



# Using Digital Modes for Terrestrial Microwave QSO's

- 
- Doug Millar K6JEY
  - Microwave Update 2017

# Current 10 GHz EME/terrestrial portable Station



# This Talk is About-

- The hardware parameters
- The additional techniques
- The challenges to moving ahead.
- General WSJT info is available in  
The reference section

# Hardware for JT mode

- Frequency stability at 10GHz
  - OCXO may be enough
- Time Source- within 2 seconds
  - GPS USB RX (BU 353 S4 ) and an NMEA Time Program from VisualGPS LLC
  - Accurately set watch. (2sec/day)
- Back end –
  - FT 817 with TCXO-9. ( Ebay TCXO \$10)
  - Elecraft K3.
  - Tigertronics USB interface. Mod. by AB8VJ



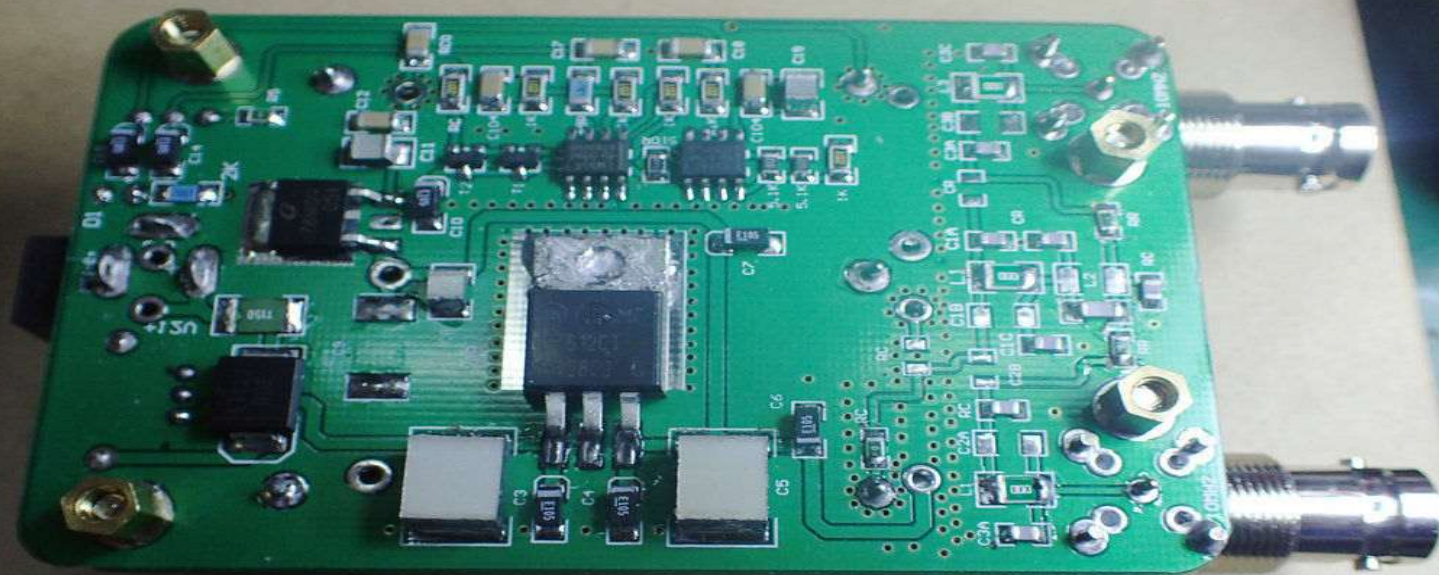
# Good OCXO

$1 \times 10^{-11}$ th



Ebay seller AMOJ1010  
\$68

DC/DC supply  
BNC/SMA  
Buffered output





# Back end Set up.

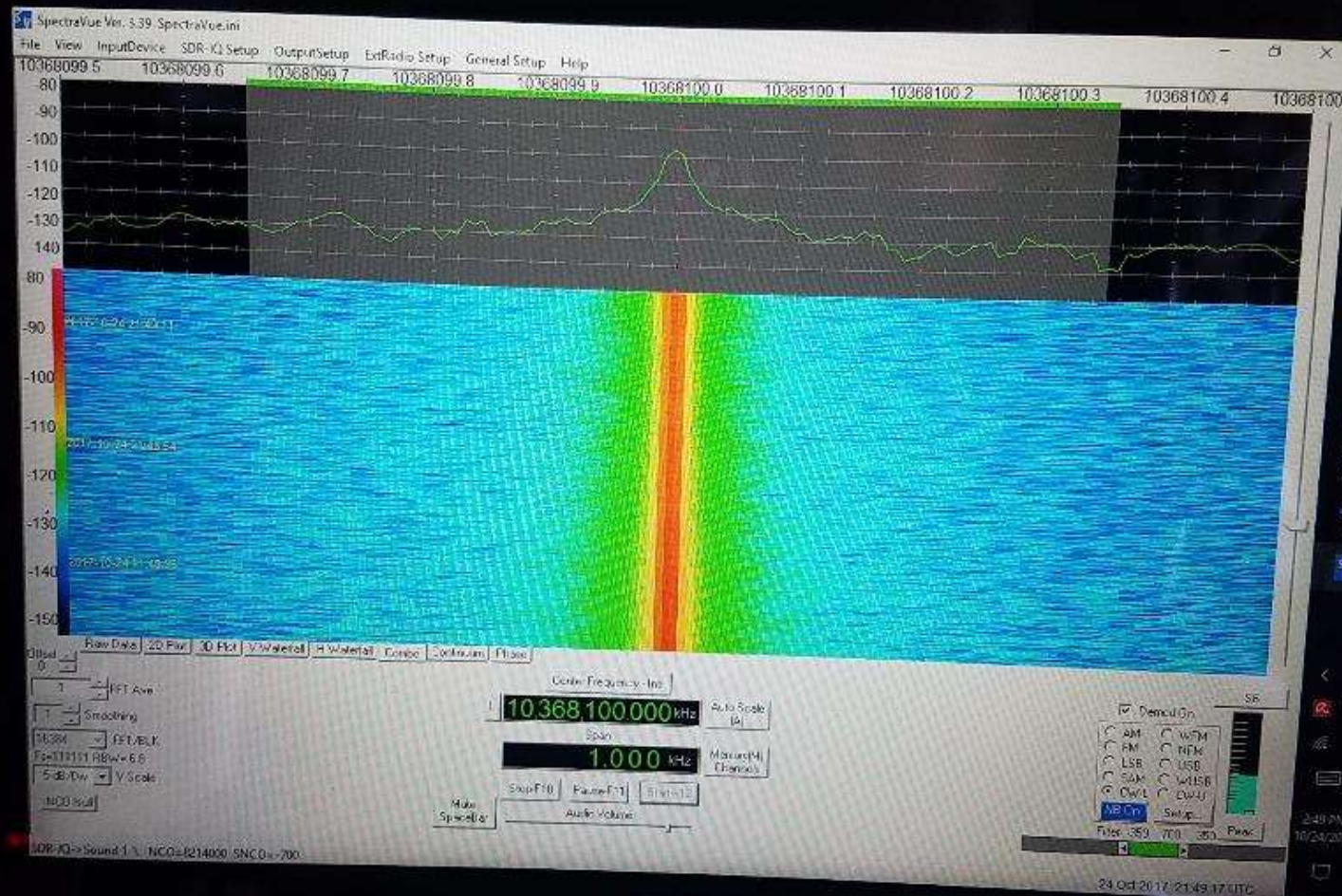
K3 and SDR IQ are reading the corrected freq.  
All units can run off of a battery





