FT8 and *JTAlert*

An Efficient QSO Generation System

Larry Banks, W1DYJ

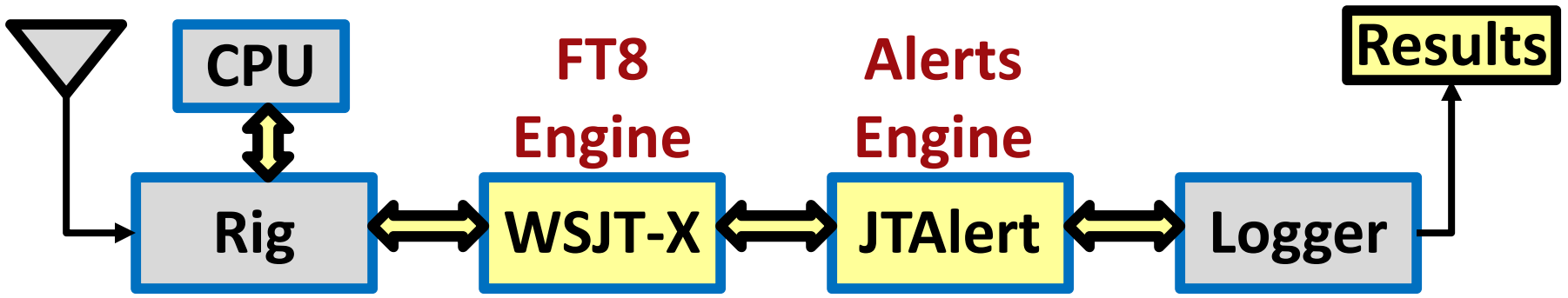
Licensed: 1961 [KN1VFX]
W1DYJ since 1966
Amateur Extra

9B DXCC [297-Cnf / 299-Wkd]
DX Challenge: 1888
8B WAS
6M VUCC [615 grids-Cnf]
All Low Power

W1DYJ ~ Larry Banks

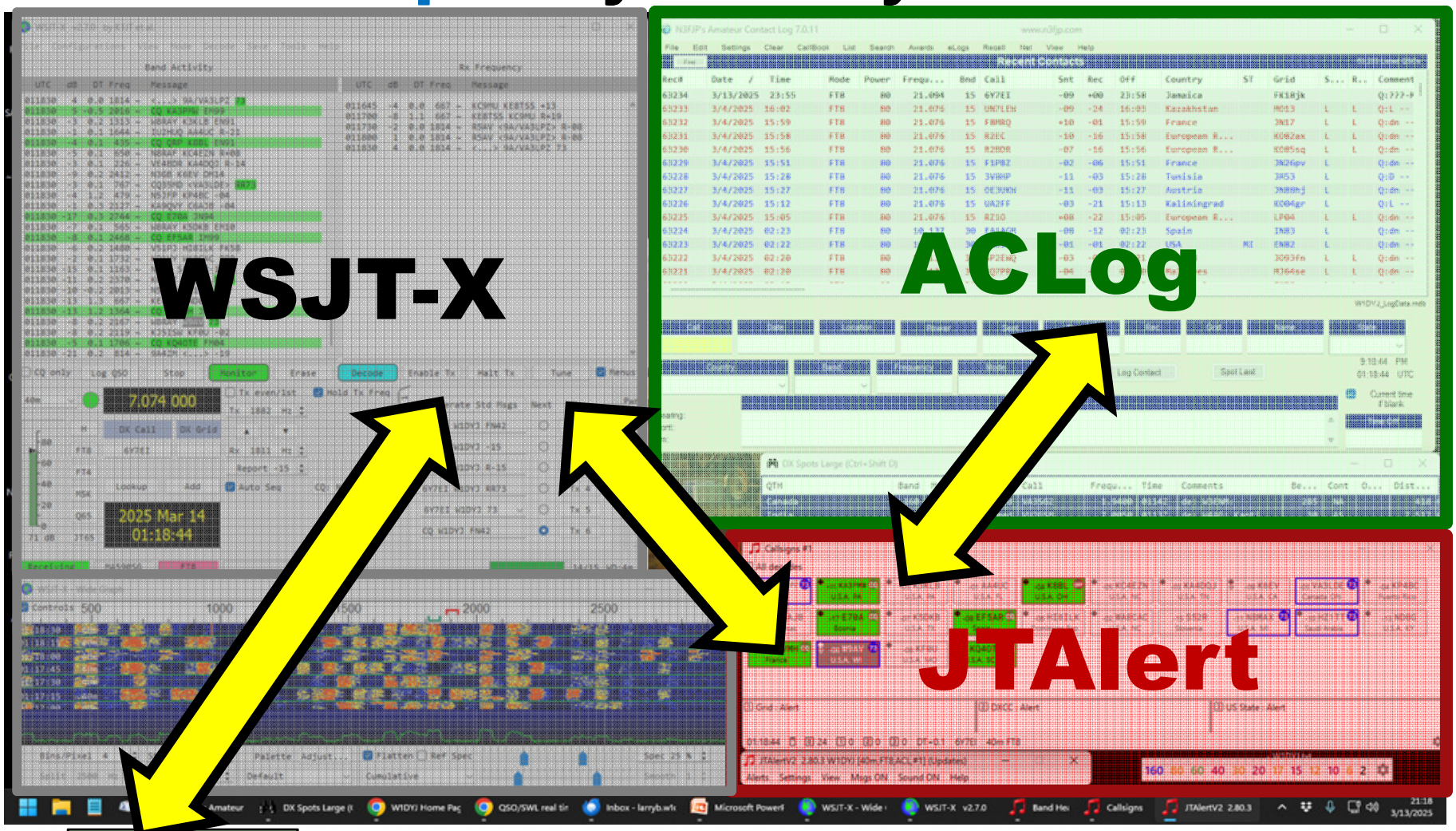
FT8 and JTAlert ~ Agenda

- Basics of WSJT-X & FT8
- HW / SW Setup
- JTAlert
- W1DYJ results



An Efficient QSO Generation System

Overall Setup ~ My Primary 23” Monitor



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I will be adding my observations and opinions as I have logged nearly 6000 QSOs on FT8 since 2017. They will be in green.

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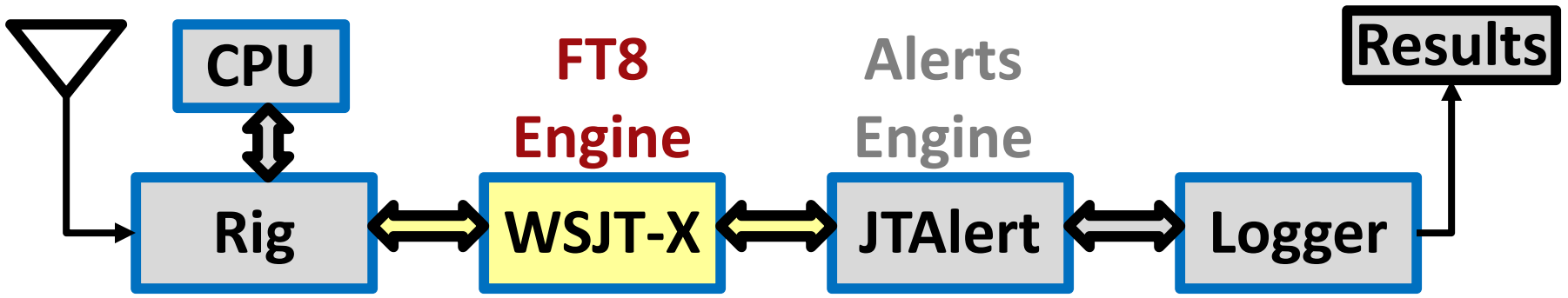


FT8 Basics ~ *What Is It???*

- ***A Weak Signal semi-automated digital communications mode riding on an USB RF signal***
- **Not for Ragchewing**
- **It can be “hard” on your rig**

FT8 Basics ~ *What Is It???*

Weak- Signal ≠ Not QRP

You will hear arguments about this.

I usually run my rig at 80w to be conservative, 1 dB below the 100w of my barefoot rig. Some rigs cannot run this much safely – read the specs!

FT8 Basics ~ *It's Controversial!*

(Disruptive Technology)

FCC Part 97:

Advance the communication and technical skills of radio

FT8, FT4, etc. →→ RTTY, PSK, etc.

is like CW →→ Spark

or SSB →→ AM

You will hear some "old-timers" claiming that FT8 QSOs

ARE NOT REAL QSOs!

or that these shouldn't count for DXCC…

FT8 Basics ~ *WSJT* *[2001]*

Weak Signal Joe Taylor

Joe Taylor, K1JT, is a retired Princeton professor and a *Nobel Prize in Physics:* *(discovered a new type of pulsar)*

The original version was intended for

VHF/UHF communication

…and had many modes for different purposes.

FT8 Basics ~ *WSJT-X [2017]*

WSJT - *Experimental*

Added

JT9	**Optimized for the LF, MF, and HF bands**
QRA64	**EME**
MSK144	**Meteor Scatter on the VHF bands**
WSPR	***Weak Signal Propagation Reporter:*** **probing potential propagation paths**
FT8	**Targeted multi-hop sporadic E propagation on 6m and higher VHF**

FT8 Basics ~ *WSJT-X [2017]*

WSJT - *Experimental*

Added

JT9	Optimized for the LF, MF, and HF bands
QRA64	EME
MSK144	Meteor Scatter on the VHF bands
WSPR	*Weak Signal Propagation Reporter:* probing potential propagation paths

The popularity of FT8 on HF is largely a happy accident in that it fulfilled a latent frustration of many potential users of WSJT-X with the slow rate of QSOs using 1 minute T/R periods.

Email, 1/10/19, Bill Somerville, G4WJS (SK)

FT8 Basics ~ *Sensitivity*

From Joe Taylor, K1JT

Typical S/N (BW = 2500 Hz.):

SSB	+10 dB
CW	+ 0 → - 10 dB
	- 15 dB (good radio/ears)
FT8	- 21 dB (I often see -24 dB)
WSPR	- 31 dB

More sensitive than CW!

FT8 Basics ~ *Technically*

Named for:

Steven *F*ranke: K9AN & Joe *T*aylor: K1JT

An 8 tone **-frequency shift keying format [FSK]**

[1 baud = 3 bits]

15 Second T/R timing

Tone spacing: 6.25 Hz

50 Hz bandwidth

77 bit word + 14 bit CRC

→ **2^{77} = 151,115,727,451,828,646,838,272**

(about 1.5 x 10^{23}) possible messages

FT8 Basics ~ *Operationally*

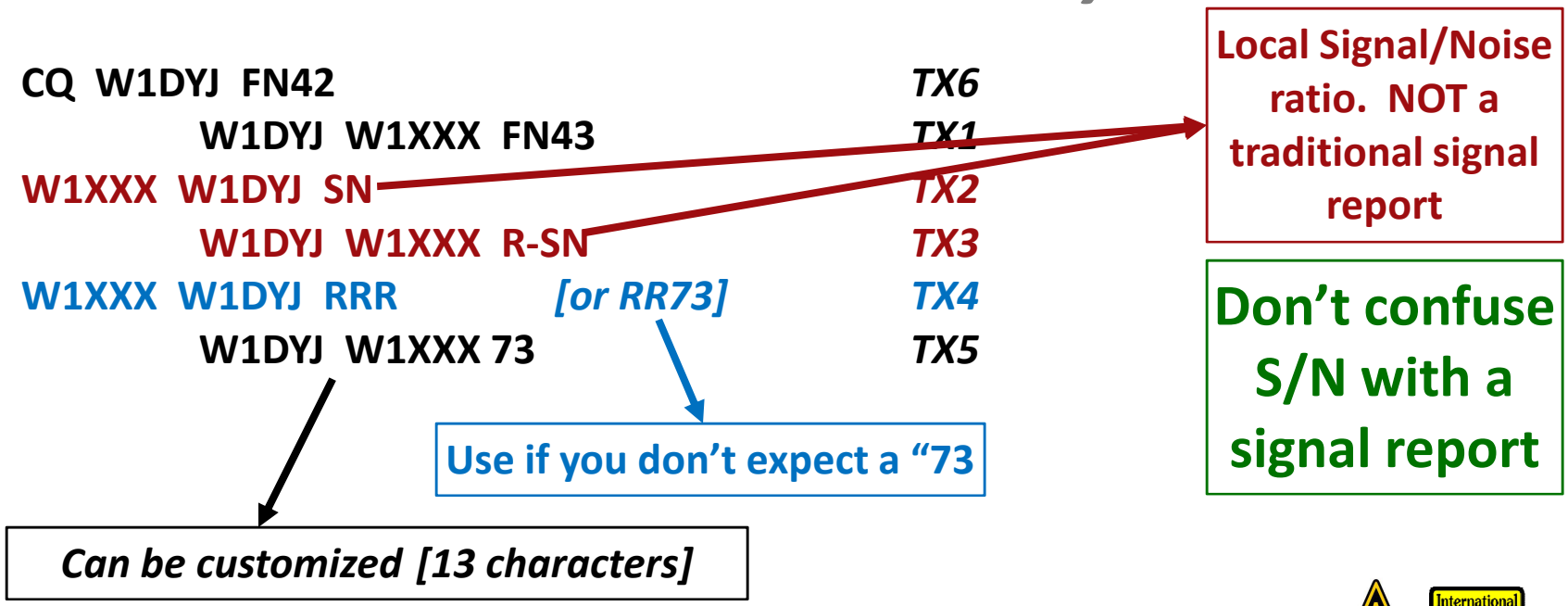
- *Very structured syntax*
- *Maximum of 13 free form characters*
- *Both ends must use the same syntax*

