WSJT-X

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WSJT-X and RPi

- WSJT-X is a program to facilitate weak signal communications for ham radio operators.
- **W**eak **S**ignal communication by K1**JT**, after the originator of WSJT-X and various weak signal protocols and programs. The "**X**" stands for experimental.
- Dr Taylor was the keynote speaker at the ARRL Centennial Banquet in 2014, and his address can be viewed on YouTube at *http://bit.ly/drtkeynote*

WSJT-X

- Detailed instructions for the WSJT-X program are located at Dr Taylor's site: *http://bit.ly/wsjtxinfo*
- The WSJT-X handbook for version 1.7 is located at: *http://bit.ly/wsjt17man*
- The installation instructions for installing WSJT-X 1.7 are available here: *http://bit.ly/wsjtxinstall*
  - This is already installed on your Compass SD Card.
  - Out of the box raspbian apt-get installs an older version of WSJT-X.

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WSJT-X

- The modes available in the WSJT-X 1.7 suite.
  - JT4, JT9, JT65, WSPR, QRA64, ISCAT, MSK144, and Echo.
- The modes included in WSJT-X are designed for Weak Signal radio communications.
- These modes are great at picking up signals that are well below the noise floor.

WSJT-X

- JT65
  - Initially developed weak signals with slow variation.
  - Encountered in EME or troposcatter communications.
  - Was initially intended for VHF, but has been adapted for HF.
  - 177.6 hz wide
- JT9
  - Similar to JT65.
  - Mainly used on MF and HF.
  - Is more powerful at digging out weak signals.
  - 15.6 hz wide
- JT4
  - Similar to JT65, and JT9.
  - Adds components and structure used in WSPR.

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WSJT-X

- QRA64
  - New experimental multiband mode for very weak signal work.
  - Is being used for EME.
  - It appears to be superior to JT65.
- ISCAT
  - “**I**onospheric **SCAT**tering mode.”
- MSK144
  - Used for meteor scatter.
  - Designed to replace FSK441.
  - It has strong error correction.
  - Similar format to JT9.
- Echo
  - Allows the user to make very sensitive tests on your own echos from the moon.

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WSJT-X: JT9 and JT65

- The JT modes available in WSJT-X use structured messages that compress text transmissions into 72 bits.
  - Maximum of 13 characters per transmission cycle.
  - 2 28 bit fields for call signs.
  - 1 15 bit field for Grid Locator, Signal Report, Acknowledgment, or 73.
  - 1 additional bit to flag a custom message, that do not fit the normal structure.
- The goal is to fit the minimal amount of information into 72 bits required to complete a valid QSO.

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WSJT-X: JT9 and JT65

- Two windows
  - Each window is 60 seconds each and stations alternate between two.
    - Transmit for 60 seconds.
    - Receive for 60 seconds.
  - Actual transmission ends at the 50 second mark.
    - This leaves 10 seconds for stations to decode messages and prepare for the next window.
- It takes a minimum of 6 minutes to complete 1 QSO.

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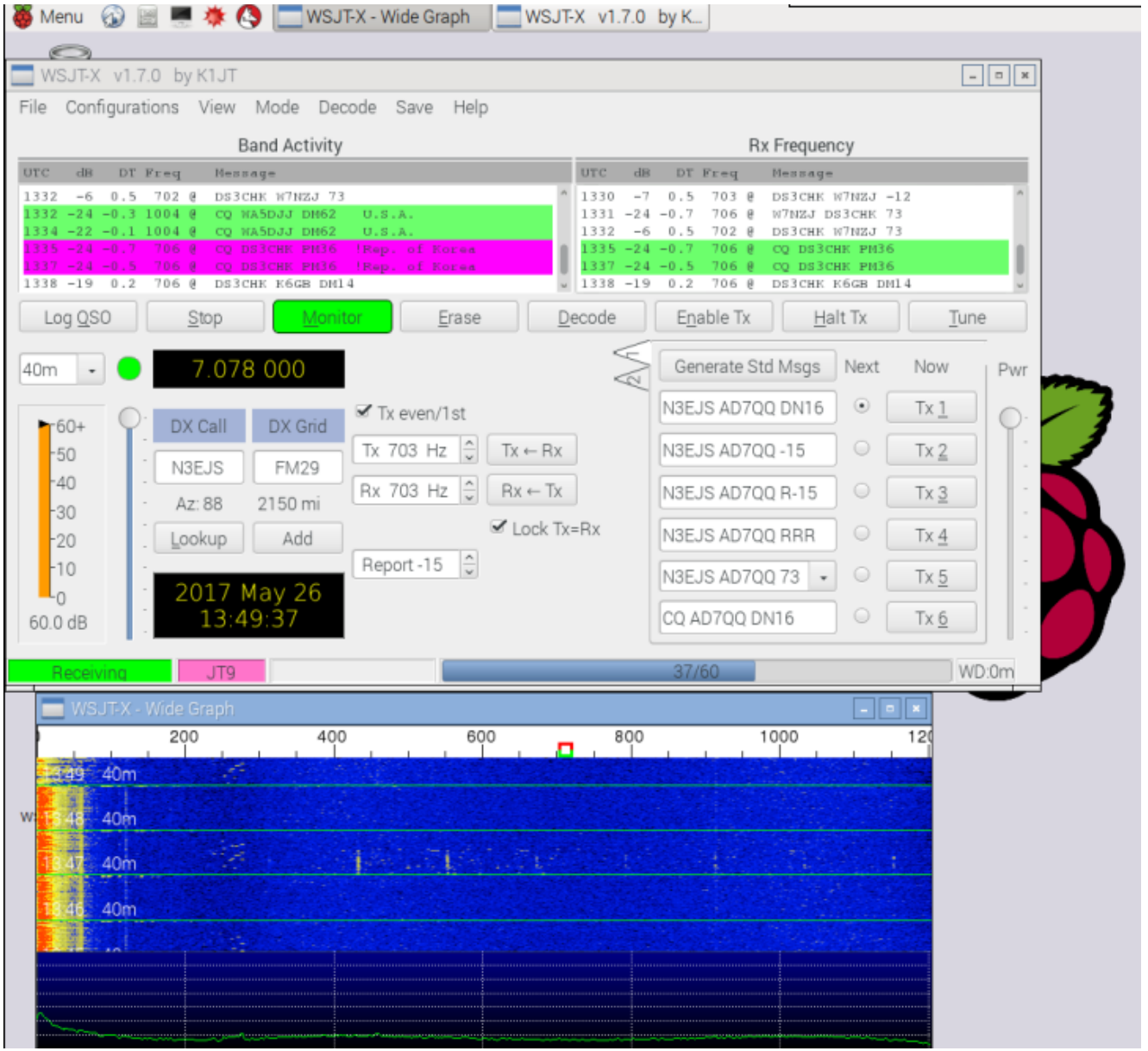
WSJT-X: Interface



WSJT-X: Setup

- What do you need?
  - A SSB Radio and an appropriate antenna.
  - A Raspberry Pi.
  - Monitor with at least 1024 x 768 resolution.
  - Computer-to-radio interface
    - Serial USB CAT
    - Audio Interface
      - UDRC-II
      - Signalink or Other Radio Interface
      - USB SoundCard with a Sample Rate of 48000 Hz.
    - VOX, PTT via CAT, or PTT via Serial

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WSJT-X: Setup

- WSJT-X is very sensitive to time.
  - If your system time is off by more than a second, other stations will not be able to decode your message.
- Ways you can resync the clock on your RPi.
  - If you are connected to the internet
    - $ sudo ntp -qg
    - $ sudo /etc/init.d/ntp restart
  - Listening to WWV
    - $ sudo date -s "Fri Jun 2 17:10:00 UTC 2017"
    - Hit enter when the WWV gives the tone.
  - Use a RTC (Real Time Clock) Daughter Board designed for the RPi.
    - DS3231