# Stability Results for OCXO

Source was  $1.2 \times 10^{-12}$  Generator to radio at 10GHz



Changed only a few Hz over 10 minutes



# Handy Voltage/Current Checker



UT 210E  
\$25 for the meter

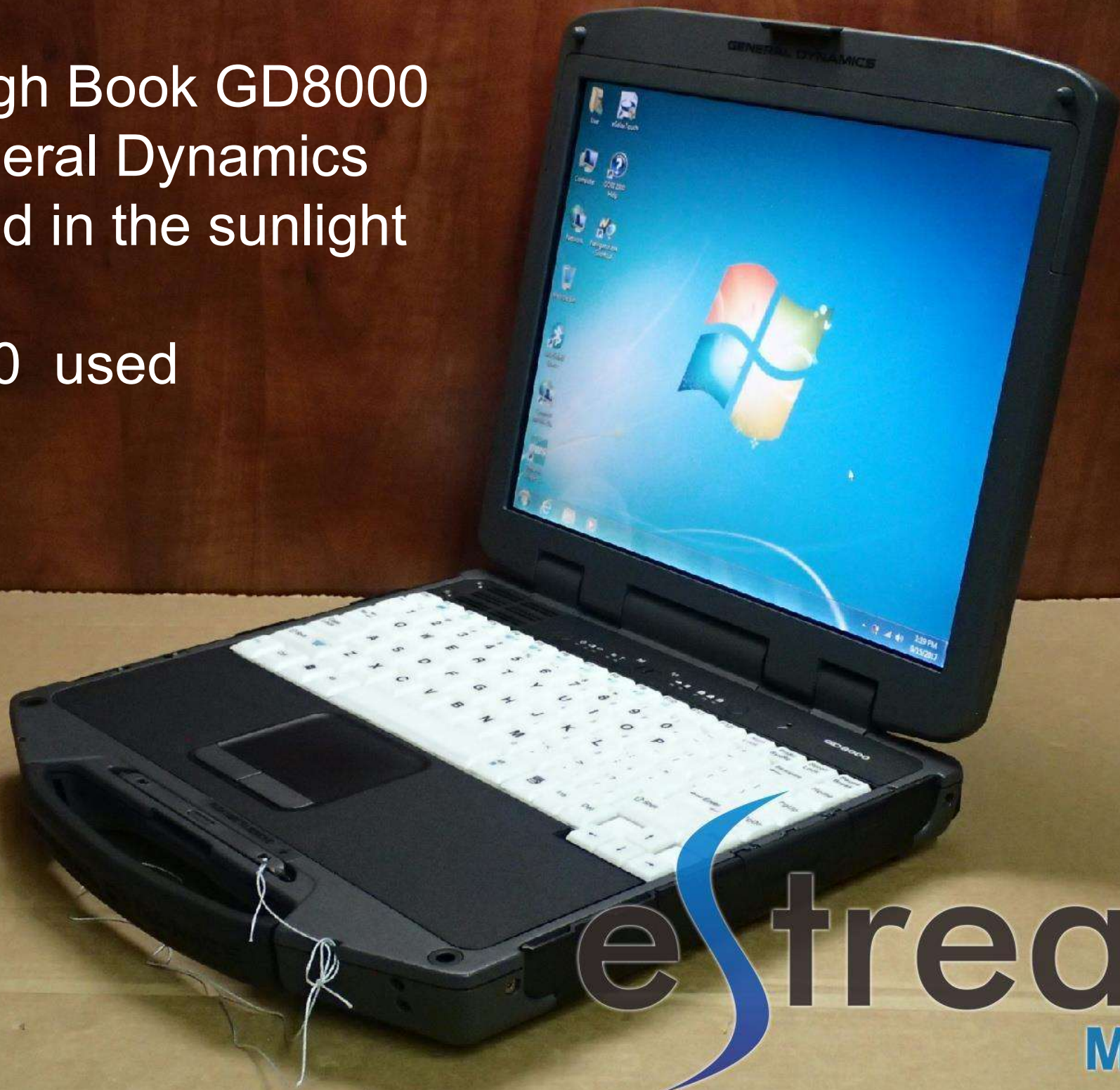


# Computer Displays

- Solutions
  - Use a hood? Walt Clark and W6SZ
  - Use another display/computer?
  - Work Inside?
- N6NB's solution
  - Have the RF on the roof and the back end in the car. Mobile microwave.
- Industrial surplus-

Tough Book GD8000  
General Dynamics  
Good in the sunlight

\$250 used





Planar 12" VGA monitor.  
Surplus police patrol car  
About \$120



# Contest Techniques

- JT contact should be worth the points
  - Minimize set up and take down.
  - Do all your digital operating at one time, or at least schedule it.
- Use a digital calling frequency around **10,368.600MHz** to avoid QRM.
- Use the synch tone to line up.
- Same techniques, different mode.