- ***Absolute minimum info to be "legal" QSO***

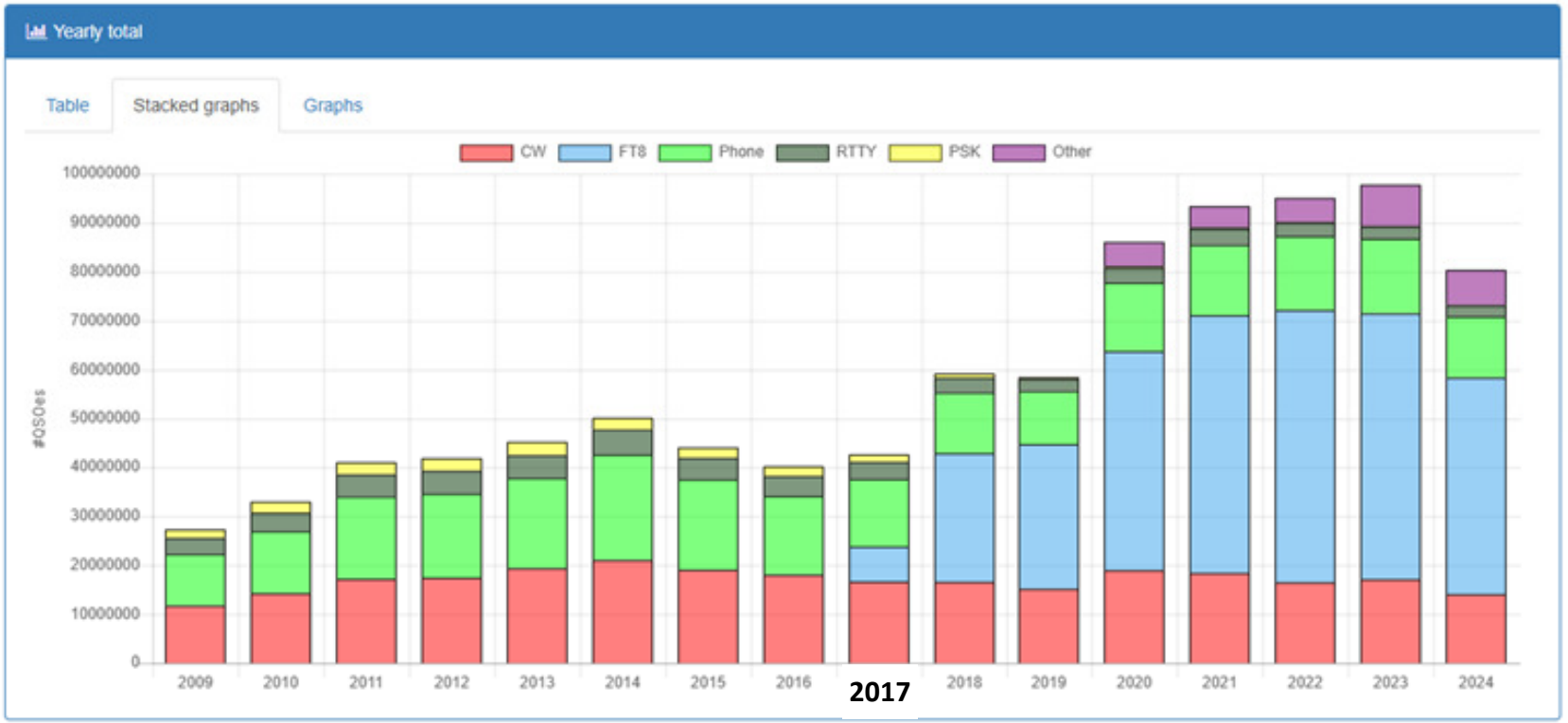
— call sign / signal report [+grid]

FT8 Basics ~ *Operationally*

- *Very structured syntax*
- *Maximum of 13 free form characters (TX5)*
- *Both ends must use the same syntax*



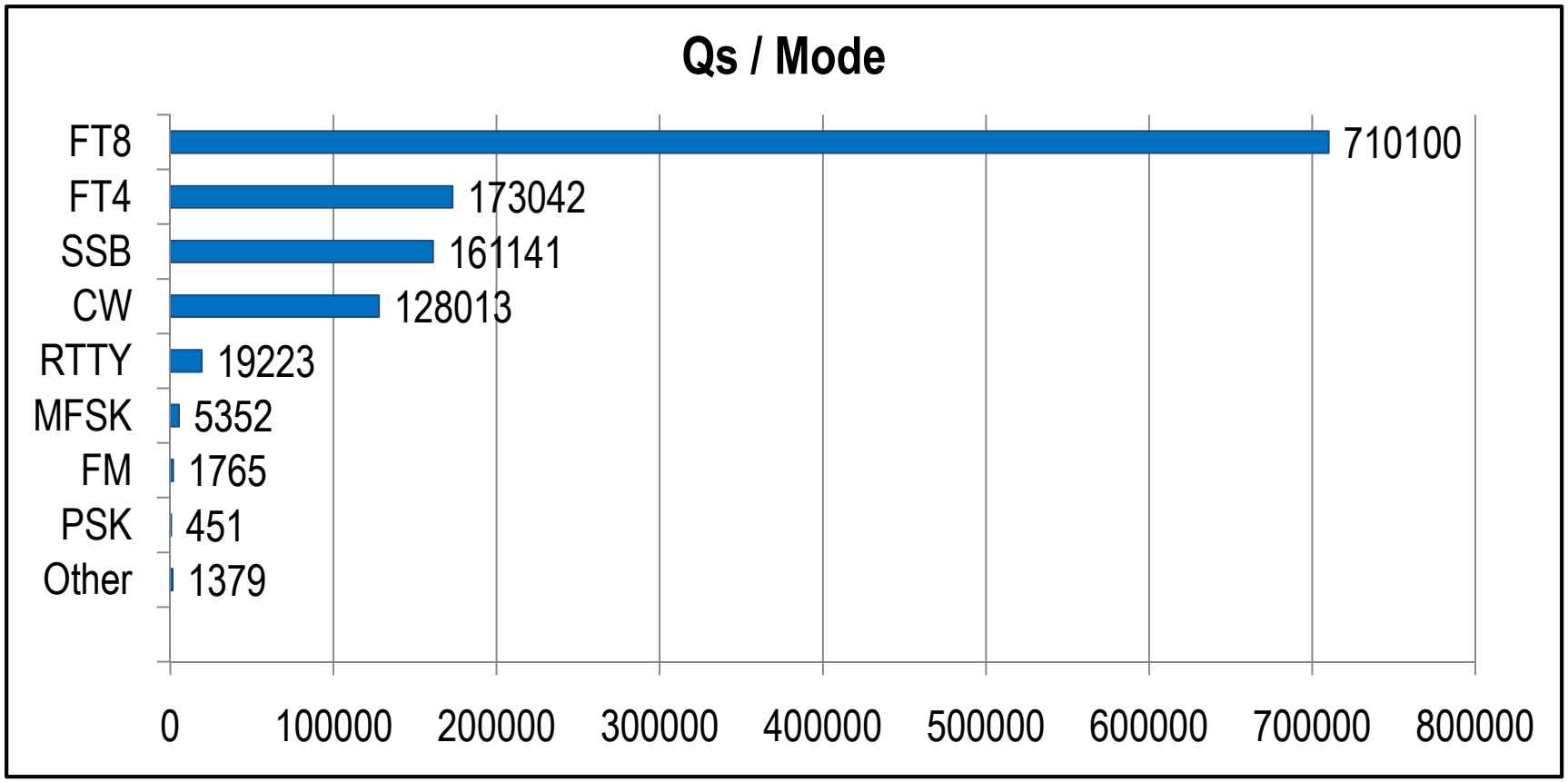
FT8 Basics ~ *Annual Growth* *based on Club Log*



Mode statistics based on data from *Club Log* – from LA8AJA

FT8 Basics ~ *A Single Day's Uploads* to Club Log

For: 1 March 2025



Mode statistics based on data from *Club Log* – from K8TE

FT8 Basics ~ *Why I do it*

- *Gave up on PSK years ago*
- *Tried JT65* – slow!
- *FT8 is More Sensitive than CW*
  - *Important for someone (like me) with MEAGER CW skills and WORSE typing skills*
- *Makes running barefoot with homebrew antennas viable for DX*

FT8 and JTAlert ~ Agenda

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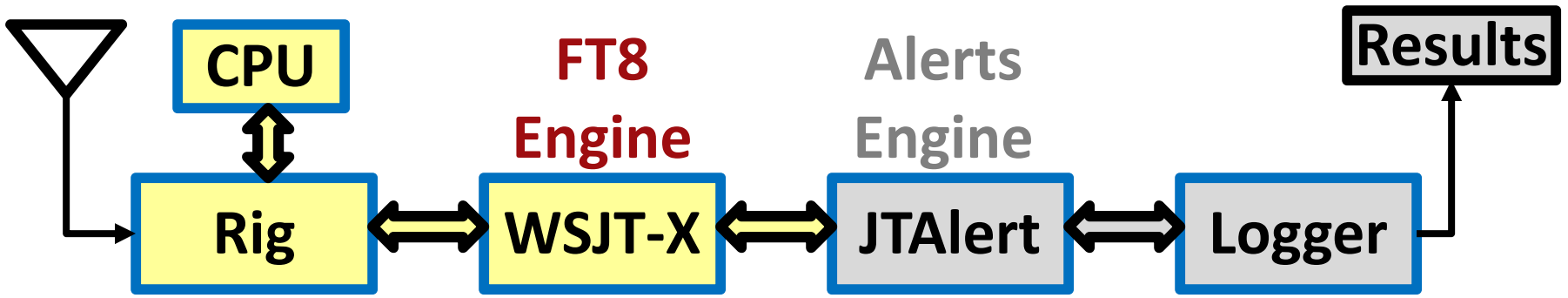
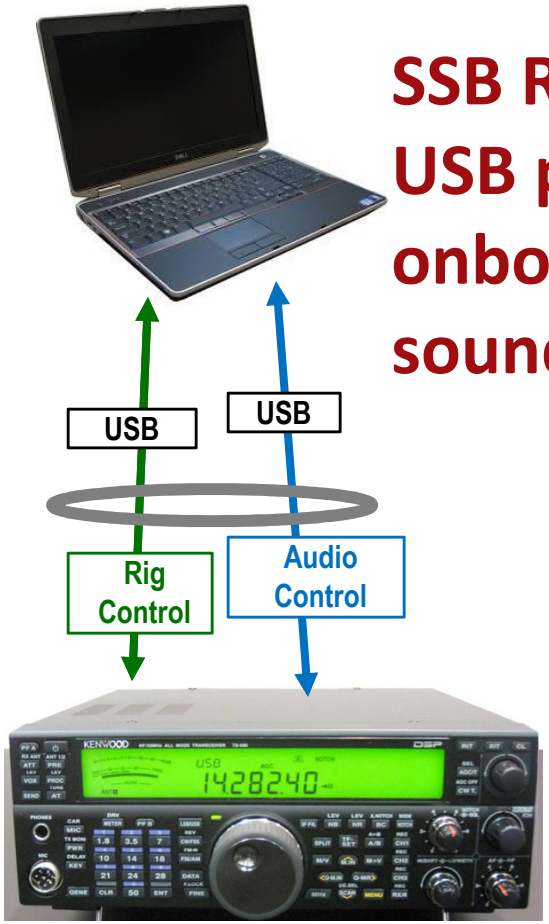
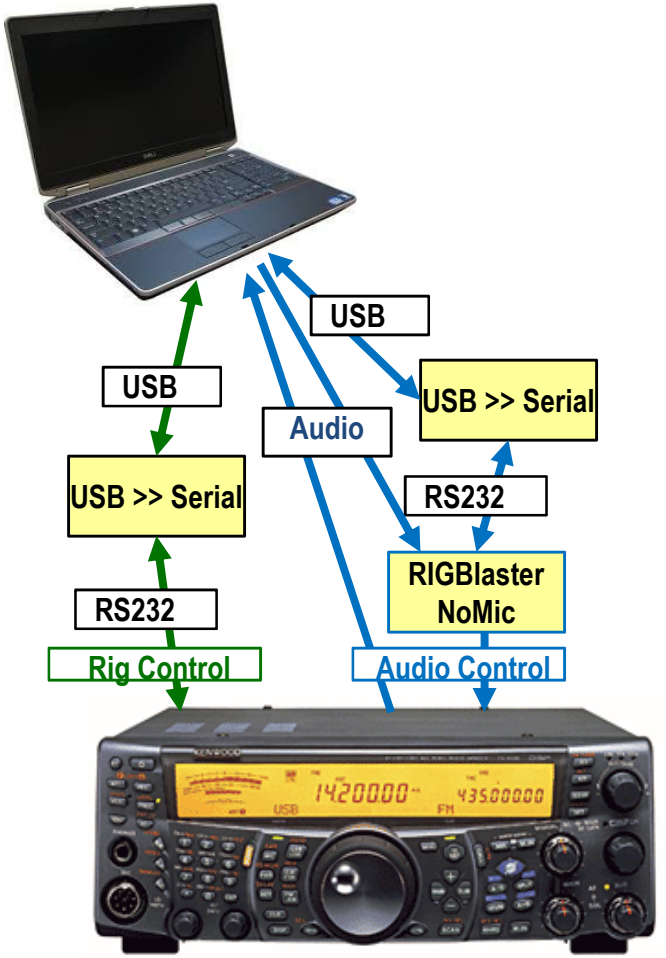
- **HW / SW Setup**
- JTAlert
- W1DYJ results



