INTRODUCTION TO FT8

THE BASICS

WHAT IS FT8?

- FT8 is the most popular of the digital modes.
- It was developed and released in 2017 by Steven Franke (K9AN) and Joe Taylor (K1JT).
- Named after the developers, FT, with the 8 coming from its 8-frequency shift keying format (more on this later).
- It handles weak signals, noise and fading very well.
- It is much faster than the similar JT65.
- It is semi-automated with a predictable sequence of messages to constitute a QSO.
- Messages are limited to 13 characters.
- FT8 has a perpetual series of 15-second periods during which messages are sent and/or received.

WHAT IS FT8?

- FT8 is sometimes called a sound-card mode.
- It uses a sound card to carry audio from your receiver into a computer for processing by software.
  - The software decodes the information embedded in the received signal.
- Then the process is reversed for transmitting.
  - The software encodes your message into audio tones that are sent to the transmitter via the sound card.
- Here is what an FT8 signal sounds like:

ADVANTAGES OF FT8

- Can copy very weak signals.
  - Good for low power stations.
  - Good for stations with compromise antennas.
- Has short, canned messages for redundancy. e.g., CQ K2PS EL98
- Messages transition automatically from one to the next.
- An entire contact can take place in one minute.
- Specific frequencies on each band are used by agreement for FT8.
  - You don't have to tune up and down the band to find stations to work.

1.840	24.915
3.573	28.074
7.074	50.313
10.136	50.323
14.074	70.154
18.100	144.174
21.074	

EXAMPLE OF A CONTACT WITH FT8

- CQ K2DM EL88
- K2DM N0SMX EL98
- N0SMX K2DM -03
- K2DM N0SMX R+02
- N0SMX K2DM RR73
- K2DM N0SMX 73

- The entire sequence took 90 seconds!

- ➢K2DM sends CQ during the first 15-sec period
- ➢N0SMX answers during the next period
- ➢K2DM sends a signal report to N0SMX
- ➢N0SMX rogers and sends a report back
- ➢K2DM rogers and says 73
- ➢N0SMX sends 73

WHAT DO YOU NEED FOR FT8?

- A transceiver with data or SSB capability.
- A computer capable of running FT8 software.
  - Most common software is WSJT-X developed by Franke and Taylor.
- Time synchronization for the computer.
  - Very important for the 15-sec transmit/receive periods to be synchronized between stations.
- An audio interface.
  - Typically a sound card interface providing:
    - A way to get receive audio from the radio into the computer and
    - A way to get audio output of the computer into the radio.
  - Many modern radios have a sound card interface built in.
  - Older, or more basic, radios require an external sound card interface.

EXTERNAL SOUND CARD INTERFACES
FOR OLDER, MORE BASIC RADIOS

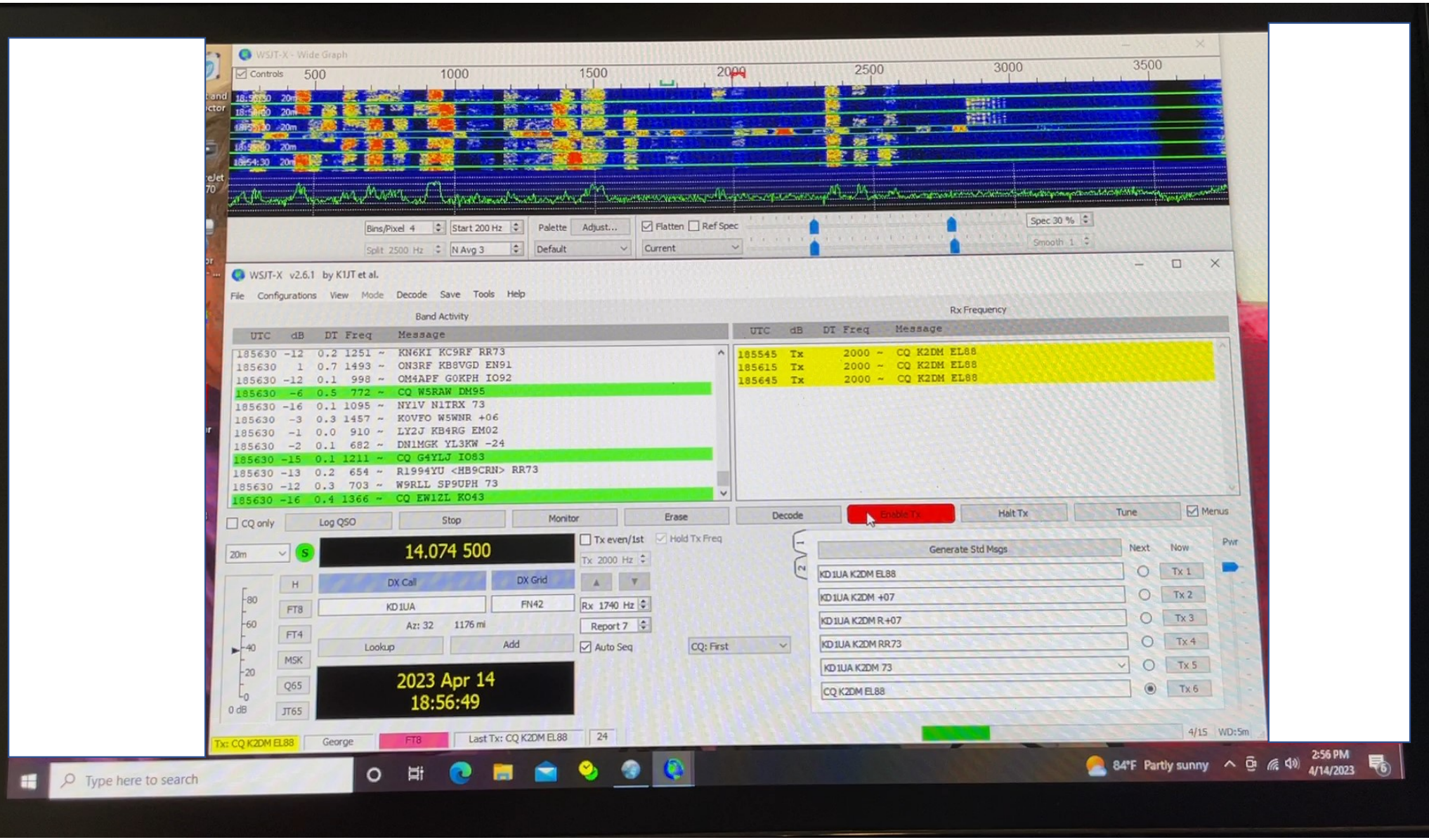
- Tigertronics SignalLink USB Interface Unit
  - Order with pre-built cable for your radio.
  - Connect the pre-built cable to your radio.
  - Connect a USB cable to your computer.

- MFJ 1204 Series USB Digital Mode Interface
  - Choose the model and cable combination that fits your radio.

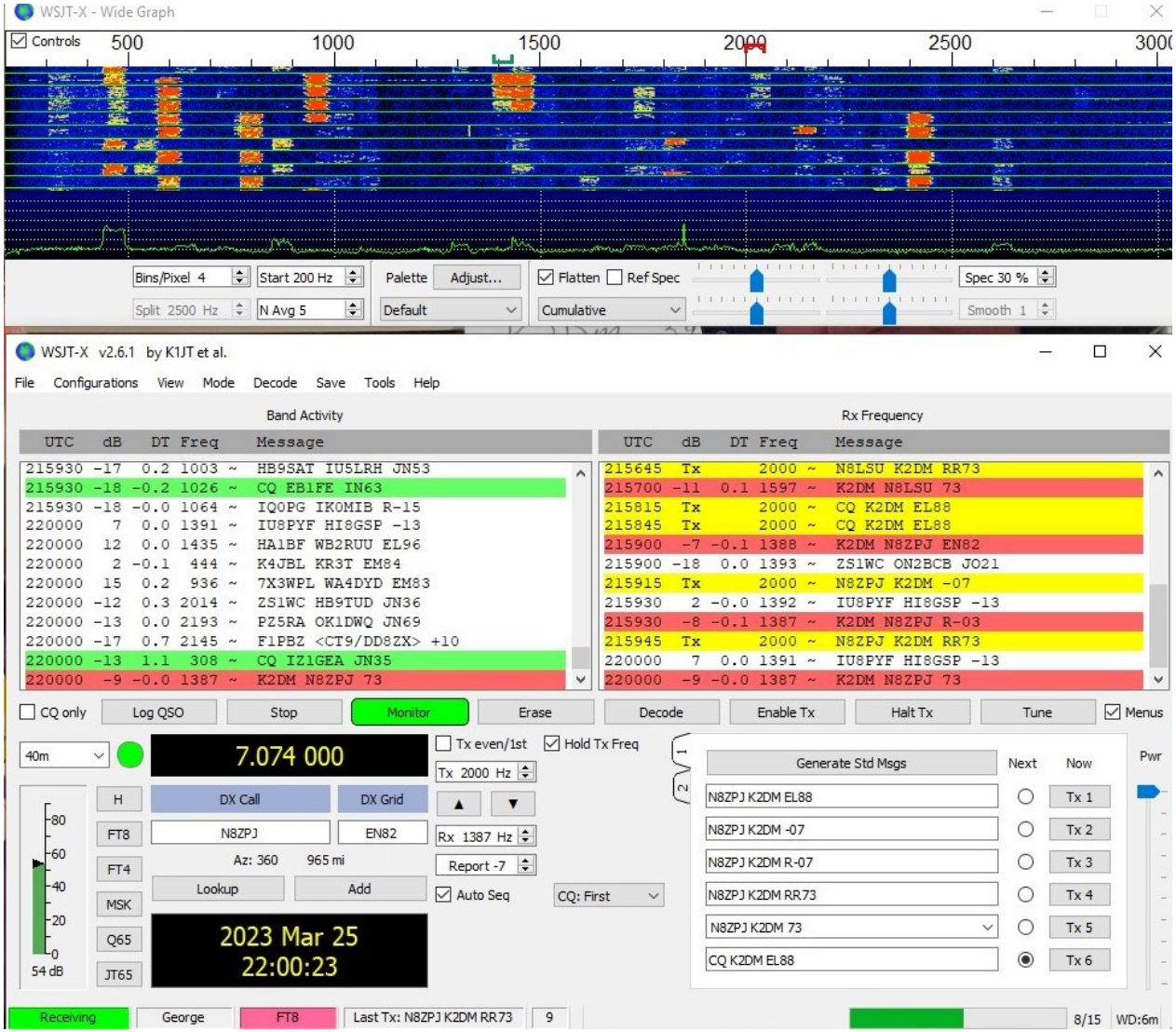
RADIOS AND FT8

- Best to have one capable of computer control.
- Nice to have one with a built-in sound card:
  - Icom IC-7300
  - Yaesu FT-991A
  - Kenwood TS-590S or SG
  - Icom IC-7100
  - Elecraft K3S
  - Flex
- Radios requiring an external sound card interface:
  - Icom IC-7000, IC-718
  - Elecraft K3
  - Kenwood TS-450, TS-850, TS-440
  - Yaesu FT-450

