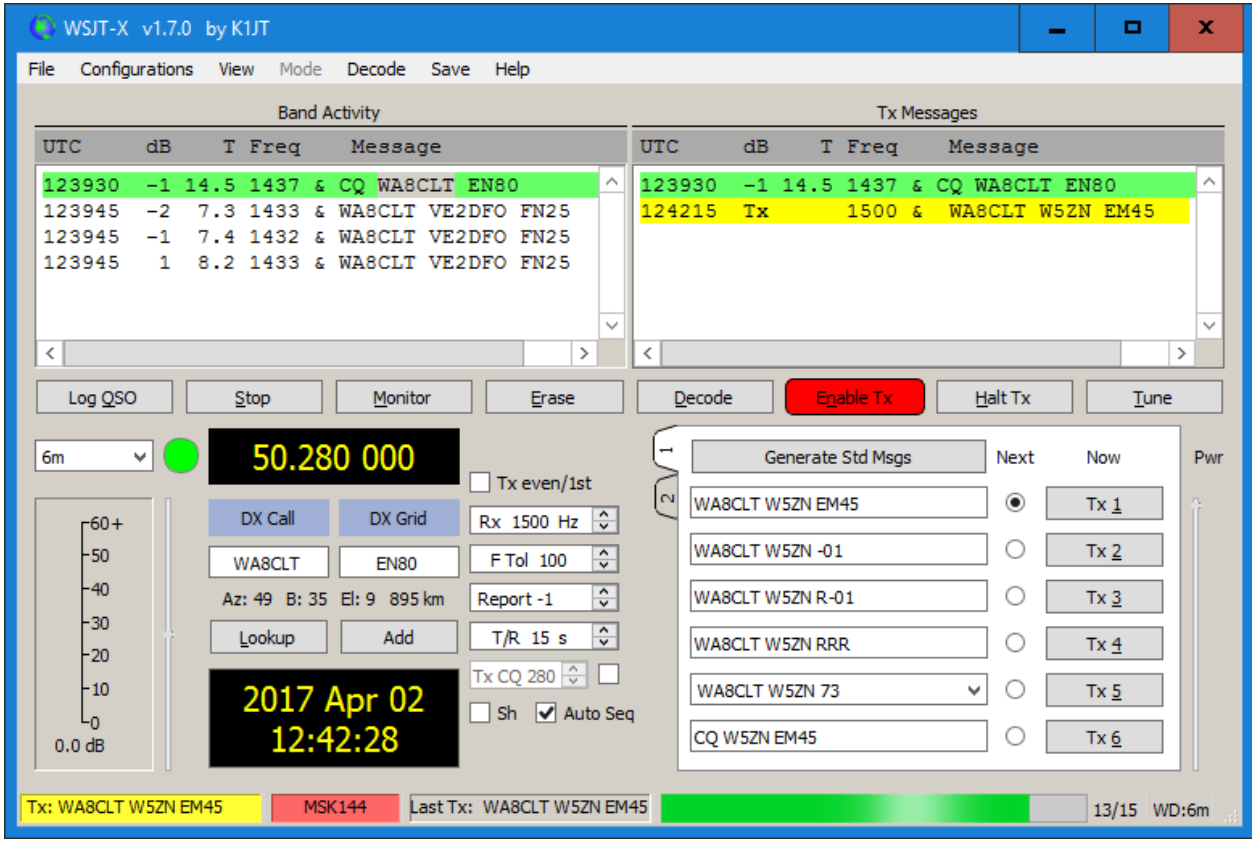

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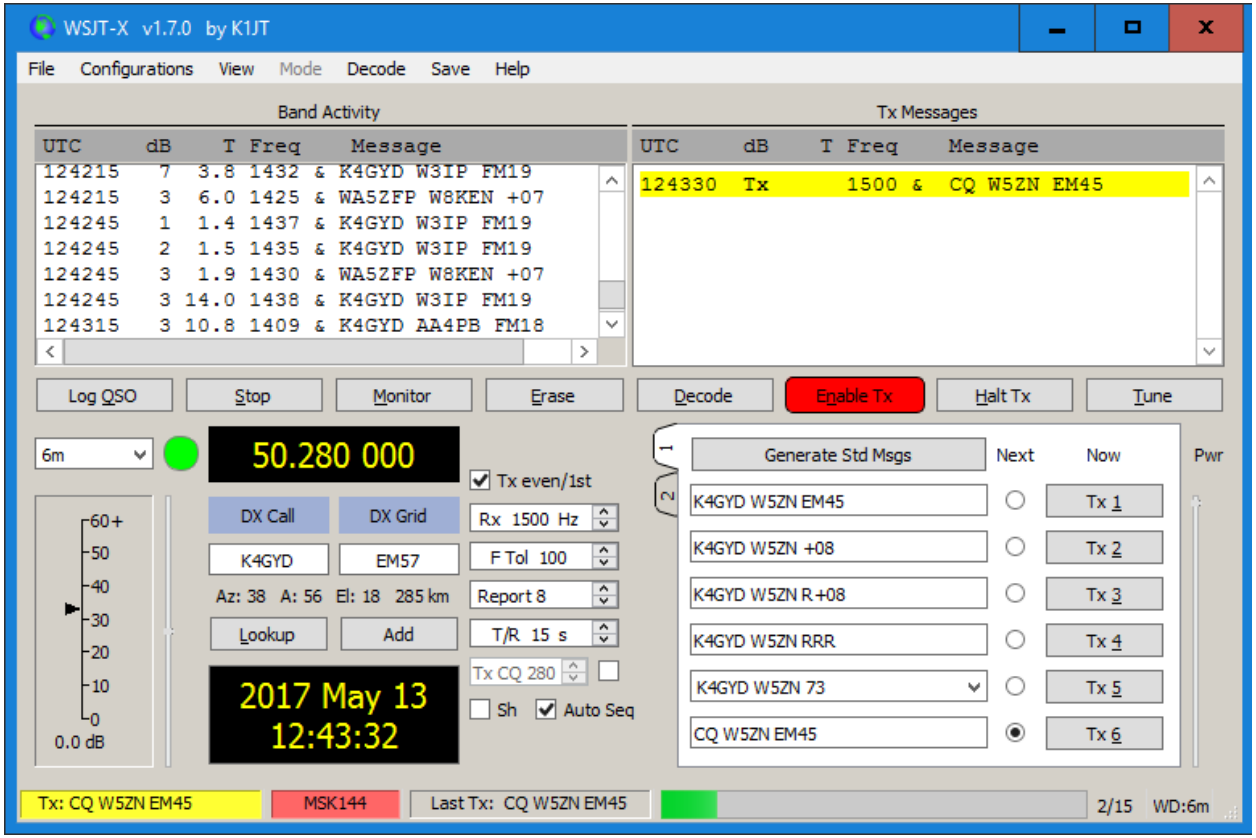