FT8 Setup ~ *HW*



SSB Rig with USB port and onboard soundcard



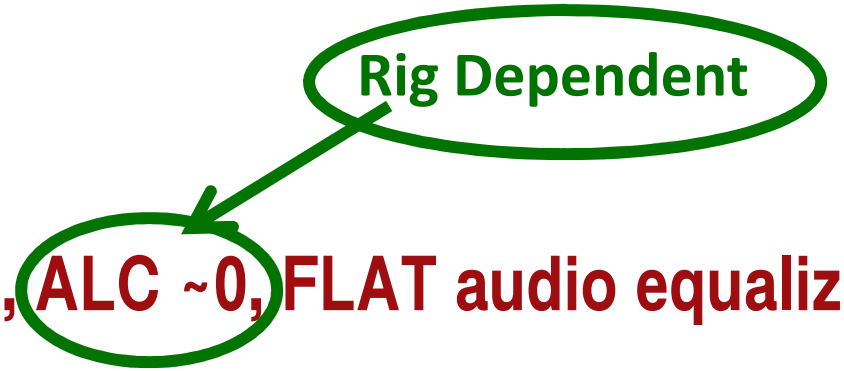
Older Rig

SSB Rig in Upper Sideband

FT8 Setup ~ *HW*

Essentially the same as PSK31 or AFSK RTTY

Rig Setup



Transmitting

→NO processing, ALC ~0, FLAT audio equalization

Receiving

→ NO noise reduction, FLAT response, full SSB BW

→*Let the WSJT-X software do it's thing*

FT8 Setup ~ *HW*

Rig Setup – Receiving: *NO noise reduction, FLAT response, full SSB BW*

Some hams claim they see better S/N ration by limiting their received bandwidth. NOT TRUE! It is apparent only.

Joe Taylor, K1JT, 10 Dec 2023:
"This question has been asked and answered many times on this and similar forums. WSJT-X measures noise power by computing the spectrum of the receiver's output, averaged over the reception interval, and fitting a baseline to the regions that have no discernible signal present. The resulting value -- effectively a noise power density, or power per unit bandwidth -- is then scaled to yield noise power in 2500 Hz bandwidth." "Do NOT use "noise reduction" features, and do NOT use a receiver bandwidth narrower than about 2.5 kHz. Wider bandwidths are even better, up to 4 or 5 kHz. WSJT-X does all necessary narrow-band filtering in software."

Reino Tararmo, OH3Ma, 22 March 2025:
Also note that the receiver bandwidth should be wider than the waterfall bandwidth for a more accurate S/N calculations especially at the edges of the waterfall.

FT8 Setup ~ *SW*

Read the Fine Manual

RTFM!

You WILL NOT operate FT8 effectively if you don't.

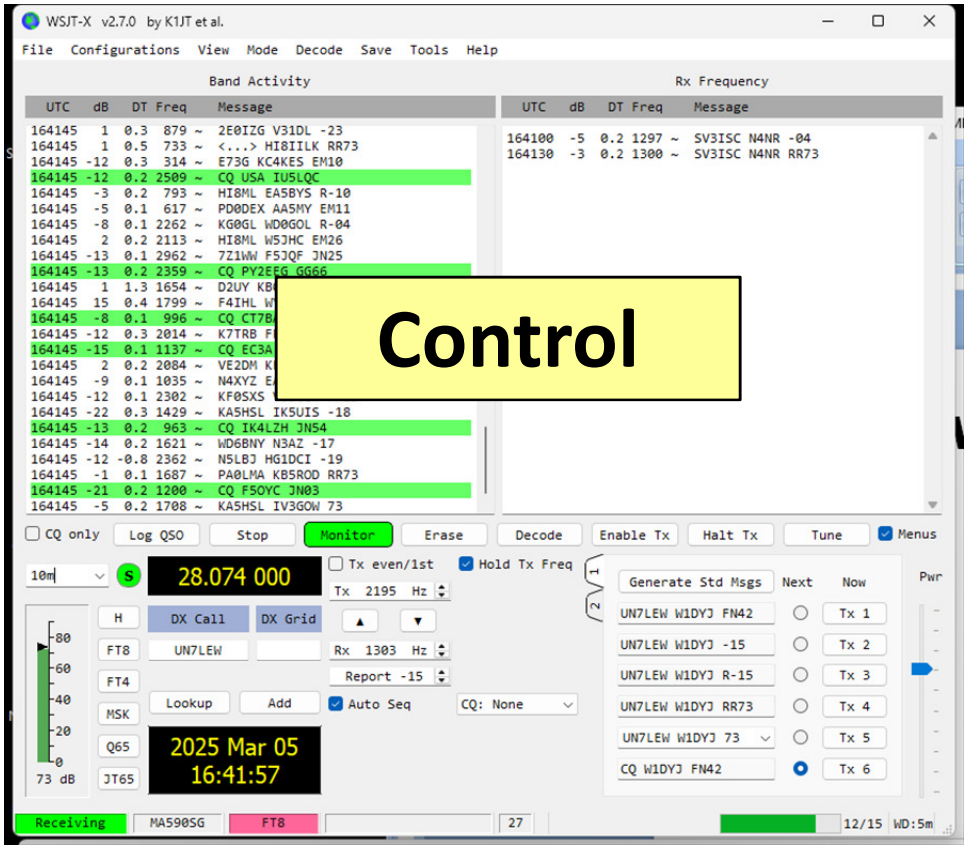
I'm only covering a small portion of the application.

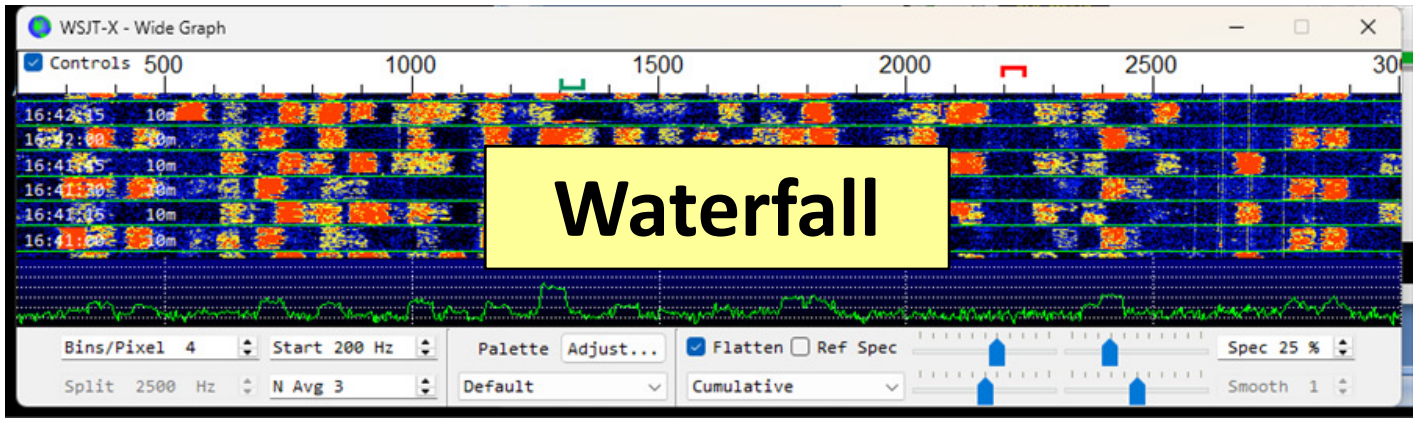
Windows Clock → **Meinberg NTP**

[or GPS Dongle if no Internet]