# Station Design

- JT mode has more wires so simplify and test equipment lay out, cable runs .
- Make a schedule at home with another station to test out the rig.
- Practice JT mode on HF.
- You now have three tasks to do-
  - RF, liaison, and computer.
  - Do you need two operators- computer and radio ?



# Which Mode?

- I think this question is best resolved in the field.
  - Start with
    - JT65 - 48sec
    - FT8- 15 seconds
    - QRA 64- airplane scatter
  - Over time the most useful modes will win out.
- 

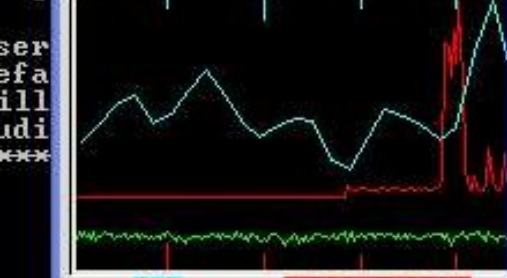


# JT Mode WSJT 7

- Practice on HF
- Get someone to tutor you.
- Lots of good net resources and videos.
- Here is a quick overview of JT65 screens.

Audio Device    Input Channels    Output Channels

0  
1 WSJT 7 by K1JT  
2  
3  
4  
5



6.8    1.0000    1.0000

| FileID | Sync | dB  | DT   | DF        |
|--------|------|-----|------|-----------|
| 222300 | 0    | -33 | 10.0 | -869 1    |
| 222400 | 0    | -21 | 2.3  | -928 6    |
| 222400 | 0    | -19 | 5.5  | -915 4    |
| 222400 | 0    | -19 | 5.5  | -915 3    |
| 222500 | 0    | -33 | 0.5  | -923 3    |
| 222600 | 1    | -17 | 2.3  | -869 20 * |

222600 1 1/2    CQ DL7APV J062    1    0

222600 2 0/2

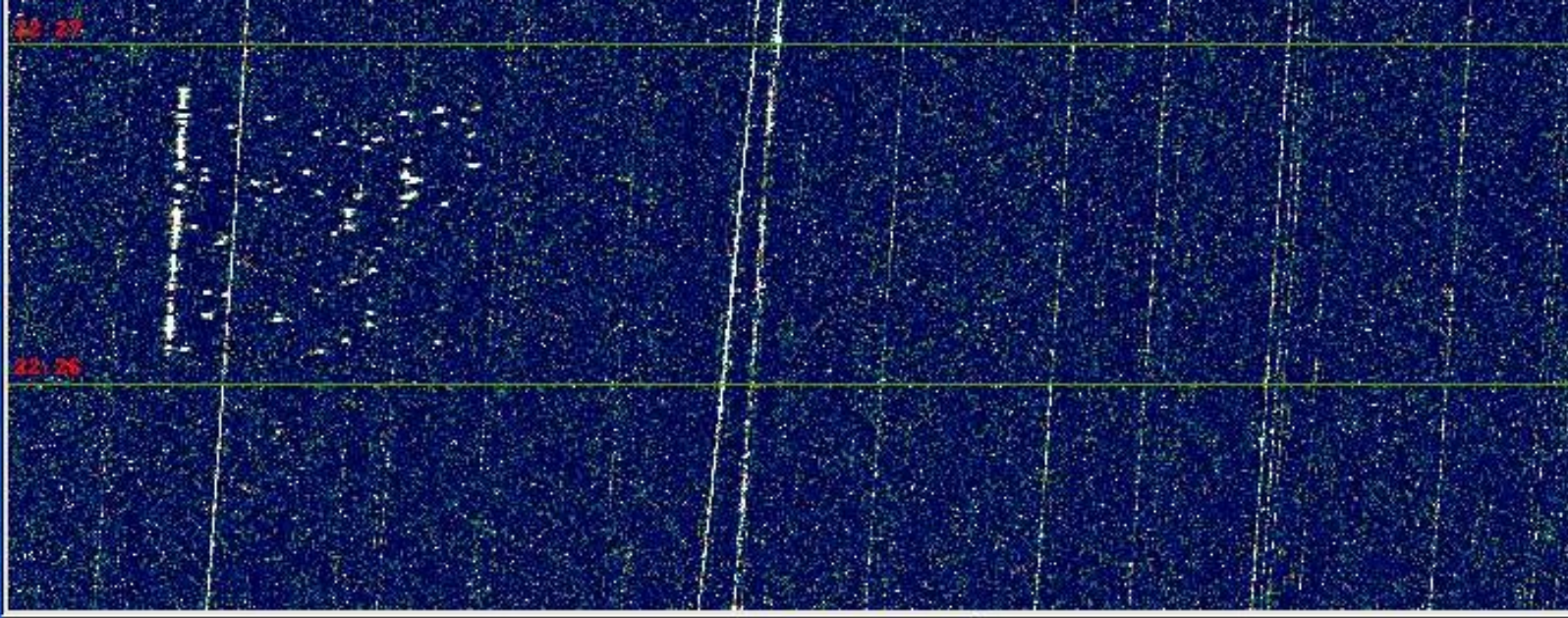
Log QSO    Stop    Monitor    Save    Decode    Erase    Clear Avg    Include    Exclude    TxStp

