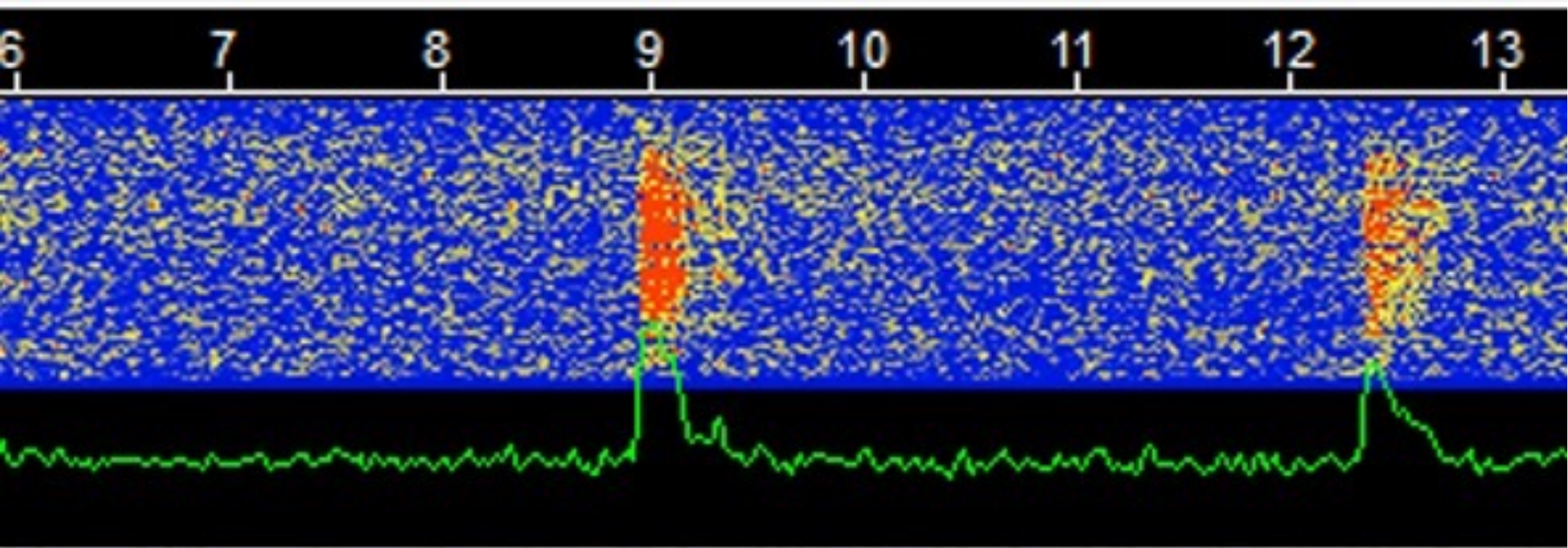


Harnessing Meteors For VHF QSOs.

QSO Today Ham Expo

Jim Wilson, K5ND



How to Make Meteor Scatter QSOs

Presenter K5ND

- Active VHF operator and addicted grid chaser.
- Worked meteor scatter contacts on six and two meters to add to VUCC and FFMA totals.
- Provided presentations on six meters and VHF contesting for the QSO Today Ham Expo.



Agenda



How Meteor Scatter Works

Meteors & Ionosphere
Meteor Showers



Meteor Scatter Operation

WSJT-X Settings
Operating Protocol

Meteors

24 / 7 / 365

- Tons of Meteors every day
- Tiny debris — grain of sand
- 3x more at 6 AM than 6 PM
- Friction ionizes the E-layer

