

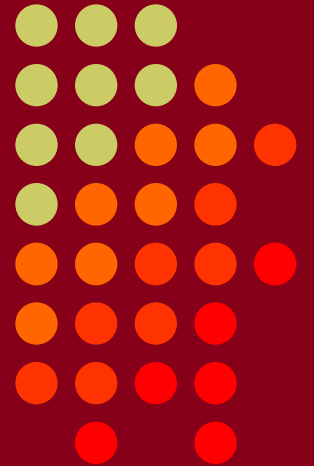
# Six Meter BBQ

Austin, TX

## CTU Presents

### Meteor Scatter Utilizing JT Digital Modes

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# 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

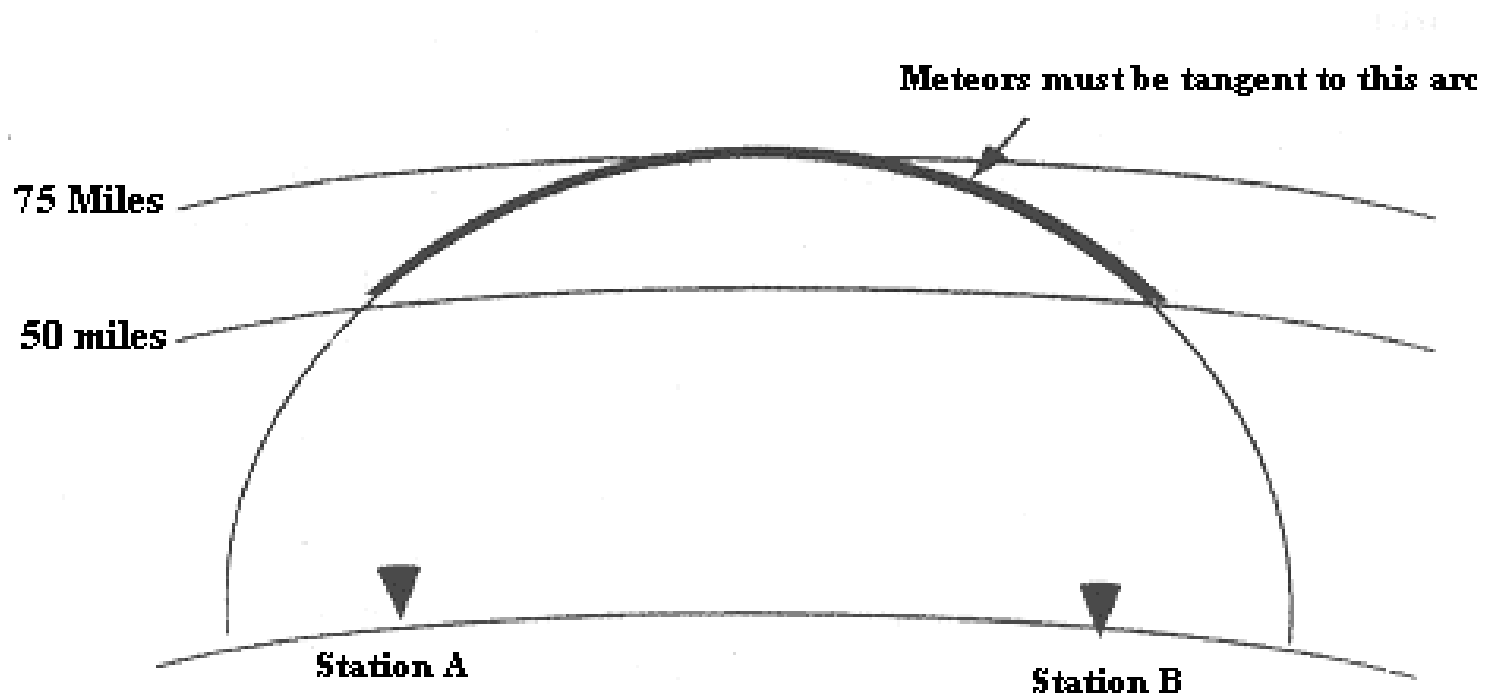


- Most particles entering the earth's atmosphere are the size of a grain of sand resulting in ionization lasting only a fraction of a second
  - much too short to convey any meaningful information using SSB or even high speed CW.
- The digital modes of FSK441 and MSK144 were designed to compress a limited 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**



# 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**

# Meteor Scatter



## Original JT "FSK441" MS Mode

The screenshot shows the WSJT6 software interface. At the top, the title bar reads "WSJT 6 by K1JT". Below the title bar is a menu bar with options: File, Setup, View, Mode, Decode, Save, Band, Help.