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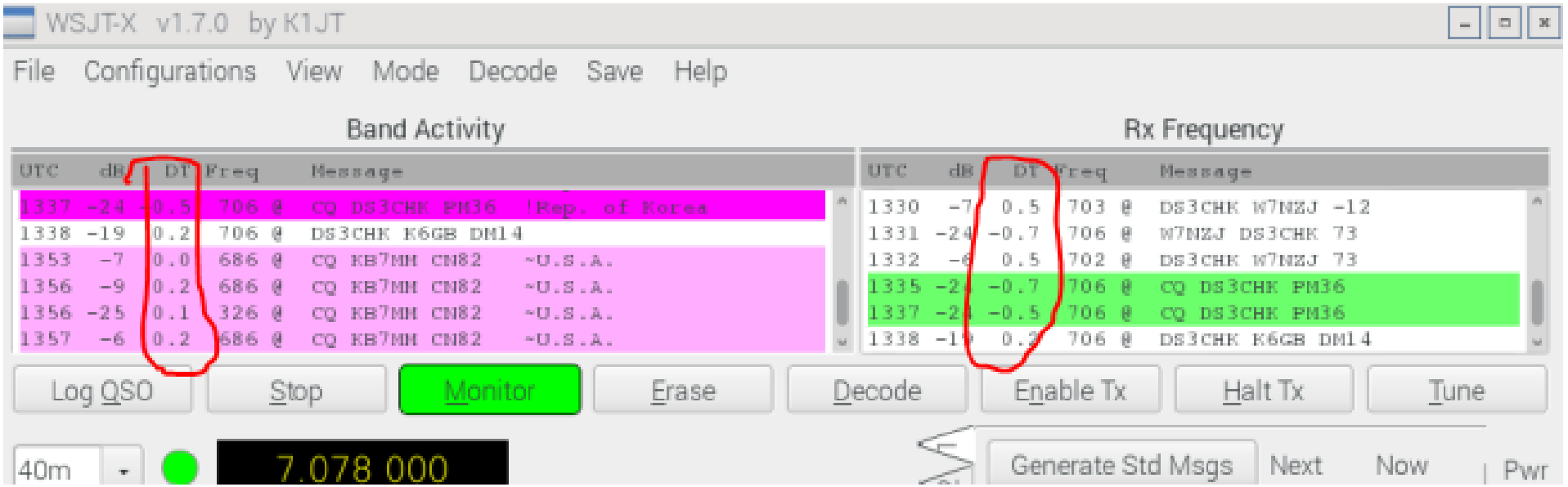
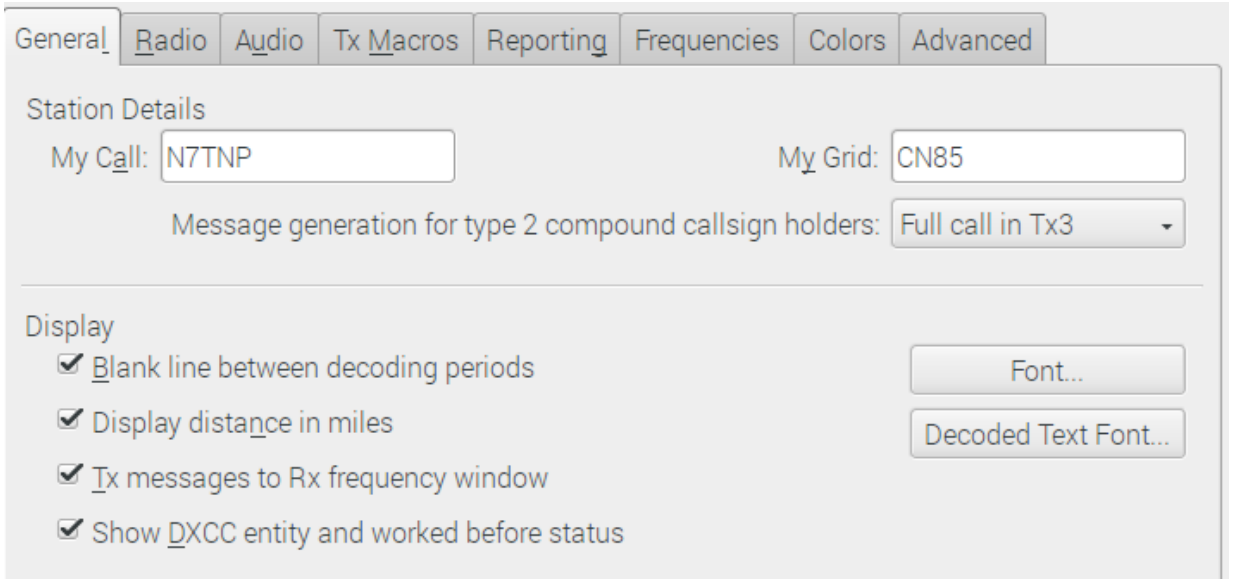
WSJT-X: Interface



WSJT-X: Setup



- Enter your call, and Grid Square
- Configure the display options.
  - Blank lines between decoding periods will insert a blank line in the band activity window.

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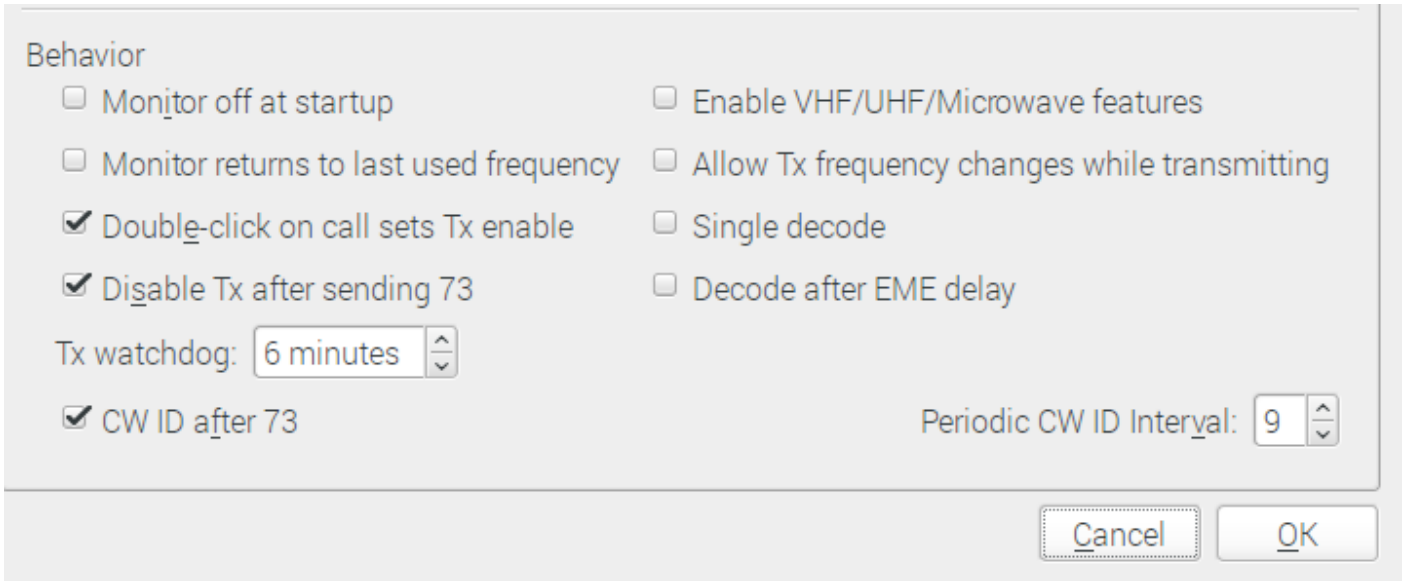
WSJT-X: Setup



- Monitor at startup will enable the software's receiving functionality at startup.
- TX Watchdog will automatically disable transmitting if you step away, and forgot that it was enabled.

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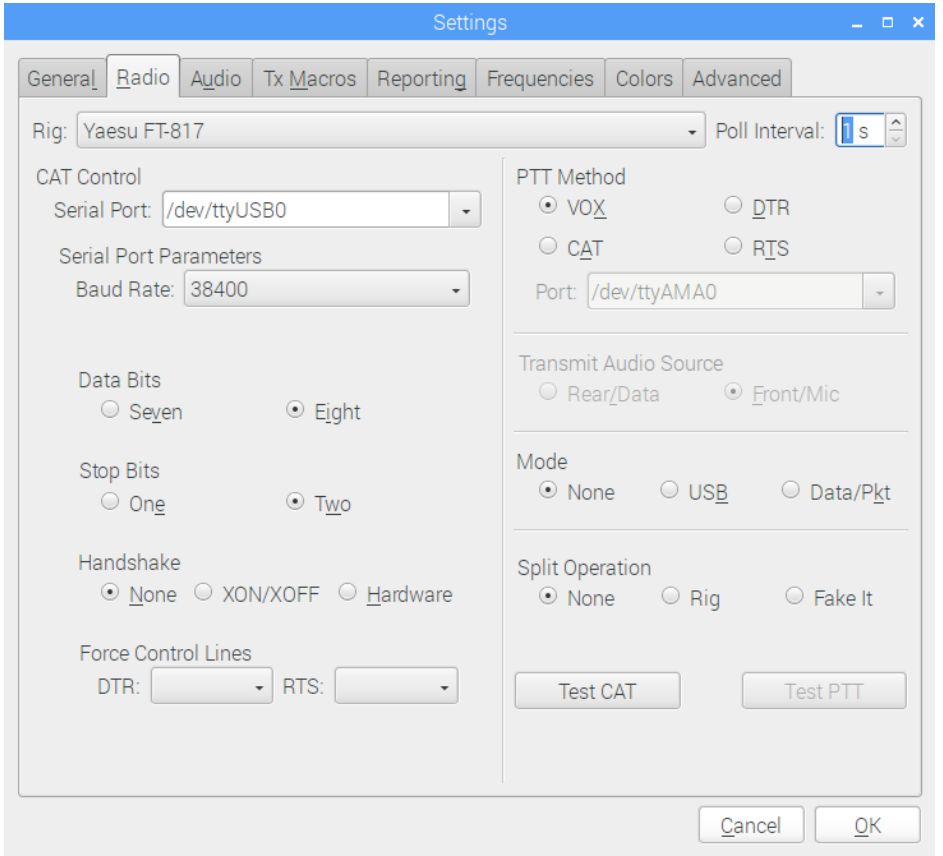
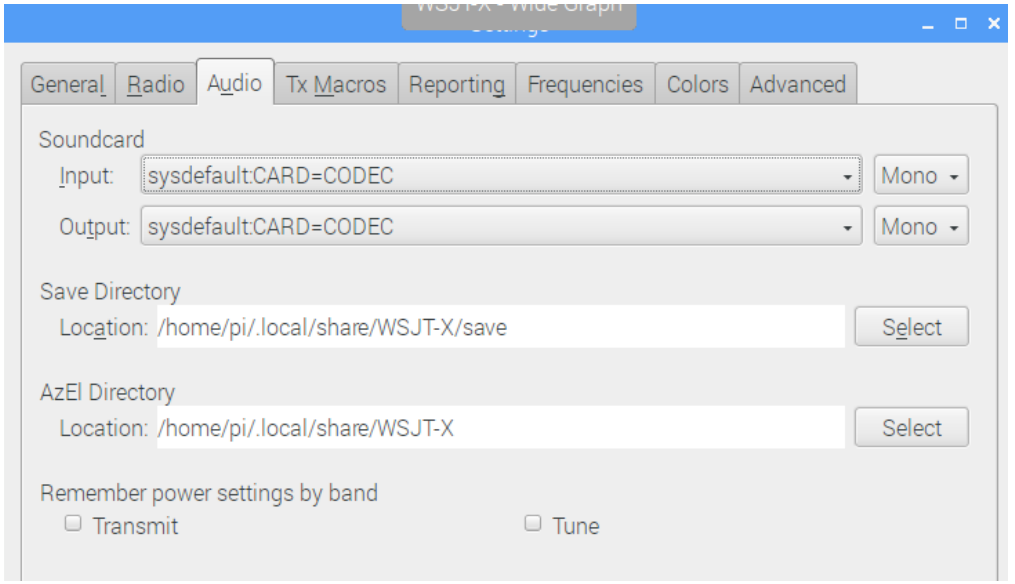
WSJT-X: Setup

- Select your radio from the list.
  - Chose the corresponding baud rate for your radio.
  - Chose correct data bits.
  - Chose the correct stop bit.
  - Select the PTT Method.