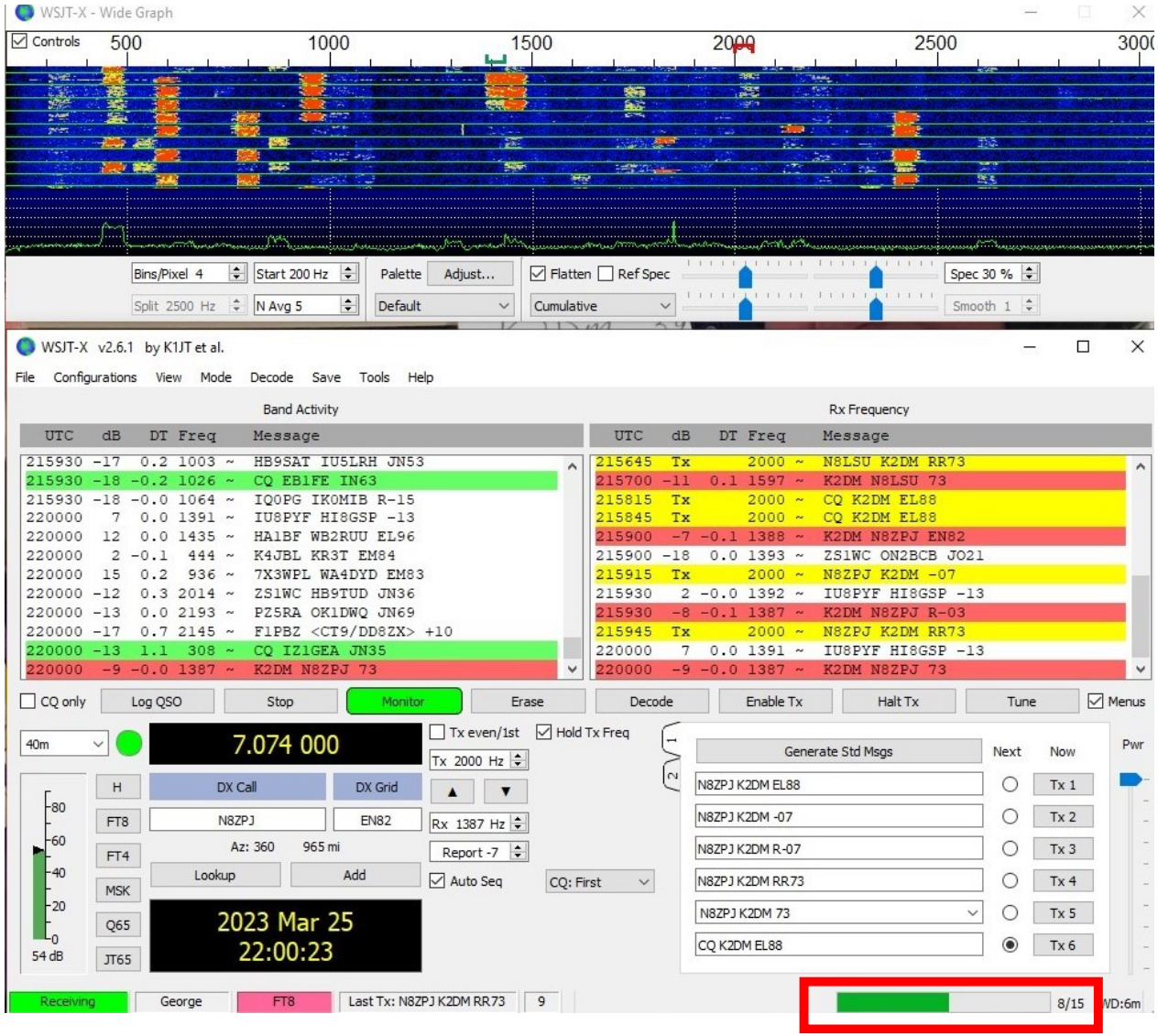
VIDEO OF COMPUTER SCREEN RUNNING FT8


WSJT-X - Wide Graph
Controls
500
1000
1500
2000
2500
3000
3500
Bins/Pixel 4
Start 200 Hz
Palette
Adjust...
Flatten
Ref Spec
Spec 30 %
Split 2500 Hz
N Avg 3
Default
Current
Smooth 1
WSJT-X v2.6.1 by K1JT et al.
File Configurations View Mode Decode Save Tools Help
Band Activity
Rx Frequency
UTC dB DT Freq Message
185630 -12 0.2 1251 ~ KN6KI KC9RF RR73
185630 1 0.7 1493 ~ ON3RF KB8VGD EN91
185630 -12 0.1 998 ~ OM4APF G0KPH IO92
185630 -6 0.5 772 ~ CQ W5RAW DM95
185630 -16 0.1 1095 ~ NY1V N1TRX 73
185630 -3 0.3 1457 ~ KOVFO W5WNR +06
185630 -1 0.0 910 ~ LY2J KB4RG EM02
185630 -2 0.1 682 ~ DN1MGK YL3KW -24
185630 -15 0.1 1211 ~ CQ G4YLJ IO83
185630 -13 0.2 654 ~ R1994YU <HB9CRN> RR73
185630 -12 0.3 703 ~ W9RLL SP9UPH 73
185630 -16 0.4 1366 ~ CQ EW1ZL KO43
185545 Tx 2000 ~ CQ K2DM EL88
185615 Tx 2000 ~ CQ K2DM EL88
185645 Tx 2000 ~ CQ K2DM EL88
CQ only
Log QSO
Stop
Monitor
Erase
Decode
Enable Tx
Halt Tx
Tune
Menus
20m
14.074 500
Tx even/1st
Hold Tx Freq
Tx 2000 Hz
H
FT8
FT4
MSK
Q65
JT65
DX Call
DX Grid
KD1UA
FN42
Rx 1740 Hz
Az: 32 1176 mi
Report 7
Lookup
Add
Auto Seq
CQ: First
2023 Apr 14
18:56:49
Generate Std Msgs
Next
Now
Pwr
KD1UA K2DM EL88
KD1UA K2DM +07
KD1UA K2DM R+07
KD1UA K2DM RR73
KD1UA K2DM 73
CQ K2DM EL88
Tx 1
Tx 2
Tx 3
Tx 4
Tx 5
Tx 6
Tx: CQ K2DM EL88
George
FT8
Last Tx: CQ K2DM EL88
24
4/15
WD:5m
Type here to search
84°F Partly sunny
2:56 PM
4/14/2023

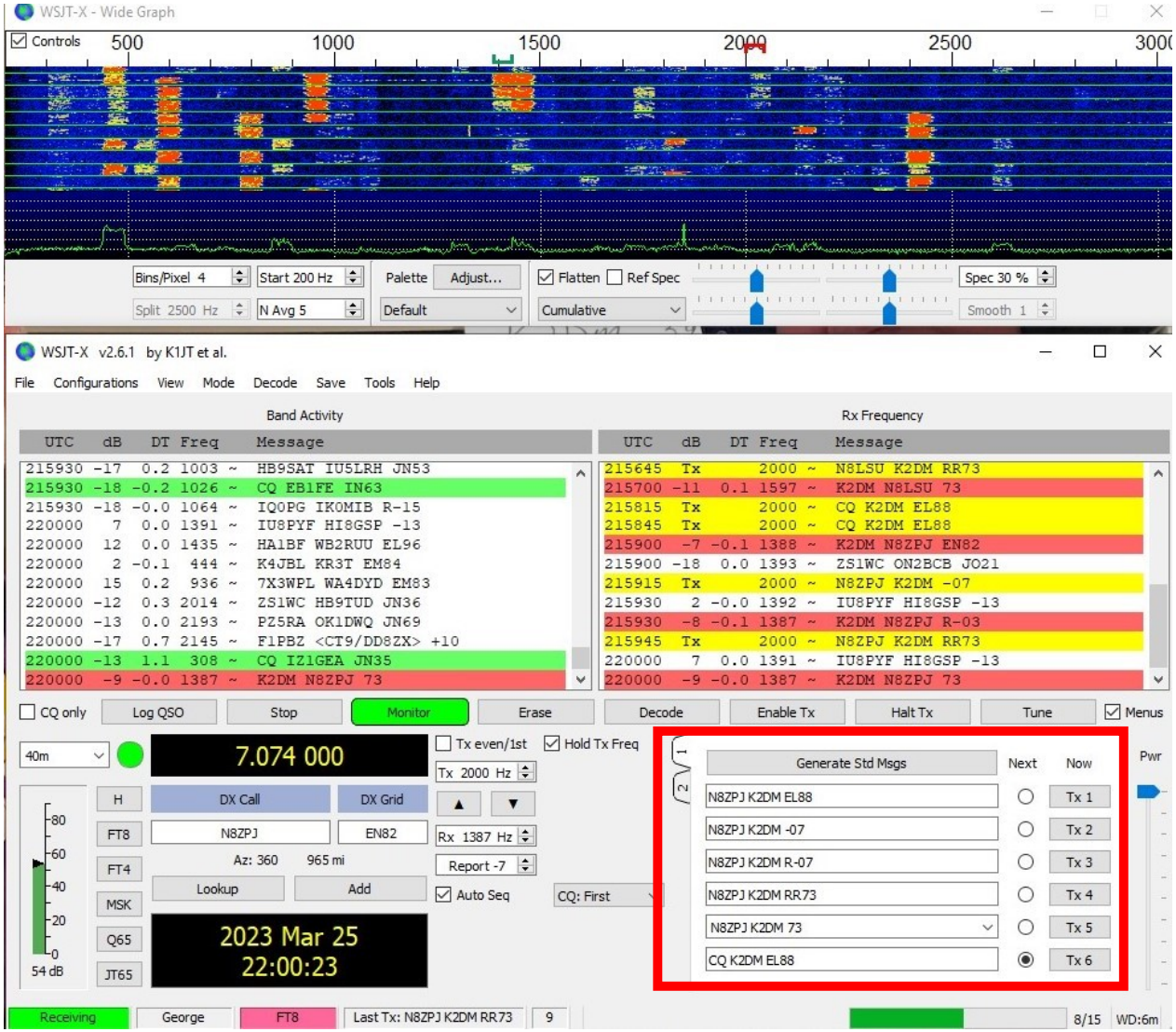
- Let’s spend some time breaking down what FT8 looks like on your computer screen.
- This example is of the WSJT-X FT8 software.
- There is a TON of information on this screen, and we will examine each major area.



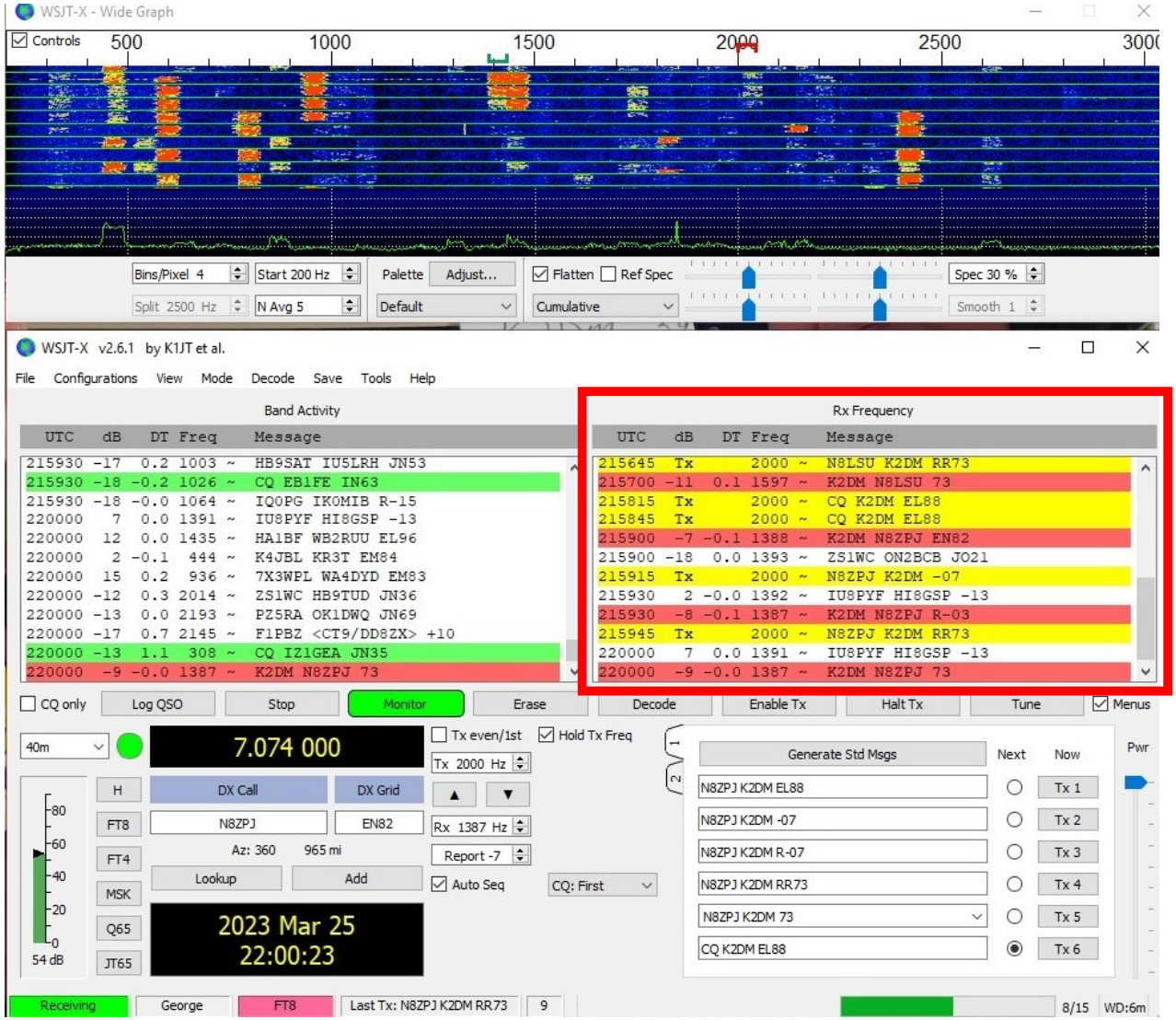
- Let’s start with this green bar at the bottom right of the screen.
- The bar shows the progression of the 15 seconds that make up an FT8 transmit/receive cycle.
- The first 13 seconds of each cycle are the transmit portion of the cycle, and the last 2 seconds are the signal processing portion of the cycle.
- These 15-second cycles keep rolling along whether you are transmitting or not.