To radio: IS0M0JU    Lookup

Grid: JN40dn    Add

Az: 38    6286 mi

**2010 Jan 23**  
**22:27:19**

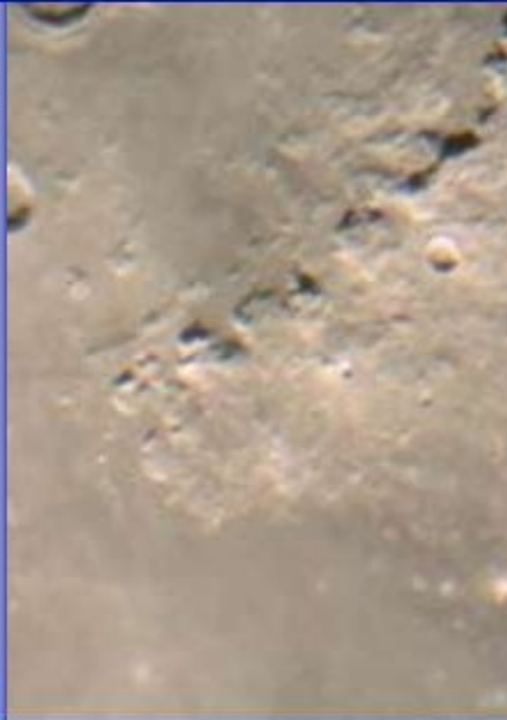


22:27:19

Tx First    IS0M0JU K6JEY    Tx1  
 28 Rpt    IS0M0JU K6JEY 000    Tx2  
 Sh Msg    RO    Tx3  
 TxDF = 0    RRR    Tx4  
 GenStdMsgs    73    Tx5  
 Auto is Off    CQ K6JEY DM03    Tx6

1.0002 1.0070    JT65B    Freeze DF: -833    Rx noise: 0 dB    TR Period: 60 s    Receiving