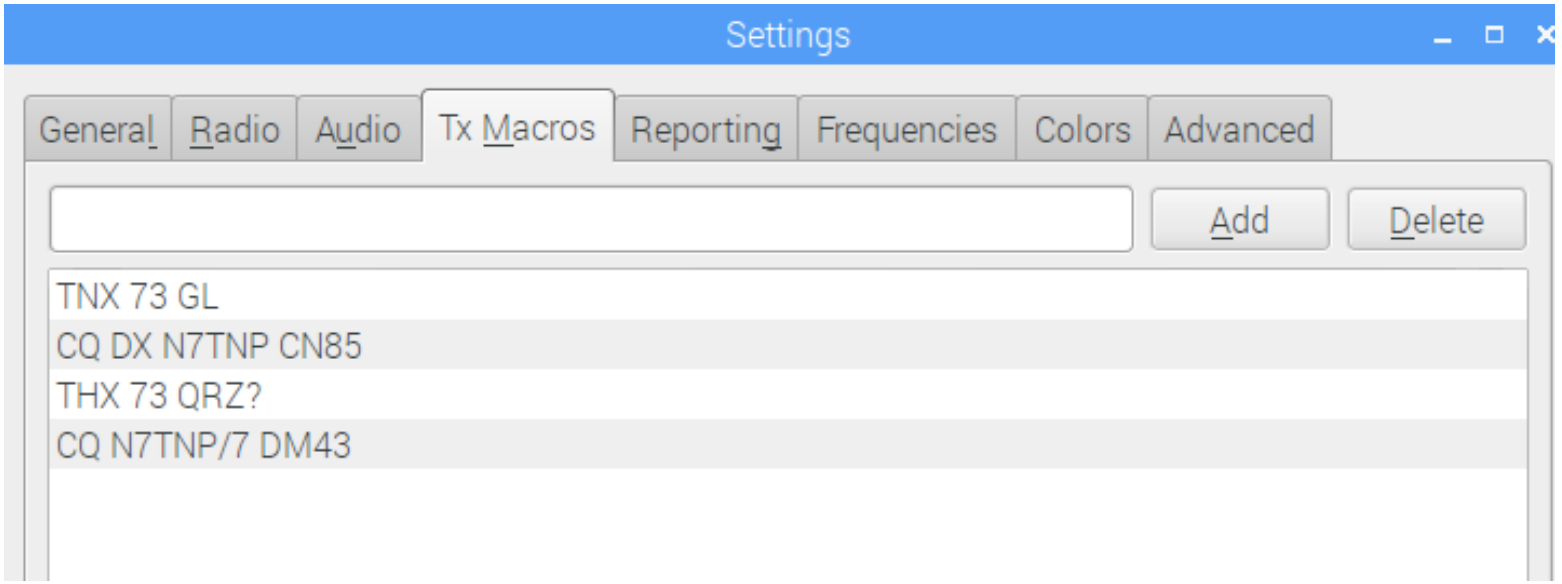


WSJT-X: Setup



- Select your sound interface from the list.
  - UDRC-II is CODEC

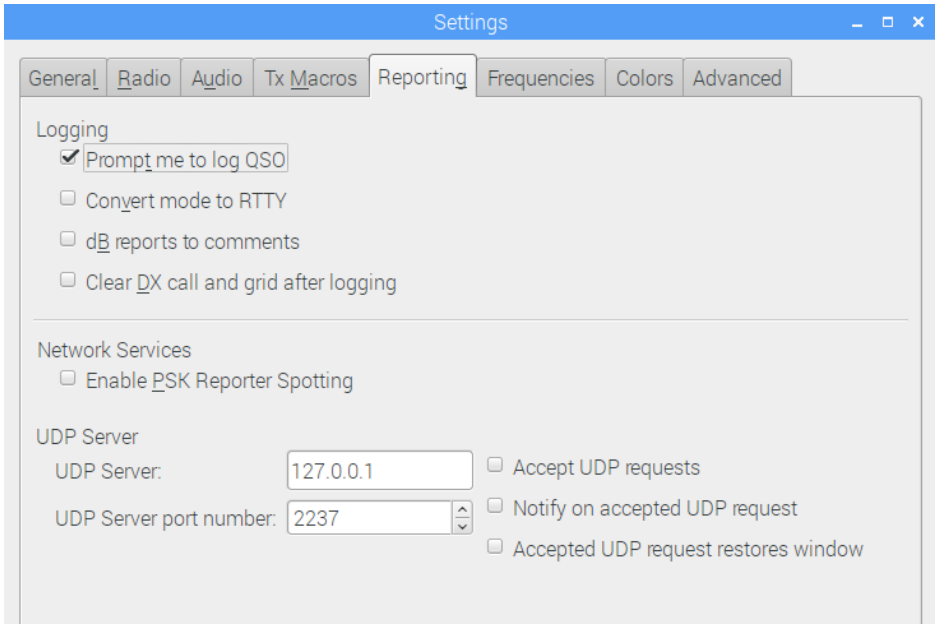
WSJT-X: Setup



You can add custom messages to a list to make preparing for your next transmission quick and easy.

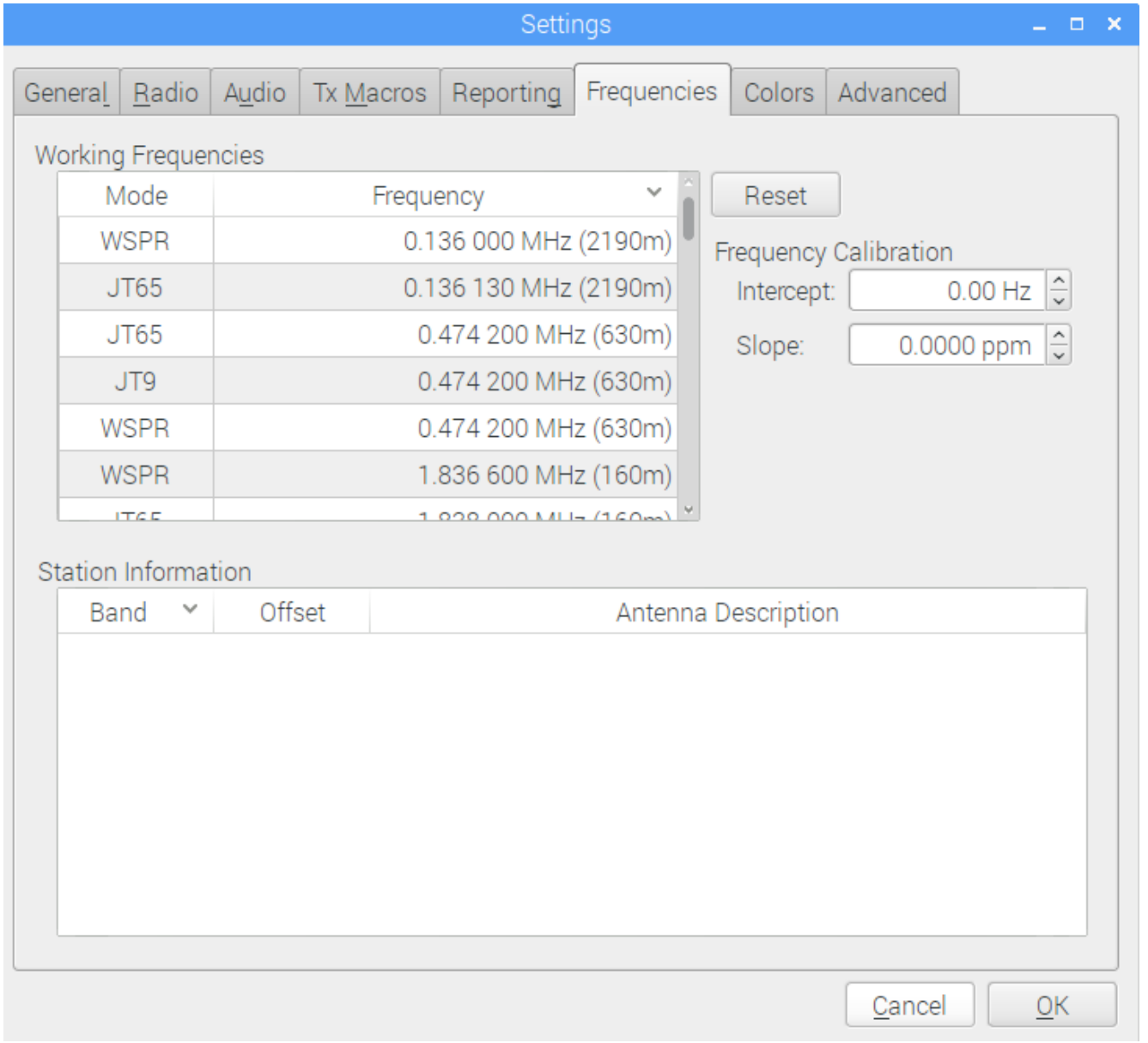
Remember you are limited to 13 characters.