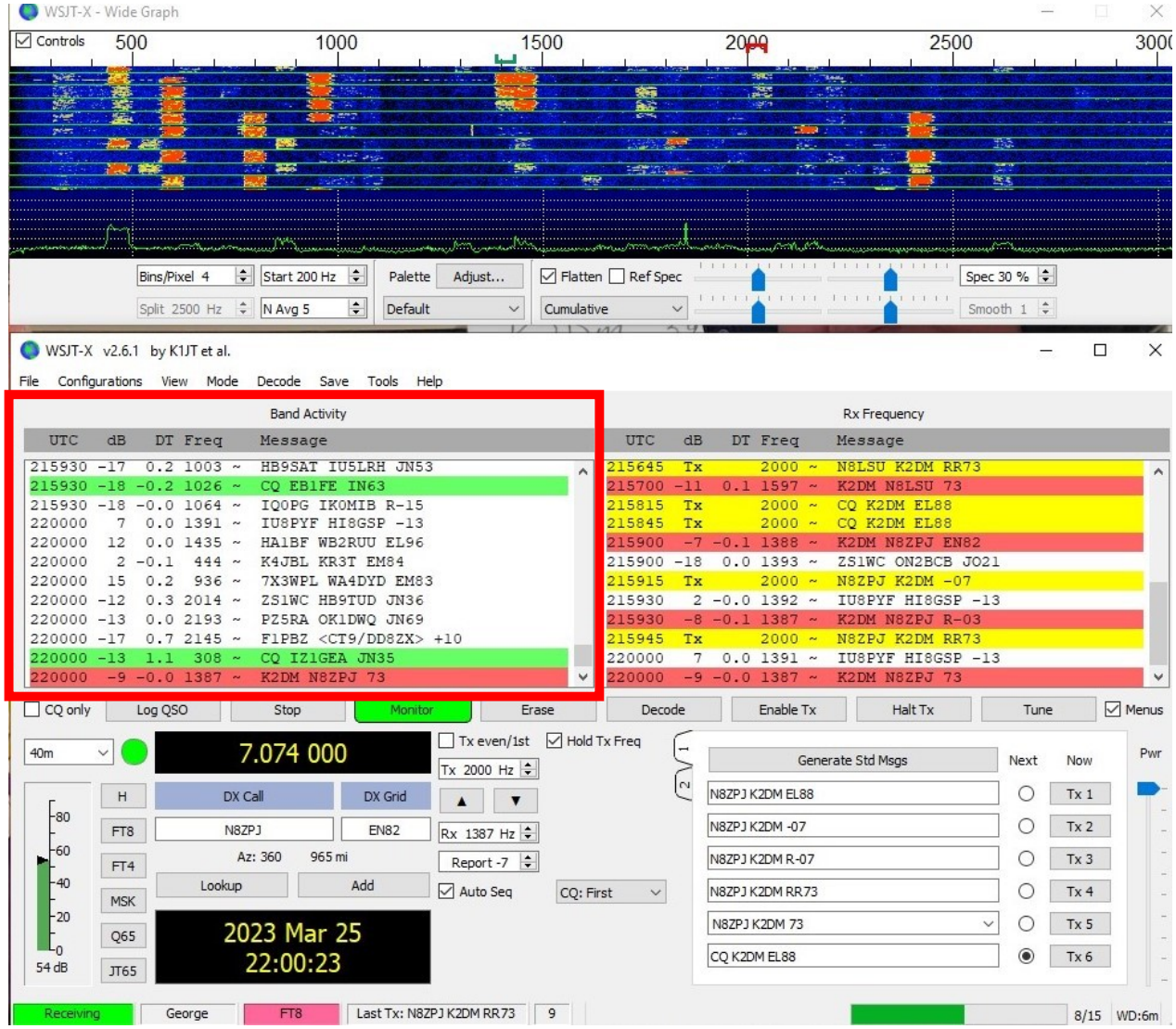
- This section lists the standard messages that you might transmit during a contact or to initiate a contact.
- Once a contact has been initiated, the messages will be sent in the proper order to complete the contact.
- You can force a particular message to be sent by selecting it in the column labeled “Next” and clicking the “Enable Tx” button.
- I just completed a QSO with N8ZPJ.



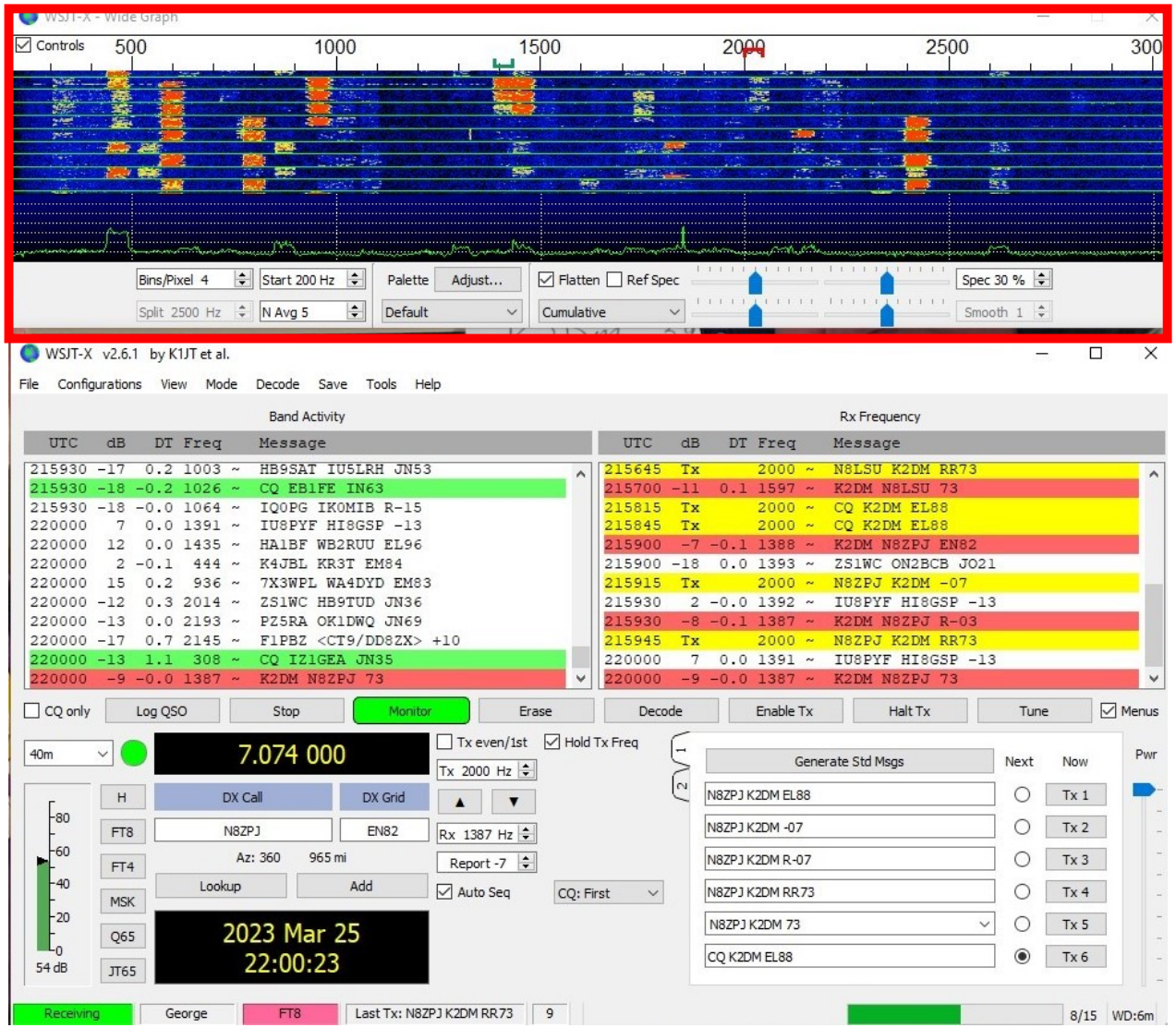
- The “Rx Frequency” portion of the WSJT-X screen lists:
  - Activity that occurs on, or very near, your receive frequency.
  - Your transmissions.
  - Transmissions of other stations that are calling you.
- These entries are color coded so you can tell what is happening at a glance.
- These entries are populated from the bottom and scroll up past the top.
- You can see how my QSO with N8ZPJ played out.



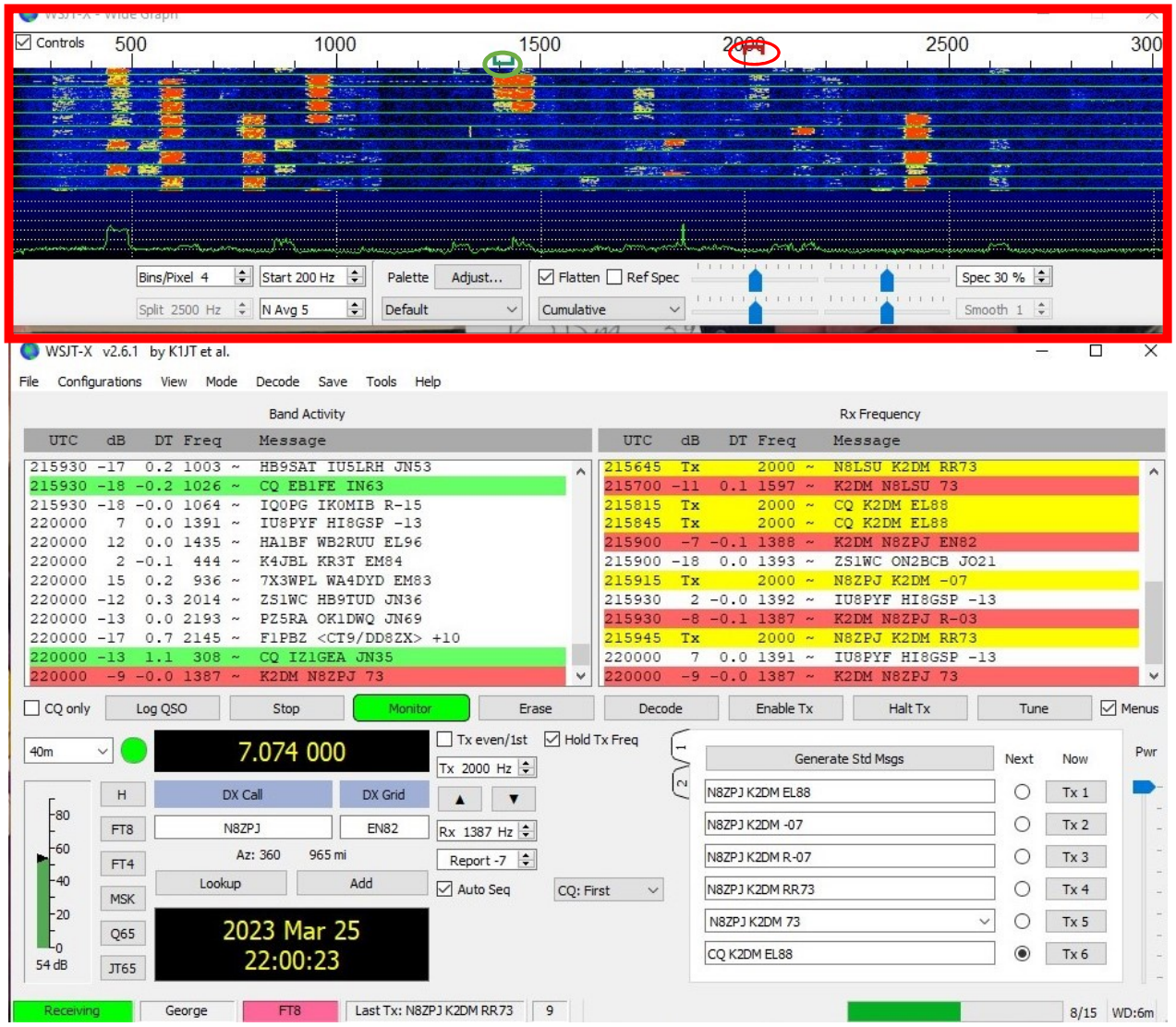
- The “Band Activity” portion of the WSJT-X screen lists stations that have been received during recent 15-second receive intervals.
- It is populated from the bottom.
- As it fills up (over one or more receive intervals) entries slide off the top of the area. Those entries can be recovered for a while using the slider to the right of the area.
- The area only populates after a receive interval.
- See that the last entry in the window is the ‘73’ message I received from N8ZPJ.