Check your computer with: *"time.is"*

FT8 Setup ~
WSJT-X *GUI*



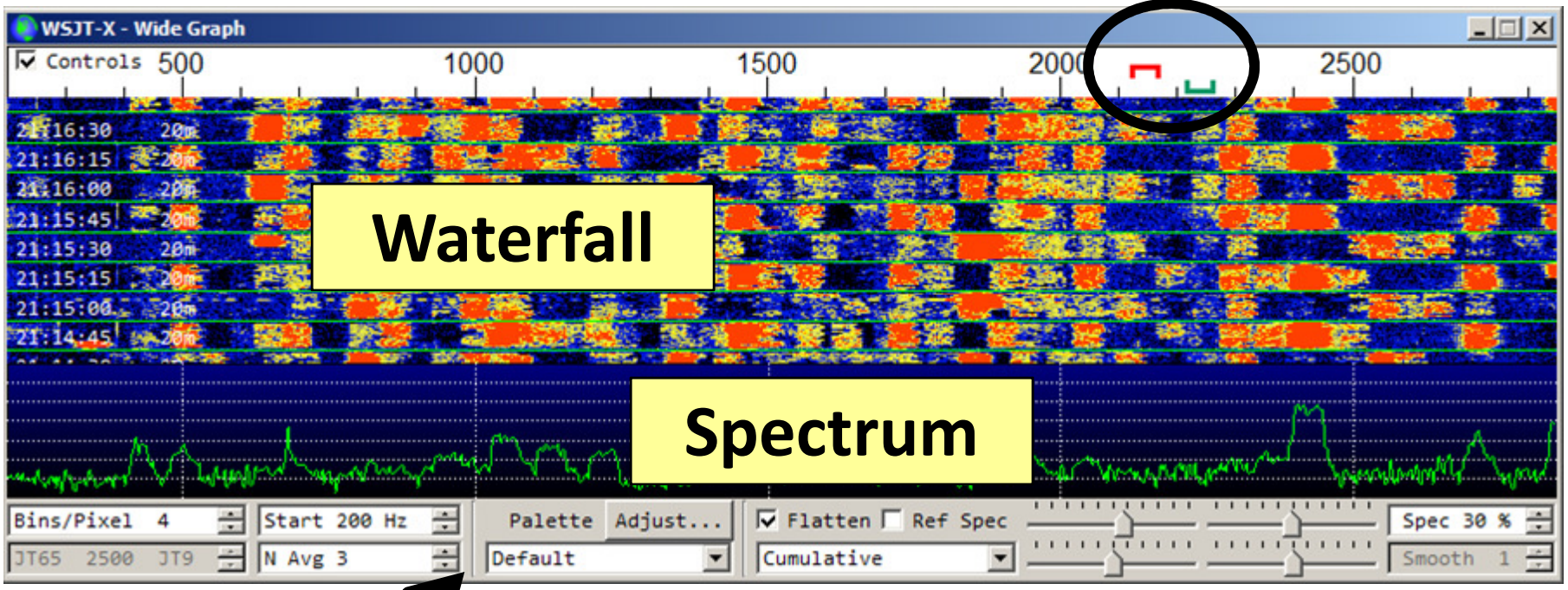


FT8 Setup ~ *Waterfall*

Your Frequencies

Transmit

Current Listening

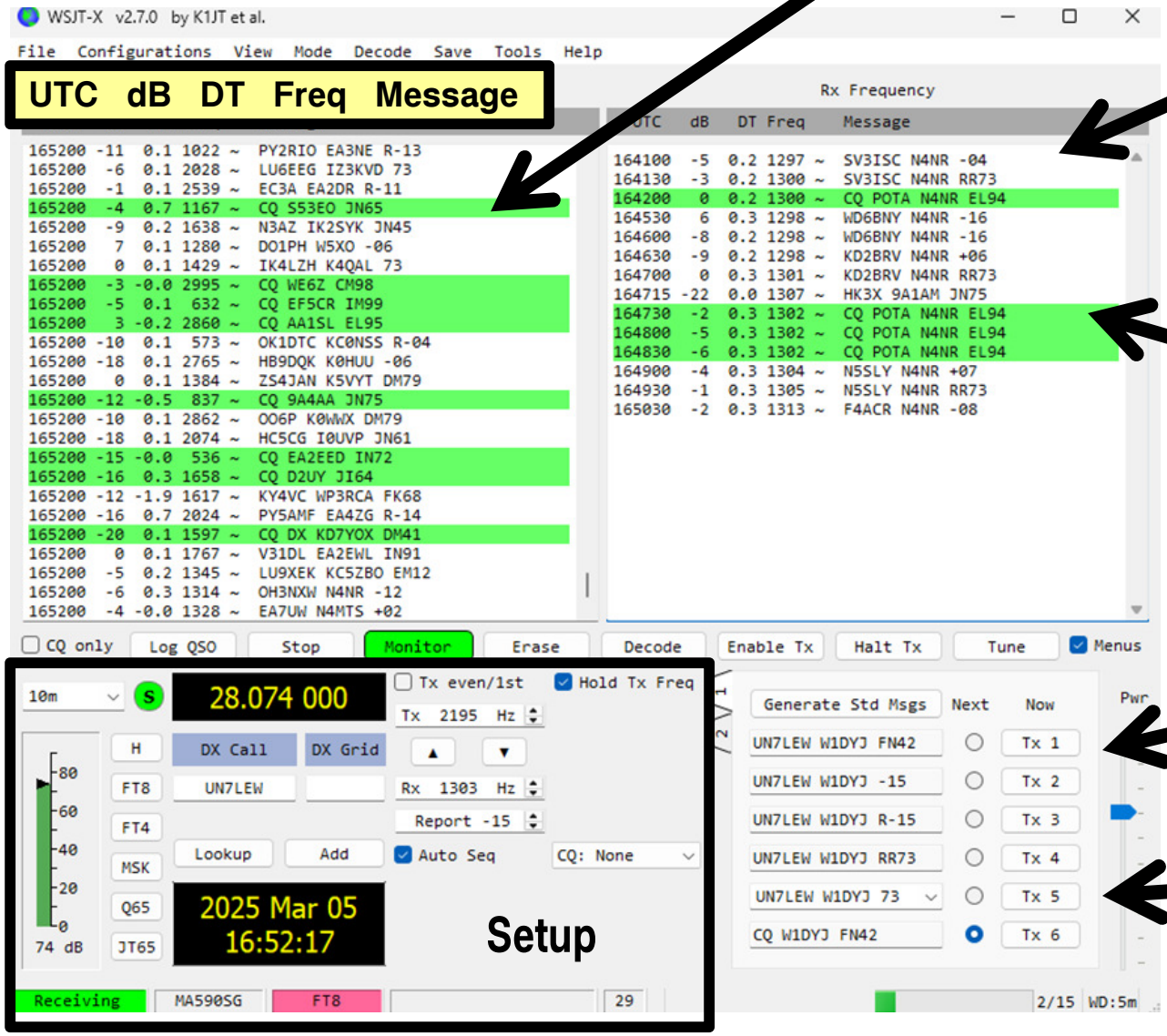


Control Panel → *RTFM*

FT8 Setup ~ *Control*

All Signals in Waterfall

What you are listening to

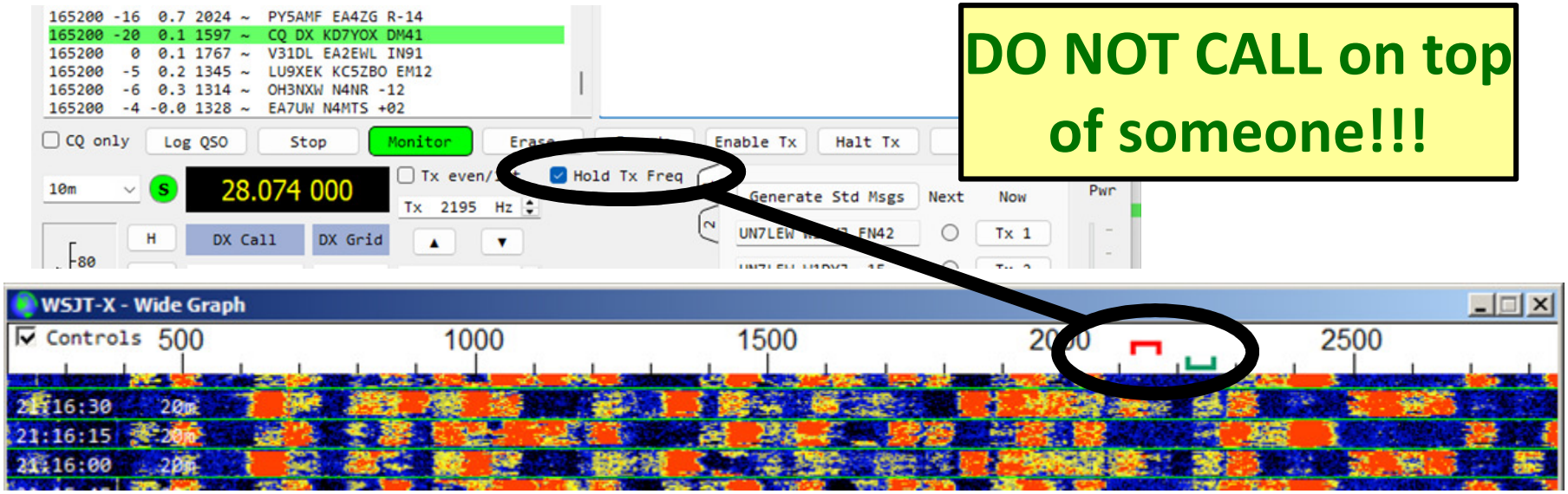


Clicking on CQ call → starts Xmit

Predefined Messages

TX5
"13 characters"

FT8 Setup ~ *Control: HOLD TX FREQ*

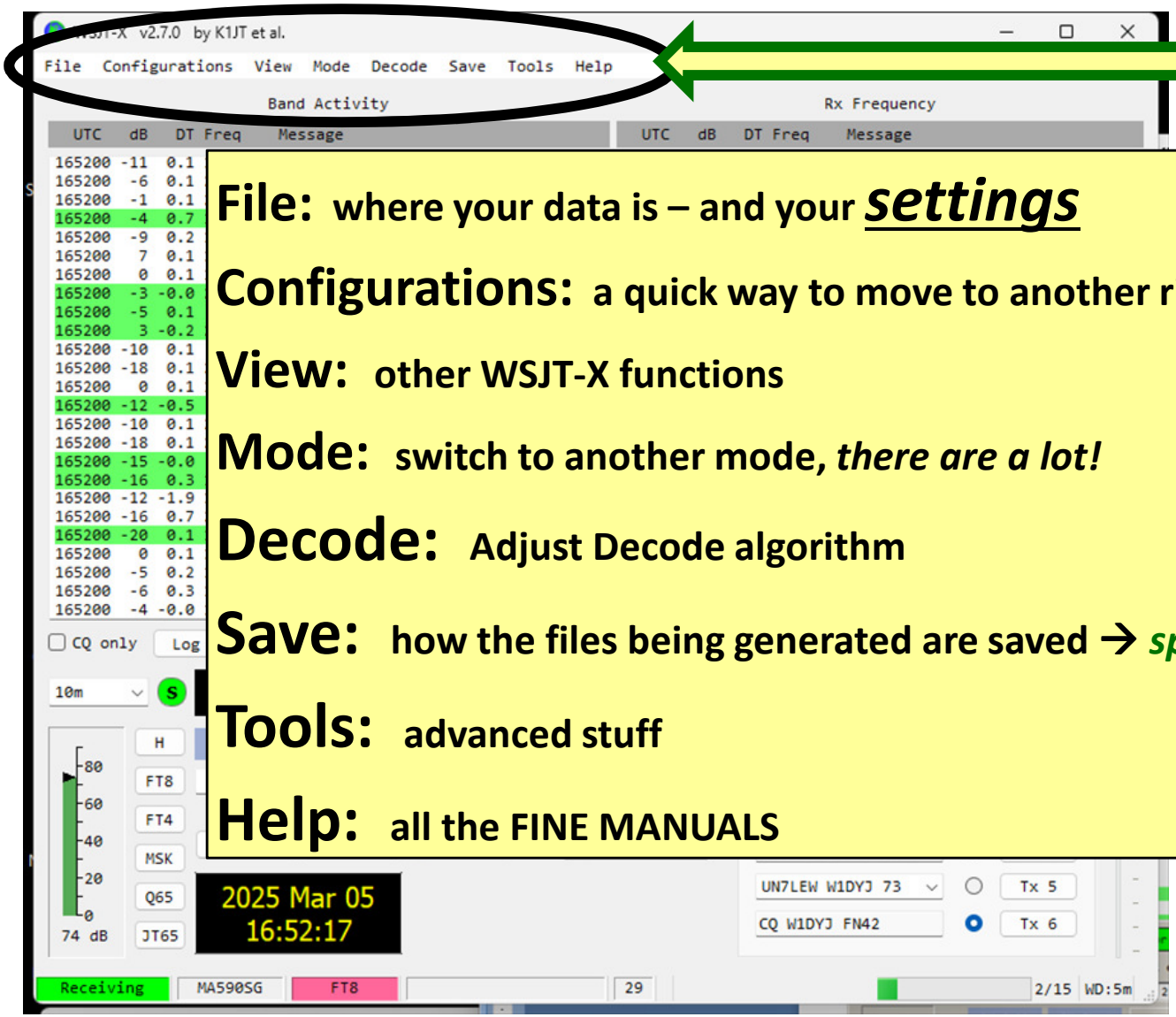


DO NOT CALL on top of someone!!!

To avoid QRM from competing callers, it is usually best to answer a CQ on a different frequency from that of the CQing station. The same is true when you tail-end another QSO. Choose a Tx frequency that appears to be not in use.

