



# FT8

A Mostly High Level Overview



# Where Did FT8 Come From?

- A new weak signal digital mode developed by Steve Franke K9AN & Joe Taylor K1JT, released in June 2017.
- Part of WSJT-X Software, released in 2001.
- Based off work done on other modes - FSK441, JT6M, JT65, JT9
- Originally intended for 10M and higher Sporadic E
- People started using JT65 on HF, then very quickly migrated to FT8 when it came out in 2017



# Reasons to Use FT8

- Make contacts - Fill up a logbook
- Work DX. Easy to find, DX Spots not necessary
- Work DX when propagation is poor.
- Awards - DXCC, WAS, WAC, etc
- Work DX with modest station/antenna. Low Power works fine.
- DX like it, no typical pile-ups, rude operators
- No language barrier
- Most popular mode on HF currently - based on Logbook of the World data
- Automatic logging
- Works with other software tools, PSK Reporter, Grid Tracker, others
- Still sending out RF. You still need a radio and antenna
- QRM less of an issue - mostly the computer has to deal with it



# Reasons to Not Use FT8

- You don't have a rig
- You don't have an antenna
- There really is no good reason not to
- But, it doesn't need to be your favorite mode
- QSOs are regimented, computer assisted, impersonal
- Interfacing rig to pc, especially older radios
- Computers can sometimes be a PITA
  - Ex. - if my pc goes into energy saver, when I come out, I may not transmit any RF
- Learning the software
  - Not too bad to get setup and going, but always a learning curve
- Low Fun Factor ?



# What do I need to Work FT8?

- Computer with Soundcard
  - *NOTE: If you already have other digital modes working, PSK31, etc, you should be all set)*
  - Pretty much all PCs qualify (Windows, Mac, Linux)
  - Can be confusing with Windows
  - Ability to interface audio to and from Transceiver
  - External soundcards/Interfaces might help (Rigblaster, Signalink)
  - All kinds of info on how to do this from many sources. Beyond the scope of this presentation.
  - Most transceivers built since early 2000s have made this easier
  - Some very recent transceivers just connect USB cable from PC to rig



# What do I need to Work FT8? (Con't)

- SSB (USB) Transceiver
- WSJT-X Software loaded on PC
  - Free - just Search WSJT-X
  - Download at: <https://physics.princeton.edu/pulsar/K1JT/wsjitx.html>
  - Keep it updated
- Accurate Time on PC (within 1 second error)
  - Exchanges are synchronized and take less than 15 seconds.
  - Free programs available (I use Dimension 4)  
<http://www.thinkman.com/dimension4/>



# Some (minimal) Technical Details

15 Second timeslots (Synchronized/Accurate clock necessary)

- FSK-8 modulation / audio tones
- 5.86 Hz tone spacing
- 6.25 baud
- 50 Hz bandwidth
- 12.6 Seconds Tx
- 77 bit message (Payload)
- Forward error detection/correction
- Domain encoding (message format, call signs)



# More

During reception, sampling from audio card is copied to disk

- At end of Tx time of timeslot data is decoded using Fast Fourier Transform (FFT) to extract multiple signals
- Decoded message can then be subtracted from sample data allowing for decoding of additional signals. Multiple stations on same "frequency"
  - 13 character limit per transmission
  - "Standard" frequencies for FT8 are default in the SW, but can be set manually
  - Theoretically 60 QSO slots in a 3 kHz bandwidth





# Basics of FT8 QSO

- Each message of up to 13 characters takes 13 seconds to send. There are 4 slots per minute, and you transmit for one 15 second block, then listen for replies for 15 seconds, and transmit again for 15 seconds.