The main display area is divided into two sections. The left section shows a waterfall plot with a time display of "11:04:00" and a frequency display of "25.0". The right section shows a spectrum plot with a frequency display of "1 2 3" kHz.

Below the plots is a table with columns: FileID, T, Width, dB, Rpt, DF, Time (s), and Freq (kHz). The table contains one row of data: "110400 18.5 780 10 26 -150 ZS0 TNX QSO TNX QSO TNX QSO TNX QSO TNX".

Below the table is a control panel with buttons: Log QSO, Stop, Monitor, Save, Decode, Erase, Clear Avg, Include, Exclude, TxStop.

The bottom section contains several input fields and checkboxes. On the left, there are fields for "To radio:" (WB8VWN), "Grid:" (EM77bq), "Hot A: 244", "Az: 257", "El: 8", and "632 mi". A digital display shows "2006 Jul 31 18:33:36". In the center, there are fields for "S 2", "Clip 0", "Tol 400", "Dsec 0.0", and checkboxes for "Zap", "NB", "Freeze", and "AFC". On the right, there are checkboxes for "Tx First", "Sh Msg", "Sked", and "Auto is Off", along with a list of call signs: "WB8VWN K1JT", "WB8VWN 26 K1JT 2626", "R26", "RRR", "73", and "CQ K1JT".

At the very bottom, there is a status bar with fields: "1.0000 1.0000", "FSK441", "Freeze DF: 0", "Rx noise: -2 dB", "TR Period: 30 s", and a green "Receiving" button.

# Meteor Scatter



- **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

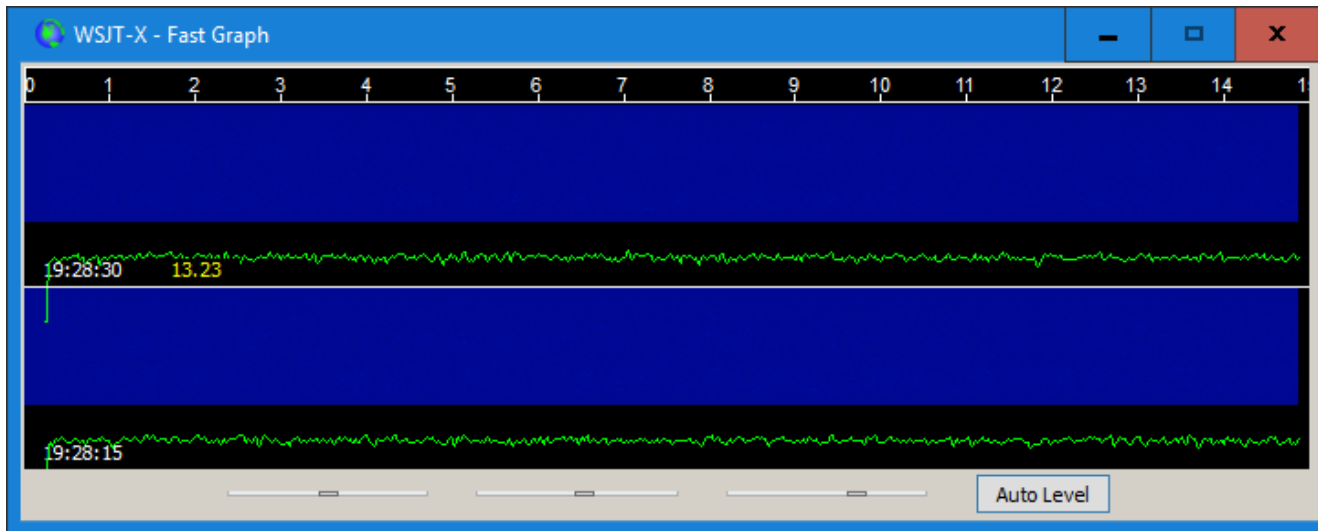


- Focussed toward contest style operation that include:
  - a machine human interface that facilitates rapid population of QSO specific information
  - shorter TX and RX periods than FSK441
  - auto sequencing that reduces human error and improves operator efficiency important considerations during contest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