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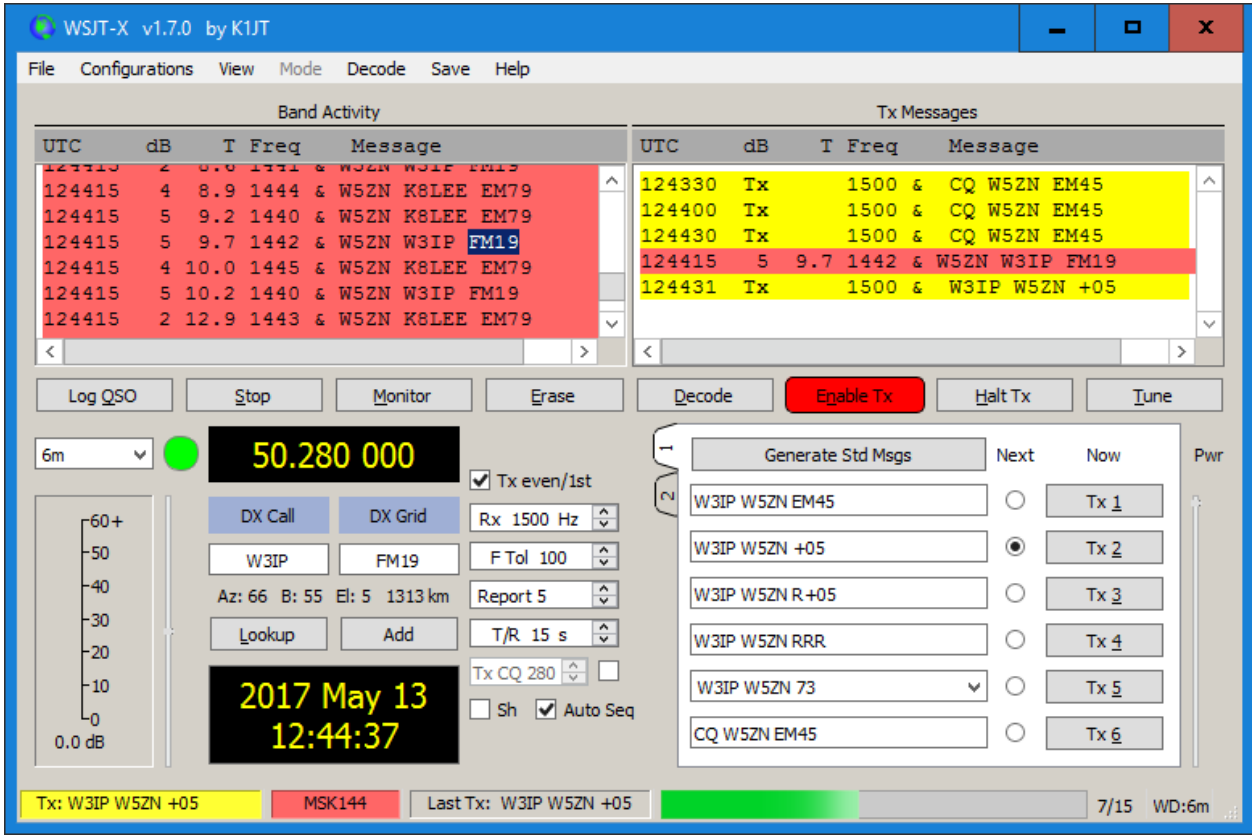

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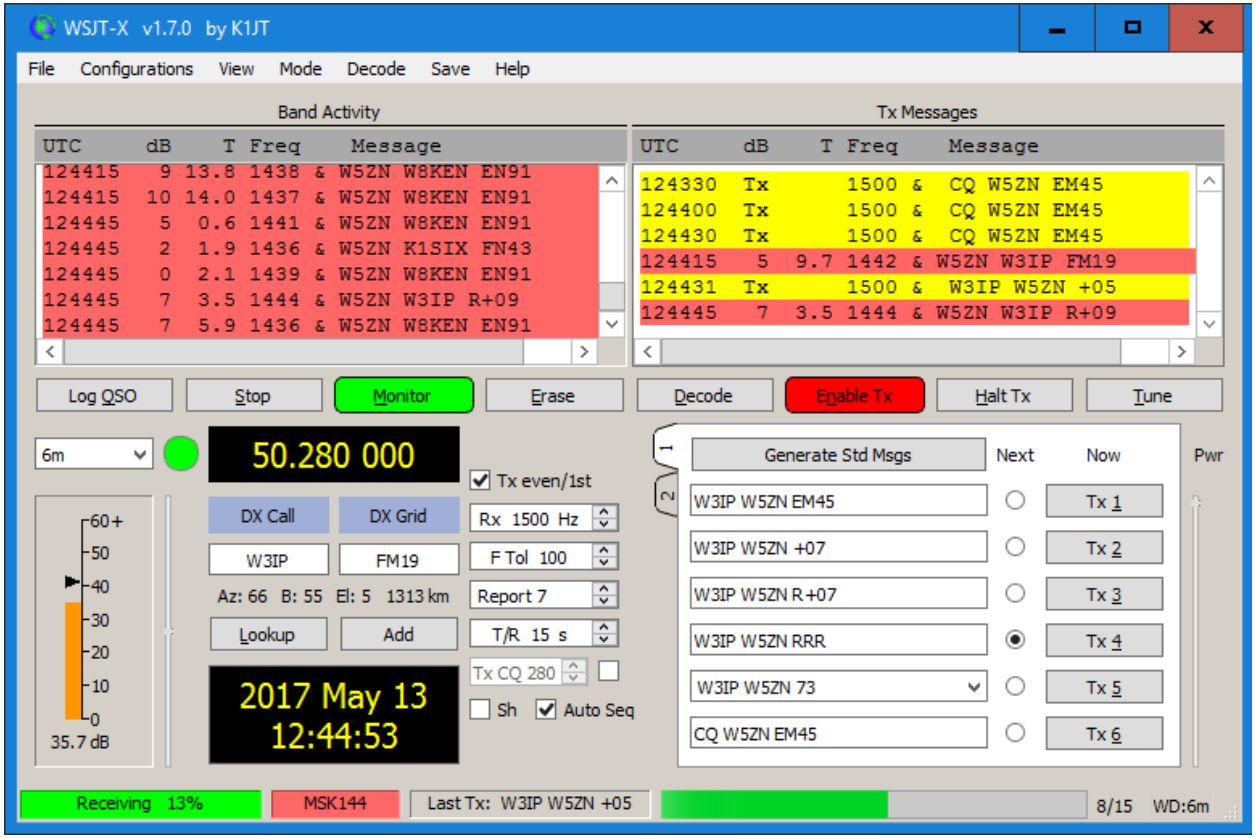