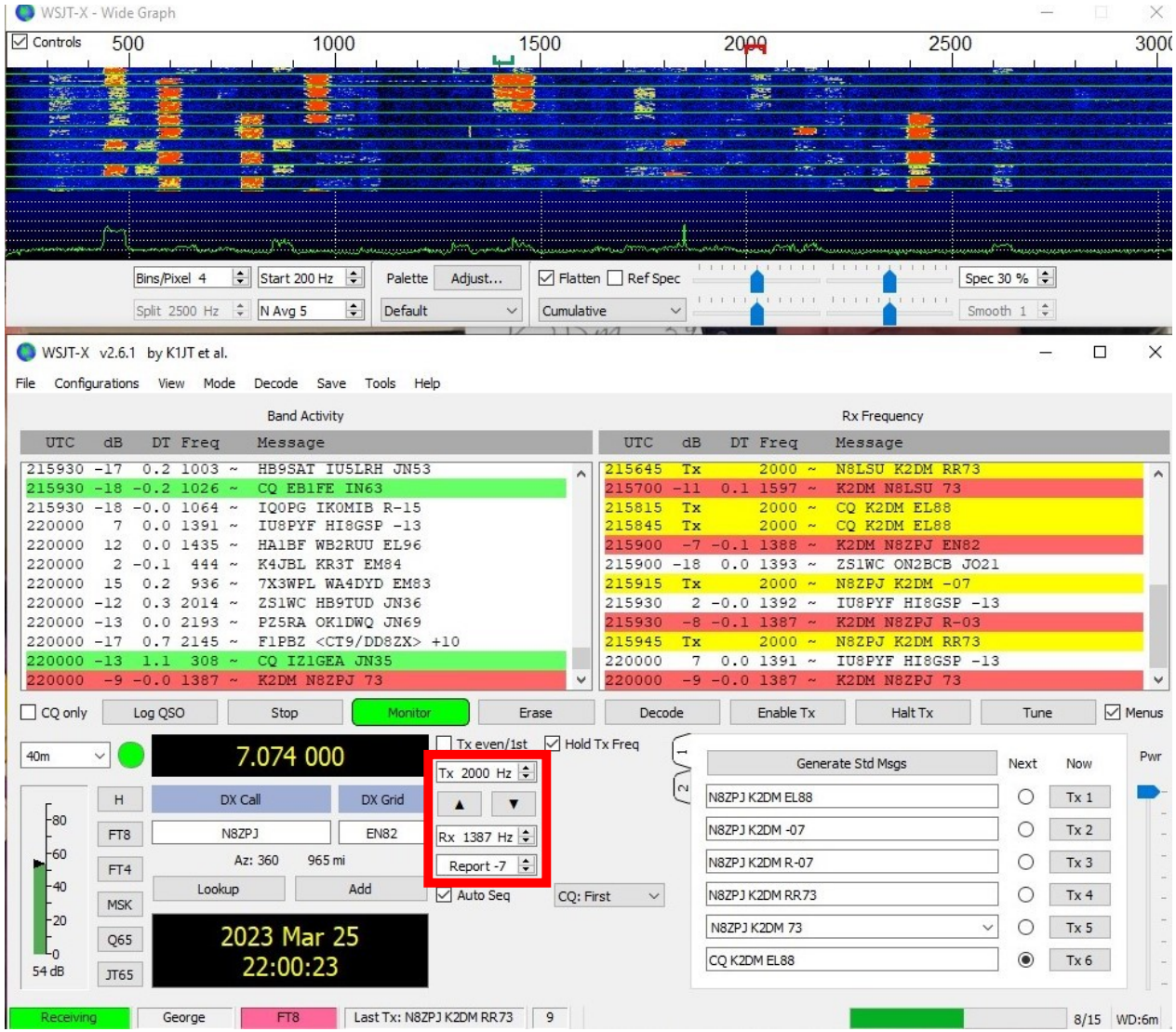
- This waterfall window comes on every time you start WSJT-X.
- It shows a graphic representation of ALL stations copied by WSJT-X during each 15-second receive window.
- Beneath the waterfall is a spectrum analyzer display of all activity within the defined frequency range and the current 15-second receive interval.
- Waterfall images remain on the display until they reach the bottom of the waterfall.



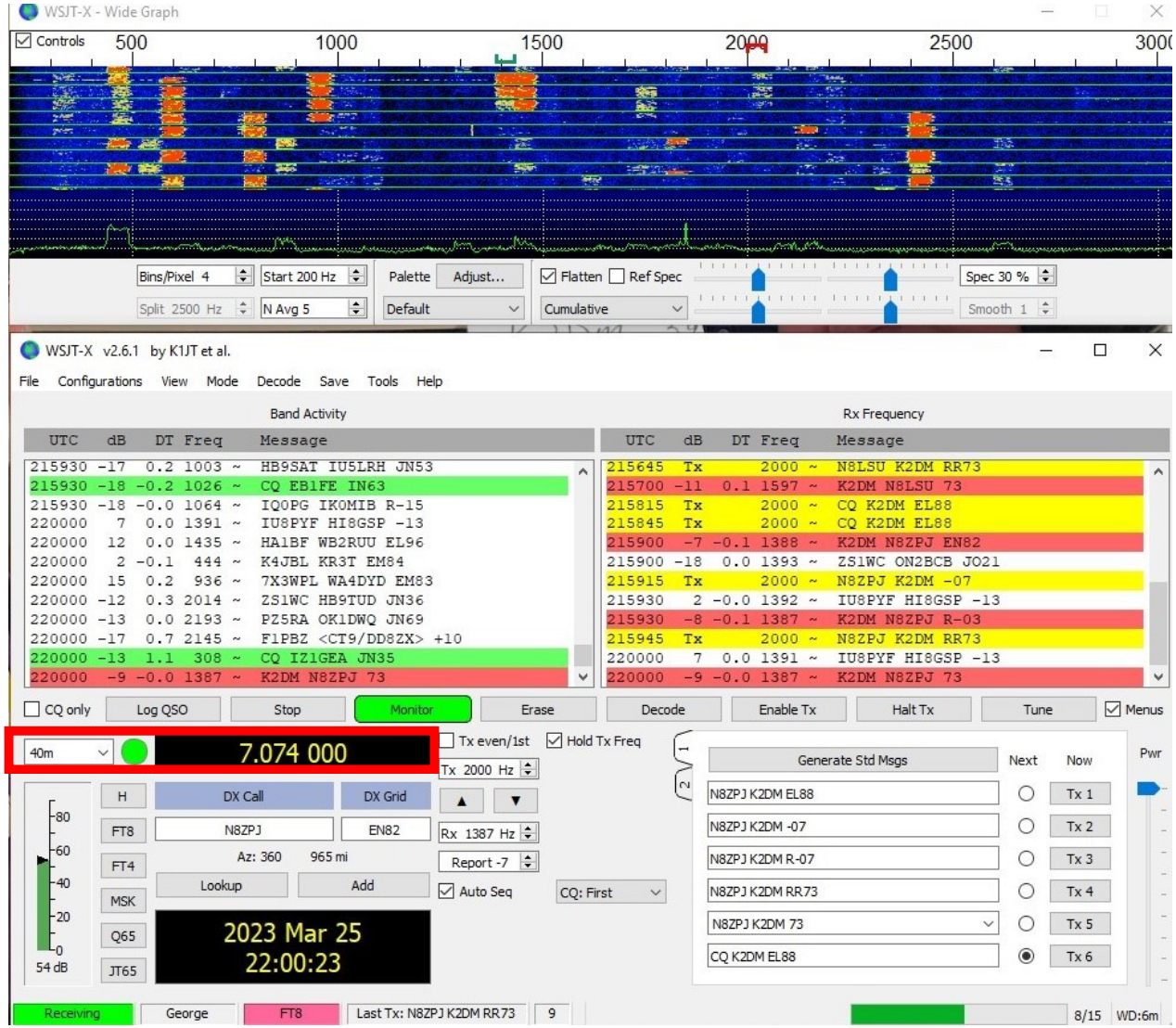
- The scale above the display is in Hz.
- The display can be extended down to 0Hz and up to more than 4000Hz, but the practical upper limit for FT8 is around 3000Hz.
- All of the signals shown here are packed into the width of a single USB signal.
- Notice that each signal on the waterfall is 50Hz wide.
- The green “goalpost” above 1387Hz indicates the current receive frequency, and the red “goalpost” above 2000Hz indicates the current transmit frequency.
- Mouse click on the waterfall to change the receive frequency.
- Shift+click to change the transmit frequency.



- Here the highlighted area shows what your transmit and receive frequencies are.
- Observe that the Tx frequency of 2000 Hz is reflected by the red upside down U above the waterfall, with the Rx frequency being reflected by the green U.
- You can change these frequencies by typing over the existing frequency in the respective window.
- You can use the larger arrows (triangles) to copy the Tx frequency to the Rx frequency or vice versa.
- Also shown is the signal “Report” of the station you are working.

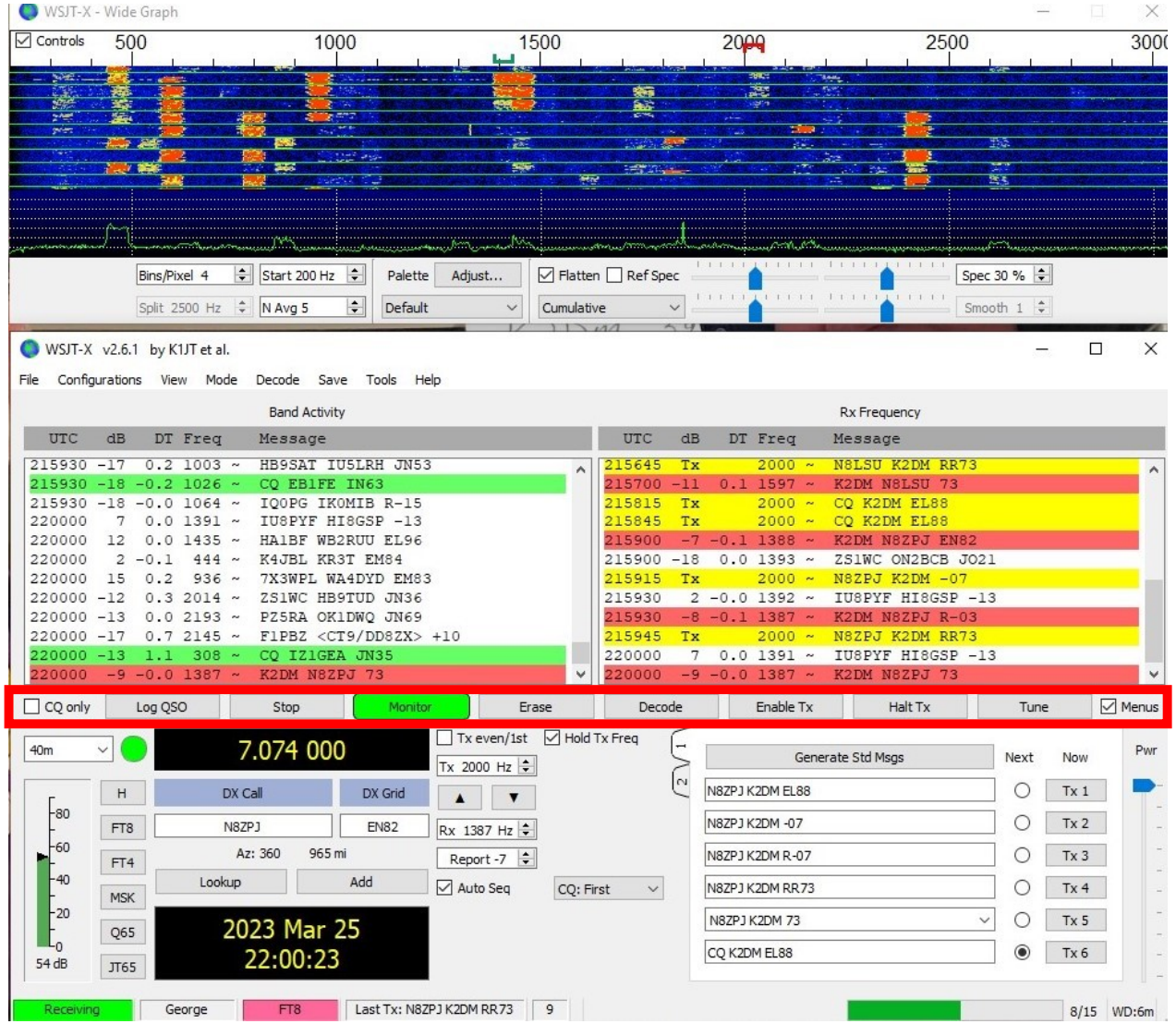


- The highlighted area shows what band you are operating on and the frequency to which your radio is tuned on that band.
- By convention there is one agreed-upon frequency that is used for FT8 on each band. As mentioned earlier, on 40M it is 7.074 MHz.
- With WSJT-X controlling your radio, you can change bands by clicking the down arrow and selecting from the bands in the drop-down list.