# Typical FT8 QSO Exchanges

FT8 Message (15 secs each)	Description
CQ K2AS FN13	CQ call from K2AS
K2AS W2XRX EM36	W2XRX replies with their location
W2XRX K2AS -12	K2AS responds with a signal report
K2AS W2XRX R-08	W2XRX confirms signal report & replies with his own report
W2XRX K2AS RRR	K2AS says Reception Report Received
K2AS W2XRX 73	W2XRX says Best regards
W2XRX K2AS 73	K2AS says Best regards

# Open image wsjtx\_screens.png

The screenshot displays the WSJT-X software interface. At the top, a waterfall plot shows frequency activity from 500 to 3000 kHz. Below the plot, a table lists detected signals with their UTC, dB, DT, Freq, and Message. The interface includes various control panels for monitoring, decoding, and generating messages.

Band Activity					Rx Frequency				
UTC	dB	DT	Freq	Message	UTC	dB	DT	Freq	Message
033000	-17	0.1	2472	~ CQ AB8OU EN90 U.S.A.	025500	14	0.0	1796	~ YV4GRO K9JMS EL98
033000	-8	-0.5	2116	~ CQ DX F5SUF JN08 France	025530	6	0.0	1796	~ YV4GRO K9JMS EL98
033000	-9	0.4	1373	~ CQ AR4T EM74 U.S.A.	025600	16	0.0	1796	~ YV4GRO K9JMS R-07
033000	-8	0.3	2354	~ CQ K7IOC CN88 U.S.A.	025630	16	0.0	1796	~ YV4GRO K9JMS 73
033000	-11	0.1	1003	~ CQ 9K2HN LM30 Kuwait	030600	-17	0.3	1802	~ XE1RCA UA6RQ -14
033000	-12	0.0	2309	~ CQ I13WRC Italy	030900	10	0.1	1802	~ CQ DX W5DUI EM50 U.S.A.
033000	-24	0.1	1904	~ CQ UA6RQ KN96 EU Russia	030930	7	0.1	1802	~ CQ DX W5DUI EM50 U.S.A.
033015	-2	-0.1	1078	~ CQ KM4ZHW EM60 U.S.A.	031000	11	0.2	1802	~ CQ DX W5DUI EM50 U.S.A.
033015	6	0.4	1629	~ CQ CO8LY FL20 Cuba	031045	2	0.1	1802	~ CQ DX W5DUI EM50 U.S.A.
033015	-11	0.1	1752	~ CQ K04LZE EM64 U.S.A.	031115	12	0.1	1802	~ CQ DX W5DUI EM50 U.S.A.
033015	-4	-0.5	1948	~ CQ AB5EO/6 U.S.A.	031145	12	0.1	1802	~ CQ DX W5DUI EM50 U.S.A.
033015	-6	-0.1	602	~ CQ WA7TV CN98 U.S.A.	031215	8	0.1	1802	~ SV5AZP W5DUI -14
033015	0	0.1	1390	~ CQ N7MDW EM75 U.S.A.	031215	1	-0.8	1803	~ W5DYQ N4TDT EL87
033015	-11	0.1	1500	~ CQ KP4MAQ FK78 Puerto Rico	031245	14	0.1	1802	~ SV5AZP W5DUI -14
033030	1	0.1	1856	~ CQ K4NYX EL97 U.S.A.	031315	9	0.1	1802	~ SV5AZP W5DUI -14
033030	-3	0.5	1498	~ CQ WP3L FK68 Puerto Rico	031345	14	0.1	1802	~ SV5AZP W5DUI -14
033030	-16	0.2	670	~ CQ I12IDT JN45 Italy	031415	5	0.1	1802	~ SV5AZP W5DUI -14
033030	-14	0.2	527	~ CQ SV5AZP FK46 Decodacnese	031445	9	0.1	1802	~ CQ DX W5DUI EM50 U.S.A.
033030	-19	0.1	2472	~ CQ AB8OU EN90 U.S.A.	031600	1	0.1	1805	~ WA7TV K5RMD 73
033030	-17	0.1	746	~ CQ K1LBUF FN43 U.S.A.	031645	-6	0.1	1797	~ 9A1CCB WV5S -11
033030	-13	0.4	1374	~ CQ AR4T EM74 U.S.A.	031715	-8	0.1	1797	~ 9A1CCB WV5S -11
033030	-18	0.2	1784	~ CQ KB8QAS EN72 U.S.A.	031745	-10	0.1	1797	~ 9A1CCB WV5S -11
					032930	-12	0.1	1796	~ N3AZ K7KRN DM33
					032945	-12	0.1	1796	~ KQ30 K7KRN DM33
					033015	-13	0.1	1796	~ KQ30 K7KRN R-12