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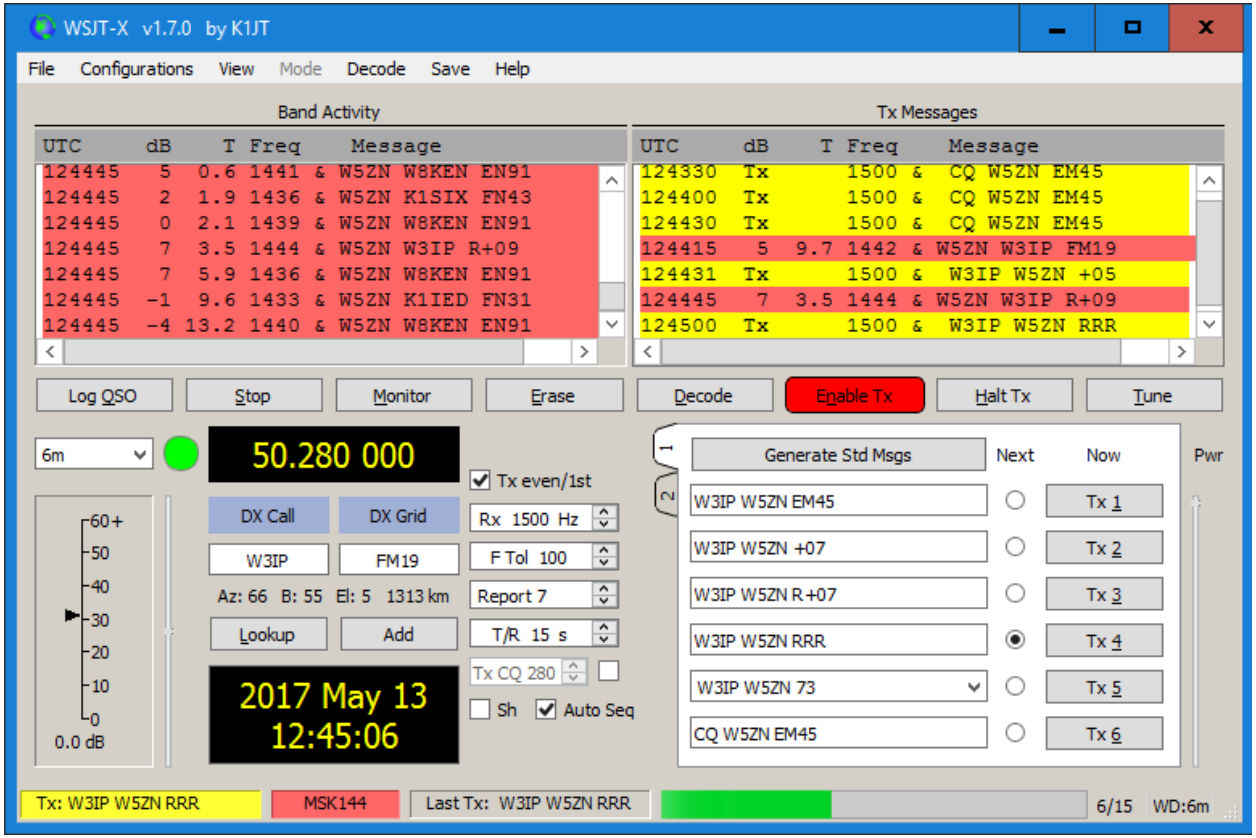

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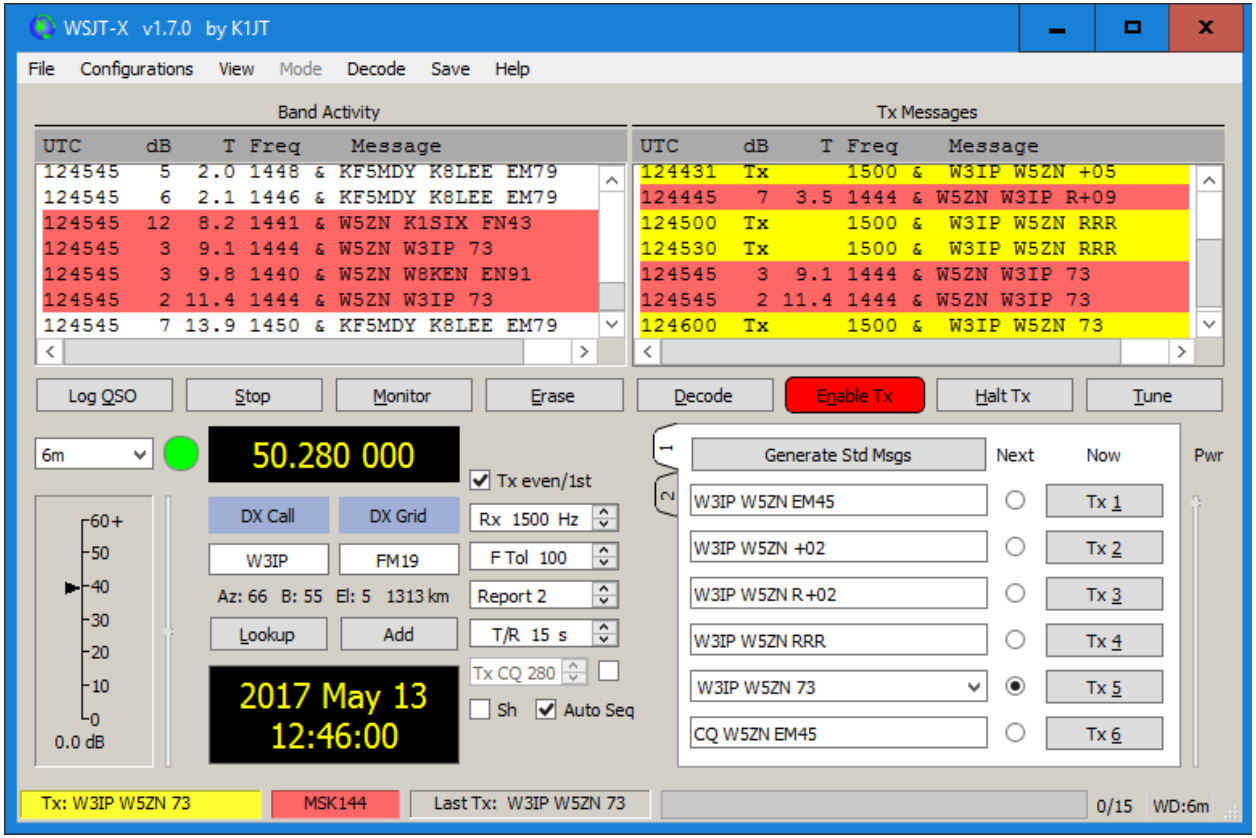