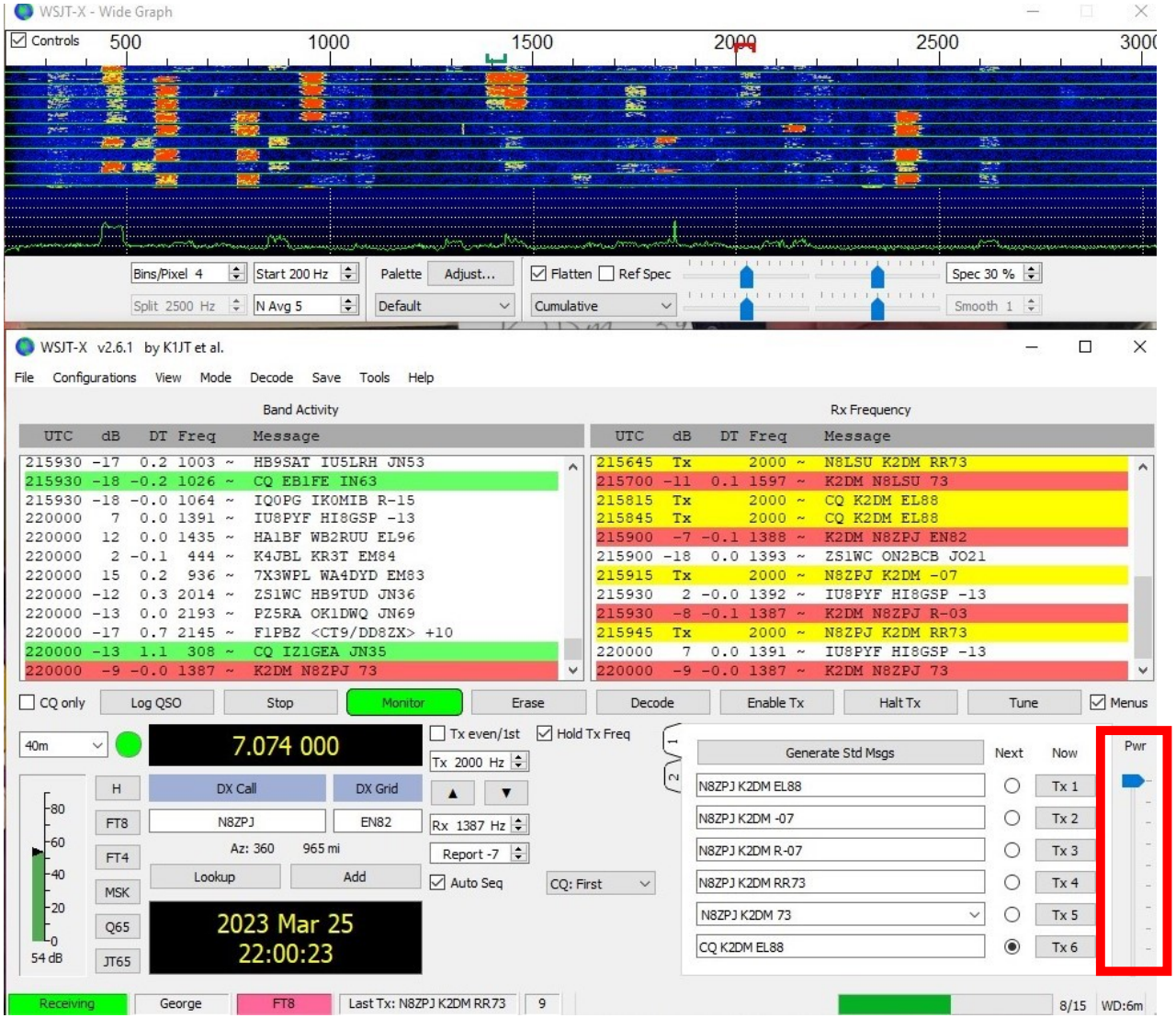


Control buttons.

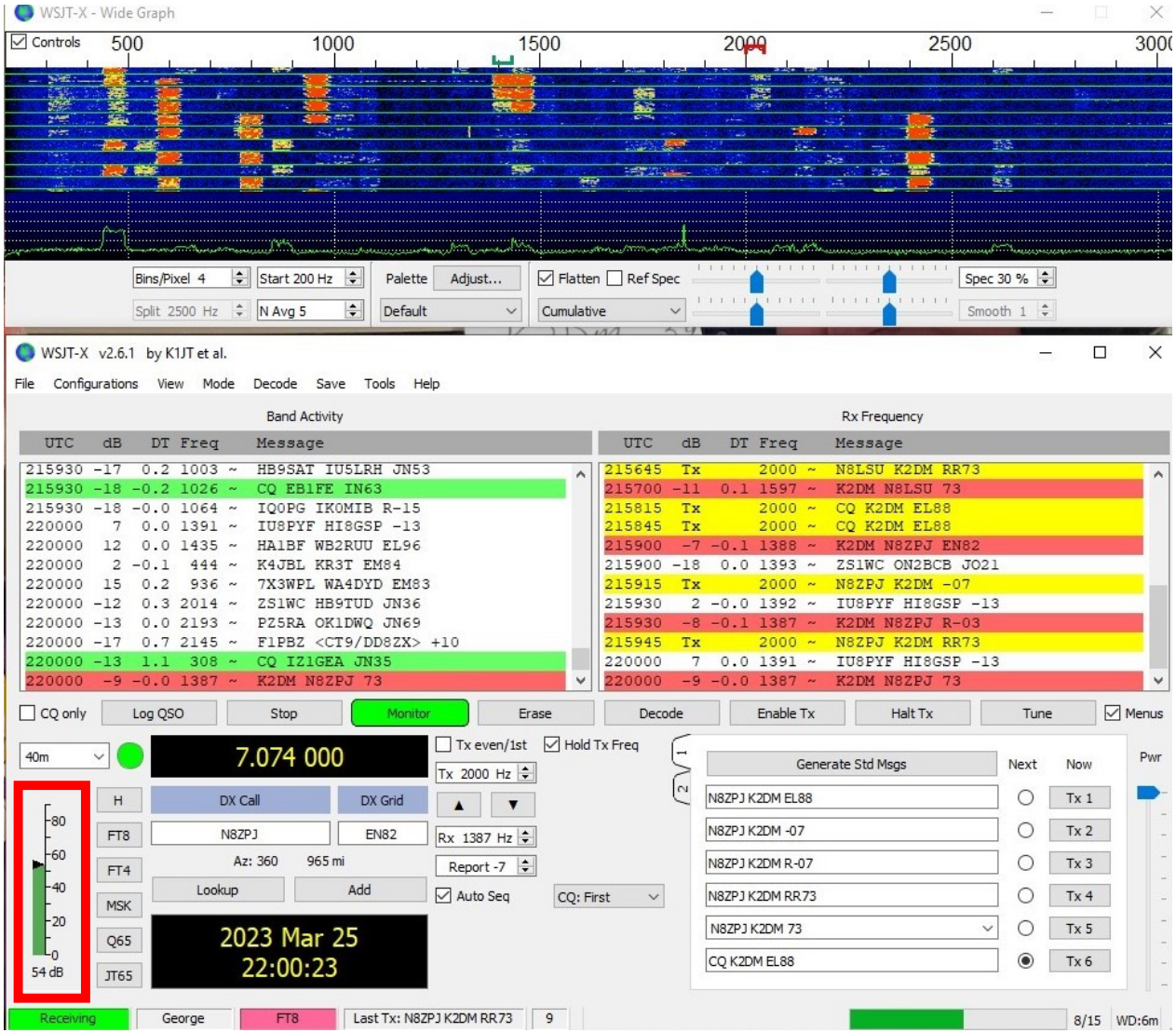
- CQ only: check this if you only want to see stations calling CQ.
- Log QSO: brings up the logging window.
- Stop: terminates normal data acquisition, like maybe you want to freeze the waterfall.
- Monitor: toggles normal receive operation on or off. GREEN when on.
- Erase: click once to clear the Rx Frequency window. Double-click to also clear the Band Activity window.
- Decode: repeats the decoding procedure at the Rx frequency.
- Enable Tx: toggles automatic T/R sequencing on or off. RED when on.
- Halt Tx: terminates a transmission immediately and disables automatic T/R sequencing.
- Tune: Generates an unmodulated carrier at the specified Tx frequency. RED when on.
- Menus: toggles the top-of-window menus.



- This control is a slider. It interacts with the power output setting on your transceiver.
- Let's say you have set your transceiver's output to 50W.
- When the slider is at the top, you are transmitting 50W.
- When the slider is halfway up, you are transmitting 25W.
- Because FT8 is a mode that transmits at a full duty cycle, you should never set your transceiver's output to full power. You can easily damage your finals.



- This highlighted area is an indicator, not a control.
- It indicates received audio level.
- It should normally read about 30dB on a band that has no signals.
- On an active band, with about 15 signals or so, it should read around 50dB.
- Notice that it reads 54dB at this time, with about 10 active signals.
- If the level gets too high, and turns red, you may be overdriving your sound card and causing sampling errors on receive.



FT8 SIGNAL REPORTS

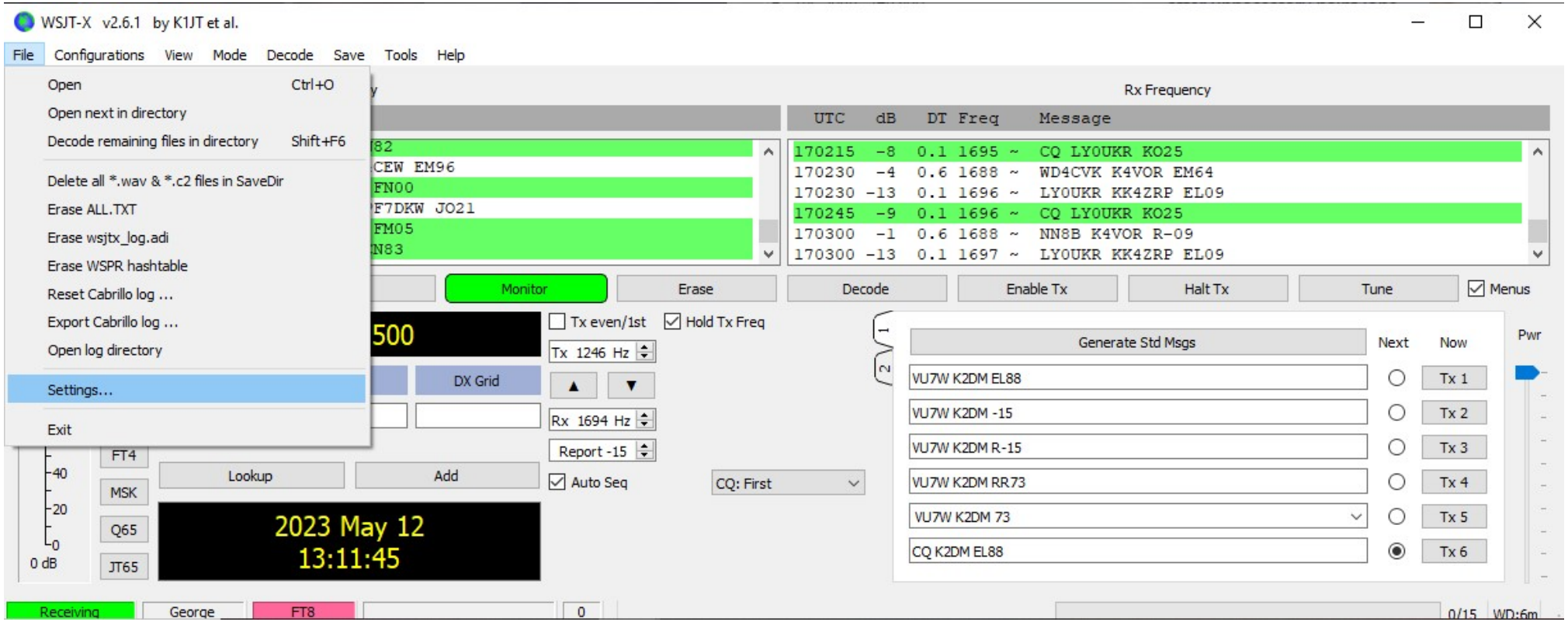
- Are mostly negative, e.g., -8, -15.
- They are based on the noise floor at the receiving station, with -26dB representing that noise floor.
- This is the point at which FT8 can start decoding signals.
- Stronger signals receive higher reports, like -9, -3, etc.
- Really strong signals receive positive reports, like 3, 7, etc.
  - These are usually from the ham a block away, or someone running a kilowatt with a big yagi antenna.