WSJT-X: Setup

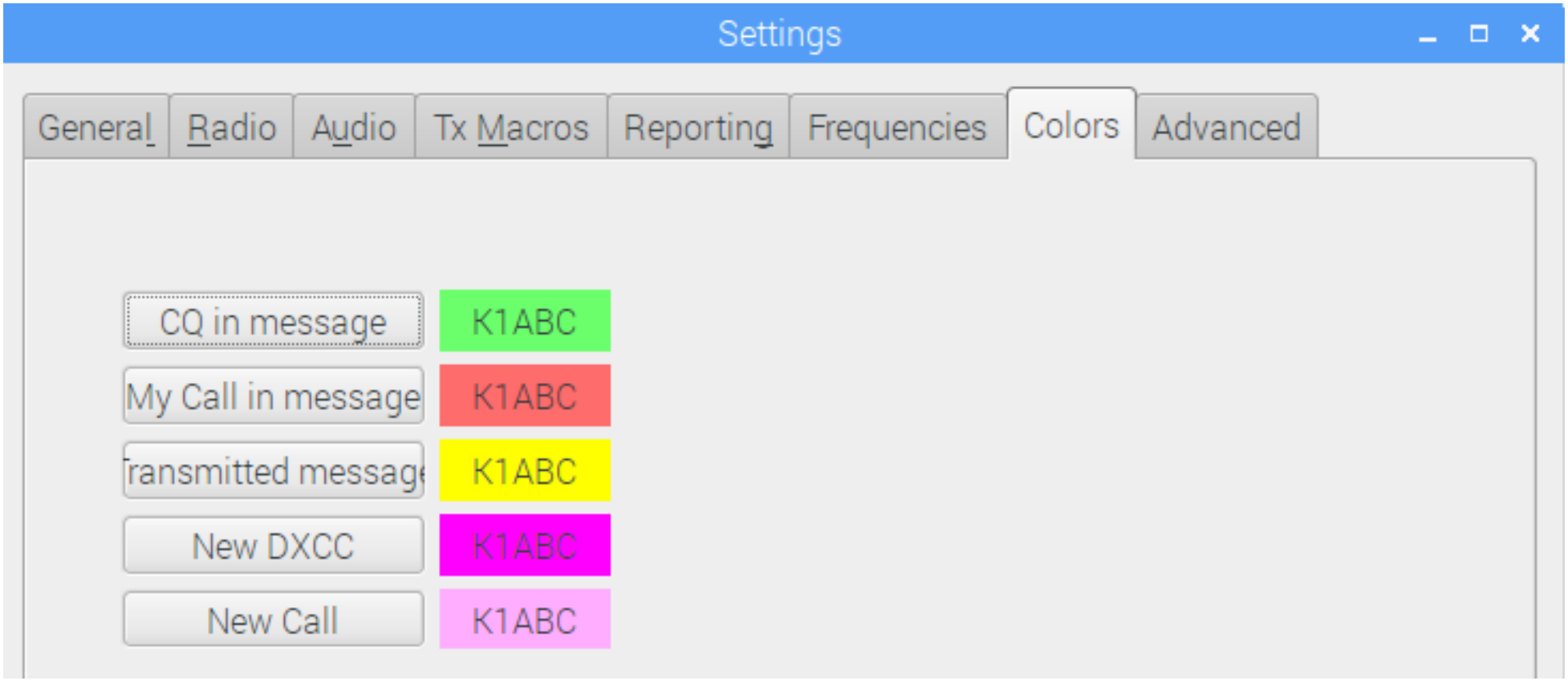


- Prompt to log QSO is useful.
  - Only works if you send a standard 73.
- PSK Reporter Spotting
  - This is a reverse beacon network.
  - http://www.pskreporter.info

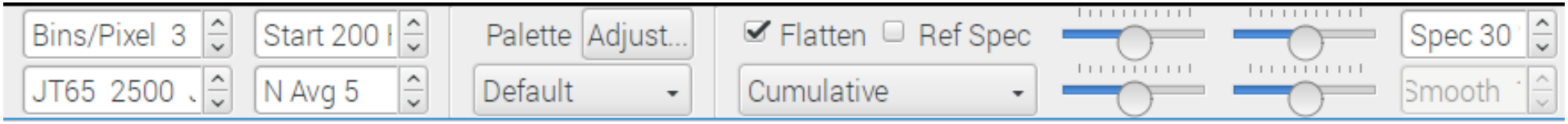
WSJT-X: Setup


Settings
General
Radio
Audio
Tx Macros
Reporting
Frequencies
Colors
Advanced
Working Frequencies
Mode
Frequency
WSPR 0.136 000 MHz (2190m)
JT65 0.136 130 MHz (2190m)
JT65 0.474 200 MHz (630m)
JT9 0.474 200 MHz (630m)
WSPR 0.474 200 MHz (630m)
WSPR 1.836 600 MHz (160m)
Reset
Frequency Calibration
Intercept: 0.00 Hz
Slope: 0.0000 ppm
Station Information
Band
Offset
Antenna Description
Cancel
OK

WSJT-X: Setup


Settings
General
Radio
Audio
Tx Macros
Reporting
Frequencies
Colors
Advanced
CQ in message
K1ABC
My Call in message
K1ABC
Transmitted message
K1ABC
New DXCC
K1ABC
New Call
K1ABC

WSJT-X: Setup

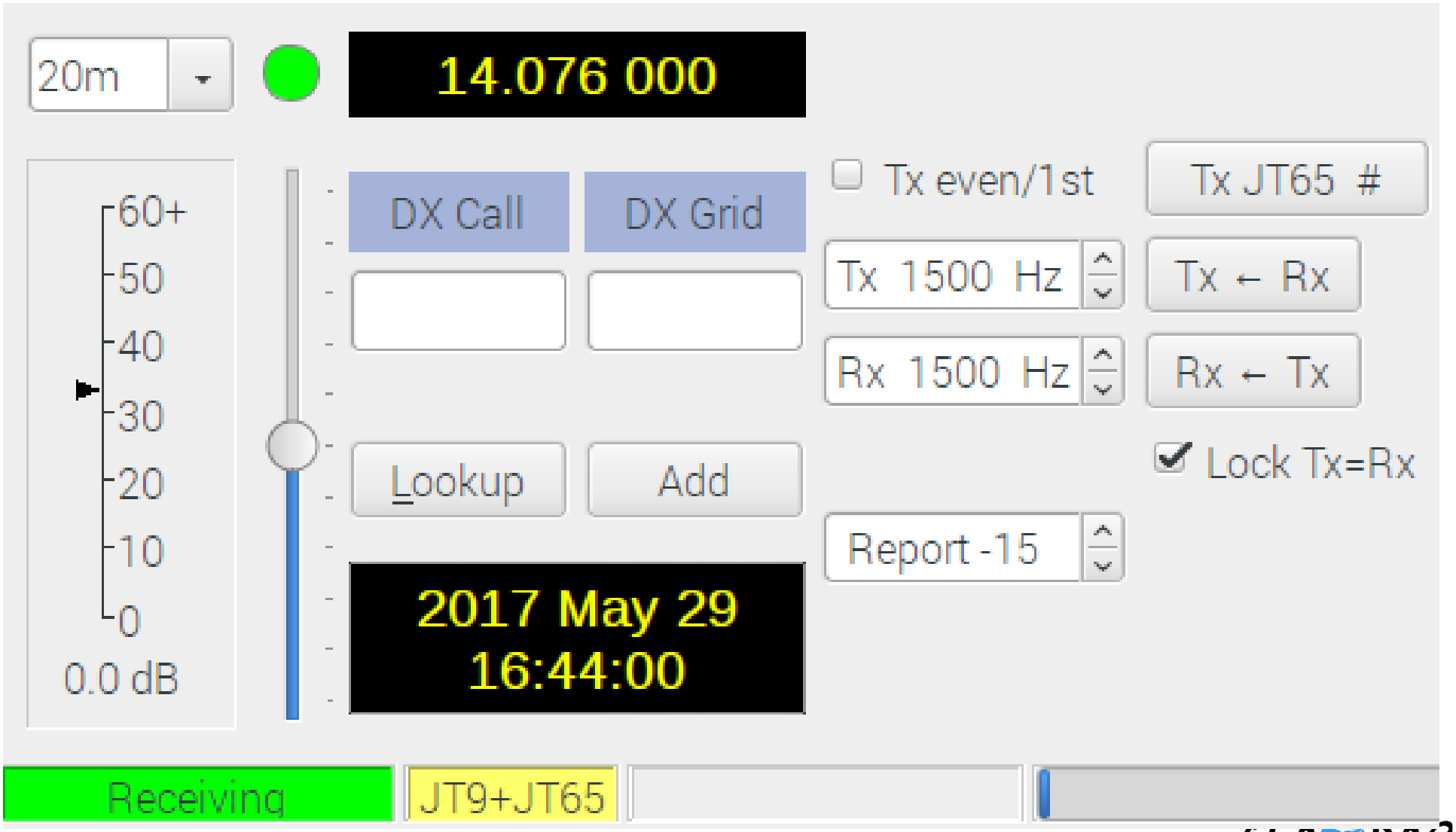


- Bins/Pixel
  - This will adjust the width of the waterfall.
    - Adjust this value to make the waterfall fit your window size or screen size.
- Start
  - This adjusts the left side of the waterfall display.

Receive Audio Level Adjustment

- Adjust the mixer, and receiver controls to around 30dB when no signals are present.
  - If it is not already highlighted in green, click the Monitor button to start normal receive operation.
    - Be sure your transceiver is set to USB (or USB Data) mode.
    - Turn off AGC, or slow it down.
    - Adjust audio mixer volume on Rpi.
    - Adjust slider next to dB meter.
      - Note: Dynamic Range is better with slider at 50% and the displayed level is 30db.
    - Adjust the RF gain on the receiver.

WSJT-X: Setup


20m
14.076 000
60+
50
40
30
20
10
0
0.0 dB
DX Call
DX Grid
Tx even/1st
Tx JT65 #
Tx 1500 Hz
Tx ← Rx
Rx 1500 Hz
Rx ← Tx
Lock Tx=Rx
Lookup
Add
Report -15
2017 May 29
16:44:00
Receiving
JT9+JT65

WSJT-X: Setup

Transmit Audio Level Adjustment

- Click the Tune button on the main screen to switch the radio into transmit mode and generate a steady audio tone.
  - Use the transmitter's 'Monitor' capability to hear the audio output from the RPi. Ensure the tone is clear, and the audio is good.
  - Adjust the output volume in the RPi Mixer software
    - Set it to where your transmitter outputs appropriate set power, and the ALC does not trigger.
  - You can make the Adjustment in WSJT-X using the power slider on the right side of the Screen.
- Toggle the Tune button once more or click Halt Tx to stop your test transmission.