From the Fine WSJT-X manual

FT8 Setup ~ *Control Options*



RTFM

File: where your data is – and your ***settings***

Configurations: a quick way to move to another rig or major mode shift

View: other WSJT-X functions

Mode: switch to another mode, *there are a lot!*

Decode: Adjust Decode algorithm

Save: how the files being generated are saved → *split ALL.TXT monthly*

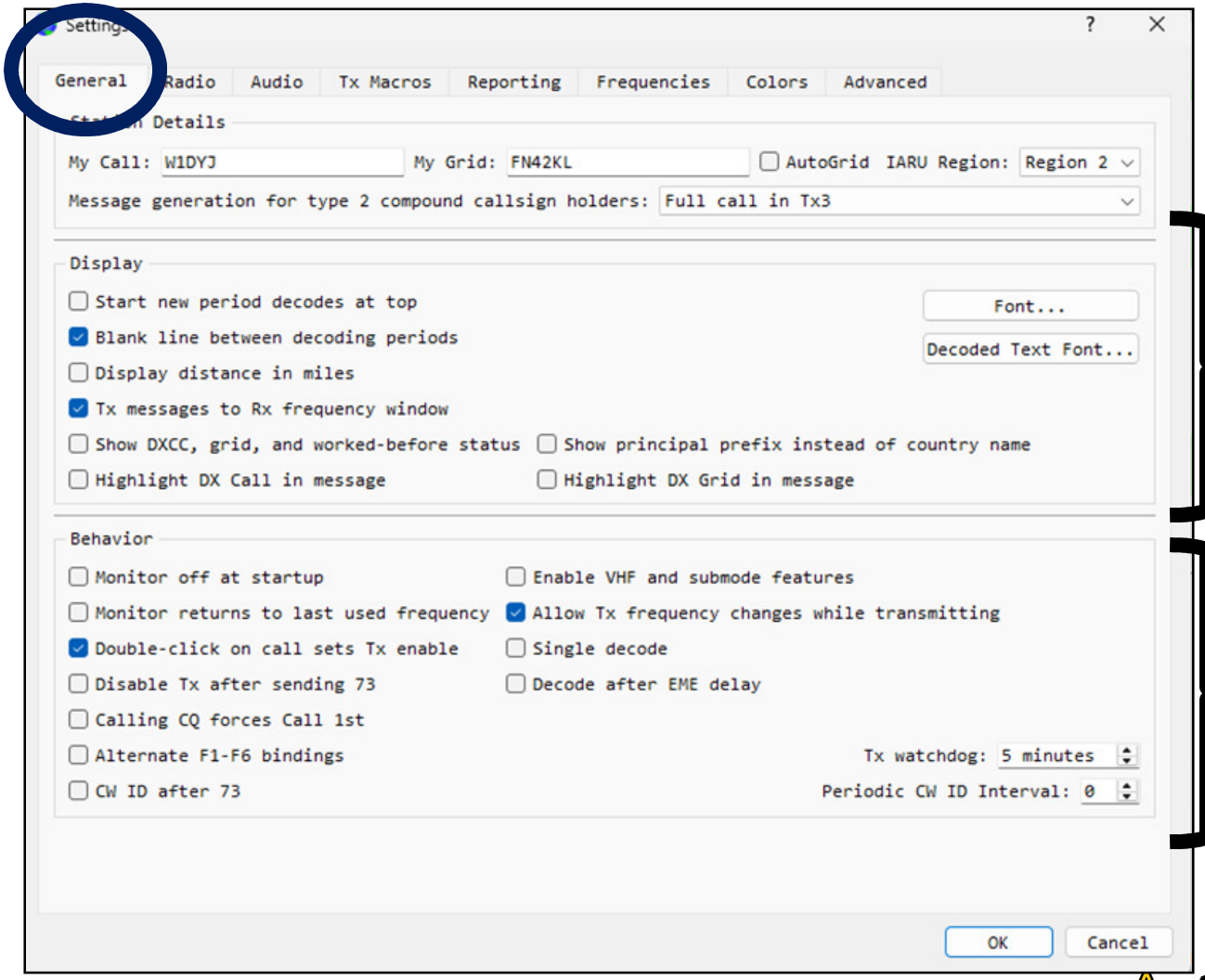
Tools: advanced stuff

Help: all the FINE MANUALS

FT8 Setup ~ *General settings*

"F2"

From main menu: *FILE >> Settings*



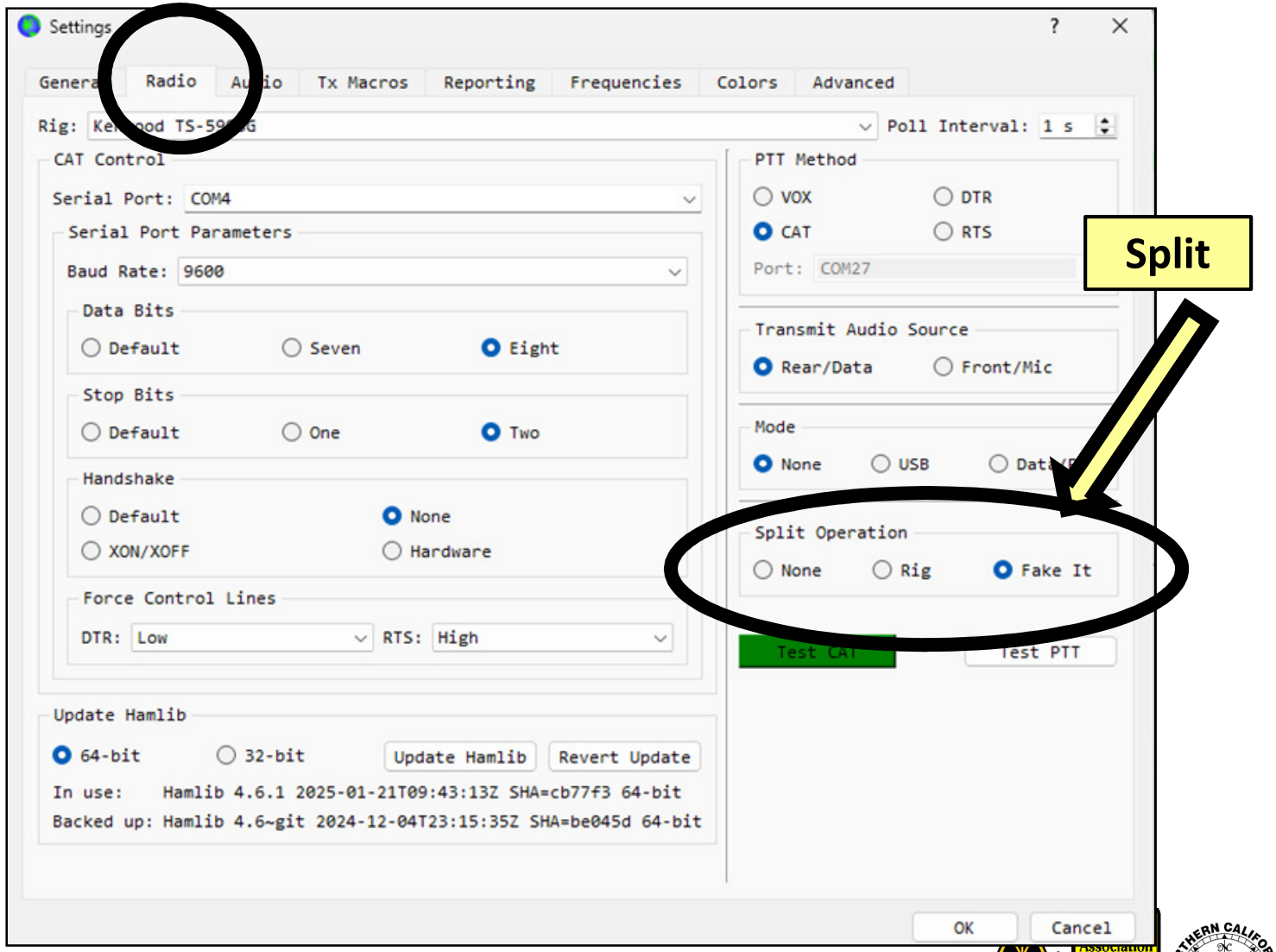
Display

Behavior

FT8 Setup ~ *Radio settings*

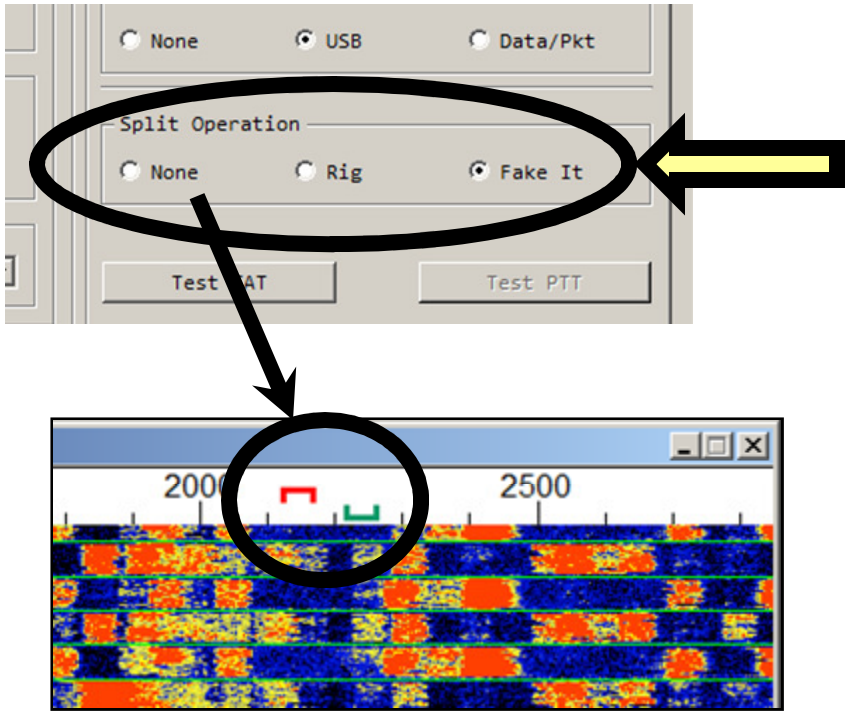
"F2"

CAT Control



Split

FT8 Setup ~ *Radio settings:* *Fake It*



Moves the RF and Audio frequencies in opposite directions, resulting in a cleaner transmitted signal. It keeps the Tx audio always in the range 1500 to 2000 Hz, where the audio pass band is flat, and puts audio harmonics above the audio pass band.

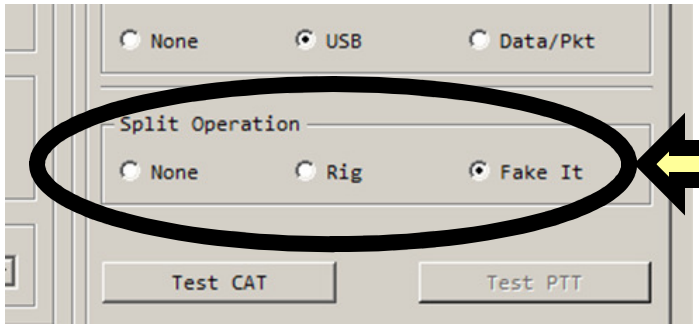
20M – audio @ 2120 Hz:

14074.00 + 2.120 = 14076.12

With Fake It:

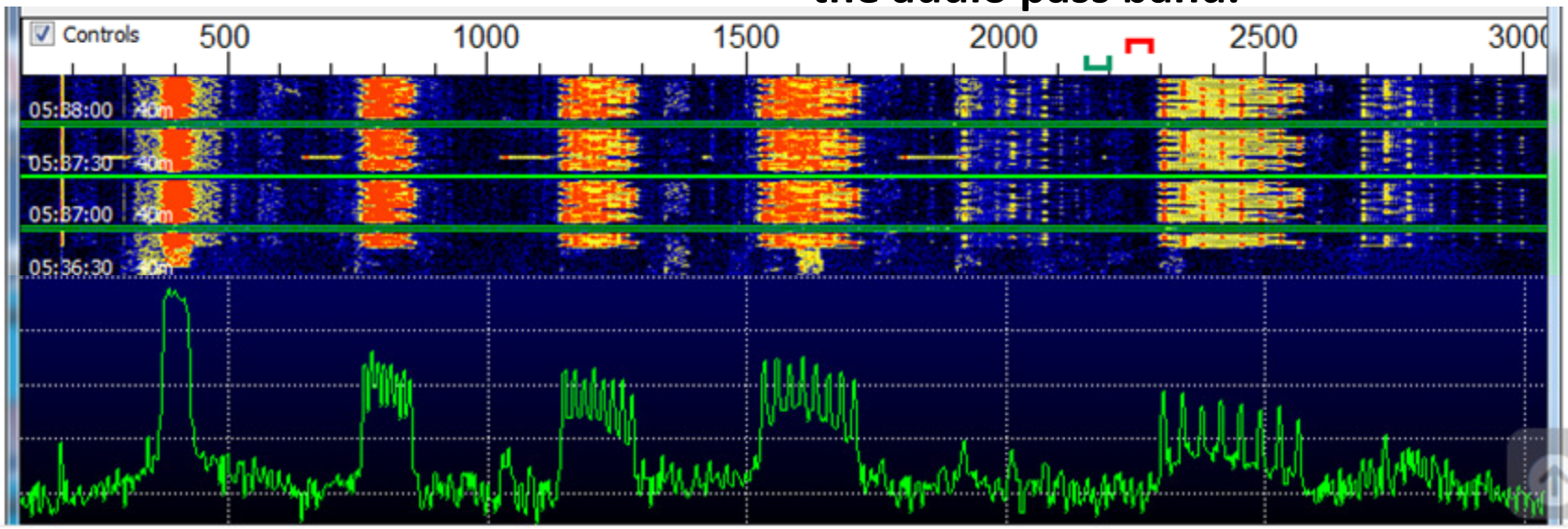
14074.50 + 1.620 = 14076.12

FT8 Setup ~ *Radio settings:* *Fake It*



Moves the RF and Audio frequencies in opposite directions, resulting in a cleaner transmitted signal. It keeps the Tx audio always in the range 1500 to 2000 Hz, where the audio pass band is flat, and puts audio harmonics above the audio pass band.