# Meteor Scatter



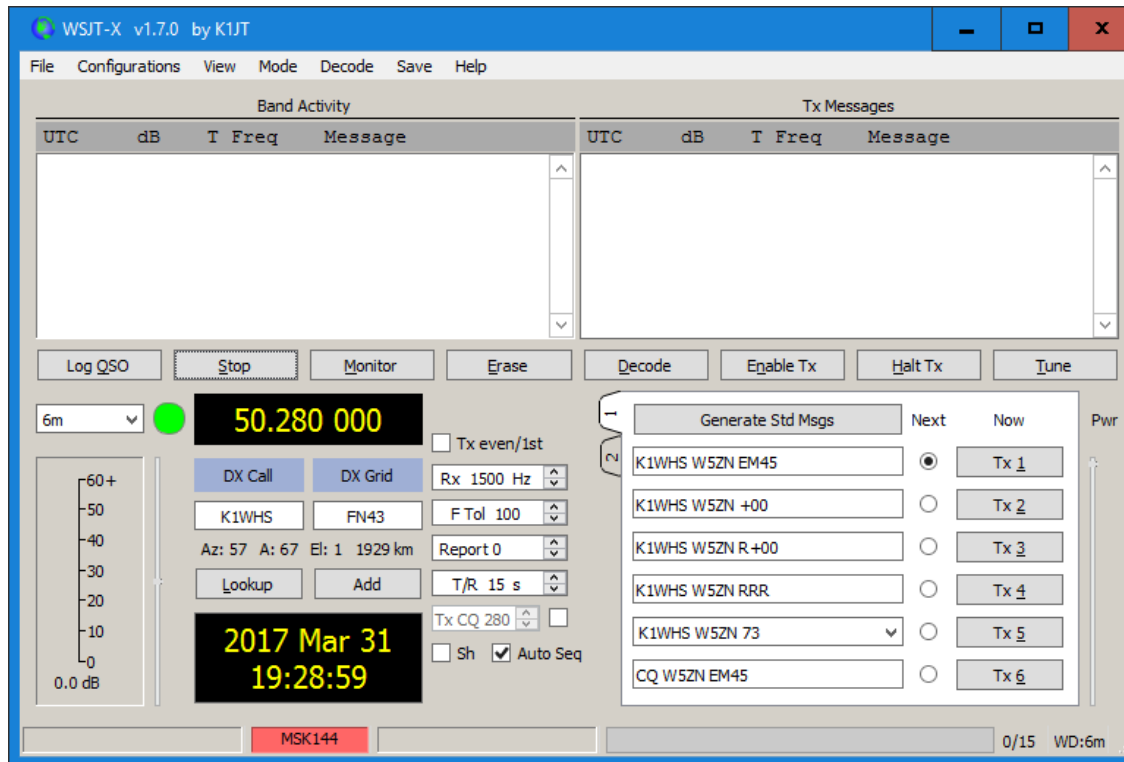
Graph still exists but in a separate window called “Fast Graph”



# Meteor Scatter



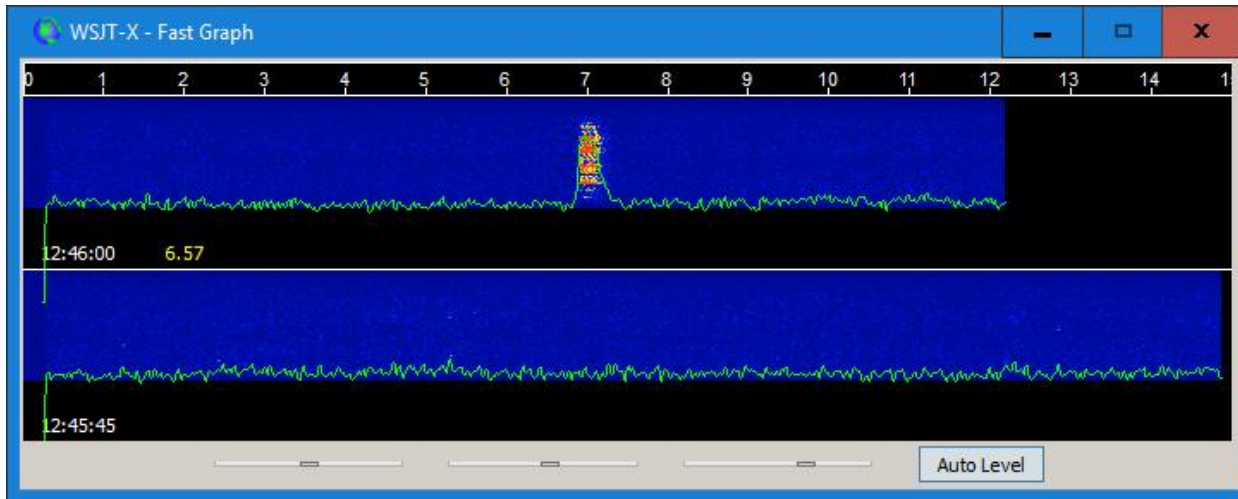
MSK144 Window is different from previous FSK441 Window”