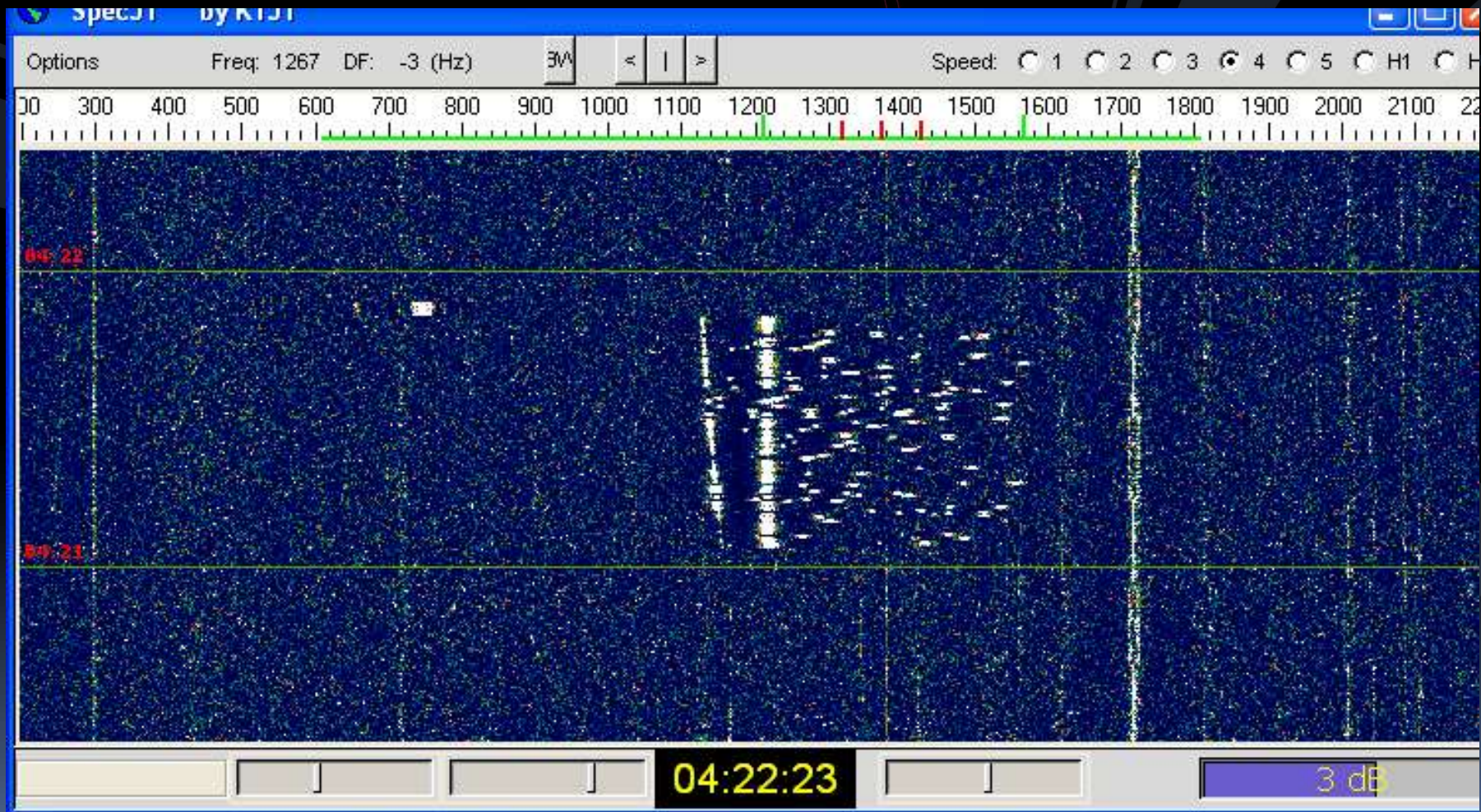
start    SM 5 BSZ - Dy...    WSJT7    WSJT 7 b...    SpecJT by...