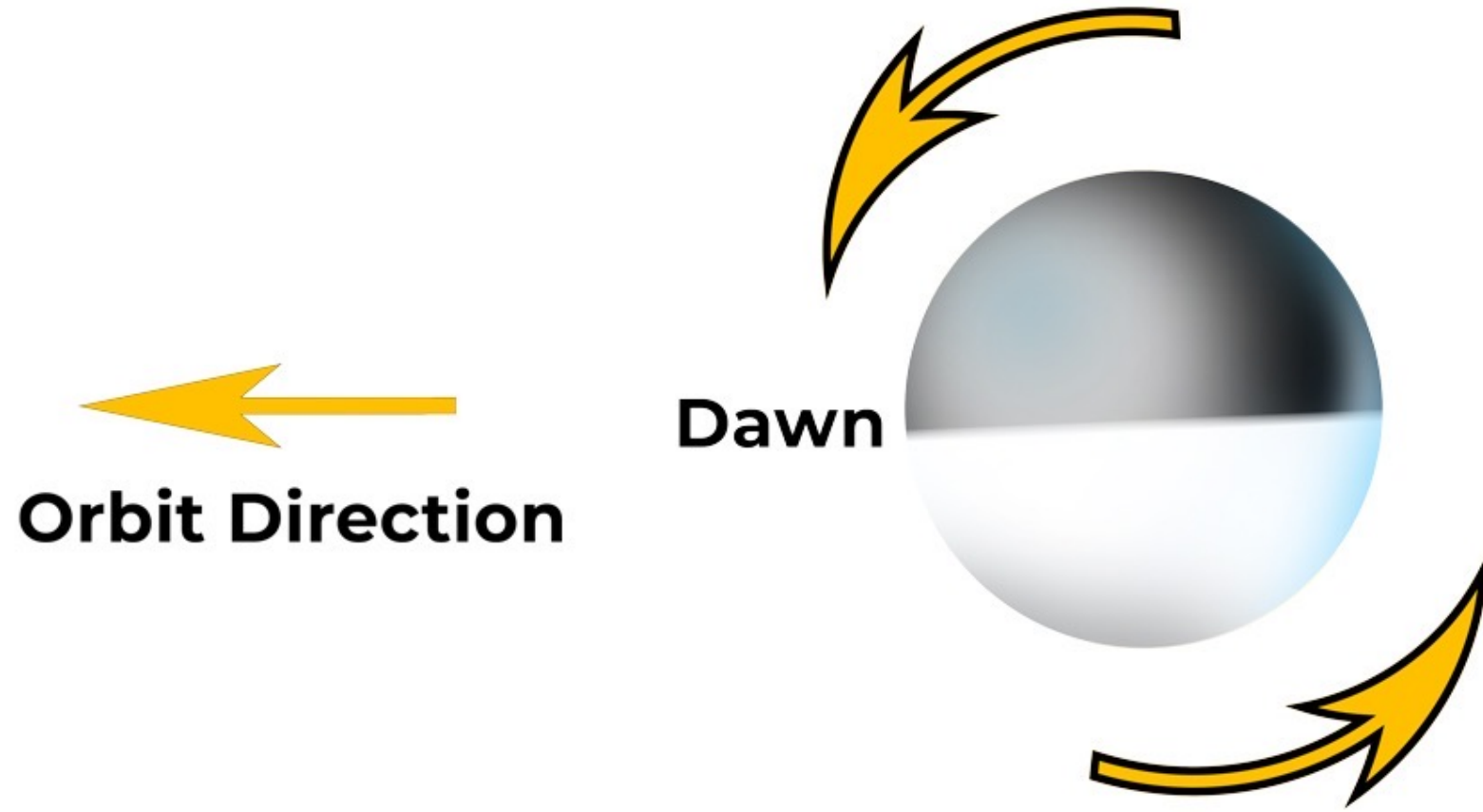
S P O R A D I C

Showers

- Predictable comet trails
- High concentration of meteors
- Major and minor showers
- Happen every year