Control Panel: CQ only, Log QSO, Stop, Monitor, Erase, Decode, Enable Tx, Halt Tx, Tune, Menus. Frequency: 7.074 000. TX 2494 Hz. RX 1801 Hz. Report -9. Auto Seq, Call 1st. Date: 2022 Feb 08 03:30:47. Status: Receiving. Last Tx: A91SD K2AS FN13.



# Typical QSO

[Start Video - Short QSO](#)



# QSO With Issues

[Start video - Long QSO](#)

Band Activity

UTC	dB	DT	Freq	Message
210400	7	0.1	1111	~ CQ N9OY EN43 U.S.A.
210400	-13	0.1	304	~ CQ WB4YTG EL49
210400	-7	0.1	840	~ CQ KP4JFR FK68
210400	-11	0.2	1283	~ CQ POTA N7LWD EL98
210400	-24	0.1	450	~ CQ IK0OEF JN61
----- 20m -----				
210415	4	0.0	1432	~ CQ K4RBW FM18
210415	-4	0.2	2702	~ CQ N5BWD EM42
210415	-1	0.0	1270	~ CQ KO4LZE EM64
210415	-15	0.2	1838	~ CQ EI9KF IO64
210415	-16	0.0	2371	~ CQ KG7MYX CN88
210415	-16	0.1	1511	~ CQ F4JGI IN94
210415	-24	0.1	2538	~ CQ G7SQS IO81
210415	-24	0.0	1166	~ CQ VE2DA FN35
----- 20m -----				
210430	-11	0.1	486	~ CQ NA EA2DP IN83
210430	10	-0.2	1521	~ CQ K4SHA EM72
210430	5	0.3	1629	~ CQ WA4CAS EM92
210430	-9	-0.1	1341	~ CQ DX N4BUA EL87
210430	14	0.0	1936	~ CQ K0LWC EN35
210430	9	0.1	1112	~ CQ N9OY EN43
210430	-13	-0.1	637	~ CQ K9MRQ CN88
210430	-14	0.0	305	~ CQ WB4YTG EL49
210430	-10	0.2	1283	~ CQ POTA N7LWD EL98
210430	-5	0.0	840	~ CQ KP4JFR FK68

CQ only  Log QSO  Stop  Tx eve

20m S 14.074 000 Tx 2549

DX Call: EA2DP DX Grid: IN83  
 Az: 62 3612 mi  
   Auto S

2022 Feb 08  
 21:04:52  
 69 dB

Rx Frequency

UTC	dB	DT	Freq	Message
205830	-11	0.1	486	~ CQ NA EA2DP IN83 Spain

**Settings** ? X

General Radio Audio Tx Macros Reporting Frequencies Colors Advanced

Station Details

My Call:  My Grid:   AutoGrid IARU Region:

Message generation for type 2 compound callsign holders:

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  Show principal prefix instead of country name

Behavior

Monitor off at startup  Enable VHF and submode features

Monitor returns to last used frequency  Allow Tx frequency changes while transmitting

Double-click on call sets Tx enable  Single decode

Disable Tx after sending 73  Decode after EME delay

Calling CQ forces Call 1st

Alternate F1-F6 bindings Tx watchdog:

CW ID after 73 Periodic CW ID Interval:

Menus

Next Now Pwr

Tx 1

Tx 2

Tx 3

Tx 4

Tx 5

Tx 6

CQ K2AS FN13

Band Activity

Rx Frequency

Freq	Message	UTC	dB	DT	Freq	Message
----- 20m						
485	~ CQ NA EA2DP IN83	205900	-7	0.1	486	~ KD8EVN EA2DP -24
840	~ CQ KP4JFR FK68					
1521	~ CQ K4SHA EM72					
902	~ CQ F4IIZ JN03					
1936	~ CQ KOLWC EN35					
636	~ CQ K9MRQ CN88					
1006	~ CQ W5VAX EM14					
254	~ CQ PY6ZL HH08					
2360	~ CQ WG4P EM73					
1628	~ CQ WA4CAS EM92					
304	~ CQ WB4YTG EL49					
2390	~ CQ KA8JIL EL97					
1743	~ CQ SOTA KL5CX EM74					
1283	~ CQ POTA N7LWD EL98					
449	~ CQ IK00EF JN61					
----- 20m						
806	~ CQ WING FN31					
893	~ CQ POTA W4CHF EM91					
1135	~ CQ EA5MT IM88					
2702	~ CQ N5BWD EM42					
1270	~ CQ KO4LZE EM64					
2371	~ CQ KG7MYX CN88					
2189	~ CQ KN4WOJ FM18					
2696	~ CQ AB5EO/6					

806	~ CQ WING FN31
893	~ CQ POTA W4CHF EM91
1135	~ CQ EA5MT IM88
2702	~ CQ N5BWD EM42
1270	~ CQ KO4LZE EM64
2371	~ CQ KG7MYX CN88
2189	~ CQ KN4WOJ FM18
2696	~ CQ AB5EO/6

QSO Stop

14.074 000

Tx even

Tx 2549

DX Call  DX Grid

EA2DP  IN83

Az: 62 3612 mi

Report

okup  Add  Auto S

2022 Feb 08 21:06:01

### Settings

Rig: Ham Radio Deluxe Poll Interval: 1 s

**CAT Control**

Network Server:

**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: COM1

**Transmit Audio Source**

Rear/Data  Front/Mic

**Mode**

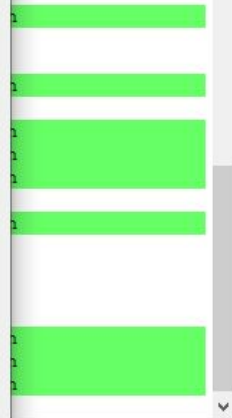
None  USB  Data/Pkt

**Split Operation**

None  Rig  Fake It

Test CAT Test PTT

OK Cancel



Tune  Menus

Next	Now	Pwr
<input type="radio"/>	Tx 1	-
<input type="radio"/>	Tx 2	-
<input type="radio"/>	Tx 3	-
<input type="radio"/>	Tx 4	-
<input type="radio"/>	Tx 5	-
<input checked="" type="radio"/>	Tx 6	-

CQ K2AS FN13

WJS, K9AN, and IV3JNV

File Decode Save Tools Help

Band Activity Rx Frequency

Message	UTC	dB	DI	Freq	Message
~ CQ K9MYX CN88 U.S.A.	205915	-10	0.1	487	~ EA2DP KX40P FM16
~ CQ KN4WOJ FM18					
~ CQ AB5EO/6					
----- 20m					
~ CQ NA EA2DP IN83					
~ CQ K9MRQ CN88					
~ CQ KP4JFR FK68					
~ CQ F4IIZ JN03					
~ CQ WG4P EM73					
~ CQ WA4CAS EM92					
~ CQ KA8JIL EL97					
~ CQ SOTA KL5CX EM74					
~ CQ IISWRTC					
~ CQ SV3EXP KM08					
~ CQ WB4YTG EL49					
~ CQ WB6OTG FM05					
----- 20m					
~ CQ WA2NBG FM02					
~ CQ KO4LZE EM64					
~ CQ POTA W4CHF EM91					
~ CQ N5BWD EM42					
~ CQ G7SQS IO81					
~ CQ KN4WOJ FM18					
~ CQ W6RPM CM98					
~ CQ AB5EO/6					