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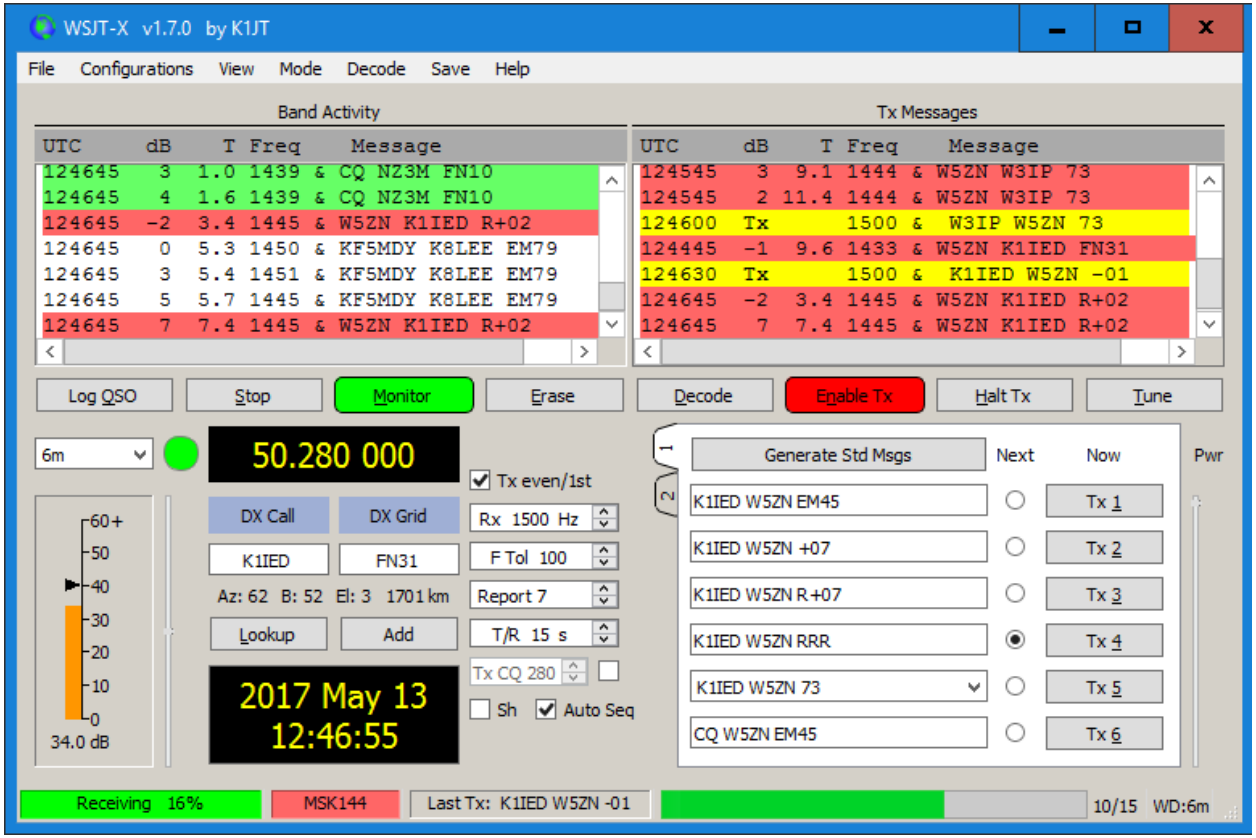

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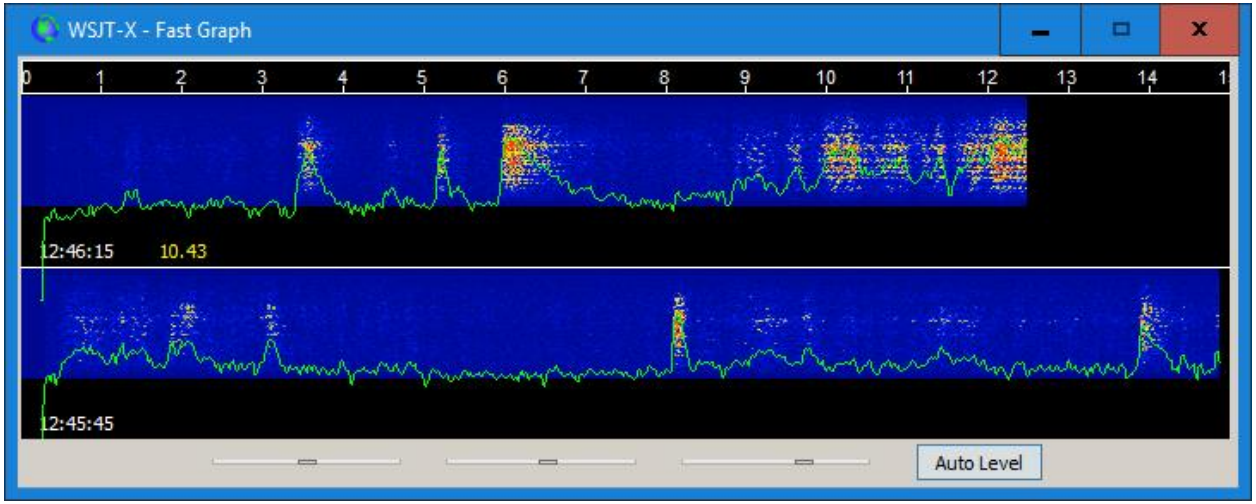