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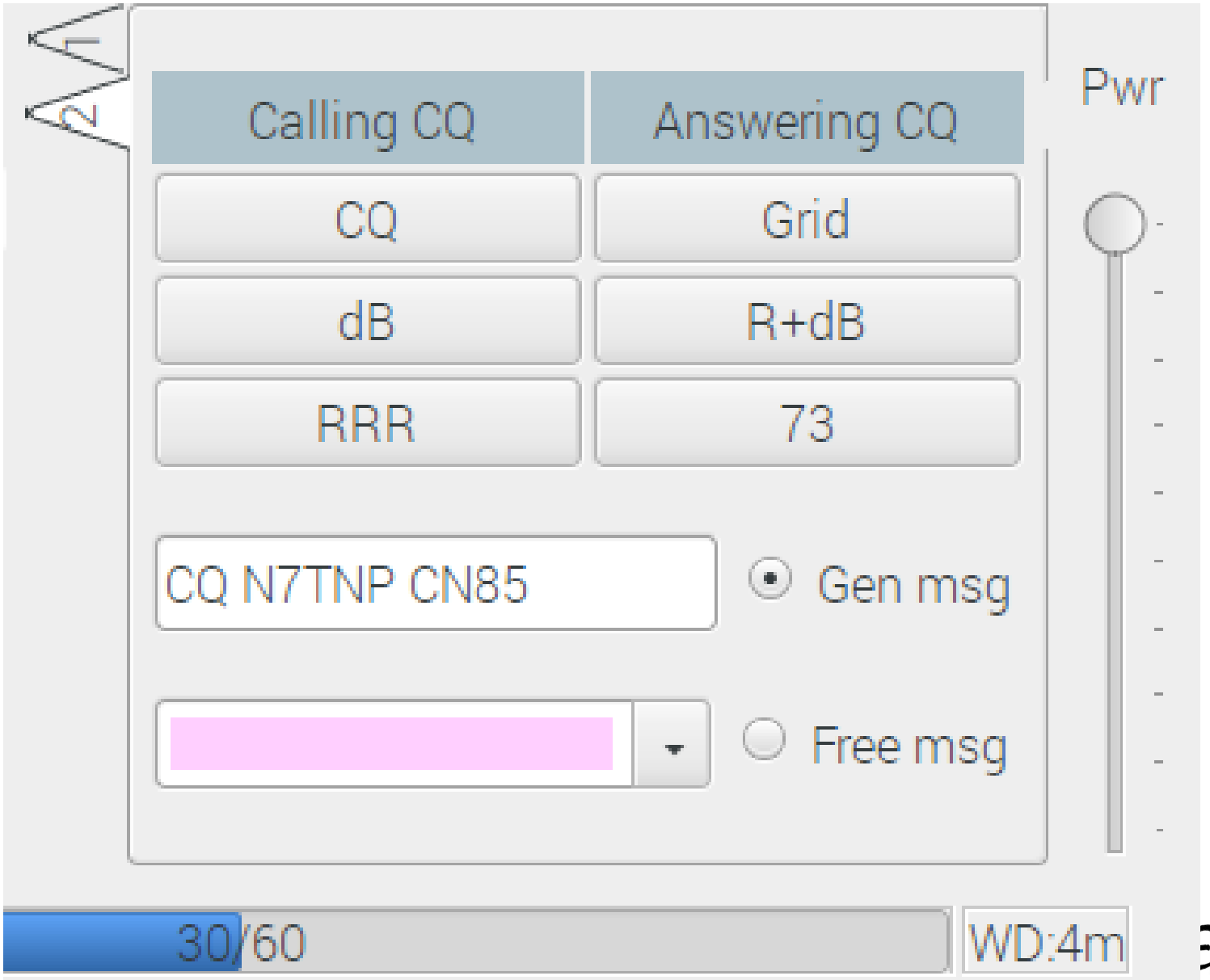
WSJT-X: Setup


1
2
Calling CQ
Answering CQ
Pwr
CQ
Grid
dB
R+dB
RRR
73
CQ N7TNP CN85
Gen msg
Free msg
30/60
WD:4m

WSHT-X: QSO

- A Standard JT QSO
  - CQ
    - CQ N7TNP CN85
  - Response
    - N7TNP AD7QQ DN16
  - Signal Report #1
    - AD7QQ N7TNP -12
  - Signal Report #2
    - N7TNP AD7QQ R-15
  - Acknowledge Report
    - AD7QQ N7TNP RRR
  - Salutation #1
    - N7TNP AD7QQ 73
  - Salutation #2
    - AD7QQ N7TNP 73

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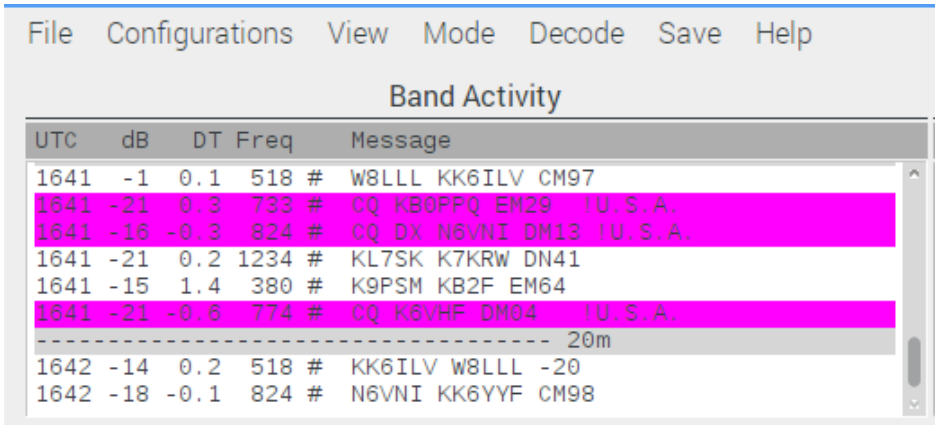
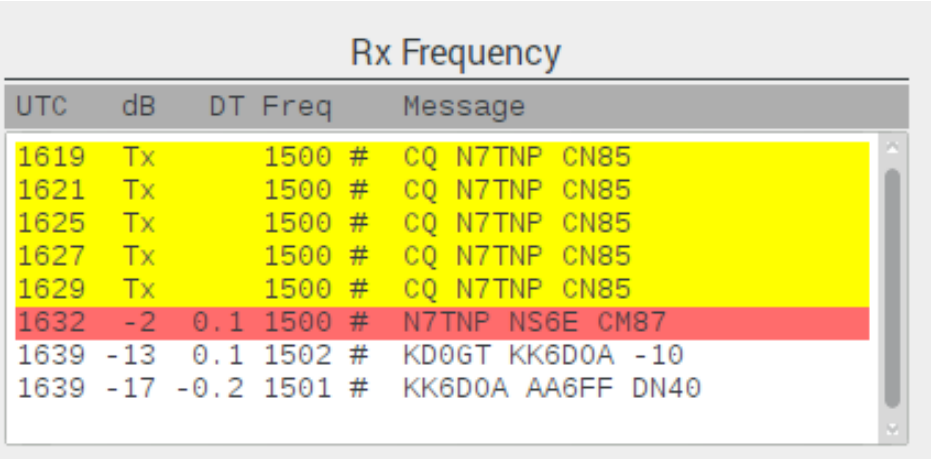
WSJT-X: QSO





- You can click a line in the band Activity box
  - This will set your software to respond to a CQ.
- Continue your QSO from the RX Frequency Box.
  - Clicking the red line will set you up for the next message in the sequence.