# JT65 Screen Shots.

JT 65 signal





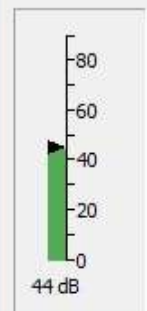
| Band Activity |     |      |      |                      | Rx Frequency |     |      |      |                      |
|---------------|-----|------|------|----------------------|--------------|-----|------|------|----------------------|
| UTC           | dB  | DT   | Freq | Message              | UTC          | dB  | DT   | Freq | Message              |
| 2315          | -4  | 0.1  | 1195 | # KC2YIL VA7RME -19  | 2309         | -20 | -0.5 | 602  | # CG7GEL JA1EGN PM95 |
| 2315          | -5  | 0.8  | 1492 | # KM6DUU AJ5ZX -01   | 2310         | -12 | 0.1  | 601  | # JA1EGN CG7GEL -15  |
| 2315          | -11 | 0.1  | 1712 | # CQ AS VE3MZD EN82  | 2312         | -11 | 0.1  | 601  | # JA1EGN R TU73      |
| 2315          | -9  | -3.0 | 2229 | # CQ W5GAK EM15      | 2313         | -18 | -0.6 | 600  | # CG7GEL JA1EGN 73   |
| 2315          | -12 | -2.4 | 997  | # JA7NX W3EJ EM66    | 2314         | -11 | 0.1  | 609  | # KE0PX CG7GEL -17   |
| 2315          | -18 | 2.5  | 1432 | # AJ5ZX W4DSH -09    |              |     |      |      |                      |
| 2315          | -12 | -0.6 | 1701 | # VE3MZD JA1EGN PM95 |              |     |      |      |                      |
| 2316          | -15 | -0.3 | 402  | # CF3LLZ K5AGE 73    |              |     |      |      |                      |
| 2316          | -22 | -0.4 | 995  | # HL4CYG JA7NX -05   |              |     |      |      |                      |
| 2316          | -15 | -0.9 | 1111 | # CQ WA2AXO FN30     |              |     |      |      |                      |
| 2316          | -8  | -0.7 | 1185 | # VA7RME KC2YIL R-08 |              |     |      |      |                      |
| 2316          | -15 | 0.1  | 1712 | # VE3MZD LU1EFX GF05 |              |     |      |      |                      |
| 2316          | -5  | 0.1  | 2229 | # W5GAK WX7SJ CN88   |              |     |      |      |                      |
| 2316          | -12 | 1.0  | 1172 | # CQ DX WA0PMO EN42  |              |     |      |      |                      |
| 2317          | -9  | 0.2  | 402  | # CQ CF3LLZ FN03     |              |     |      |      |                      |
| 2317          | -6  | 0.5  | 731  | # HL1BX WB7EC -19    |              |     |      |      |                      |
| 2317          | -17 | -2.0 | 996  | # JA7NX W3EJ EM66    |              |     |      |      |                      |
| 2317          | -2  | 0.1  | 1194 | # KC2YIL VA7RME RRR  |              |     |      |      |                      |
| 2317          | -19 | 0.8  | 1491 | # KM6DUU AJ5ZX RR73  |              |     |      |      |                      |
| 2317          | -8  | 0.4  | 1965 | # CQ KG5LWL EM35     |              |     |      |      |                      |
| 2317          | -19 | -0.5 | 2027 | # CQ JA1EGN PM95     |              |     |      |      |                      |

WSJT x Mode

Log QSO Stop **Monitor** Erase Decode Enable Tx Halt Tx Tune  Menus

20m

**14.076 000**



Tx even/1st Tx JT65 #  
 DX Call: JA1EGN DX Grid: PM95 Tx 602 Hz Tx ← Rx  
 Az: 298 13264 km Rx 2254 Hz Rx ← Tx  
 Lock Tx=Rx  
 Report -20  
**2017 Oct 10 23:18:10**

Generate Std Msgs

| Msg         | Next                             | Now                   | Pwr  |
|-------------|----------------------------------|-----------------------|------|
| JA1EGN      | <input type="radio"/>            | <input type="radio"/> | Tx 1 |
| JA1EGN -20  | <input checked="" type="radio"/> | <input type="radio"/> | Tx 2 |
| JA1EGN R-20 | <input type="radio"/>            | <input type="radio"/> | Tx 3 |
| JA1EGN RRR  | <input type="radio"/>            | <input type="radio"/> | Tx 4 |
| JA1EGN 73   | <input type="radio"/>            | <input type="radio"/> | Tx 5 |
|             | <input type="radio"/>            | <input type="radio"/> | Tx 6 |



# Waterfall.

## FT8 Left, JT65 right



# Suggested Procedures for a Digital QSO

- Let's say that K6JEY is on Mt. Wazzat in Nevada.
- He announces on liaison that he will work FT8 on .600 and will transmit on even minutes, sending pilot tones starting at 4pm local. (15 seconds each)
- The receiving station announces they would like to work him and tells him the direction. He sends pilot tones for the second sequence.
- If signals are usable, JEY begins sending regular FT8 messages on the third sequence and the QSO is underway.



# Challenges

- We need more field experience to see which modes and practices work best.
- We need an effective answer to the computer monitor problem.
- We may want a separate contest for digital.
- We may want a separate entry category for existing contests.
- We may want to use 10,368.600MHz
- to avoid QRM.



# Additional Resources

“Work the World with WSJT X.....Part 2”  
by Joe Taylor et al.

QST November 2017 Pgs. 34-39

Good thorough discussion.