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Meteor Scatter – MSK144

K8ZR Test Results

- **Contest QSO Non-Contest QSO**
- **Tx Time:**
- 15 sec. CQ N8JX EN64
- 15 sec. N8JX K8ZR EN91
- 15 sec. K8ZR N8JX R EN64
- 15 sec. N8JX K8ZR RRR
- 15 sec. K8ZR N8JX 73
- Total time: 75 seconds

- **Non-Contest QSO**
- **Tx Time:**
- 15 sec. CQ WB4JWM EM83
- 15 sec. WB4JWM K8ZR EN91
- 15 sec. K8ZR WB4JWM +05
- 15 sec. WB4JWM K8ZR R+07
- 15 sec. K8ZR WB4JWM RRR
- 15 sec. WB4JWM K8ZR 73
- Total time: 90 seconds

Meteor Scatter – MSK144

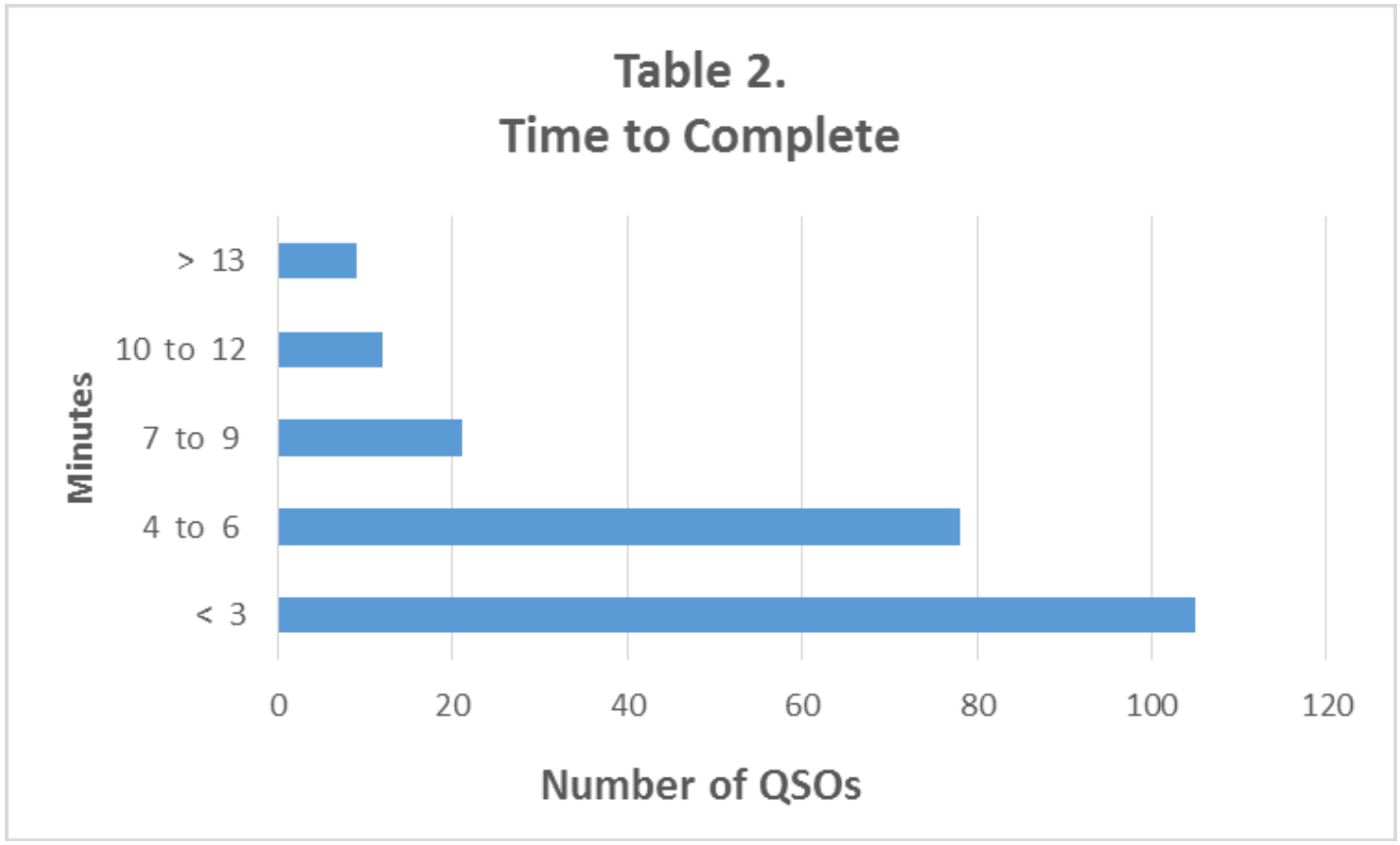
K8ZR Test Results

50 MHz MSK144 QSO Summary

Period January 23rd- March 13th:	50 days
Number of 50 MHz MSK144 QSOs:	225
Average number of minutes to complete a QSO:	4.6
Number of unique callsigns worked:	50
Number of unique callsigns decoded:	98
Number of States worked:	22
Number of unique Grids worked:	42
Number of 90 second QSOs:	10
Best DX K5DOG EM00wh:	1,223 miles

Meteor Scatter – MSK144

K8ZR Test Results



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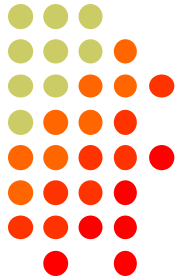
FT-8 “The Game Changer” ?