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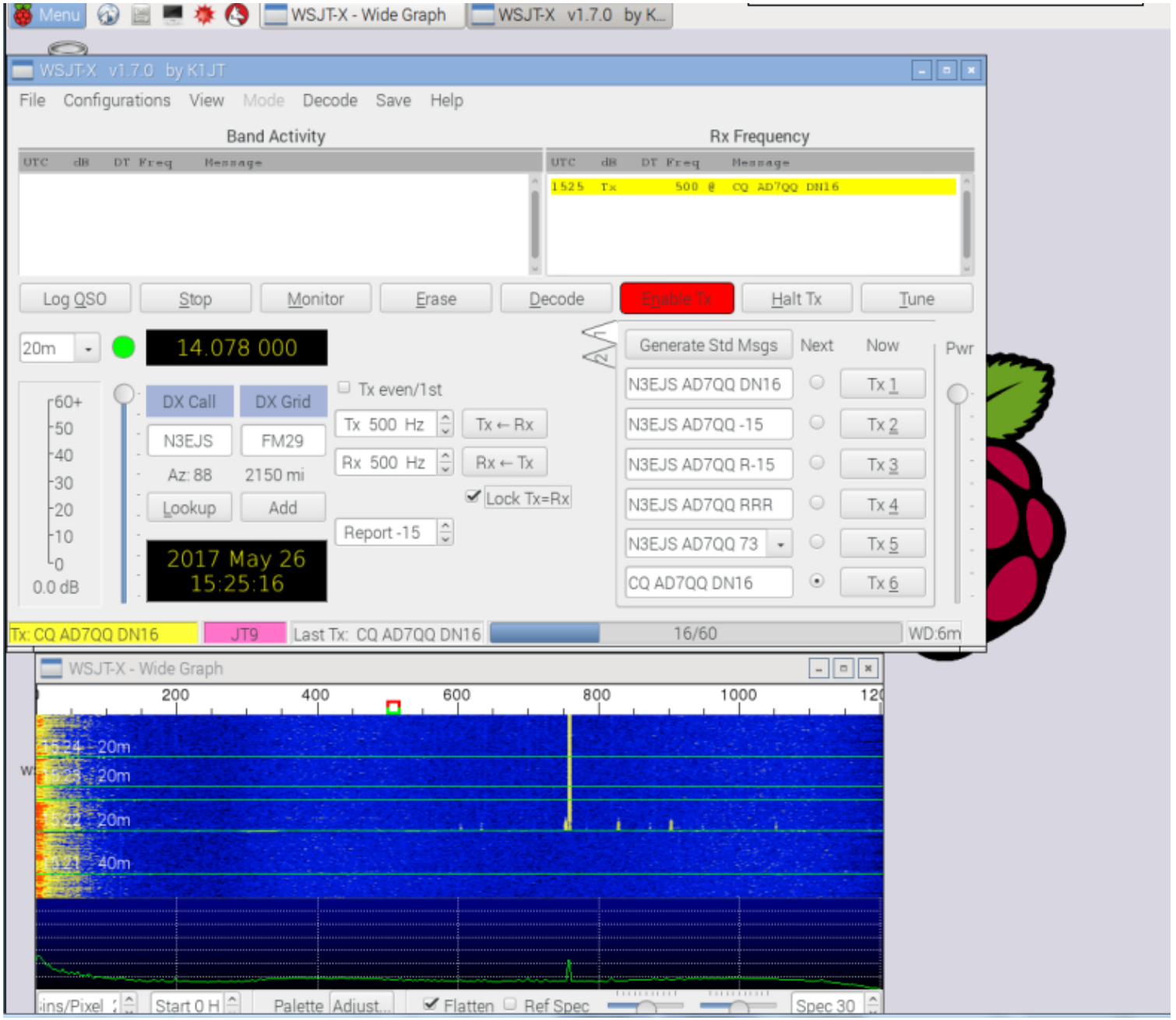
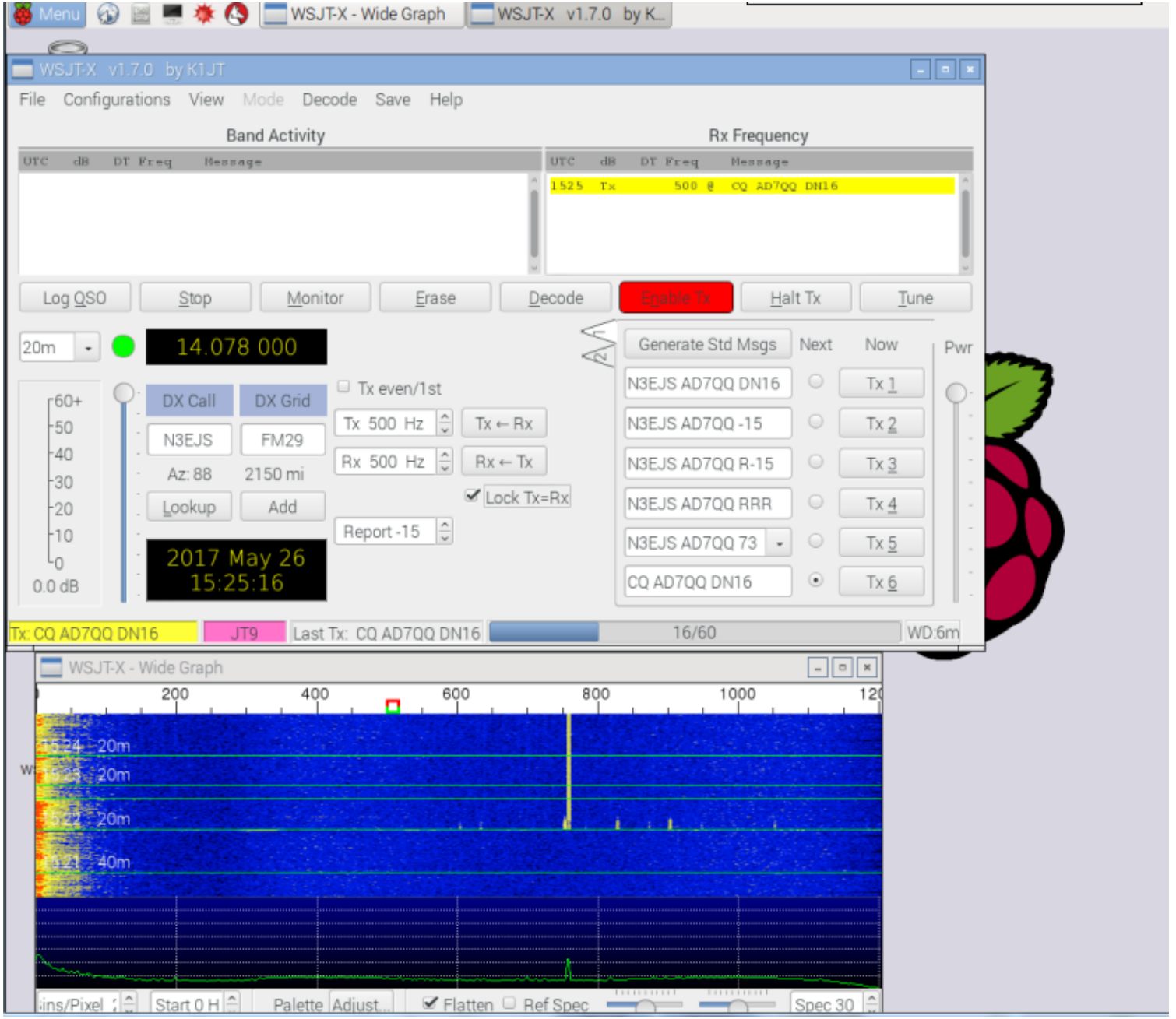
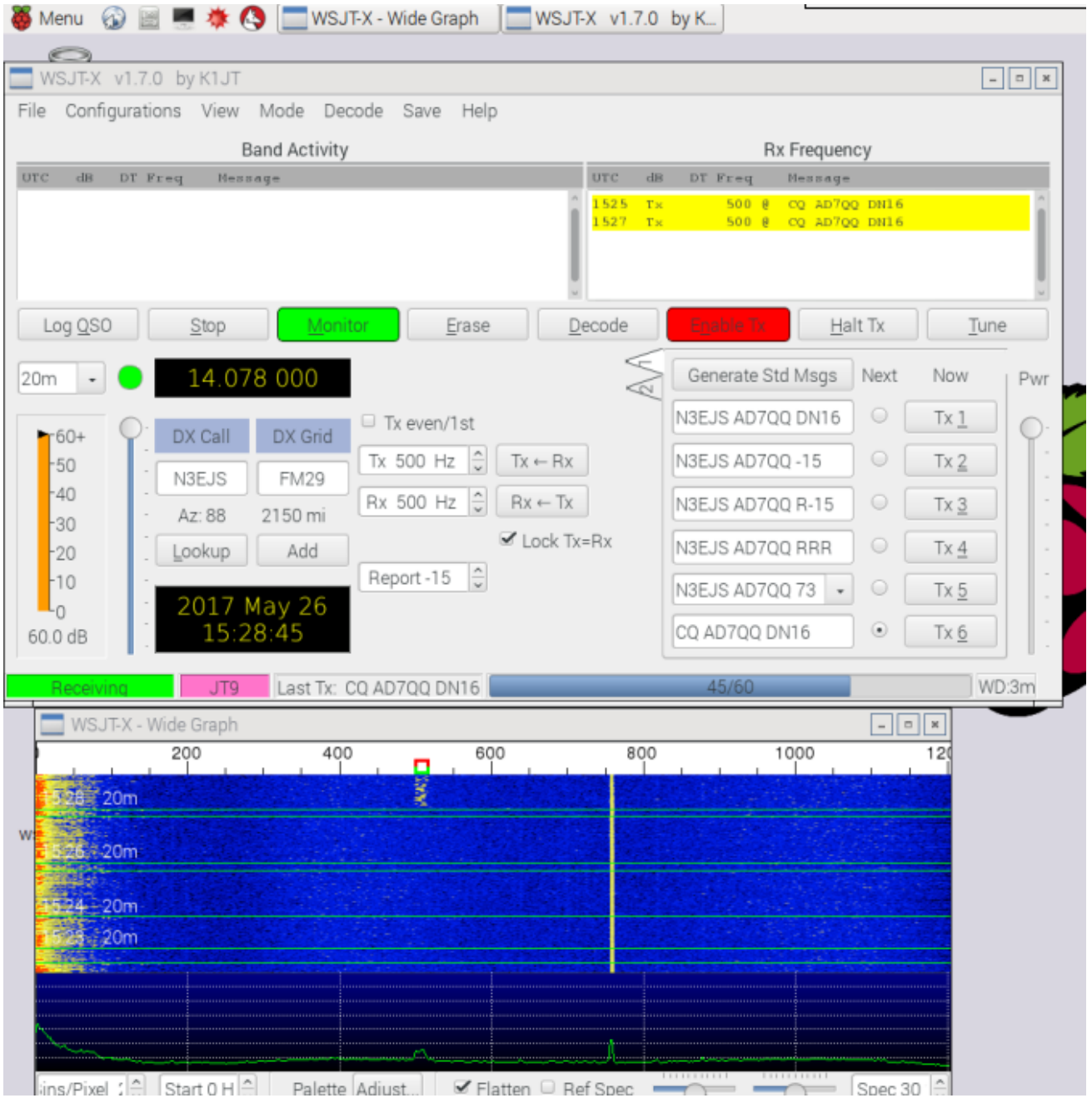
WSJT-X: JT9 QSO