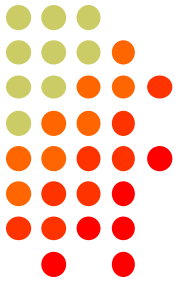
# Meteor Scatter



Signal bursts still appear in the “Fast Graph”



# Meteor Scatter



WSJT-X v1.7.0 by K1JT

File Configurations View Mode Decode Save Help

| Band Activity |    |      |      |                      | Tx Messages |    |   |      |         |
|---------------|----|------|------|----------------------|-------------|----|---|------|---------|
| UTC           | dB | T    | Freq | Message              | UTC         | dB | T | Freq | Message |
| 123930        | -1 | 14.5 | 1437 | & CQ WA8CLT EN80     |             |    |   |      |         |
| 123945        | -2 | 7.3  | 1433 | & WA8CLT VE2DFO FN25 |             |    |   |      |         |
| 123945        | -1 | 7.4  | 1432 | & WA8CLT VE2DFO FN25 |             |    |   |      |         |
| 123945        | 1  | 8.2  | 1433 | & WA8CLT VE2DFO FN25 |             |    |   |      |         |

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune

6m **50.280 000** Tx even/1st

Digital Signal Strength: 34.5 dB

DX Call: K1WHS DX Grid: FN43 Rx: 1500 Hz F Tol: 100 Report: 0 T/R: 15 s Tx CQ: 280 Sh Auto Seq

**2017 Apr 02 12:41:41**

| Generate Std Msgs | Next                             | Now  | Pwr |
|-------------------|----------------------------------|------|-----|
| K1WHS W5ZN EM45   | <input checked="" type="radio"/> | Tx 1 |     |
| K1WHS W5ZN +00    | <input type="radio"/>            | Tx 2 |     |
| K1WHS W5ZN R+00   | <input type="radio"/>            | Tx 3 |     |
| K1WHS W5ZN RRR    | <input type="radio"/>            | Tx 4 |     |
| K1WHS W5ZN 73     | <input type="radio"/>            | Tx 5 |     |
| CQ W5ZN EM45      | <input type="radio"/>            | Tx 6 |     |

Receiving 15% MSK144 Last Tx: TUNE 11/15 WD:6m



# Meteor Scatter



WSJT-X v1.7.0 by K1JT

File Configurations View Mode Decode Save Help

| Band Activity |    |      |      |                      | Tx Messages |    |      |      |                  |
|---------------|----|------|------|----------------------|-------------|----|------|------|------------------|
| UTC           | dB | T    | Freq | Message              | UTC         | dB | T    | Freq | Message          |
| 123930        | -1 | 14.5 | 1437 | & CQ WA8CLT EN80     | 123930      | -1 | 14.5 | 1437 | & CQ WA8CLT EN80 |
| 123945        | -2 | 7.3  | 1433 | & WA8CLT VE2DFO FN25 |             |    |      |      |                  |
| 123945        | -1 | 7.4  | 1432 | & WA8CLT VE2DFO FN25 |             |    |      |      |                  |
| 123945        | 1  | 8.2  | 1433 | & WA8CLT VE2DFO FN25 |             |    |      |      |                  |

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune

6m **50.280 000** Tx even/1st

WA8CLT EN80 Rx 1500 Hz F Tol 100 Report -1 T/R 15 s Tx CQ 280 Sh Auto Seq

Az: 49 B: 35 El: 9 895 km

2017 Apr 02 12:42:09

| Generate Std Msgs | Next                             | Now  | Pwr |
|-------------------|----------------------------------|------|-----|
| WA8CLT W5ZN EM45  | <input checked="" type="radio"/> | Tx 1 |     |
| WA8CLT W5ZN -01   | <input type="radio"/>            | Tx 2 |     |
| WA8CLT W5ZN R-01  | <input type="radio"/>            | Tx 3 |     |
| WA8CLT W5ZN RRR   | <input type="radio"/>            | Tx 4 |     |
| WA8CLT W5ZN 73    | <input type="radio"/>            | Tx 5 |     |
| CQ W5ZN EM45      | <input type="radio"/>            | Tx 6 |     |

Receiving 24% MSK144 Last Tx: TUNE 9/15 WD:6m

# Meteor Scatter



The screenshot displays the WSJT-X v1.7.0 software interface. The main window is titled "WSJT-X v1.7.0 by K1JT" and features a menu bar with "File", "Configurations", "View", "Mode", "Decode", "Save", and "Help".