O N S C H E D U L E

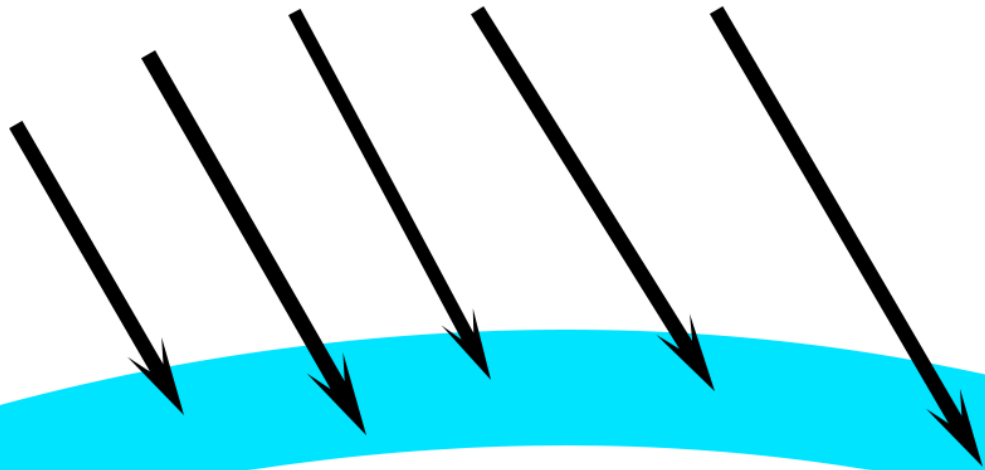
View From above the North Pole



E Layer



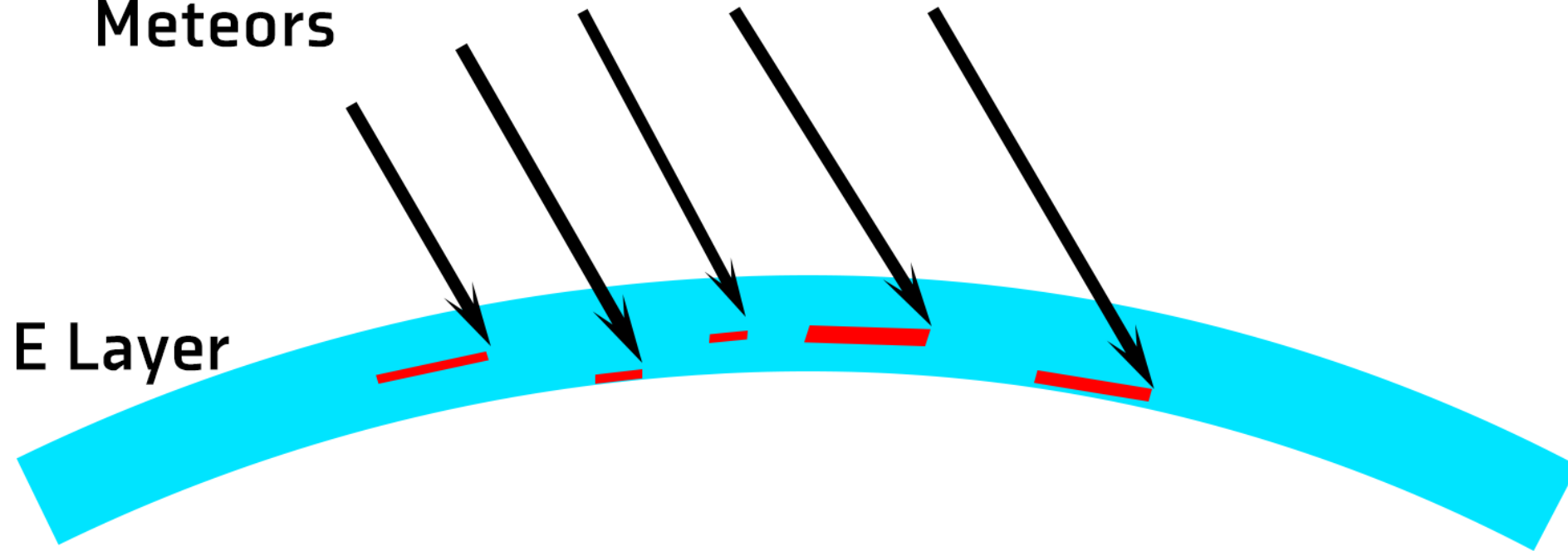
Meteors



E Layer



Meteors

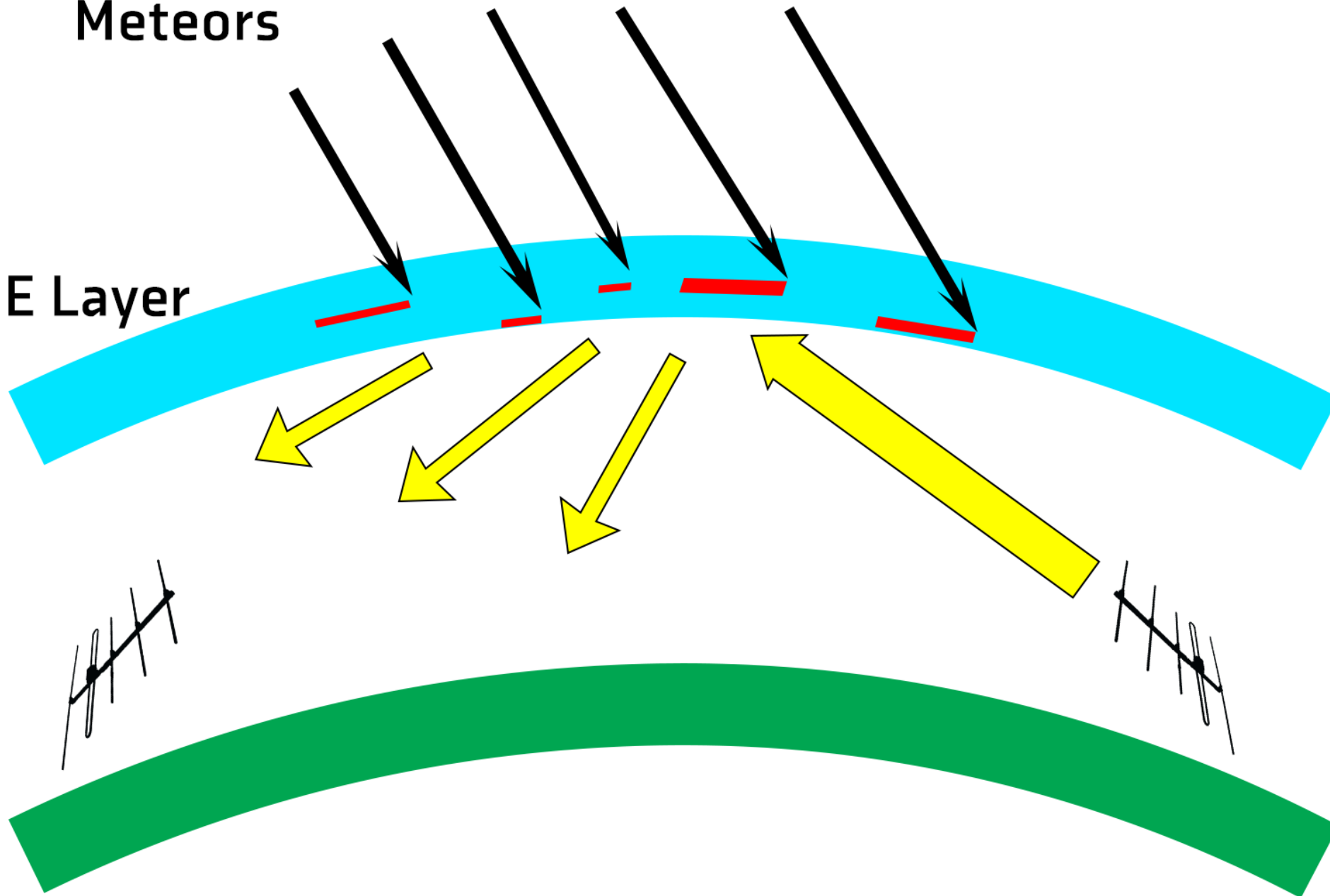


E Layer



Meteors

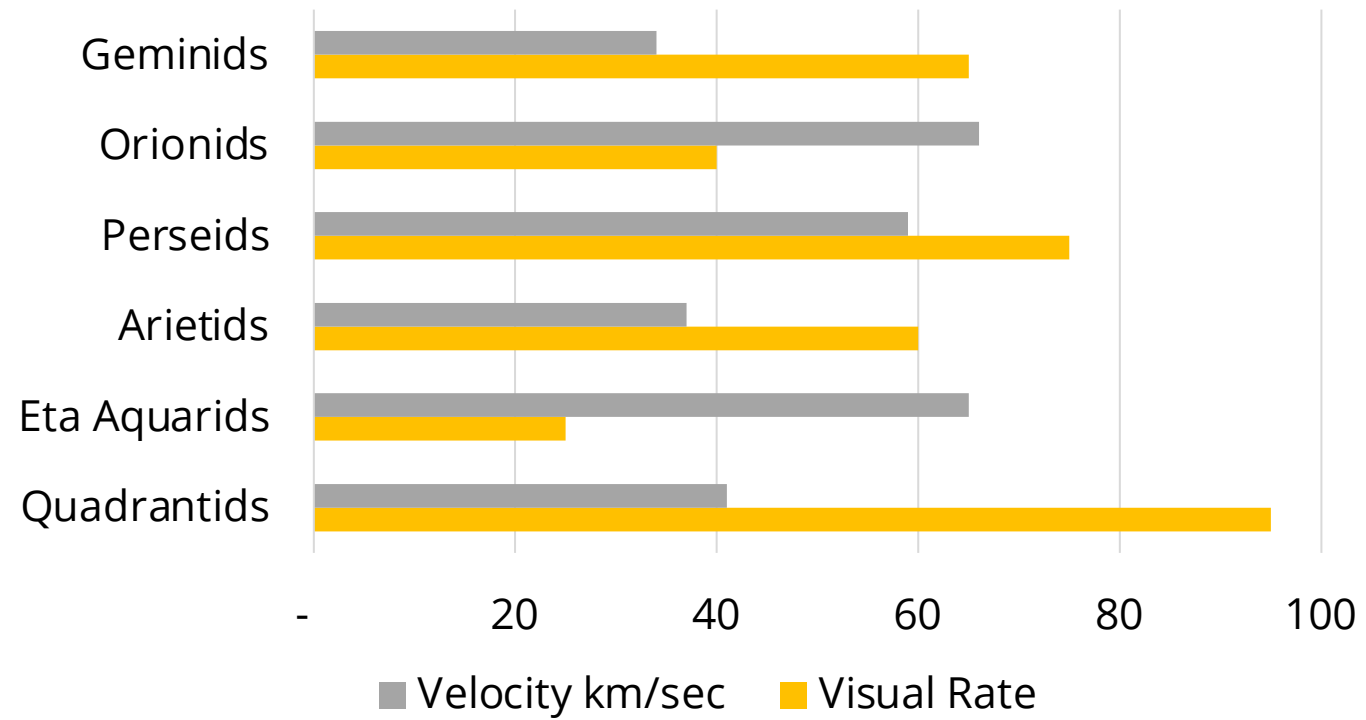
E Layer



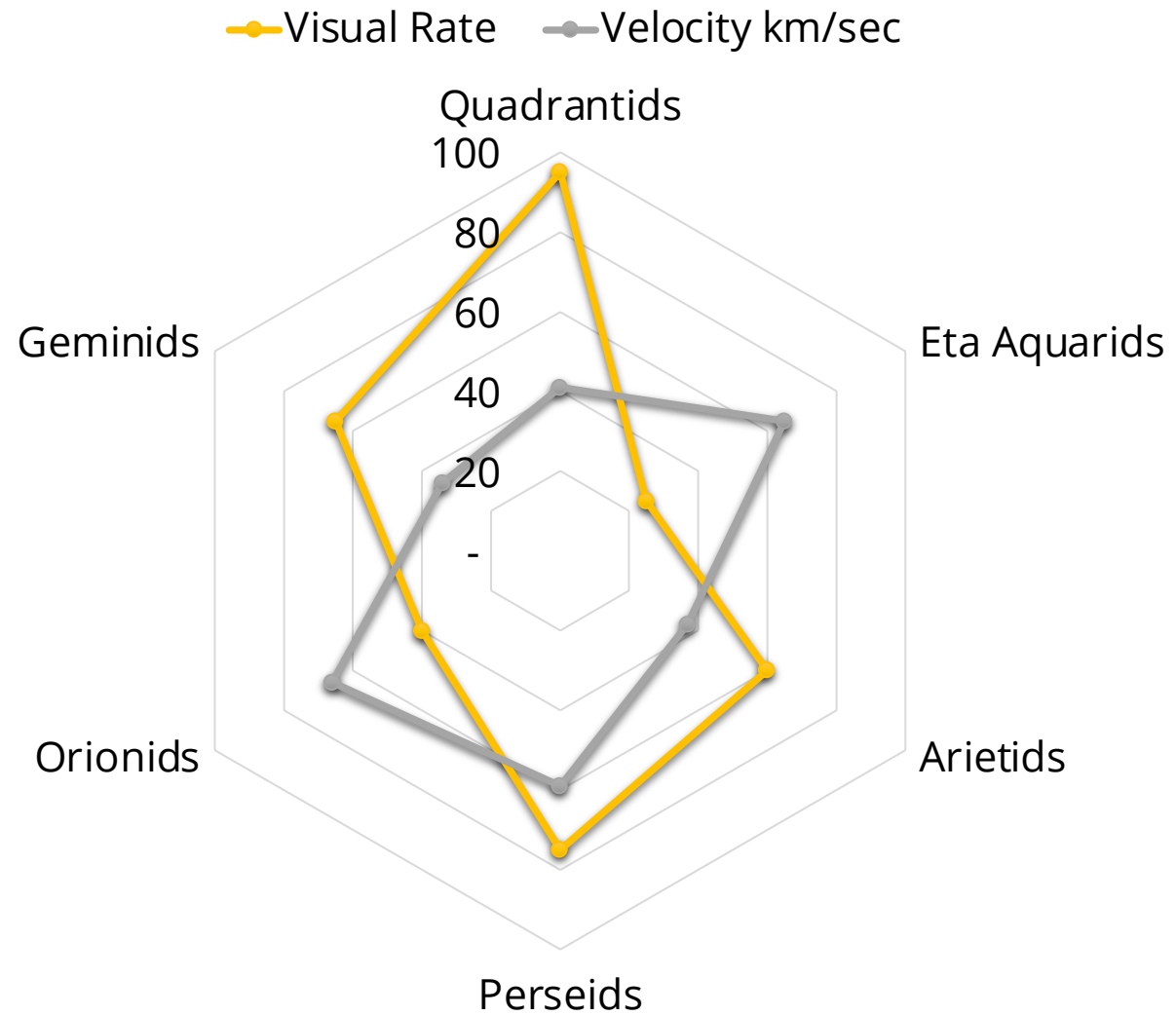
Meteor Showers

| Major Showers | Date Range | Peak Date | Time Max |
|---------------|-------------------------|-------------|-------------|
| Quadrantids | January 1-6 | January 3-4 | 14 hours |
| Eta Aquarids | April 21 to May 12 | May 4-5 | 3 days |
| Arietids | May 29 to June 19 | June 7 | |
| Perseids | July 23 to August 20 | August 12 | 4 to 6 days |
| Orionids | October 2 to November 7 | October 20 | 2 days |
| Geminids | December 4 to 16 | December 13 | 2.6 days |