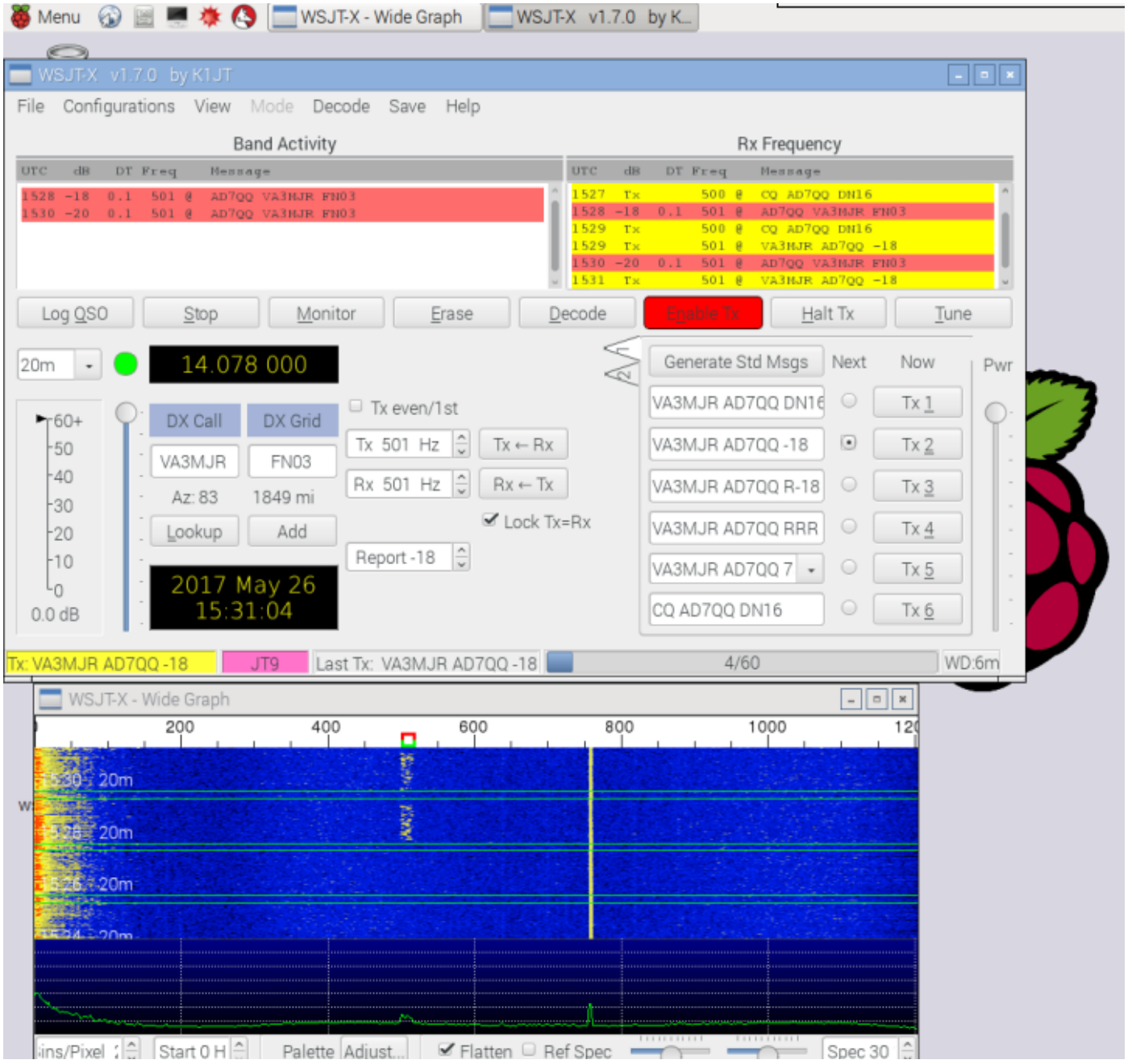
WSJT-X: JT9 QSO



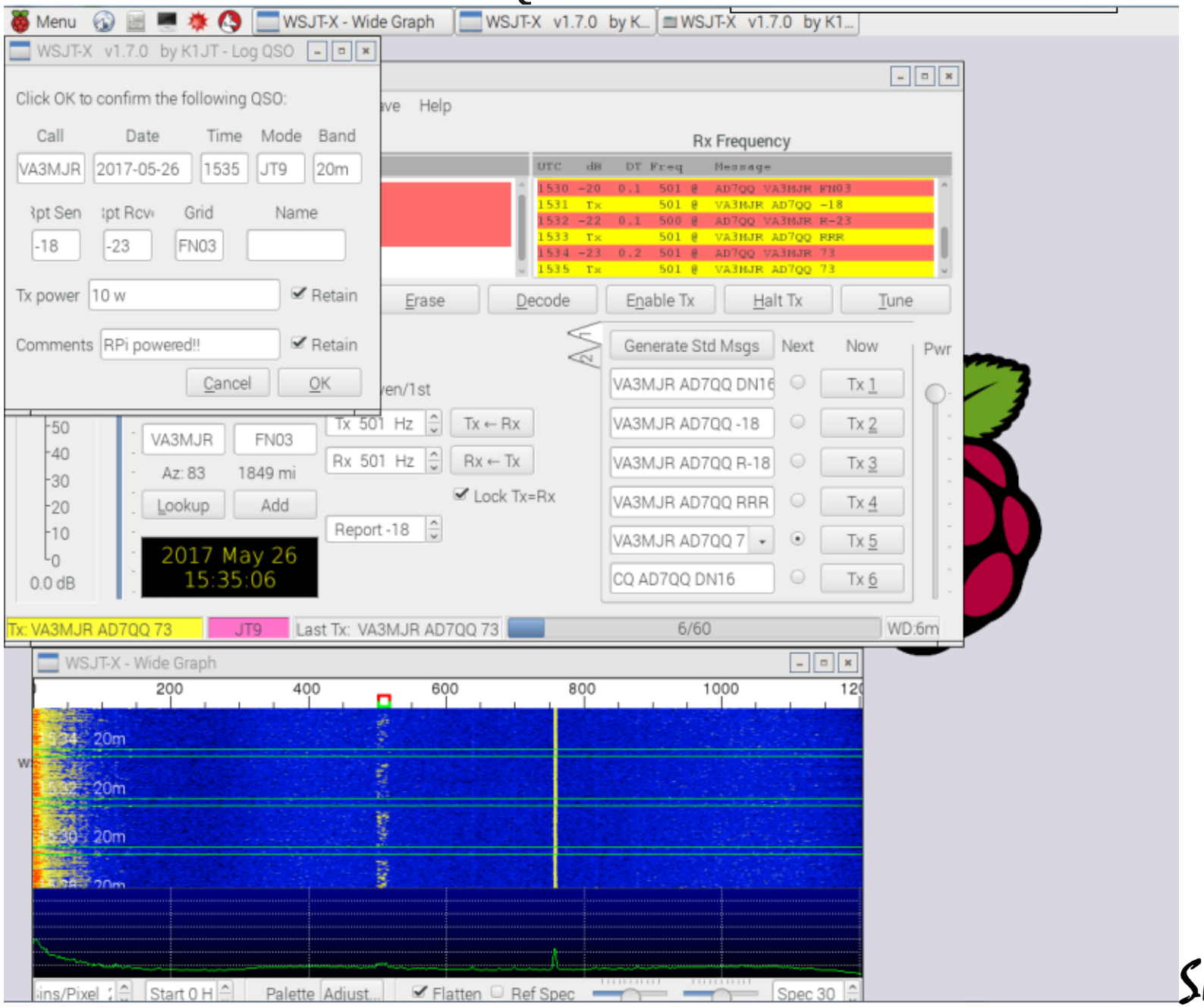
WSJT-X: JT9 QSO



WSJT-X: JT9 QSO



WSJT-X: JT9 QSO



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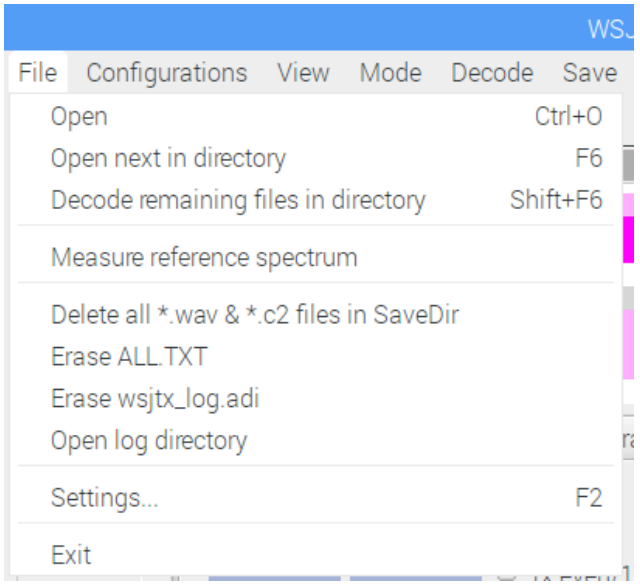
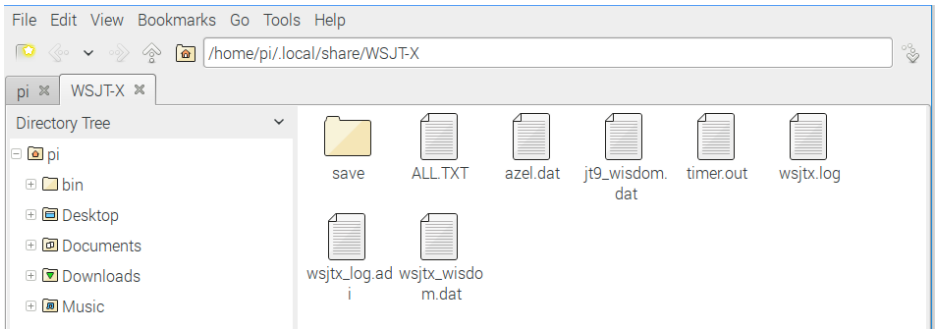
WSJT-X: Logs

- ALL.TXT
  - Stores all decoded messages.
  - Band Changes.
  - Transmissions.
- wsjtx.log; wsjtx_log.adi
  - Stores logged contacts.





WSJT-X: WSPR

- **W**eak **S**ignal **P**ropagation **R**eporter
- Originally written by Joe Taylor.
- It uses an F1D frequency shift keying.
- It transmits:
  - Station’s call sign.
  - Maidenhead Grid Location.
  - Power in dBm.
- Each transmission is 2 minutes.
- It is not a QSO.
  - It is more like a reverse beacon.