Stop Tune  Menus

**4.074 000**  Tx even

Tx 2549

DX Grid  ▲

IN83 Rx 486

2 3612 mi Report

Add  Auto S

**2 Feb 08**

**10:06:40**

CQ K2AS FN13

Settings

General Radio Audio Tx Macros Reporting Frequencies Colors Advanced

Soundcard

Input: Line (3-USB AUDIO CODEC) Mono

Output: Speakers (3-USB AUDIO CODEC) Mono

Save Directory

Location: C:/Users/Owner/AppData/Local/WSJT-X/save Select

AzEl Directory

Location: C:/Users/Owner/AppData/Local/WSJT-X Select

Remember power settings by band

Transmit  Tune

OK Cancel

Tune  Menus

Next Now Pwr

Tx 1

Tx 2

Tx 3

Tx 4

Tx 5

Tx 6



Message	UTC	dB	DT	Freq	Message
W4QYV EM92 U.S.A.	205930	-10	0.1	485	KD8EVN EA2DP -24
----- 20m					
K4RBW FM18					
POTA W4CHF EM91					
WA2NBG FM02					
KB4RZG FM05					
POTA N7LWD EL98					
KN4WOJ FM18					
VE7ADO CN89					
N9KJN EN52					
EI9KF IO64					
AB5EO/6					
W6RPM CM98					
----- 20m					
NA EA2DP IN83					
WA4CAS EM92					
SOTA KL5CX EM74					
W5VAX EM14					
W4QYV EM92					
WG4P EM73					
W4ZGR EL97					
KN6KBS CM87					
II5WRIC					
DX K9KU EN65					
WB6OTG FM05					

Stop  Tx even

000

Tx 2549

DX Grid  IN83

2 mi  Rx 486

Add  Report

Auto S

08  
4

### Settings

- General
- Radio
- Audio
- Tx Macros
- Reporting
- Frequencies
- Colors
- Advanced

**Logging**

- Prompt me to log QSO Op Call:
- Log automatically (contesting only)
- Convert mode to RTTY
- dB reports to comments
- Clear DX call and grid after logging

**Network Services**

- Enable PSK Reporter Spotting  Use TCP/IP connection

**UDP Server**

- UDP Server:   Accept UDP requests
- UDP Server port number:   Notify on accepted UDP request
- Outgoing interfaces:   Accepted UDP request restores window
- Multicast TTL:

**Secondary UDP Server (deprecated)**

- Enable logged contact ADIF broadcast
- Server name or IP address:
- Server port number:

OK Cancel

Tune  Menus

Next Now Pwr

- Tx 1
- Tx 2
- Tx 3
- Tx 4
- Tx 5
- Tx 6

CQ K2AS FN13

ge

UTC dB DT Freq Message

MPH EN25 U.S.A. 210000 -14 0.1 485 ~ KD8EVN EA2DP RR73

NG FN31

PPH JN07

1XX FN42

2NBG FM02

KJN EN52

JVP EN72

SQS IO81

YNI FN00

4WOJ FM18

RPM CM98

4RZG FM05

----- 20m

EA2DP IN83

4CAS EM92

4P EM73

ZGR EL97

QYV EM92

6KBS CM87

60TG FM05

3NFN FN03

8/DM3HZN

K9KU EN65

7B DN31

JPH DM79

stop

10

DX Grid

IN83

Rx 486

Report

add

Auto S

3

CQ K2AS FN13

Settings

General Radio Audio Tx Macros Reporting Frequencies Colors Advanced

Decode Highlighting

- My Call in message [f/g unset]
- New Continent [f/g unset]
- New Continent on Band [f/g unset]
- New CQ Zone [f/g unset]
- New CQ Zone on Band [f/g unset]
- New ITU Zone [f/g unset]
- New ITU Zone on Band [f/g unset]
- New DXCC [f/g unset]
- New DXCC on Band [f/g unset]
- New Grid [f/g unset]
- New Grid on Band [f/g unset]
- New Call [f/g unset]
- New Call on Band [f/g unset]

Reset Highlighting

Highlight by Mode Rescan ADIF Log

Only grid Fields sought

Include extra WAE entities

Logbook of the World User Validation

Users CSV file URL:  Fetch Now

Age of last upload less than:

OK Cancel

Tune

Next Now Pwr

Tx 1

Tx 2

Tx 3

Tx 4

Tx 5

Tx 6

Band Activity

Message	UTC	dB	DT	Freq	Message
CQ F6CBN IN87 France	210100	-8	0.1	486 ~	CQ NA EA2DP IN83 Spain
CQ EA8/DM3HZN					
CQ N6JPH DM79					
----- 20m -----					
CQ ON75LLV					
CQ F1PPH JN07					
CQ AB5EO/6					
CQ KO4LZE EM64					
CQ W8JVP EN72					
CQ G7SQS IO81					
CQ KN4WOJ FM18					
CQ VE2DA FN35					
----- 20m -----					
CQ WA4CAS EM92					
CQ W4QYV EM92					
CQ W5VAX EM14					
CQ WB6OTG FM05					
CQ K4SHA EM72					
CQ KP4JFR FK68					
CQ CO7CRJ FL11					
CQ KN6KBS CM87					
CQ N4FH EM64					
CQ KD2RUY FN12					
CQ W3MJ FN21					
CQ NB7B DN31					

Stop

074 000

Tx event

Tx 2549

DX Grid

IN83

Rx 486

3612 mi

Report

Add

Auto S

Feb 08 08:51

CQ K2AS FN13

Rx Frequency

Settings

General Radio Audio Tx Macros Reporting Frequencies Colors Advanced

JT65 VHF/UHF/Microwave decoding parameters

Random erasure patterns: 6

Aggressive decoding level: 0

Two-pass decoding

Miscellaneous

Degrade S/N of .wav file: 0.0 dB

Receiver bandwidth: 3000 Hz

Tx delay: 0.2 s

Tone spacing

x 2  x 4

Waterfall spectra

Low sidelobes  Most sensitive

Special operating activity: Generation of FT4, FT8, and MSK144 messages

Fox  Hound

NA VHF Contest  ARRL Field Day

FD Exch: ID WNY

EU VHF Contest  RTTY Roundup messages

RTTY RU Exch:

WW Digi Contest

OK Cancel

Tune  Menus

Next Now Pwr

Tx 1

Tx 2

Tx 3

Tx 4

Tx 5

Tx 6



# Special Operating Activities

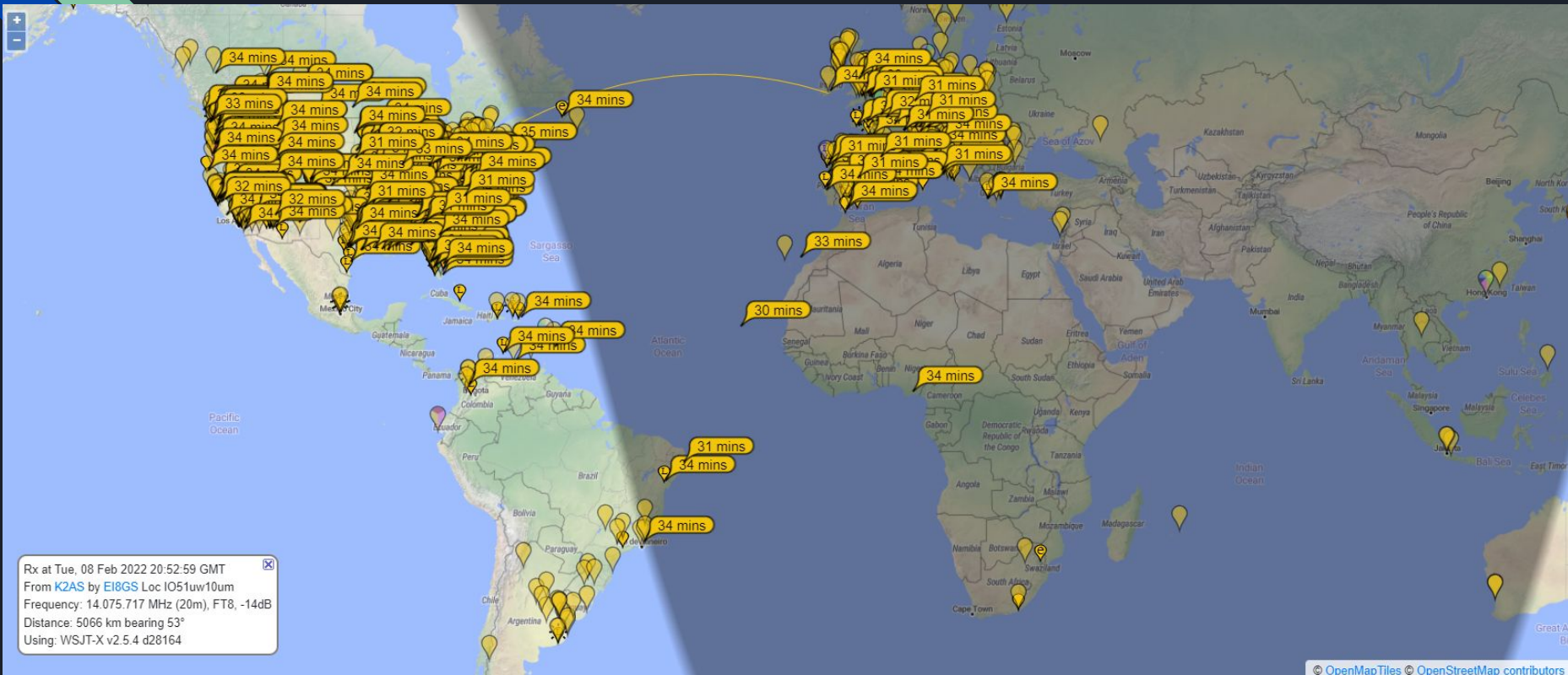
Seen in Settings -> Advanced

- Fox/Hound - For DXpeditions
  - DX Station is Fox
  - Everyone Else is Hound
  - Often on different frequencies - publicized
  - Need to read User Guides
- Contests
  - Field Day
  - VHF Contests
  - Messages/Exchanges change



# Some Basic Hints/Tips

- Use widest filter possible. 2.4 - 3 KHz best
- Don't answer CQ on callers frequency (use Hold TX Freq option)
- Adjust Transmit Power Slider until output power starts to drop off and little or no ALC
- Use PSK Reporter to see if your signal is getting out to station you are calling
- Adjust TX frequency if a station keeps sending a message - there is likely QRM on his side
- Keep Transceiver volume down - no need to listen to audio
- Shift + Right Mouse click to set TX Freq
- Don't give up on DX stations if you don't get response at first. Usually many stations calling them.
  - Watch the RX message side. You should be able to see who he is in QSO with and when they complete QSO.
  - I usually don't keep calling while they are in QSO, but many do. As long as you are in a clear spot, shouldn't be causing QRM, and he will see your call in red.
  - When he's finished, he may call you next.
  - Be ready to answer with TX message 3. He already has your grid and he will give ur report, so no need to start from beginning
- Turn off AGC? I haven't done this. Usually hear them better than they hear me.





# Other Programs that Work With WSJT-X

- DX Lab Suite, Omni-Rig, and Ham Radio Deluxe
- PSK Reporter
- JTAlert,
- AlarmsJT (Linux)
- JT-Bridge (Mac)
- N1MM Logger+
- Writelog



# Resources

- WSJT-X User Guide (URL changes with version. Go to WSJT-X Web Page)
- FT8 Guide by ZL2IFB (Gary Hinson . . . . . Tips)
  - [https://www.g4ifb.com/FT8 Hinson tips for HF DXers.pdf](https://www.g4ifb.com/FT8%20Hinson%20tips%20for%20HF%20DXers.pdf)
- Discussion Group - <https://wsjtx.groups.io/g/main/topics>
- <https://qrpguys.com/digital-transceiver>
- <http://crkits.com>
- <https://midnightdesignsolutions.com/phaser/>
-