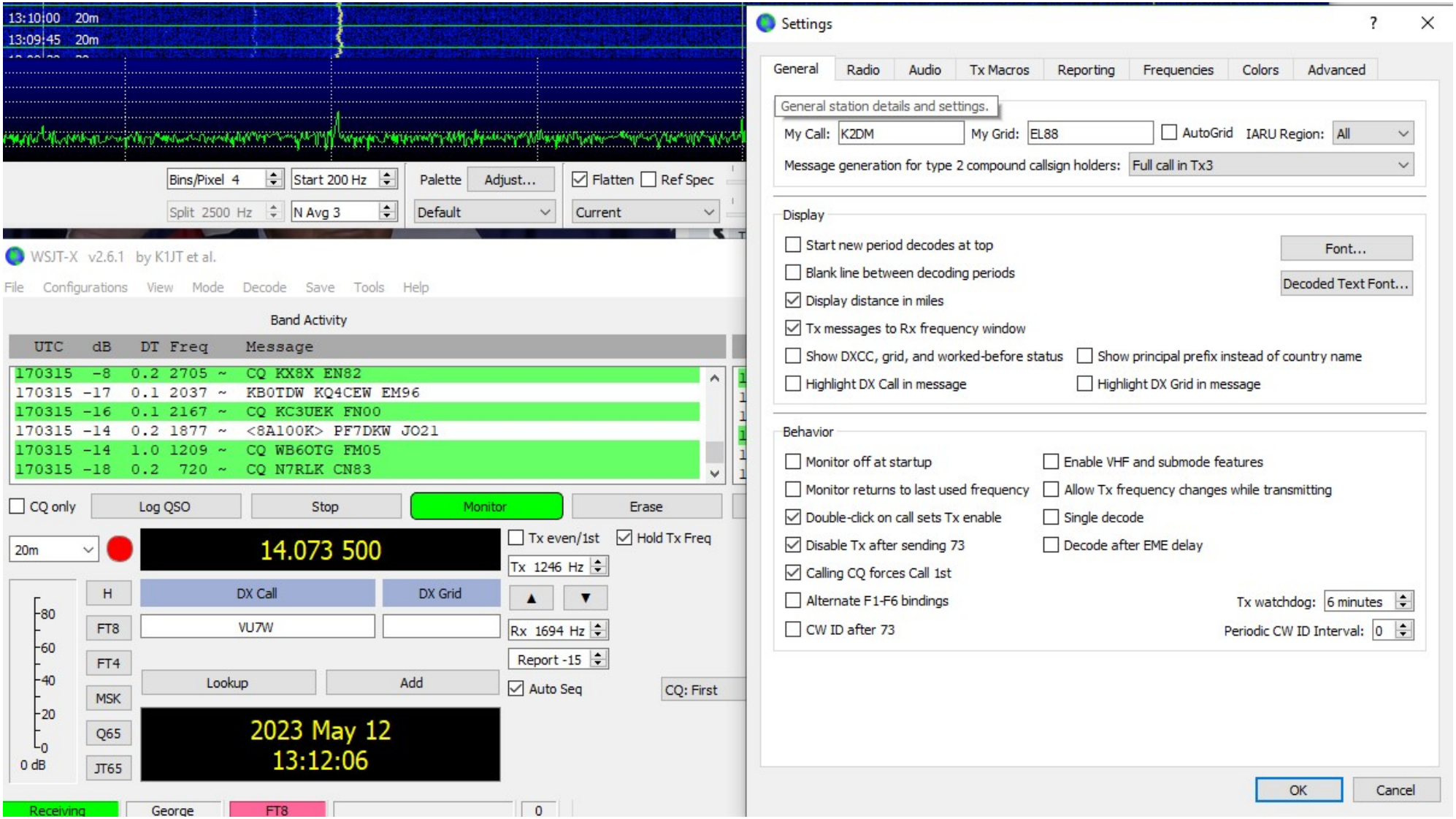
SETTING UP WSJT-X

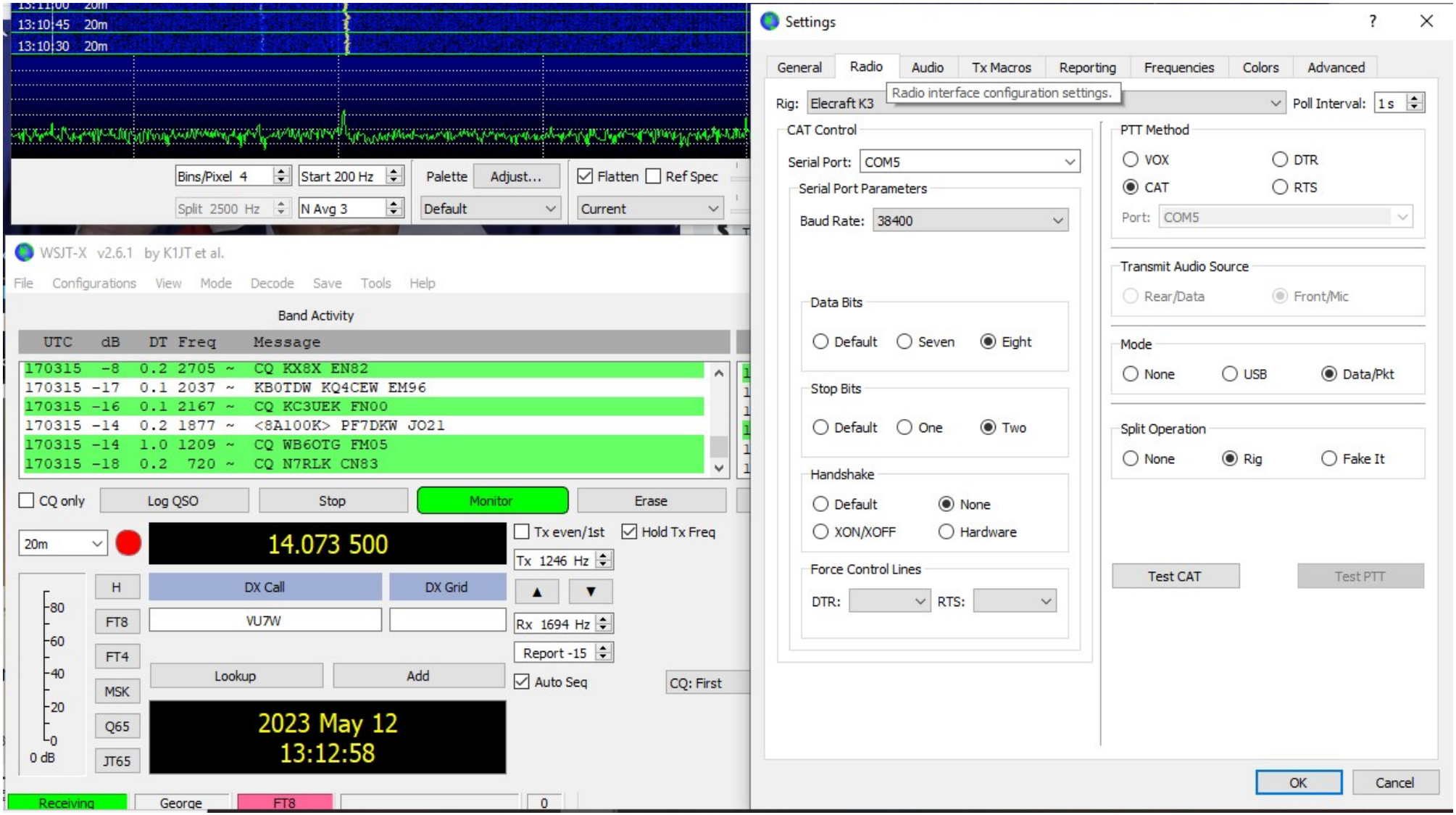
DOWNLOAD WSJT-X

- WSJT Home Page (sourceforge.io)
- Select WSJT-X (on the left side of the screen)
- Scroll down to Installation Packages and select the one that matches your system
  - **Installation packages for *WSJT-X 2.6.1***
    Windows:
  - Version 2.6.1, 32-bit: wsjtx-2.6.1-win32.exe. (Windows 7 and later)
  - Version 2.6.1, 64-bit: wsjtx-2.6.1-win64.exe. (Windows 7 and later)
- Select the installation package that matches your system to download it.
- Open the downloaded file, install it and run it.

ADMINISTER WSJT-X


WSJT-X v2.6.1 by K1JT et al.
File
Configurations
View
Mode
Decode
Save
Tools
Help
Open Ctrl+O
Open next in directory
Decode remaining files in directory Shift+F6
Delete all *.wav & *.c2 files in SaveDir
Erase ALL.TXT
Erase wsjtx_log.adi
Erase WSPR hashtable
Reset Cabrillo log ...
Export Cabrillo log ...
Open log directory
Settings...
Exit
Rx Frequency
UTC dB DT Freq Message
170215 -8 0.1 1695 ~ CQ LY0UKR KO25
170230 -4 0.6 1688 ~ WD4CVK K4VOR EM64
170230 -13 0.1 1696 ~ LY0UKR KK4ZRP EL09
170245 -9 0.1 1696 ~ CQ LY0UKR KO25
170300 -1 0.6 1688 ~ NN8B K4VOR R-09
170300 -13 0.1 1697 ~ LY0UKR KK4ZRP EL09
Monitor
Erase
Decode
Enable Tx
Halt Tx
Tune
Menus
Tx even/1st
Hold Tx Freq
Tx 1246 Hz
DX Grid
Rx 1694 Hz
Report -15
Auto Seq
CQ: First
Generate Std Msgs
Next
Now
VU7W K2DM EL88
VU7W K2DM -15
VU7W K2DM R-15
VU7W K2DM RR73
VU7W K2DM 73
CQ K2DM EL88
Tx 1
Tx 2
Tx 3
Tx 4
Tx 5
Tx 6
Pwr
FT4
MSK
Q65
JT65
Lookup
Add
2023 May 12
13:11:45
Receiving
George
FT8
0
0/15
WD:6m


13:10:00 20m
13:09:45 20m
Bins/Pixel 4
Start 200 Hz
Palette
Adjust...
Flatten
Ref Spec
Split 2500 Hz
N Avg 3
Default
Current
WSJT-X v2.6.1 by K1JT et al.
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB DT Freq Message
170315 -8 0.2 2705 ~ CQ KX8X EN82
170315 -17 0.1 2037 ~ KB0TDW KQ4CEW EM96
170315 -16 0.1 2167 ~ CQ KC3UEK FN00
170315 -14 0.2 1877 ~ <8A100K> PF7DKW JO21
170315 -14 1.0 1209 ~ CQ WB6OTG FM05
170315 -18 0.2 720 ~ CQ N7RLK CN83
CQ only
Log QSO
Stop
Monitor
Erase
20m
14.073 500
Tx even/1st
Hold Tx Freq
Tx 1246 Hz
H
DX Call
DX Grid
FT8
VU7W
Rx 1694 Hz
FT4
Report -15
Lookup
Add
Auto Seq
CQ: First
MSK
Q65
JT65
2023 May 12
13:12:06
80
60
40
20
0
0 dB
Receiving
George
FT8
0
Settings
General
Radio
Audio
Tx Macros
Reporting
Frequencies
Colors
Advanced
General station details and settings.
My Call: K2DM
My Grid: EL88
AutoGrid
IARU Region: All
Message generation for type 2 compound callsign holders: Full call in Tx3
Display
Start new period decodes at top
Blank line between decoding periods
Display distance in miles
Tx messages to Rx frequency window
Show DXCC, grid, and worked-before status
Highlight DX Call in message
Font...
Decoded Text Font...
Show principal prefix instead of country name
Highlight DX Grid in message
Behavior
Monitor off at startup
Monitor returns to last used frequency
Double-click on call sets Tx enable
Disable Tx after sending 73
Calling CQ forces Call 1st
Alternate F1-F6 bindings
CW ID after 73
Enable VHF and submode features
Allow Tx frequency changes while transmitting
Single decode
Decode after EME delay
Tx watchdog: 6 minutes
Periodic CW ID Interval: 0
OK
Cancel