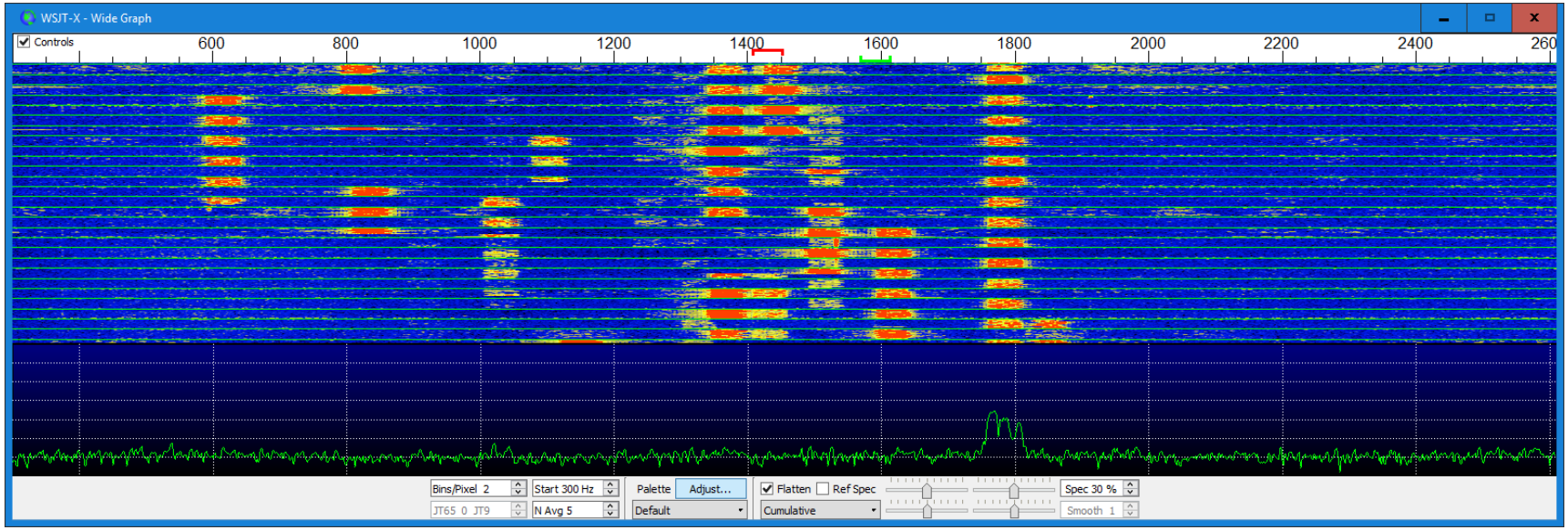
- **Outgrowth of JT65**
- **Shorter transmit-receive cycle**
  - Faster contacts – up to 4 times faster
  - Can complete within 1 minute
- **Sensitivity down to -20 dB**
- **Uses 8-Frequency Shift Keying format**

FT-8 “The Game Changer” ?



- **Excellent for multi-hop sporadic E**
  - Deep QSB often times impacts normal mode Q’s
- **Operation centered on 50.313**

FT-8 “The Game Changer” ?



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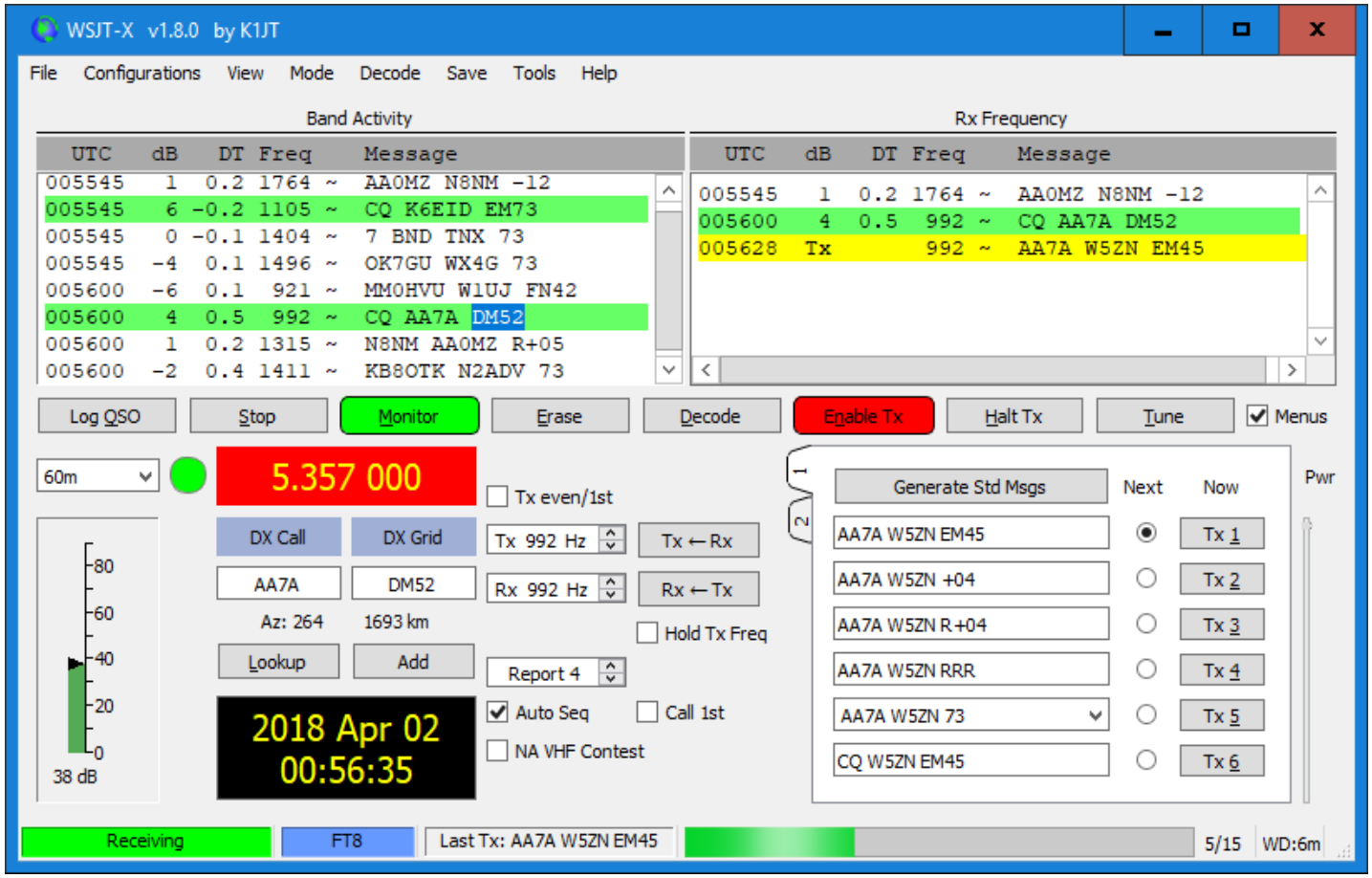