<http://www.nmvhf.org/wsjt.pdf>



This talk is available at:

[http://www.nitehawk.com/k6jey/k6jey\\_download.html](http://www.nitehawk.com/k6jey/k6jey_download.html)



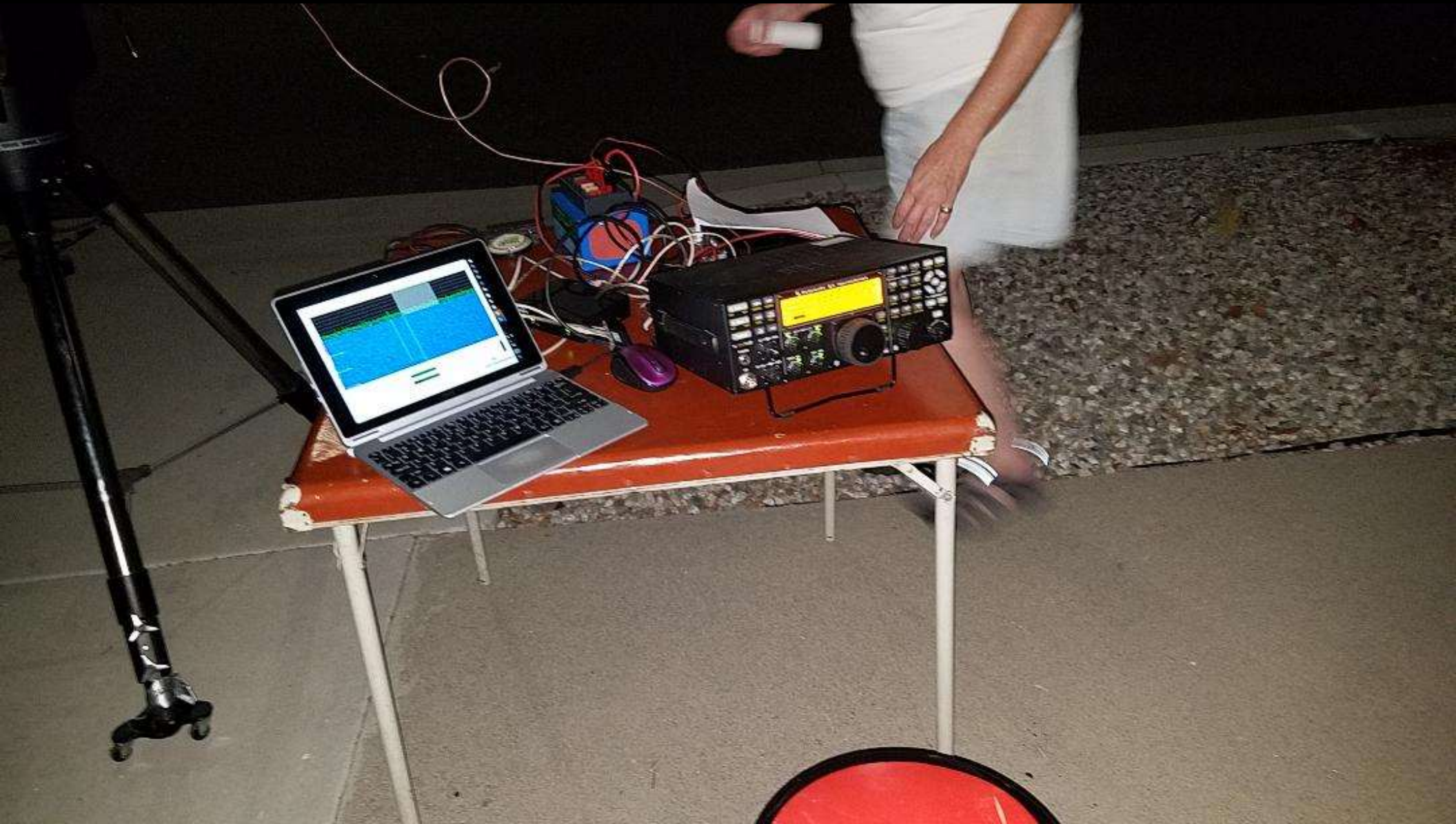
- Questions?
- Many thanks to Rein W6SZ for his guidance.





Fin

# EME JT mode Set Up



K3 and Acer One notebook, all on battery