Meteor Showers



Meteor Showers



Meteor Scatter Operation

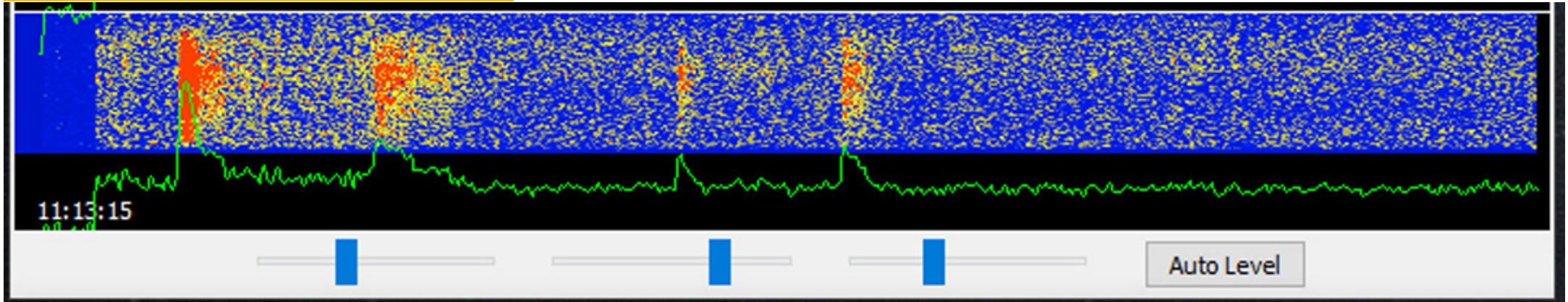


WSJT-X
Settings

Operating
Protocol

Getting on the Air
Burst of Excitement

WSJT-X FAST GRAPH



```
111315 18 1.7 1496 & K5ND KOTPP EM48  
111315 19 1.7 1495 & K5ND KOTPP EM48  
111315 5 8.1 1500 & K5ND KOTPP EM48
```

Sample of MSK144 Audio File and Screen Shots



Pings at 1.7, 3.5, 6.1, and 8.1
Decodes only at 1.7 and 8.1
50.260 MHz

MSK144

Actual QSO

16 Minute QSO

Lots of silence

Pings without decodes

Pings with decodes

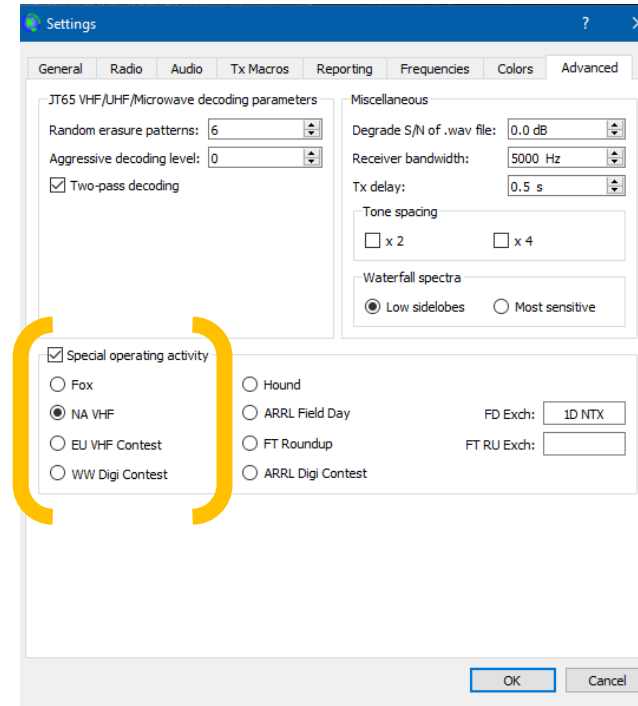
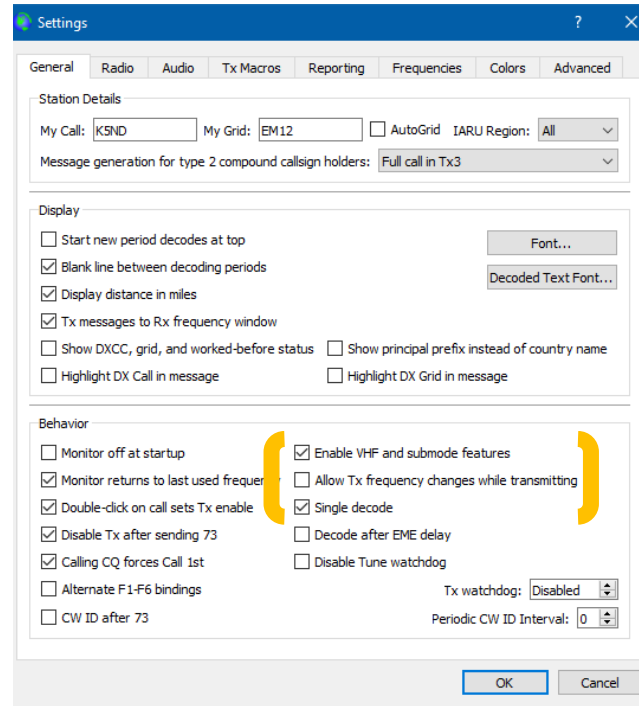
The screenshot displays two columns of log data from a radio software interface. The left column, titled 'Band Activity', shows a list of received signals with columns for UTC, dB, T, Freq, and Message. The right column, titled 'Tx Messages', shows a list of transmitted signals with columns for UTC, dB, T, Freq, and Message. The interface includes a control panel at the bottom with buttons for 'Log QSO', 'Stop', 'Monitor', 'Erase', 'Decode', 'Enable Tx', 'Halt Tx', 'Tune', and 'Menus'. A frequency display shows '50.260 000' and a mode selector is set to '6m'.