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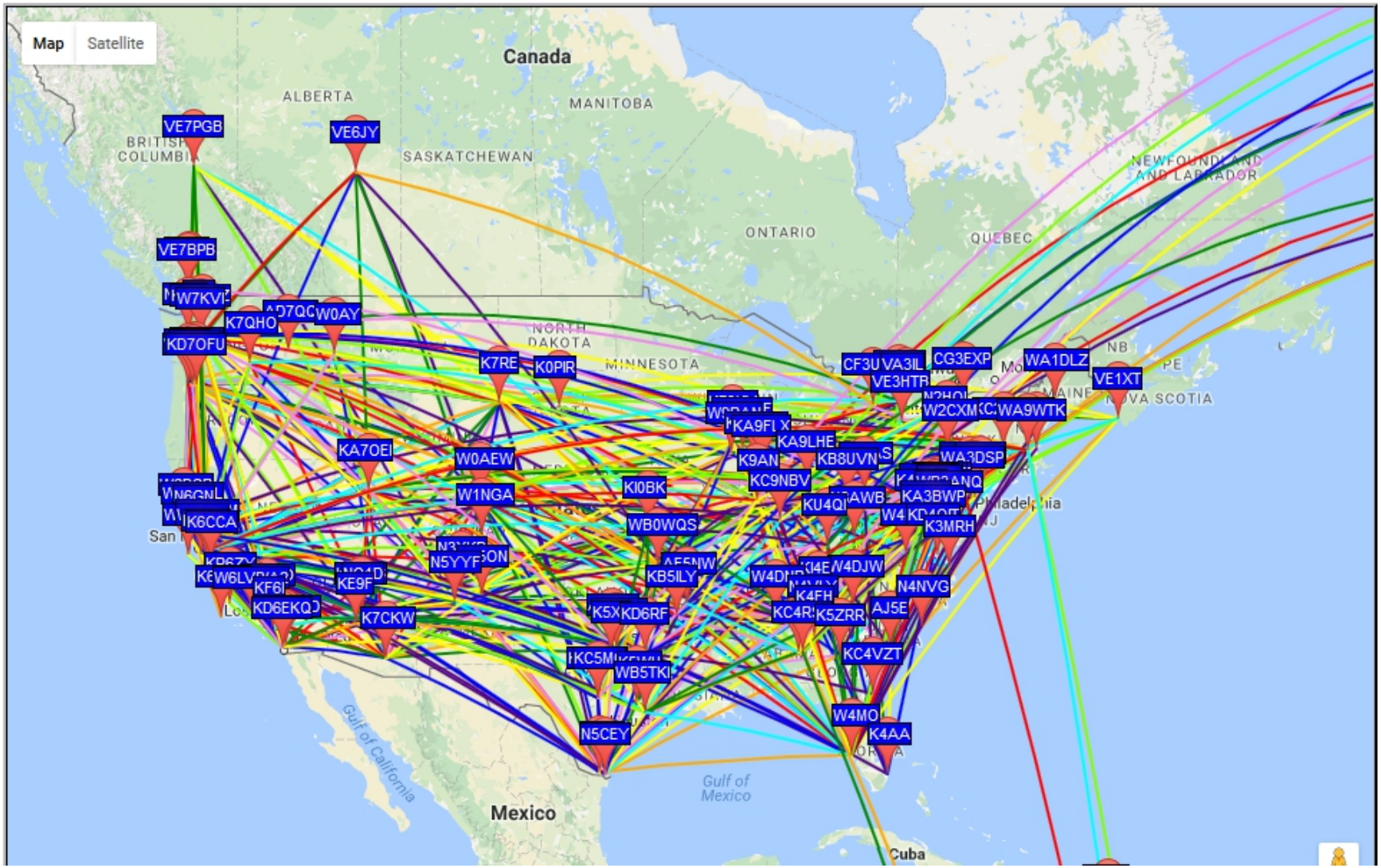
WSJT-X: WSPR

- Reports are collected on the WSPRnet site: *http://bit.ly/wsprmap*
- You can query your call sign and see who has heard you.

WSJT-X: WSPR

Map



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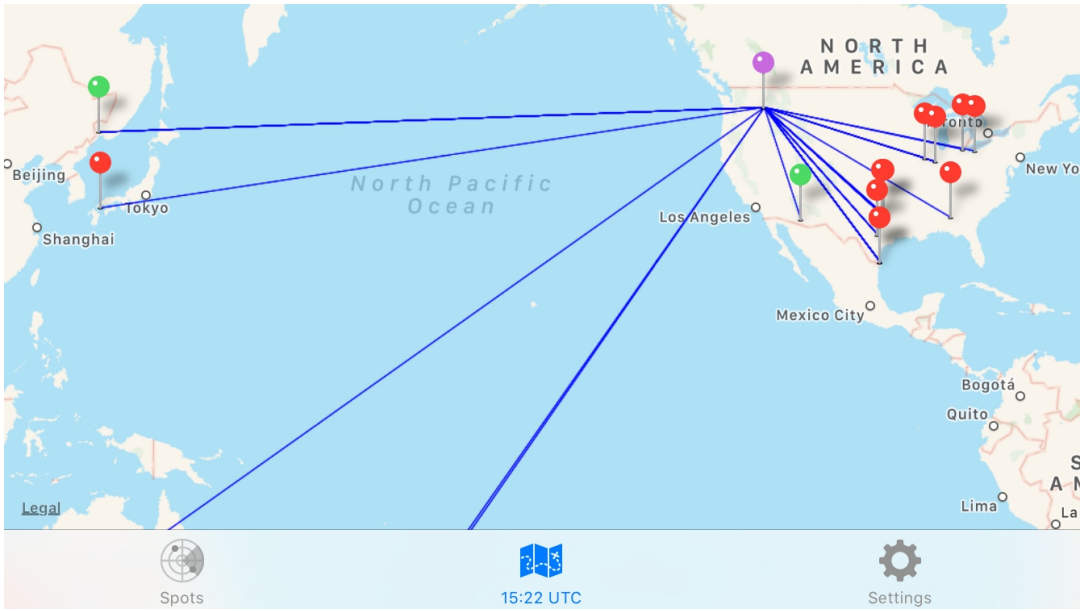
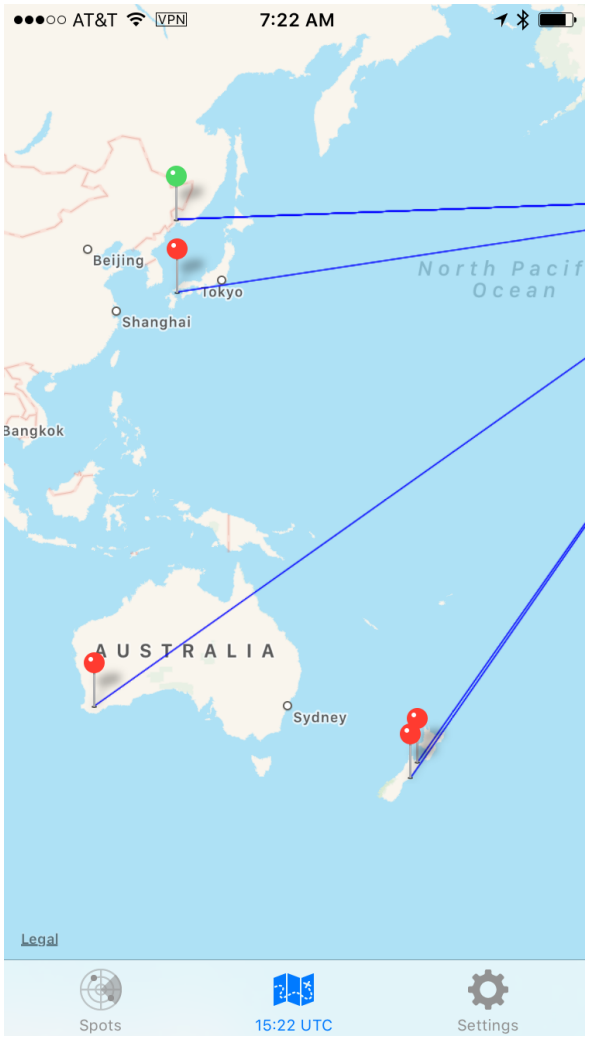
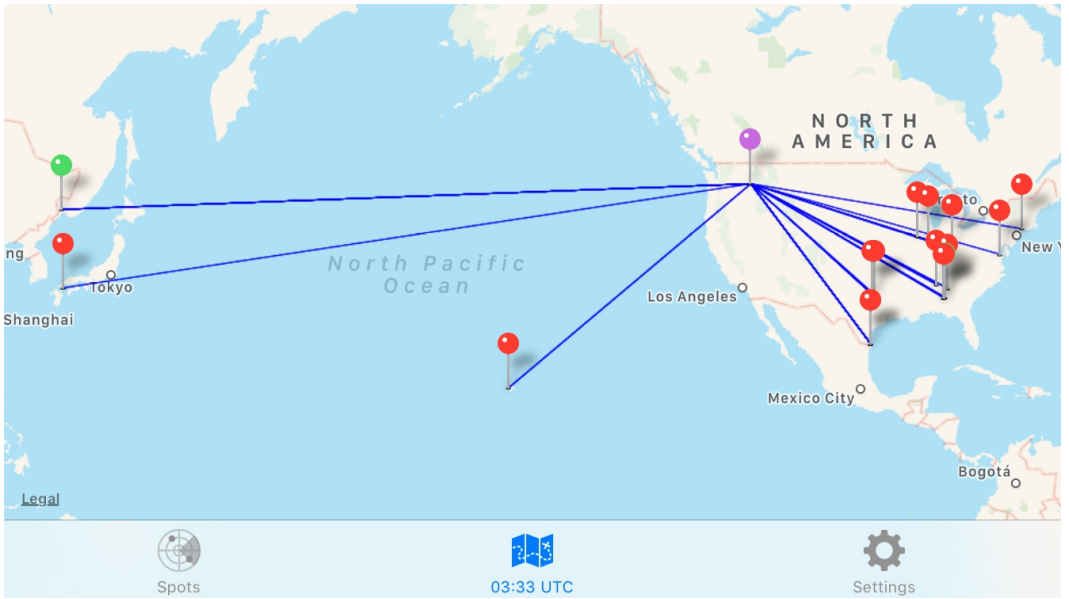
WSJT-X: WSPR


NORTH AMERICA
North Pacific Ocean
Beijing
Tokyo
Shanghai
Los Angeles
Mexico City
Bogotá
Quito
Lima
Legal
Spots
15:22 UTC
Settings


AT&T
VPN
7:22 AM
Beijing
Tokyo
Shanghai
Bangkok
North Pacif
Ocean
AUSTRALIA
Sydney
Legal
Spots
15:22 UTC
Settings


NORTH AMERICA
North Pacific Ocean
Tokyo
Shanghai
Los Angeles
Mexico City
Bogotá
Legal
Spots
03:33 UTC
Settings

WSJT-X: Additional Notes

- Use the file menu then “exit” to shutdown the application.
- Avoid using the “x” button in the upper right.
  - Sometimes this will fail to properly clear the temporary files and the program will not re-open.
  - If this happens you must manually clear the temp files.
  - Terminal commands
    - $ cd /tmp
    - $ ls
    - $ sudo rm -ri *

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WSJT-X

Questions?

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