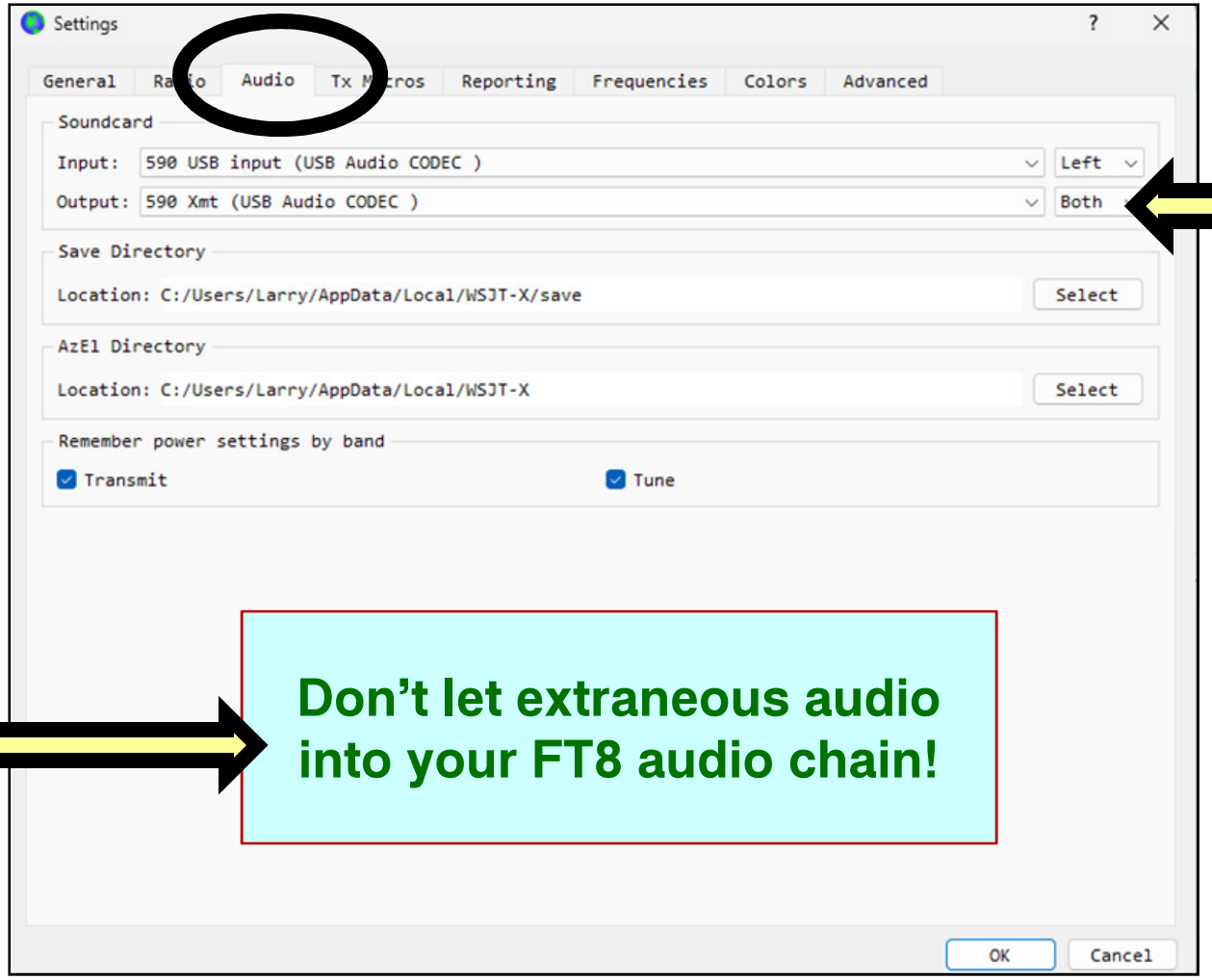
Audio = 400 Hz.



Vastly over modulated and bad harmonics

FT8 Setup ~ *Audio settings*

"F2"



Configure audio device for 48000 Hz, 16 bits

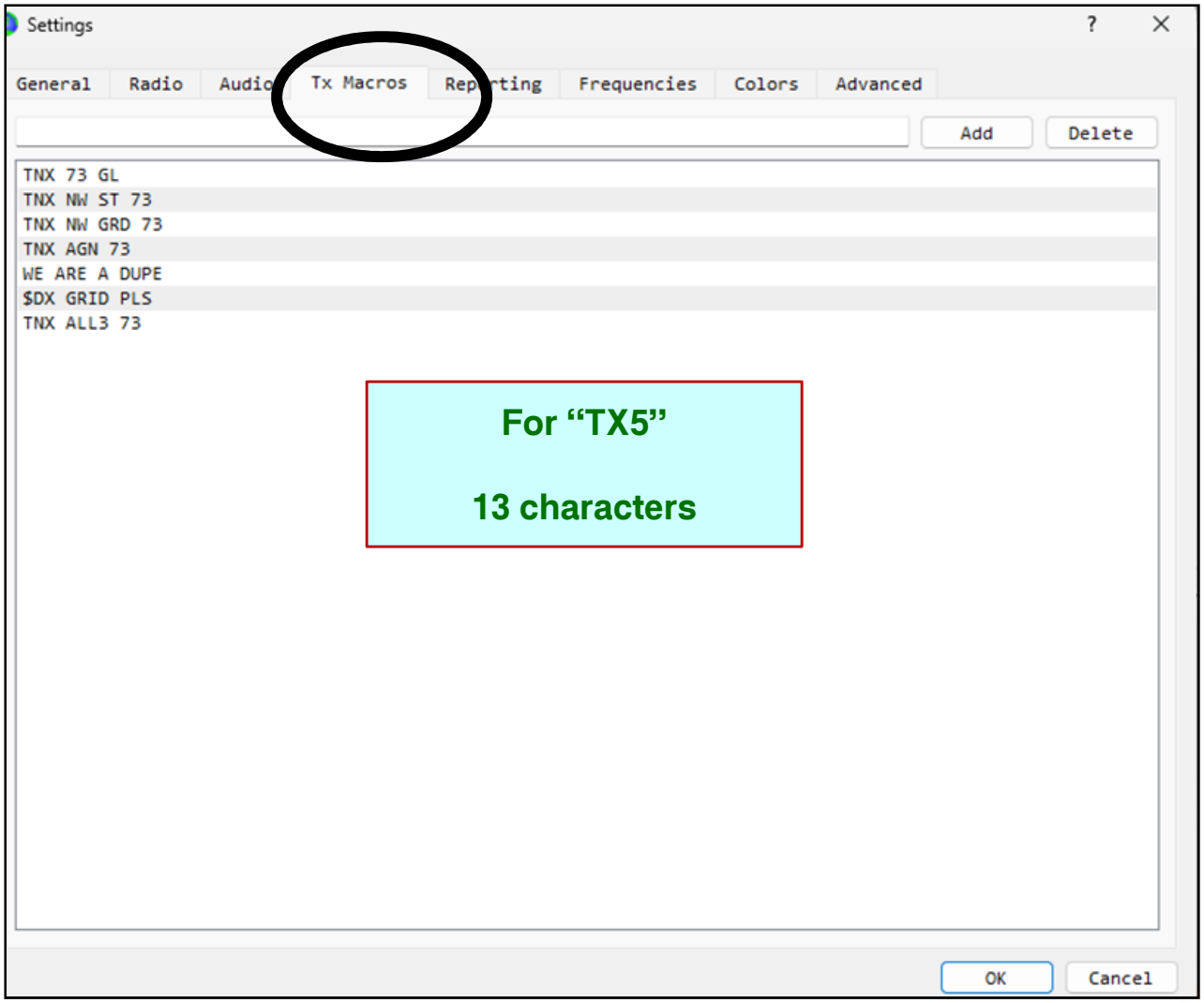
Audio I/O

DO NOT USE **the windows default device**

Don't let extraneous audio into your FT8 audio chain!

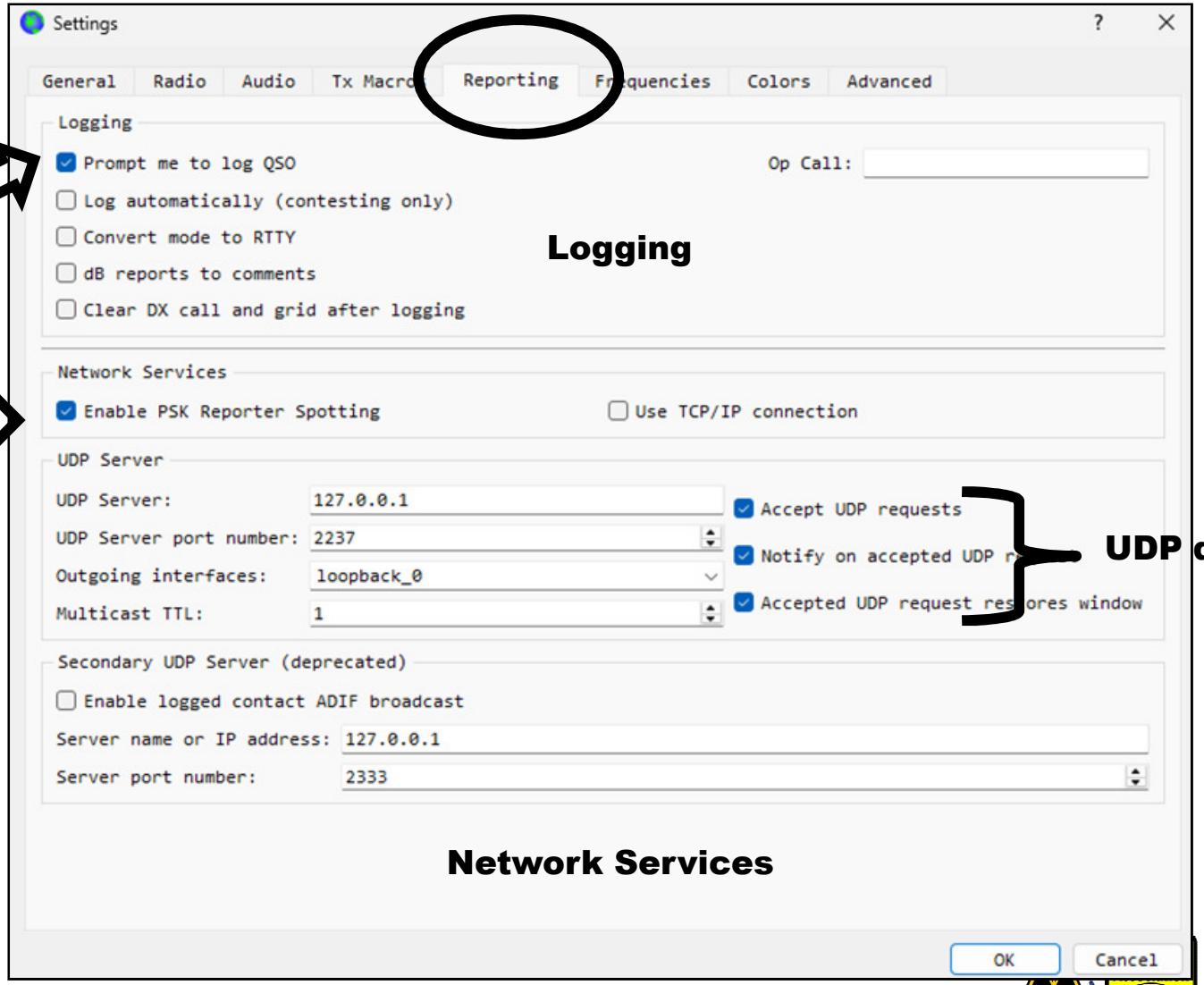
FT8 Setup ~ *TX5 Macros*

"F2"