13:10:45 20m
13:10:30 20m
Bins/Pixel 4
Start 200 Hz
Palette
Adjust...
Flatten
Ref Spec
Split 2500 Hz
N Avg 3
Default
Current
WSJT-X v2.6.1 by K1JT et al.
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB DT Freq Message
170315 -8 0.2 2705 ~ CQ KX8X EN82
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170315 -16 0.1 2167 ~ CQ KC3UEK FN00
170315 -14 0.2 1877 ~ <8A100K> PF7DKW JO21
170315 -14 1.0 1209 ~ CQ WB6OTG FM05
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Tx even/1st
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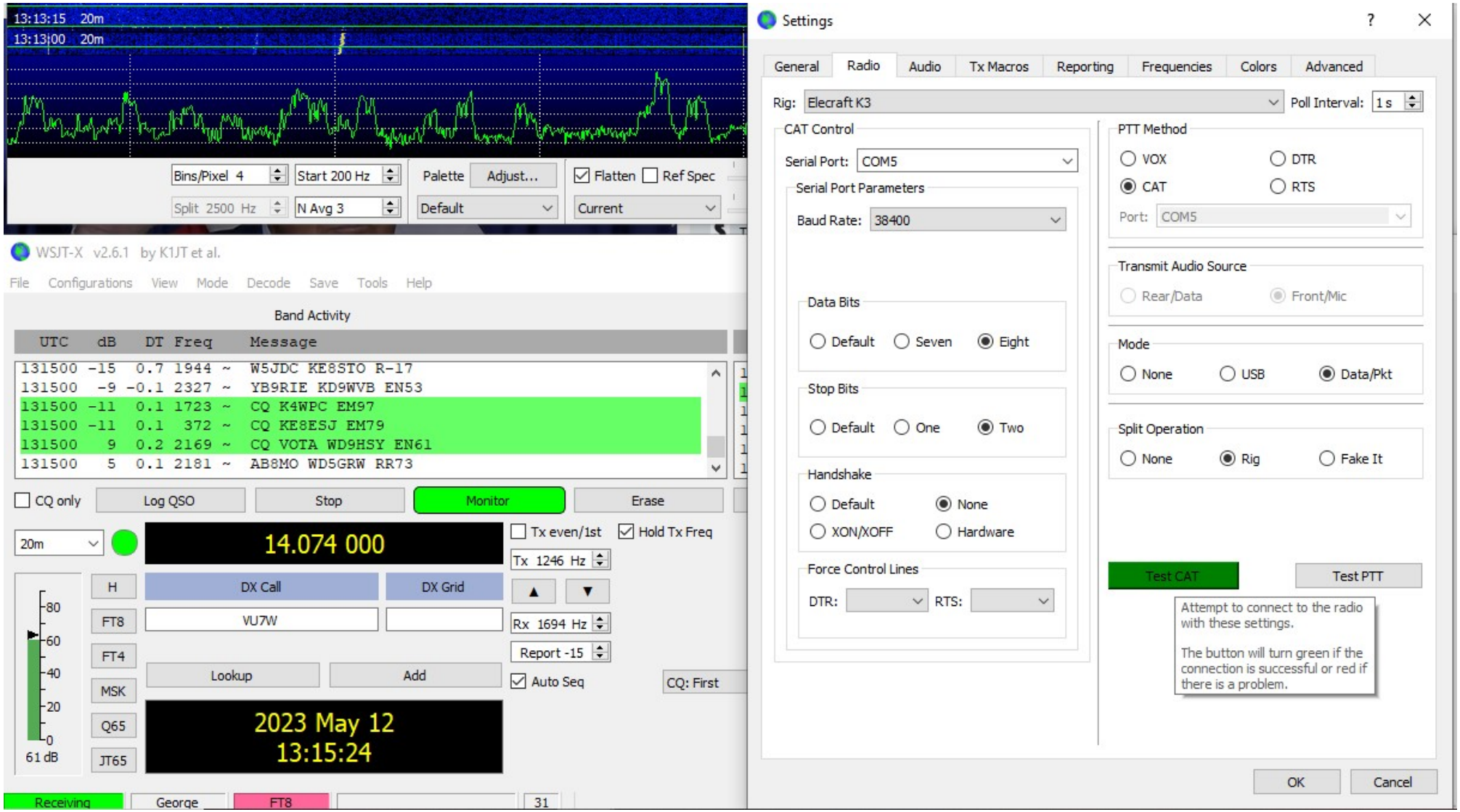
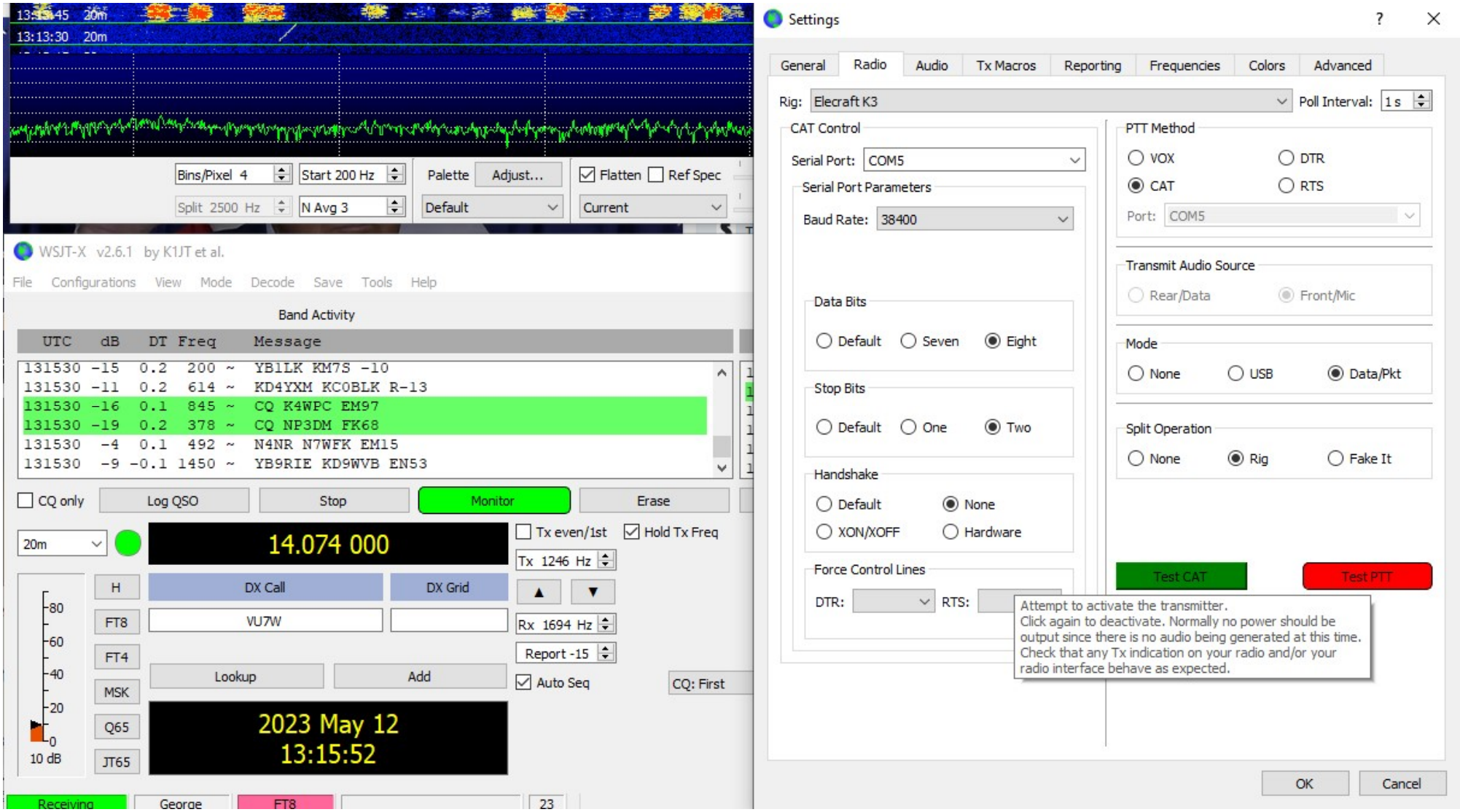
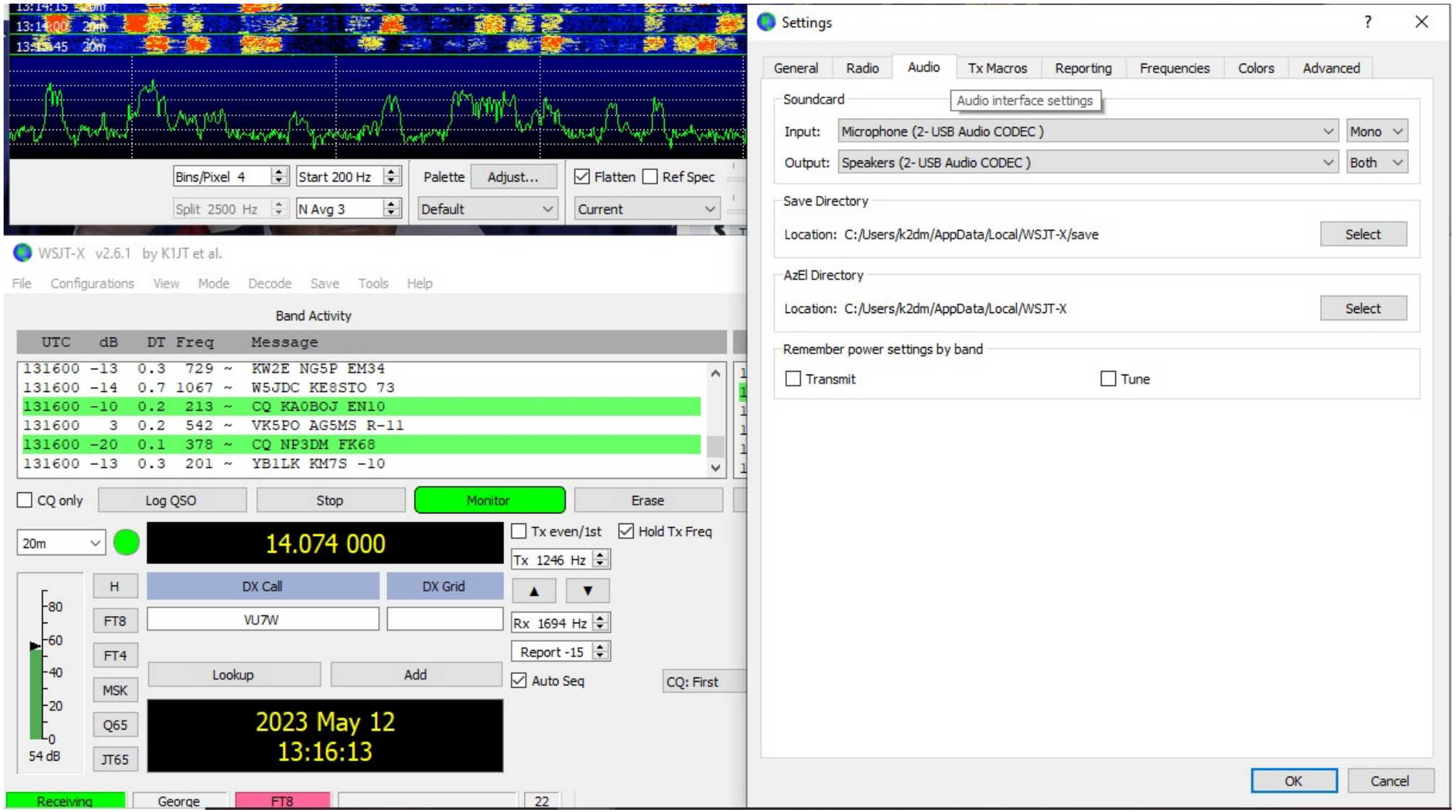
H
DX Call
DX Grid
FT8
VU7W
FT4
Rx 1694 Hz
Report -15
MSK
Lookup
Add
Auto Seq
CQ: First
Q65
2023 May 12
13:12:58
JT65
0 dB
Receiving
George
FT8
0
Settings
General
Radio
Audio
Tx Macros
Reporting
Frequencies
Colors
Advanced
Radio interface configuration settings.
Rig: Elecraft K3
Poll Interval: 1 s
CAT Control
Serial Port: COM5
Serial Port Parameters
Baud Rate: 38400
Data Bits
Default Seven Eight
Stop Bits
Default One Two
Handshake
Default None
XON/XOFF Hardware
Force Control Lines
DTR: RTS:
PTT Method
VOX DTR
CAT RTS
Port: COM5
Transmit Audio Source
Rear/Data Front/Mic
Mode
None USB Data/Pkt
Split Operation
None Rig Fake It
Test CAT
Test PTT
OK
Cancel


13:13:15 20m
13:13:00 20m
Bins/Pixel 4
Start 200 Hz
Palette
Adjust...
Flatten
Ref Spec
Split 2500 Hz
N Avg 3
Default
Current
WSJT-X v2.6.1 by K1JT et al.
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB DT Freq Message
131500 -15 0.7 1944 ~ W5JDC KE8STO R-17
131500 -9 -0.1 2327 ~ YB9RIE KD9WVB EN53
131500 -11 0.1 1723 ~ CQ K4WPC EM97
131500 -11 0.1 372 ~ CQ KE8ESJ EM79
131500 9 0.2 2169 ~ CQ VOTA WD9HSY EN61
131500 5 0.1 2181 ~ AB8MO WD5GRW RR73
CQ only
Log QSO
Stop
Monitor
Erase
20m
14.074 000
Tx even/1st
Hold Tx Freq
Tx 1246 Hz
H
DX Call
DX Grid
FT8
VU7W
Rx 1694 Hz
FT4
Report -15
Lookup
Add
MSK
Auto Seq
CQ: First
Q65
2023 May 12
13:15:24
JT65
80
60
40
20
0
61 dB
Receiving
George
FT8
31
Settings
General
Radio
Audio
Tx Macros
Reporting
Frequencies
Colors
Advanced
Rig: Elecraft K3
Poll Interval: 1 s
CAT Control
Serial Port: COM5
Serial Port Parameters
Baud Rate: 38400
Data Bits
Default Seven Eight
Stop Bits
Default One Two
Handshake
Default None
XON/XOFF Hardware
Force Control Lines
DTR: RTS:
PTT Method
VOX DTR
CAT RTS
Port: COM5
Transmit Audio Source
Rear/Data Front/Mic
Mode
None USB Data/Pkt
Split Operation
None Rig Fake It
Test CAT
Test PTT
Attempt to connect to the radio with these settings.
The button will turn green if the connection is successful or red if there is a problem.
OK
Cancel