The interface is divided into several sections:

- Band Activity:** A table showing received signals. The first row is highlighted in green: UTC 123930, dB -1, T 14.5, Freq 1437, Message "& CQ WA8CLT EN80".
- Tx Messages:** A table showing transmitted messages. The first row is highlighted in yellow: UTC 123930, dB -1, T 14.5, Freq 1437, Message "& CQ WA8CLT EN80". The second row is also highlighted in yellow: UTC 124215, Tx, Freq 1500, Message "& WA8CLT W5ZN EM45".
- Control Panel:** Includes buttons for "Log QSO", "Stop", "Monitor", "Erase", "Decode", "Enable Tx" (highlighted in red), "Halt Tx", and "Tune".
- Frequency and Mode:** A dropdown menu is set to "6m". The frequency is displayed as "50.280 000".
- Call Sign and Grid:** "DX Call" is "WA8CLT" and "DX Grid" is "EN80".
- Transmission Parameters:** Includes "Rx 1500 Hz", "F Tol 100", "Report -1", "T/R 15 s", "Tx CQ 280", and "Auto Seq" checked.
- Message Queue:** A list of messages to be transmitted, with "WA8CLT W5ZN EM45" selected. Other messages include "WA8CLT W5ZN -01", "WA8CLT W5ZN R-01", "WA8CLT W5ZN RRR", "WA8CLT W5ZN 73", and "CQ W5ZN EM45".
- Status Bar:** Shows "Tx: WA8CLT W5ZN EM45", "MSK144", "Last Tx: WA8CLT W5ZN EM45", and "13/15 WD:6m".

# 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

# K8ZR Test Results



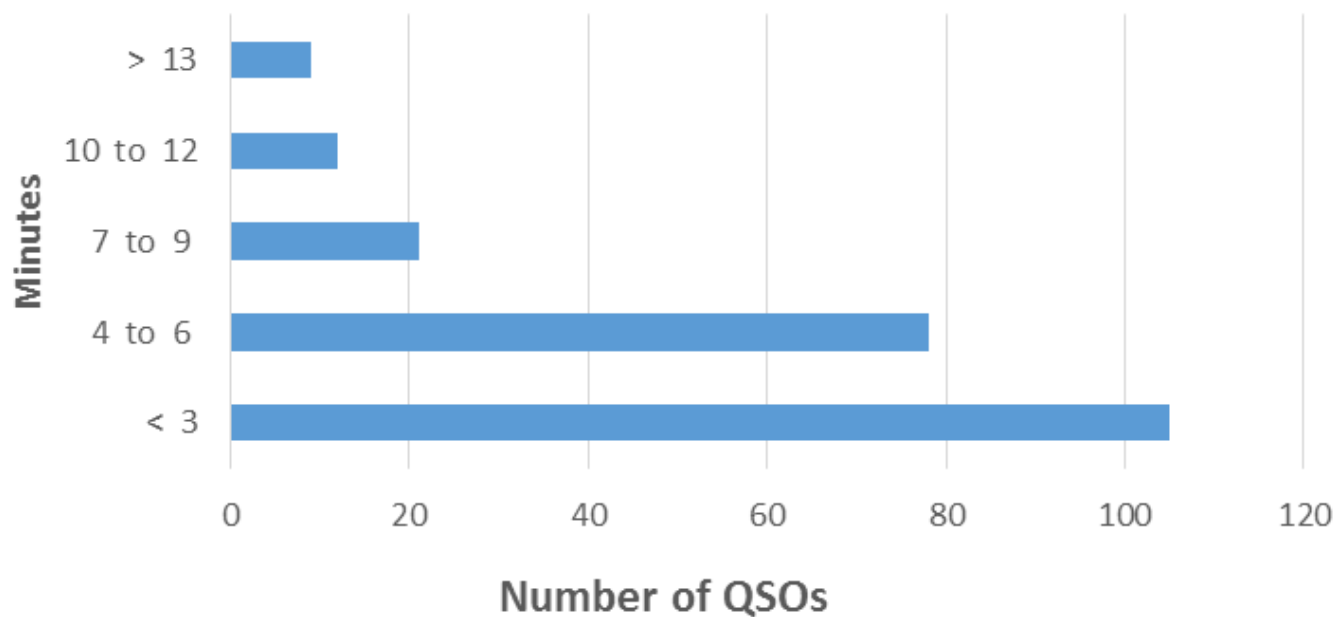
## 50 MHz MSK144 QSO Summary

|                                                |             |
|------------------------------------------------|-------------|
| ● 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 |

# K8ZR Test Results



Table 2.  
Time to Complete



# Acknowledgement



- Thanks to Tony, K8ZR (x-WA8RJF) for supplying additional information on Meteor Scatter