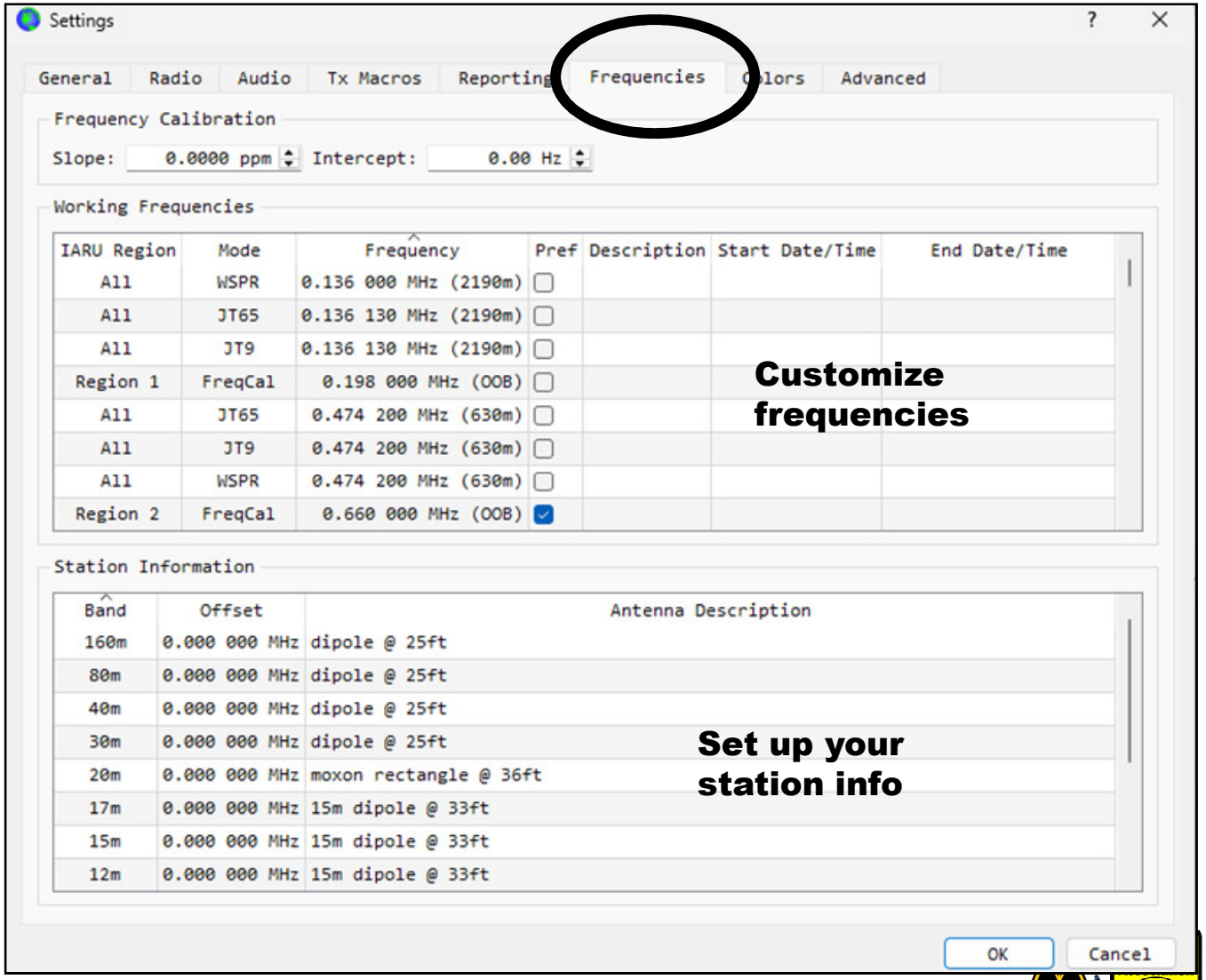
FT8 Setup ~ *Reporting*

"F2"



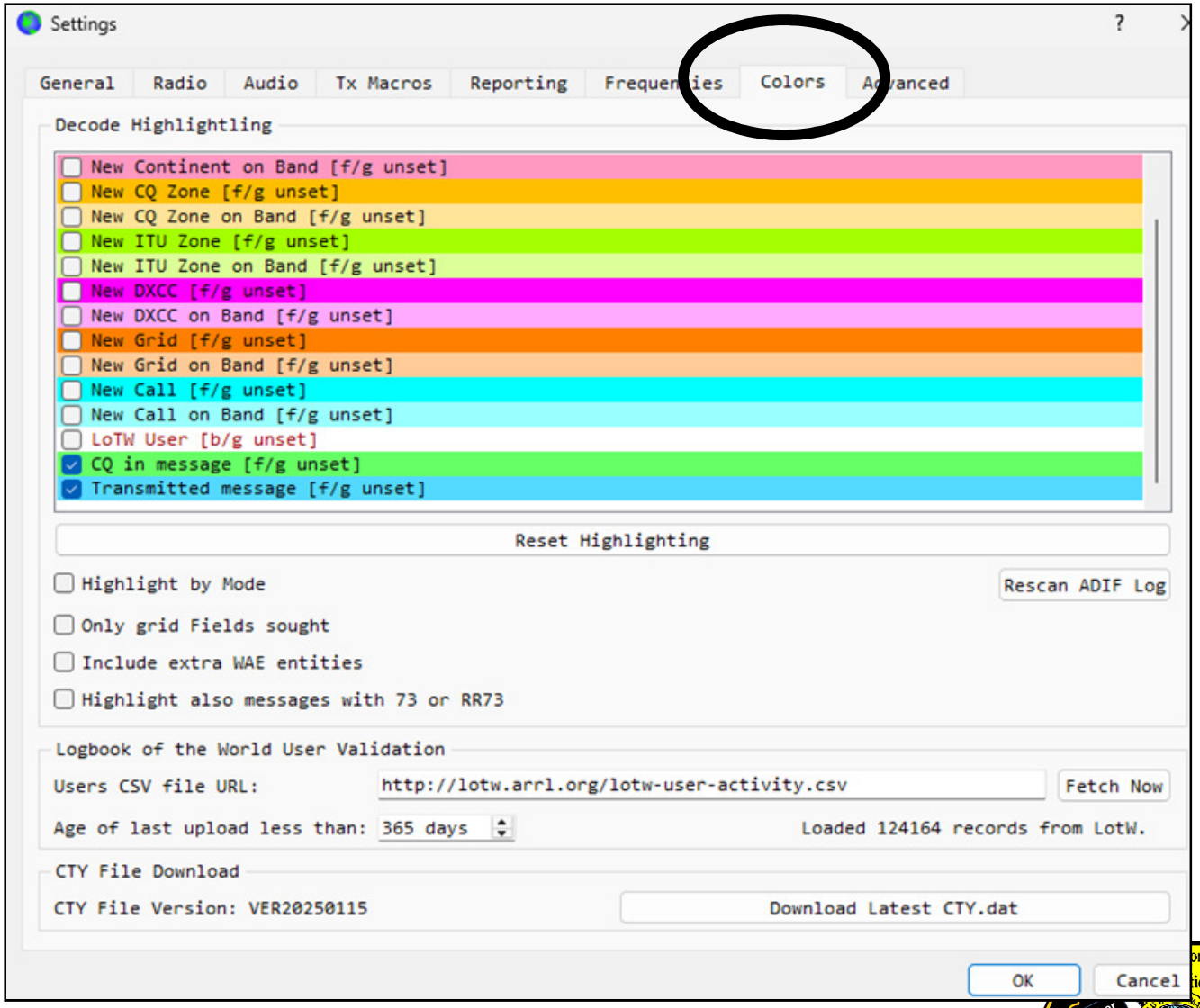
FT8 Setup ~ *Frequencies*

"F2"



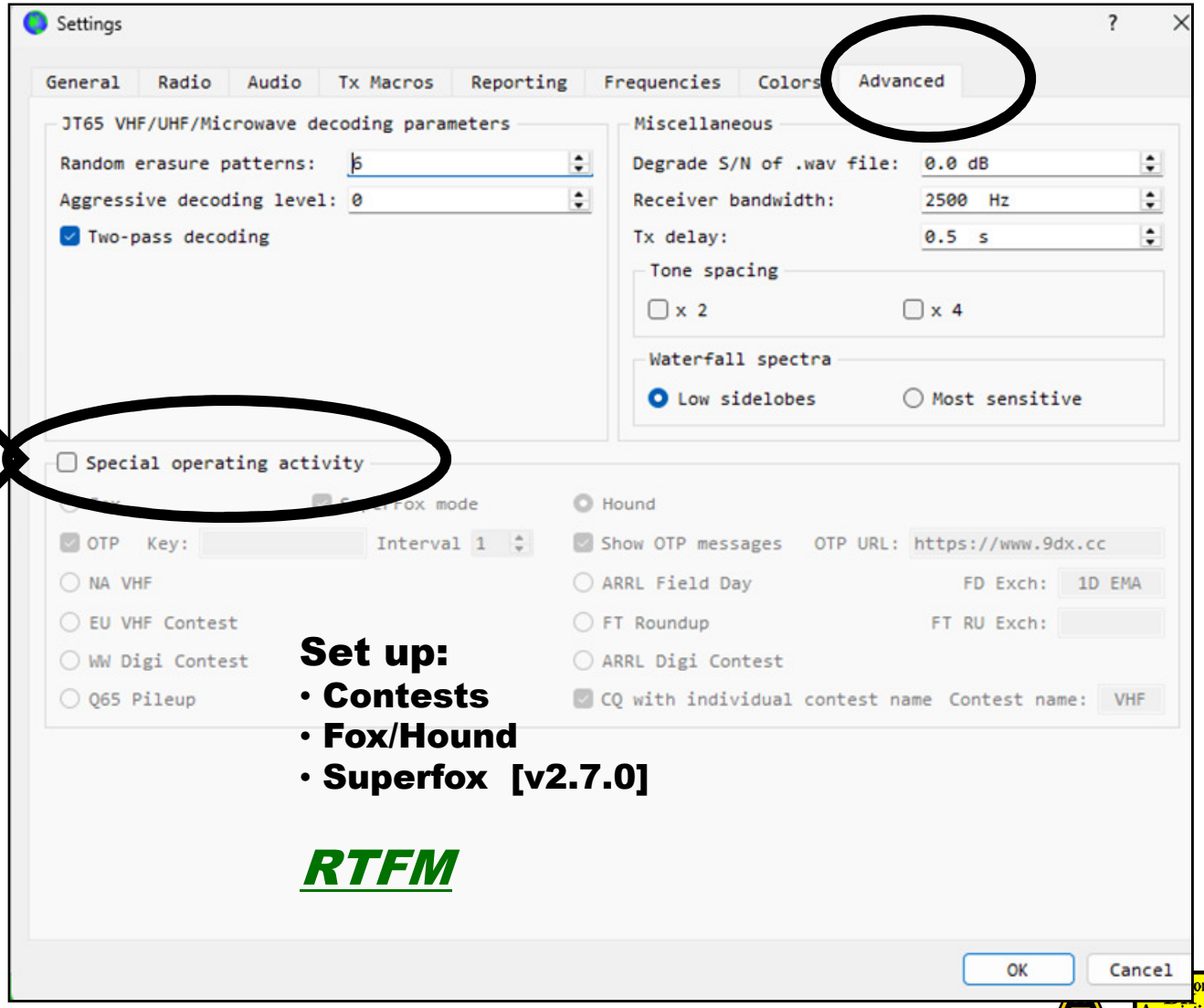
FT8 Setup ~ *Colors*

"F2"



FT8 Setup ~ *Advanced*

"F2"