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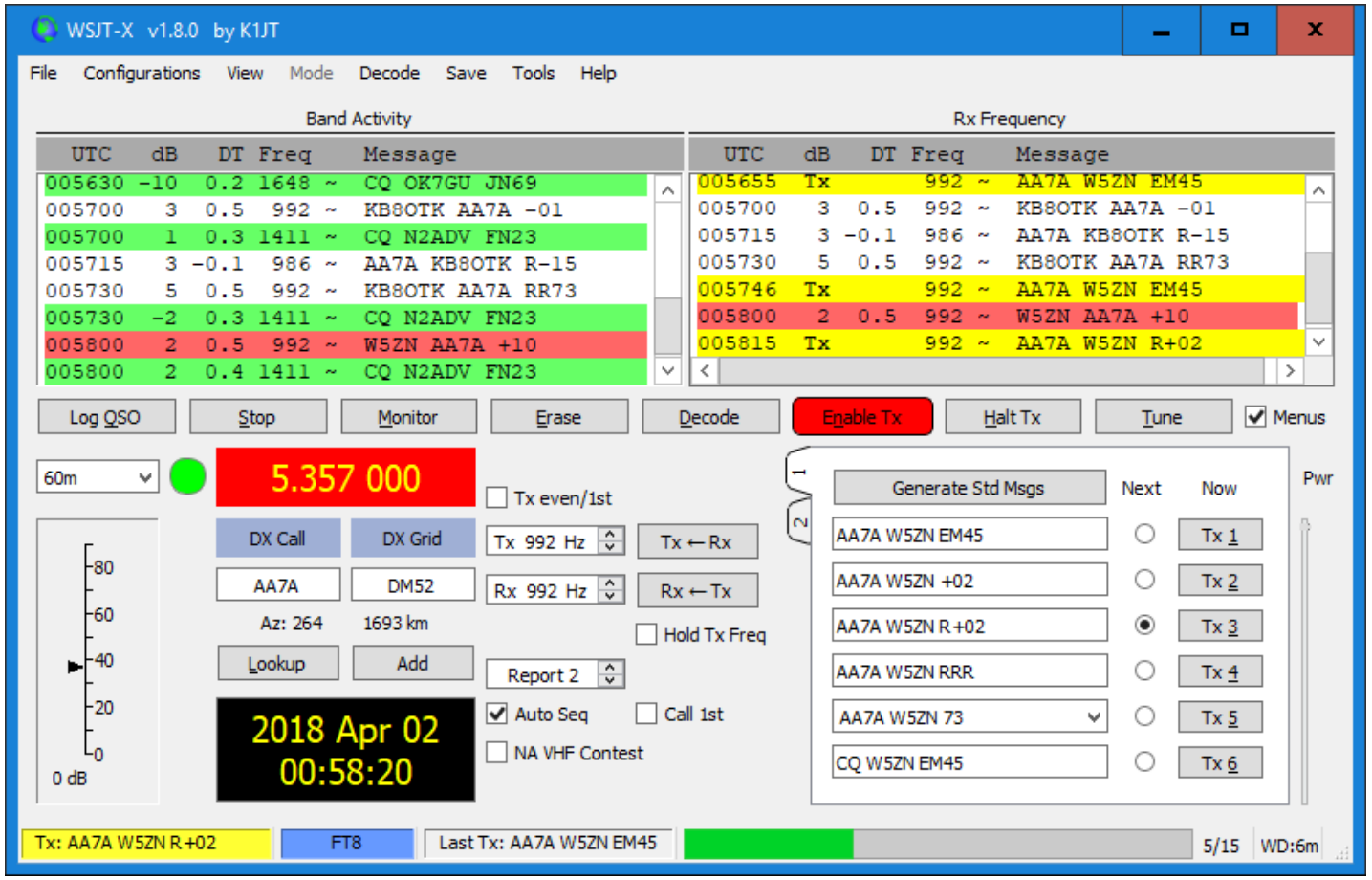

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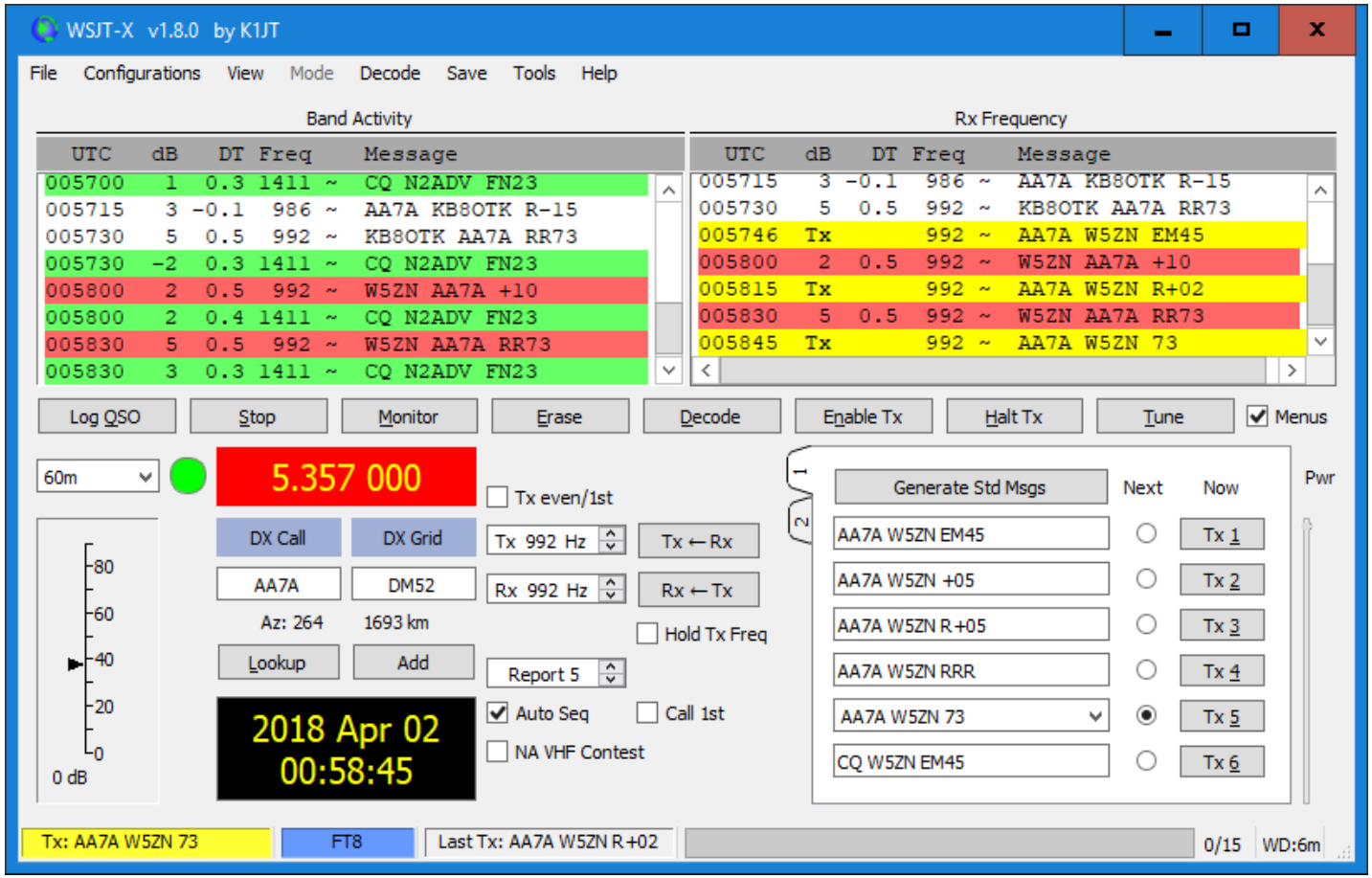