| Band Activity | | | | | Tx Messages | | | | |
|---------------|----|------|------|-------------------------|-------------|----|------|------|--------------------|
| UTC | dB | T | Freq | Message | UTC | dB | T | Freq | Message |
| 125530 | -2 | 11.8 | 1466 | & W5AJ KASYEU +03 | 125530 | -2 | 11.8 | 1466 | & W5AJ KASYEU +03 |
| 130300 | 9 | 14.3 | 1461 | & K5ND KASYEU +02 | 125815 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 130500 | 2 | 1.9 | 1465 | & K5ND KASYEU +02 | 125845 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 130500 | 7 | 3.4 | 1464 | & K5ND KASYEU +02 | 125915 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 131300 | -7 | 9.0 | 1468 | & K5ND KASYEU RR73 | 125945 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 131300 | -3 | 9.1 | 1468 | & K5ND KASYEU RR73 | 130015 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 131300 | -1 | 9.8 | 1469 | & K5ND KASYEU RR73 | 130045 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 131830 | 6 | 4.0 | 1469 | & CQ KASYEU EL07 U.S.A. | 130115 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 132130 | 17 | 13.9 | 1490 | & W5LDA N5DUW EM11 | 130145 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 132130 | 20 | 14.2 | 1489 | & W5LDA N5DUW EM11 | 130215 | | Tx | 1500 | & KASYEU K5ND EM12 |
| 132145 | 20 | 0.4 | 1489 | & W5LDA N5DUW EM11 | 130245 | | Tx | 1500 | & KASYEU K5ND EM12 |
| | | | | | 130300 | 9 | 14.3 | 1461 | & K5ND KASYEU +02 |
| | | | | | 130315 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130345 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130415 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130445 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130500 | 2 | 1.9 | 1465 | & K5ND KASYEU +02 |
| | | | | | 130500 | 7 | 3.4 | 1464 | & K5ND KASYEU +02 |
| | | | | | 130515 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130545 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130615 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130645 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130715 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130745 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130815 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130845 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130915 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 130945 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 131015 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 131045 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 131115 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 131145 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 131215 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 131245 | | Tx | 1500 | & KASYEU K5ND R+09 |
| | | | | | 131300 | -7 | 9.0 | 1468 | & K5ND KASYEU RR73 |
| | | | | | 131300 | -3 | 9.1 | 1468 | & K5ND KASYEU RR73 |
| | | | | | 131300 | -1 | 9.8 | 1469 | & K5ND KASYEU RR73 |
| | | | | | 131315 | | Tx | 1500 | & KASYEU K5ND 73 |
| | | | | | 131351 | | Tx | 1500 | & KASYEU K5ND 73 |
| | | | | | 131415 | | Tx | 1500 | & KASYEU K5ND 73 |

WSJT-X

MSK144

SETTINGS



Rig Control and Audio Settings are the Same as any WSJT Mode (FT8)

Enable VHF Settings and Single Decode

For Contest Mode use NA VHF

WSJT-X MSK144

SETTINGS

The screenshot shows the WSJT-X software interface. The title bar reads "WSJT-X - ig-name=IC-9100 v2.6.0-rc2 by K1JT et al.". The menu bar includes "File", "Configurations", "View", "Mode", "Decode", "Save", "Tools", and "Help". The "Mode" menu is open, showing a list of modes: "MSK", "Q65", and "JT65". The "MSK" mode is selected, and the "MSK144" mode is highlighted in red at the bottom of the interface. A yellow arrow points to the "Mode" menu, and another yellow arrow points to the "MSK" mode in the list. The main window displays "Band Activity" and "Tx Messages" tables. The "Band Activity" table has columns for "UTC", "dB", "T", "Freq", and "Message". The "Tx Messages" table has columns for "UTC", "dB", "T", "Freq", and "Message". The status bar at the bottom shows "Receiving 12%", "6m SDR", "MSK144", and "9/15".

Mode Menu — Select MSK144

WSJT-X MSK144

SETTINGS

The screenshot shows the WSJT-X software interface. The title bar reads "WSJT-X - ig-name=IC-9100 v2.6.0-rc2 by K1JT et al.". The menu bar includes "File", "Configurations", "View", "Mode", "Decode", "Save", "Tools", and "Help". The "Mode" menu is open, showing "MSK144" selected. The "Decode" menu is also open, showing "Fast", "Normal", and "Deep" options. A yellow arrow points to the "Mode" menu. A yellow box highlights the "Receiving 12%" status indicator in the bottom left corner. The main interface displays a frequency of 50.260 000 MHz, a date and time of 2022 Aug 16 16:31:39, and a "Generate Std Msgs" section with a list of messages and transmission options.

Mode Menu — Select MSK144

Decode Menu — Fast, Normal, Deep

WSJT-X MSK144

SETTINGS

The screenshot shows the WSJT-X software interface. The title bar reads "WSJT-X - ig-name=IC-9100 v2.6.0-rc2 by K1JT et al.". The menu bar includes "File", "Configurations", "View", "Mode", "Decode", "Save", "Tools", and "Help". The main window is divided into "Band Activity" and "Tx Messages" sections, both currently empty. Below these are control buttons: "Log QSO", "Stop", "Monitor" (highlighted in green), "Erase", "Decode", "Enable Tx", "Halt Tx", "Tune", and "Menus". The central display shows a frequency of "50.260 000" and a date/time of "2022 Aug 16 16:31:39". A yellow box highlights the "Mode Menu" settings: "F Tol 200", "Rx 1500 Hz", "Report 0", and "T/R 15 s". To the right, there is a "Generate Std Msgs" section with a list of transmission slots (Tx 1 to Tx 6) and a "Pwr" slider. The status bar at the bottom shows "Receiving 12%", "6m SDR", "MSK144", and "9/15".