13:15:45 20m
13:13:30 20m
Bins/Pixel 4
Start 200 Hz
Palette
Adjust...
Flatten
Ref Spec
Split 2500 Hz
N Avg 3
Default
Current
WSJT-X v2.6.1 by K1JT et al.
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB DT Freq Message
131530 -15 0.2 200 ~ YB1LK KM7S -10
131530 -11 0.2 614 ~ KD4YXM KC0BLK R-13
131530 -16 0.1 845 ~ CQ K4WPC EM97
131530 -19 0.2 378 ~ CQ NP3DM FK68
131530 -4 0.1 492 ~ N4NR N7WFK EM15
131530 -9 -0.1 1450 ~ YB9RIE KD9WVB EN53
CQ only
Log QSO
Stop
Monitor
Erase
20m
14.074 000
Tx even/1st
Hold Tx Freq
Tx 1246 Hz
H
DX Call
DX Grid
FT8
VU7W
FT4
Rx 1694 Hz
Report -15
MSK
Lookup
Add
Auto Seq
CQ: First
Q65
2023 May 12
13:15:52
JT65
10 dB
Receiving
George
FT8
23
Settings
General
Radio
Audio
Tx Macros
Reporting
Frequencies
Colors
Advanced
Rig: Elecraft K3
Poll Interval: 1 s
CAT Control
Serial Port: COM5
Serial Port Parameters
Baud Rate: 38400
Data Bits
Default Seven Eight
Stop Bits
Default One Two
Handshake
Default None
XON/XOFF Hardware
Force Control Lines
DTR: RTS:
PTT Method
VOX DTR
CAT RTS
Port: COM5
Transmit Audio Source
Rear/Data Front/Mic
Mode
None USB Data/Pkt
Split Operation
None Rig Fake It
Test CAT
Test PTT
Attempt to activate the transmitter.
Click again to deactivate. Normally no power should be output since there is no audio being generated at this time.
Check that any Tx indication on your radio and/or your radio interface behave as expected.
OK
Cancel


13:14:15 20m
13:14:00 20m
13:13:45 20m
Bins/Pixel 4
Start 200 Hz
Palette
Adjust...
Flatten
Ref Spec
Split 2500 Hz
N Avg 3
Default
Current
WSJT-X v2.6.1 by K1JT et al.
File Configurations View Mode Decode Save Tools Help
Band Activity
UTC dB DT Freq Message
131600 -13 0.3 729 ~ KW2E NG5P EM34
131600 -14 0.7 1067 ~ W5JDC KE8STO 73
131600 -10 0.2 213 ~ CQ KA0BOJ EN10
131600 3 0.2 542 ~ VK5PO AG5MS R-11
131600 -20 0.1 378 ~ CQ NP3DM FK68
131600 -13 0.3 201 ~ YB1LK KM7S -10
CQ only
Log QSO
Stop
Monitor
Erase
20m
14.074 000
Tx even/1st
Hold Tx Freq
Tx 1246 Hz
H
DX Call
DX Grid
FT8
VU7W
FT4
MSK
Q65
JT65
Rx 1694 Hz
Report -15
Lookup
Add
Auto Seq
CQ: First
80
60
40
20
0
54 dB
2023 May 12
13:16:13
Receiving
George
FT8
22
Settings
General
Radio
Audio
Tx Macros
Reporting
Frequencies
Colors
Advanced
Soundcard
Audio interface settings
Input:
Microphone (2- USB Audio CODEC)
Mono
Output:
Speakers (2- USB Audio CODEC)
Both
Save Directory
Location: C:/Users/k2dm/AppData/Local/WSJT-X/save
Select
AzEl Directory
Location: C:/Users/k2dm/AppData/Local/WSJT-X
Select
Remember power settings by band
Transmit
Tune
OK
Cancel

INTO THE BELLY OF THE BEAST

HOW FT8 ENCODES MESSAGES

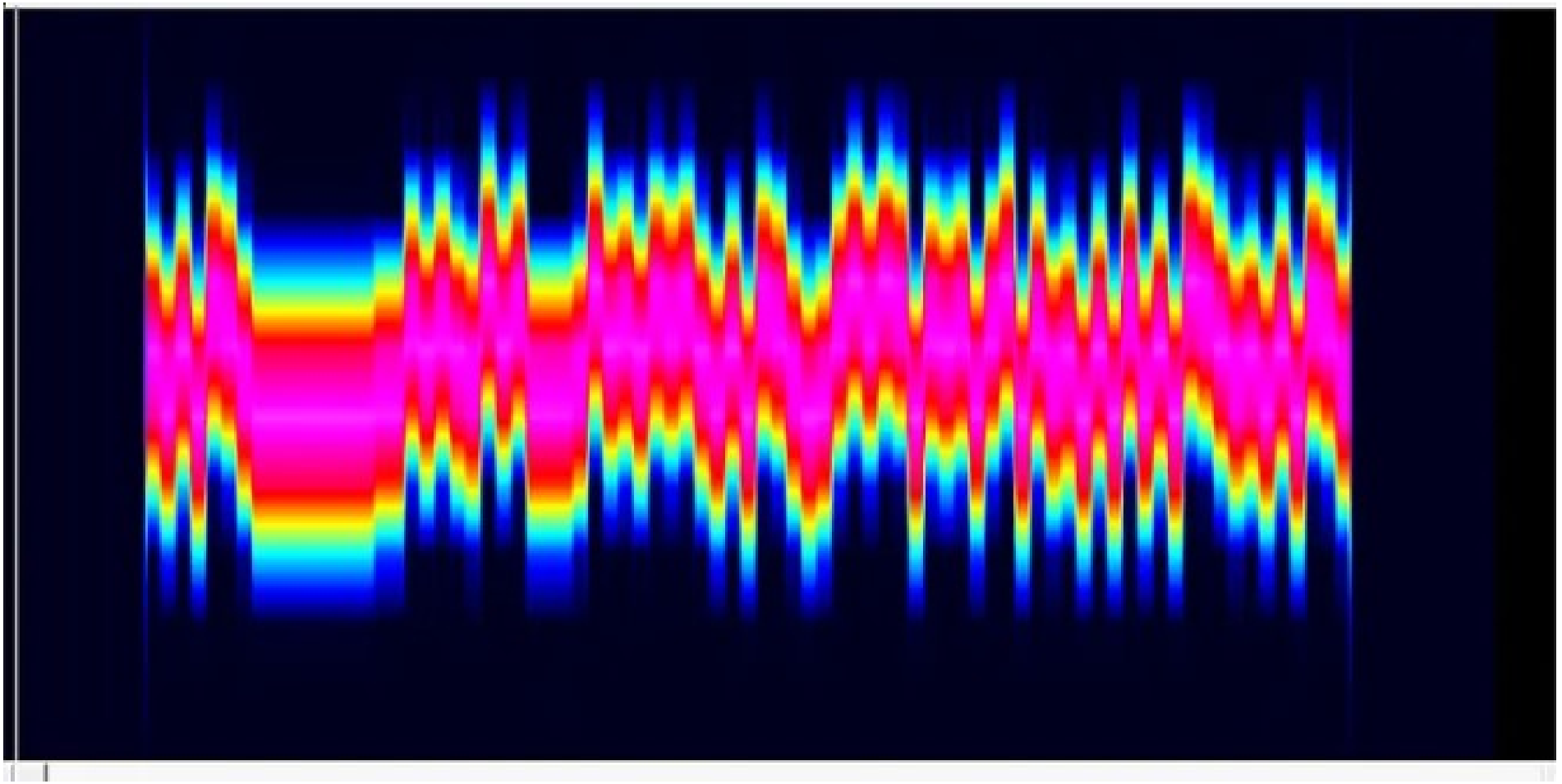
- Common abbreviations (like CQ, DX) are replaced by shorter codes.
- Because of their strictly defined nature, callsigns can be recorded in a more compact form, using indexes to replace characters.
- Similarly with grid locators.
- These steps are necessary because the maximum MESSAGE length is 77 bits.
- To this is added a 14-bit CRC, so the DATA STREAM is now 91 bits.
- The message is then converted to a Low-Density Parity-Check code 174 bits long.
  - This redundancy is used to correct errors during transmission.
- Example: CQ DL1ABC JO62 is converted to this data block:
  - 00 00 00 23 44 4A 11 91 3F 8B 57 7E CF 78 77 39 55 DE 36 EF 01 48

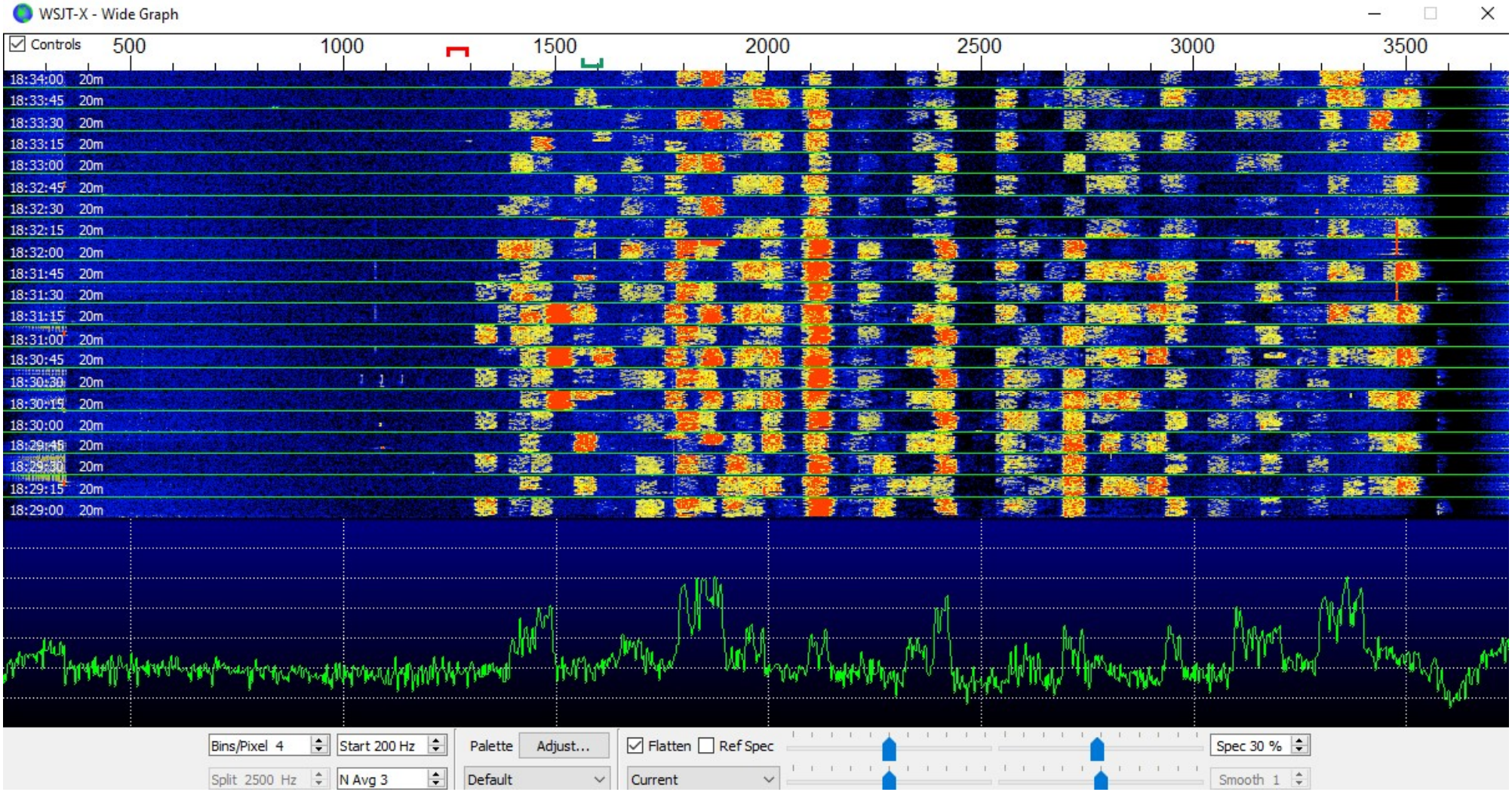
TRANSFORMING AND SENDING THE MESSAGE

- After digitizing the text, FT8 uses an 8-frequency shift keying format to transmit the text.
  - So the data block has to be transformed into a tones sequence of 8 tones.
  - Special data for synchronization is added for proper signal decoding.
  - This yields a final sequence of:
  - 31406520 00000001 04531130 52105775 34623140 65267442 47514714 36372416 64750133 3140652 where each digit represents a tone number from 0 to 7
- The 8 tones are spaced 6.25 Hz apart, so an FT8 signal occupies 50 Hz (8 x 6.25 = 50).
- Each tone is sent for 0.16 seconds, so the entire message takes 12.64 seconds to send.
- Compare this to a CW signal that occupies between 25 Hz and 50 Hz depending on keying speed, and an SSB signal that occupies 3 kHz.

CQ DL1ABC JO62 – FT8 SPECTRUM DISPLAY

31406520 00000001 04531130 52105775 34623140 65267442 47514714 36372416 64750133 3140652




WSJT-X - Wide Graph
Controls
500
1000
1500
2000
2500
3000
3500
18:34:00 20m
18:33:45 20m
18:33:30 20m
18:33:15 20m
18:33:00 20m
18:32:45 20m
18:32:30 20m
18:32:15 20m
18:32:00 20m
18:31:45 20m
18:31:30 20m
18:31:15 20m
18:31:00 20m
18:30:45 20m
18:30:30 20m
18:30:15 20m
18:30:00 20m
18:29:45 20m
18:29:30 20m
18:29:15 20m
18:29:00 20m
Bins/Pixel 4
Start 200 Hz
Palette
Adjust...
Flatten
Ref Spec
Spec 30 %
Split 2500 Hz
N Avg 3
Default
Current
Smooth 1

ADMINISTERING THE RADIO FOR FT8