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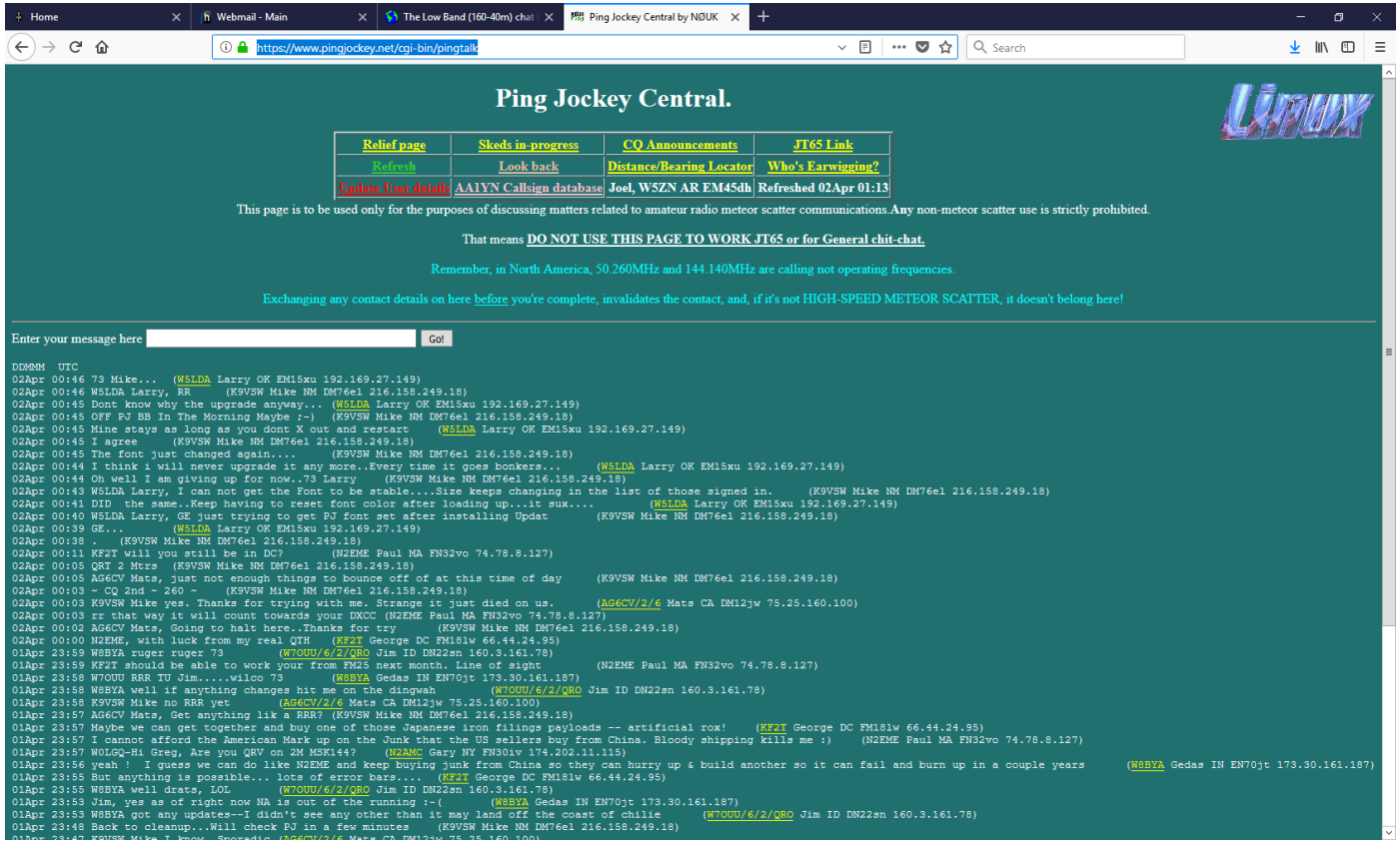
FT-8 Disadvantage

- **QSO rates can be larger on other modes during big Sporadic E Openings**
  - While a quick FT-8 contact can be completed in 1 minute, SSB or CW rates can be 5 to 10 times that
- **Too many stations sit on 50.313 when the band opens and closes quickly on CW & SSB Frequencies!**

The Competitive Advantage

- **REMEMBER – you can use any mode**
  - Be prepared to USE THEM ALL!
- **Strategy:**
  - 1800z to 0200z
    - Monitor ~50.095 CW; ~50.125 SSB; 50.313 FT8
  - 0200z to 1500z
    - Meteors with MSK144 centered on 50.265
      - Use PingJockey to monitor activity & set skeds
        - https://www.pingjockey.net/cgi-bin/pingtalk

The Competitive Advantage



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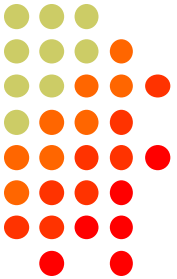

- **Use 2 Radios or 2nd RX**
  - Keep 2nd Radio on 50.313 FT-8 ***at all times***
  - Keep main radio on CW/SSB frequencies
    - Move to MS frequencies during those peak times
- **Put up a separate antenna for RX #2**
  - Even a 3 or 4 element antenna will produce results
  - Fixed direction will work if toward activity area

The Competitive Advantage

- **Remember you can listen on several frequencies at the same time**
  - Only one transmitted signal per band at one time !!!!

The Competitive Advantage

- **How do I log digital Q's?**
  - Remember you can use any mode so you are not penalized if the mode is not logged correctly (SSB –vs- FT8, digital, etc)
- **Making the contact is the important step!**
  - Get the callsign & grid correct in your log