Mode Menu — Select MSK144

Decode Menu — Fast, Normal, Deep

F Tol — 200 Hz

Rx — 1500 Hz

T/R — 15 seconds

WSJT-X MSK144

SETTINGS

144.150 000

DX Call: WBOJPN, DX Grid: EM29

Az: 12 A: 28 El: 11 495 mi

Lookup Add

2022 Aug 16 16:52:01

Tx even/1st

F Tol 200

Rx 1500 Hz

Report 0

T/R 15 s

Sh Auto Seq

NA VHF SWL

1 Generate Std Msgs

2 WBOJPN K5ND EM12

WBOJPN K5ND EM12

WBOJPN K5ND R EM12

WBOJPN K5ND RRR

WBOJPN K5ND 73

CQ TEST K5ND EM12

Contest Mode
RRR instead of RR73

144.150 000

DX Call: WBOJPN, DX Grid: EM29

Az: 12 A: 28 El: 11 495 mi

Lookup Add

2022 Aug 16 16:52:51

Tx even/1st

F Tol 200

Rx 1500 Hz

Report 1

T/R 15 s

Sh Auto Seq

NA VHF SWL

1 Generate Std Msgs

2 WBOJPN K5ND EM12

WBOJPN K5ND EM12

WBOJPN K5ND R EM12

<WBOJPN K5ND> RRR

<WBOJPN K5ND> 73

CQ TEST K5ND EM12

Contest Mode with SH Messages
Short-Hand 20 ms messages
Normally 72 ms messages

Meteor Scatter Operating Protocol

- Frequencies: 50.260 and 50.265 — 144.150
- Early Mornings are Best Times
- Pointing East, Send 1st Sequence
- Pointing West, Send 2nd Sequence
- Contest Mode often used on 6 meters
- Contest Mode + SH used on 2 meters
- Random Contacts Are Rare
- Usually, Coordinate via Chat Rooms
- Ping Jockey – VHF-Chat-Slack – ON4KST
- PSK Reporter – Virgo

Meteor Scatter Operating Protocol

| Major Showers | Date Range | Best Paths and Local Times |
|---------------------|-------------------------|---|
| Quadrantids | January 1-6 | NE-SW 1300 to 1500, SE-NW 0500 to 0700 |
| Eta Aquarids | April 21 to May 12 | NE-SW 0500 to 0700, E-W 0600 to 0900, SE-NW 0900 to 1100 |
| Arietids | May 29 to June 19 | N-S 0600 to 0700 and 1300 to 1400 |
| Perseids | July 23 to August 20 | NE-SW 0900 to 1100, SE-NW 0700 to 0800 |
| Orionids | October 2 to November 7 | NE-SW 0100 to 0300, N-S 0100 to 0200 and 0700 to 0900, NW-SE 0700 to 0800 |
| Geminids | December 4 to 16 | N-S 2200 to 2400 and 0500 to 0700 |

Sample QSO

C M S H

The screenshot displays a radio software interface with two main log windows and a control panel. The 'Band Activity' window on the left shows a list of received messages with columns for UTC, dB, T, Freq, and Message. The 'Tx Messages' window on the right shows transmitted messages with similar columns. The control panel at the bottom includes a frequency display set to 144.150 000, a date and time display for 2022 Aug 13 17:59:25, and various operational controls like 'Monitor', 'Erase', 'Decode', and 'Generate Std Msgs'. A status bar at the very bottom indicates 'Receiving 8%' and 'Last Tx: <W0VB K5ND> 73'.

| Band Activity | | | | | Tx Messages | | | | |
|---------------|----|------|------|---------------------|-------------|----|------|------|---------------------|
| UTC | dB | T | Freq | Message | UTC | dB | T | Freq | Message |
| 173130 | -1 | 8.9 | 1454 | & CQ CMSH KO9A EN52 | 174330 | 0 | 3.9 | 1502 | & CQ TEST W0VB DN74 |
| 173130 | 0 | 9.6 | 1454 | & CQ CMSH KO9A EN52 | 174449 | Tx | 1500 | & | W0VB K5ND EM12 |
| 173615 | -6 | 8.8 | 1487 | & KO9A AASAM EM13 | 174515 | Tx | 1500 | & | W0VB K5ND EM12 |
| 173615 | -5 | 8.8 | 1486 | & KO9A AASAM EM13 | 174545 | Tx | 1500 | & | W0VB K5ND EM12 |
| 173615 | -2 | 9.9 | 1487 | & KO9A AASAM EM13 | 174615 | Tx | 1500 | & | W0VB K5ND EM12 |
| 174200 | 0 | 5.5 | 1493 | & CQ TEST W0VB DN74 | 174645 | Tx | 1500 | & | W0VB K5ND EM12 |
| 174200 | 1 | 5.5 | 1495 | & CQ TEST W0VB DN74 | 174715 | Tx | 1500 | & | W0VB K5ND EM12 |
| 174330 | -2 | 3.4 | 1499 | & CQ TEST W0VB DN74 | 174745 | Tx | 1500 | & | W0VB K5ND EM12 |
| 174330 | 0 | 3.9 | 1502 | & CQ TEST W0VB DN74 | 174815 | Tx | 1500 | & | W0VB K5ND EM12 |
| 175400 | -3 | 14.9 | 1501 | & K5ND W0VB DN74 | 174845 | Tx | 1500 | & | W0VB K5ND EM12 |
| 175600 | 1 | 0.9 | 1508 | & <K5ND W0VB> RRR | 174915 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 174945 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175015 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175045 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175115 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175145 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175215 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175245 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175315 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175345 | Tx | 1500 | & | W0VB K5ND EM12 |
| | | | | | 175400 | -3 | 14.9 | 1501 | & K5ND W0VB DN74 |
| | | | | | 175415 | Tx | 1500 | & | W0VB K5ND R EM12 |
| | | | | | 175445 | Tx | 1500 | & | W0VB K5ND R EM12 |
| | | | | | 175515 | Tx | 1500 | & | W0VB K5ND R EM12 |
| | | | | | 175545 | Tx | 1500 | & | W0VB K5ND R EM12 |
| | | | | | 175600 | 1 | 0.9 | 1508 | & <K5ND W0VB> RRR |
| | | | | | 175615 | Tx | 1500 | & | <W0VB K5ND> 73 |

Answering CQ TEST, which usually means Contest Mode, Short-Hand on 2 meter MS QSOs

10 minutes for a reply

Note the < brackets > for the SH

QSY QSO

QSY CQ CALL

The screenshot displays two windows: 'Band Activity' and 'Tx Messages'. The 'Band Activity' window shows a list of signals with columns for dB, T, Freq, and Message. The 'Tx Messages' window shows a list of transmitted messages with columns for UTC, dB, T, Freq, and Message. A yellow arrow points from the 'Tx Messages' window to the text on the right. Another yellow arrow points to the 'Tx CQ 260' dropdown menu in the control panel.

| Band Activity | | | | Tx Messages | | | | |
|---------------|------|------|-----------------------------|-------------|----|------|----------------------|-----------------------------|
| dB | T | Freq | Message | UTC | dB | T | Freq | Message |
| -1 | 8.9 | 1523 | & WSSUM NOLL/P RRR | 103300 | -2 | 8.2 | 1521 | & WSSUM NOLL/P RRR |
| 0 | 12.3 | 1521 | & WSSUM NOLL/P RRR | 103315 | Tx | 1500 | & NOLL/P K5ND EM12 | |
| 0 | 12.3 | 1520 | & WSSUM NOLL/P RRR | 103345 | Tx | 1500 | & NOLL/P K5ND EM12 | |
| 2 | 0.8 | 1525 | & WSSUM NOLL/P RRR | 103400 | 4 | 0.7 | 1525 | & K5ND NOLL/P +00 |
| 4 | 0.9 | 1523 | & WSSUM NOLL/P RRR | 103415 | Tx | 1500 | & NOLL/P K5ND R EM12 | |
| 5 | 8.5 | 1524 | & WSSUM NOLL/P RRR | 103430 | -4 | 5.5 | 1525 | & K5ND NOLL/P RRR |
| 6 | 8.5 | 1524 | & WSSUM NOLL/P RRR | 103430 | 2 | 14.2 | 1515 | & K5ND NOLL/P RRR |
| 6 | 9.3 | 1486 | & CQ 250 KG5CCI EM07 U.S.A. | 103445 | Tx | 1500 | & NOLL/P K5ND 73 | |
| 4 | 12.0 | 1524 | & WSSUM NOLL/P RRR | 103515 | Tx | 1500 | & NOLL/P K5ND 73 | |
| 4 | 0.7 | 1525 | & K5ND NOLL/P +00 | 103835 | | | | QSY 50.250 |
| -4 | 5.5 | 1525 | & K5ND NOLL/P RRR | 103500 | 0 | 2.5 | 1493 | & CQ 250 KG5CCI EM07 U.S.A. |
| 2 | 14.2 | 1515 | & K5ND NOLL/P RRR | 103900 | 1 | 8.5 | 1494 | & W55N KG5CCI 73 |
| 0 | 2.5 | 1493 | & CQ 250 KG5CCI EM07 U.S.A. | 103916 | Tx | 1500 | & KG5CCI K5ND EM12 | |
| 14 | 1.3 | 1488 | & NOLL/P WASTKU R+06 | 103945 | Tx | 1500 | & KG5CCI K5ND EM12 | |
| 14 | 0.5 | 1487 | & NOLL/P WASTKU R+06 | 104000 | 2 | 10.2 | 1475 | & K5ND KG5CCI -03 |
| 13 | 1.4 | 1487 | & NOLL/P WASTKU 73 | 104015 | Tx | 1500 | & KG5CCI K5ND R EM12 | |
| 13 | 0.4 | 1489 | & NOLL/P WASTKU 73 | 104030 | 0 | 6.4 | 1492 | & K5ND KG5CCI -03 |
| 12 | 1.2 | 1487 | & NOLL/P WASTKU 73 | 104030 | 1 | 6.4 | 1493 | & K5ND KG5CCI -03 |

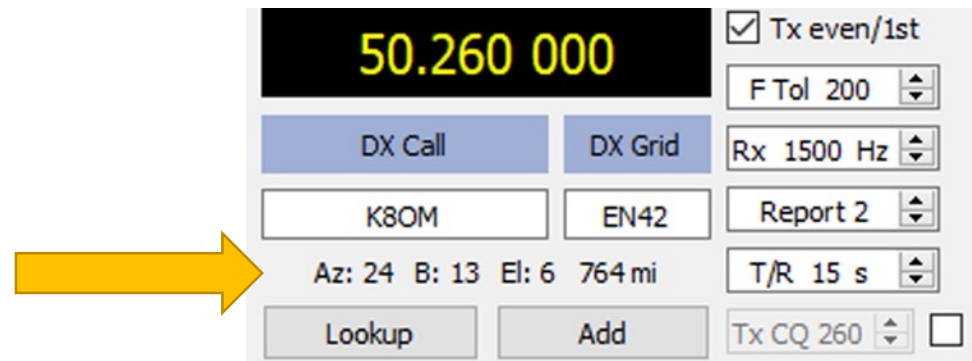
Control Panel:

- Stop, Monitor, Erase, Decode, Enable Tx, Halt Tx, Tune
- 50.250 000
- DX Call, DX Grid, Report 1, T/R 15 s, Tx CQ 260
- Generate Std Msgs, Next, Now, Tx 1, Tx 2, Tx 3, Tx 4, Tx 5, Tx 6
- KG5CCI K5ND 73, CQ TEST K5ND EM12

Used during heavy activity levels
Call on the Calling Frequency
QSY to another frequency for QSO

Meteor Scatter Gear

- Computer and Rig Interface
- Rig with 100+ watts on 6 meters
- High power is helpful, particularly on 2 meters
- Directional antennas are best – Preamps on 2
- K1JT recommends 16-degree beamwidth for long paths and 32-degree beamwidth for shorter paths
- B or A indicate optimum offset azimuth vs. Az direct
- See the window on WSJT for Azimuth and Elevation





My station uses a push-up mast in the backyard with simple antennas.

Running about 200 watts on both 6 and 2.

Personal Distance Records:

6 m - N6RMJ - DM14 - 1,195 miles

2 m - W3XTT - FN01 - 1,224 miles

**Get on
the Air**

WSJT-X Operating Manual

https://physics.princeton.edu//pulsar/k1jt/wsjt-x-doc/wsjt-x-main-2.5.4.html#_msk144

WSJT References Page – MSK144 Protocol, QEX July/August 2017

<https://physics.princeton.edu//pulsar/k1jt/refs.html>

VHF Meteor Scatter—An Astronomical Perspective

By Michael Owen, W9IP/2, QST June 1986

References

Thanks.

Jim Wilson

K5ND.
RADIO