Set up:
- **Contests**
- **Fox/Hound**
- **Superfox [v2.7.0]**

RTFM

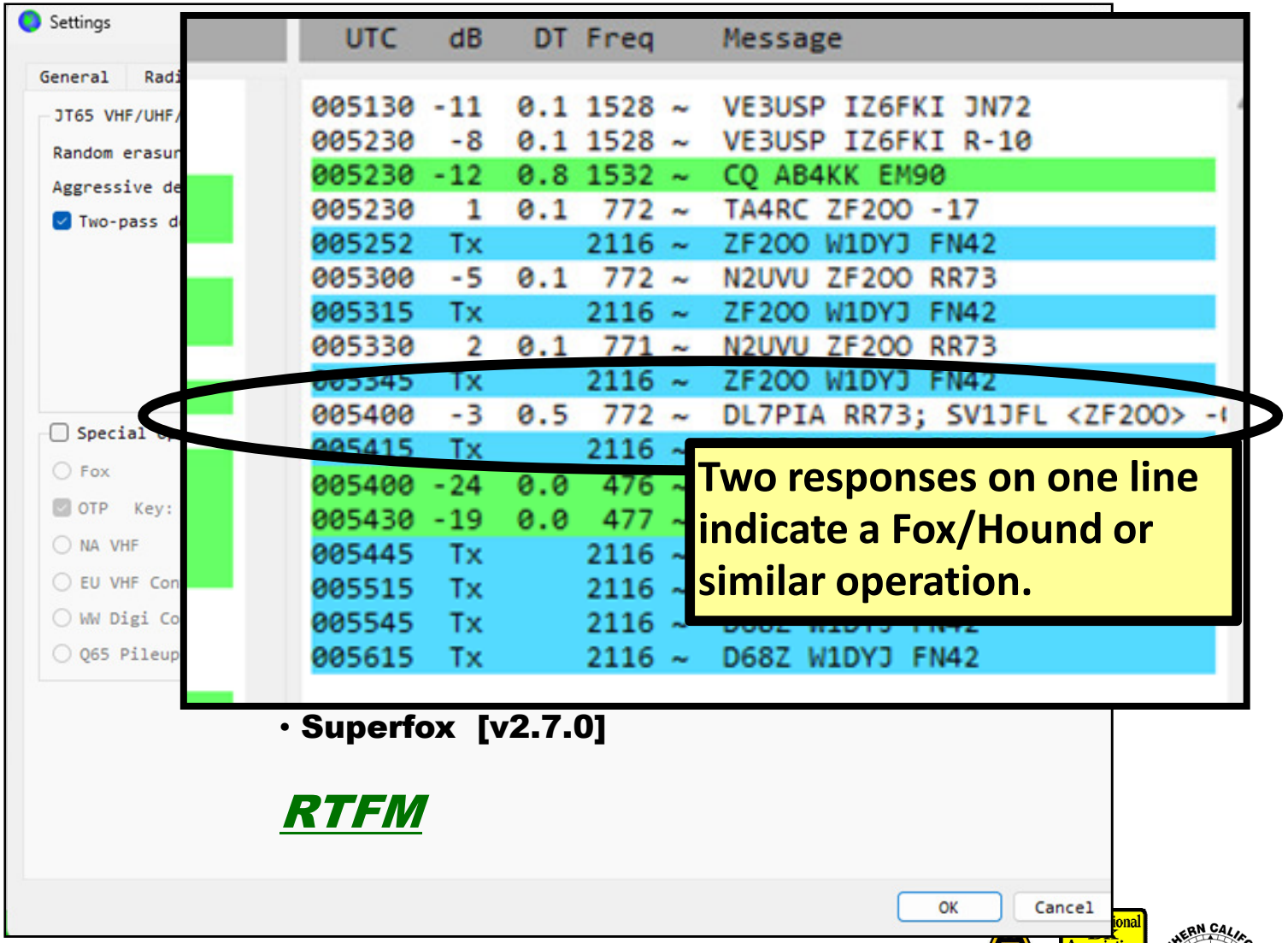
FT8 Setup ~ *Advanced*

There are some Clones:

WSJT Improved

MSHV

JTDX



Two responses on one line indicate a Fox/Hound or similar operation.

- **Superfox [v2.7.0]**

RTFM

FT8 Setup ~ *Special Call Signs*

<...> represents a call Sign that is not yet decoded, or a Call Sign that doesn't fit the specified format.

```
160630   2 -0.0  619 ~  N1MCJ S51XA RR73
160630 -11  0.5 2872 ~  CQ HA7EC JN97
160630  -5  0.1 1743 ~  N9QPI [illegible] JN64
160630 -14  0.1 1182 ~  <...> N1[illegible]LW -13
160630 [illegible] CM99
160630 -11 -0.8 2825 ~  CQ DL1FTY JO62
160630 -24  0.2 2183 ~  CQ M0SAC JO01
160630  -3 -0.2  629 ~  AC9HP F5KSE -22
160630 -12  0.2  727 ~  WP4PRD KC0BLK -06
160630 -18  0.2  570 ~  CQ G8KHF IO92
160630 -13  0.1 2640 ~  CO9JAB KB9QDI EM79
160630 [illegible]
160630  -2  0.6 1417 ~  LA8[illegible]TA <...> -[illegible]
160630 -24  0.2 2627 ~  W9DH[illegible] PD1RMB [illegible]032
160630 -22  0.1  910 ~  VE1JCC DL1DEU R+09
160630 -20  0.1 1717 ~  <...> ON100A RR73
160630  -6 -0.3 1404 ~  DG5TF HP1SEB RR73
```

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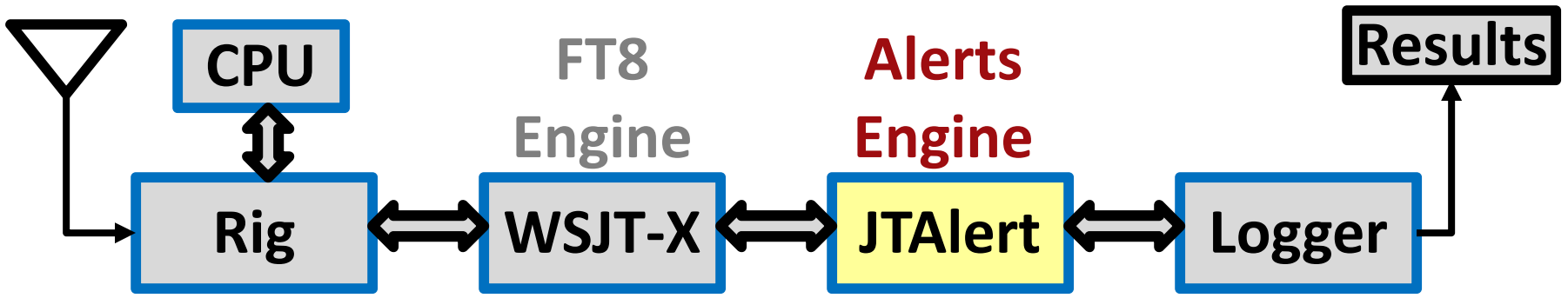


FT8 and JTAlert ~ JTAlert

JTAlert

Integrates with WSJT-X

and

Provides *Real Time* Audio & Visual Alerts

My personal preference for integrating WSJT with my logger (ACLog from N3FJP)

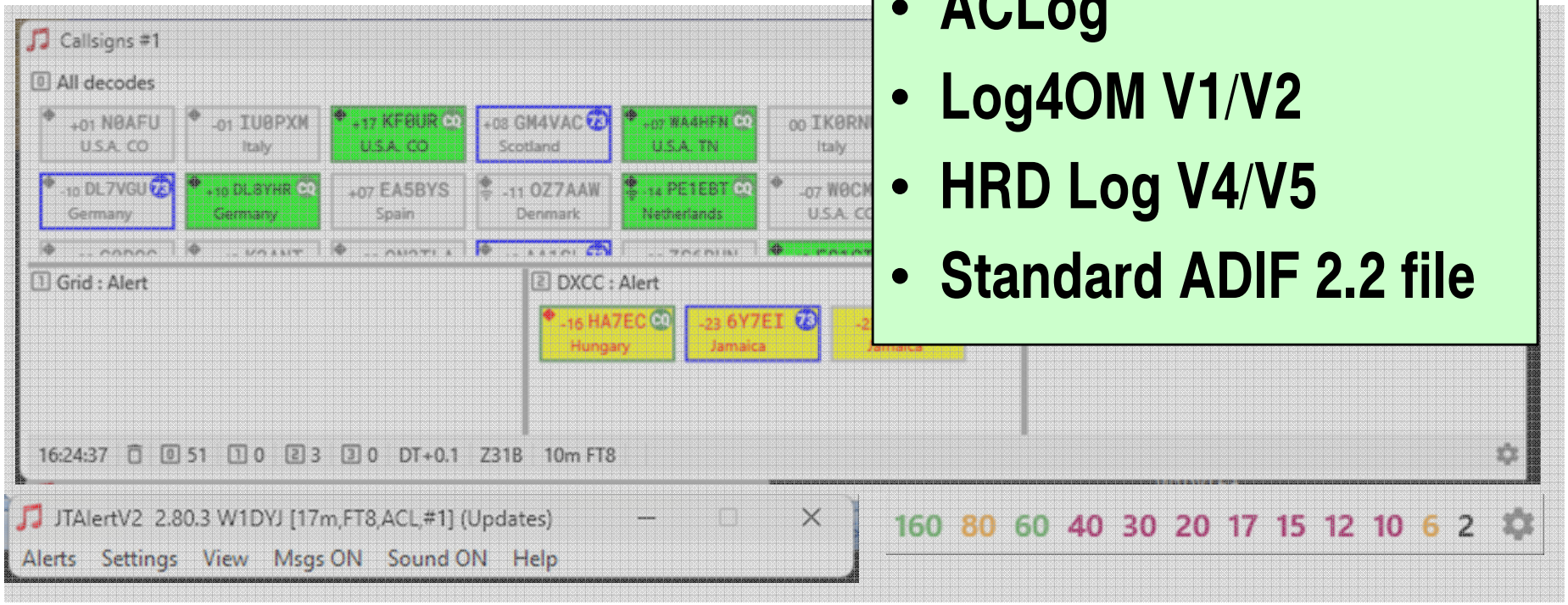
I know nothing about GridTracker

JTAlert

Laurie Cowcher, VK3AMA *https://hamapps.com/jtalert*

Compatible Loggers

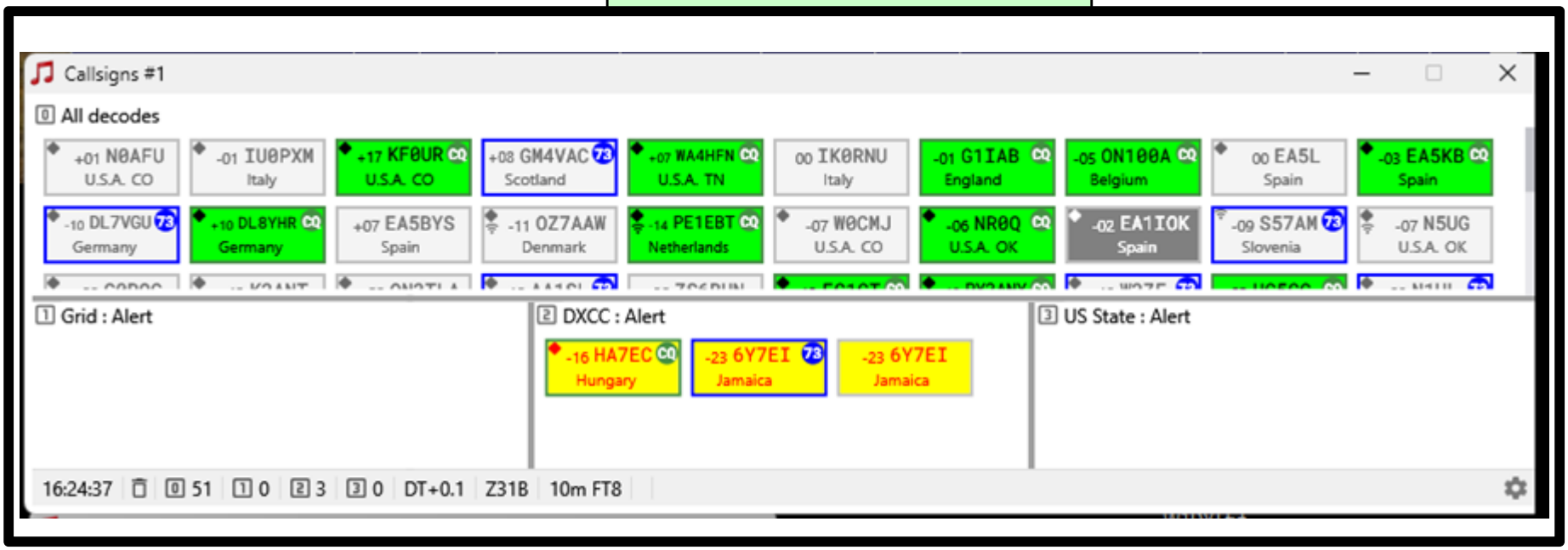
- DXKeeper
- ACLog
- Log4OM V1/V2
- HRD Log V4/V5
- Standard ADIF 2.2 file

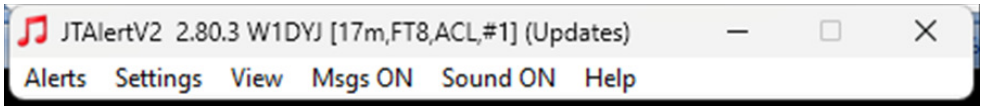


Real Time Audio & Visual Alerts.

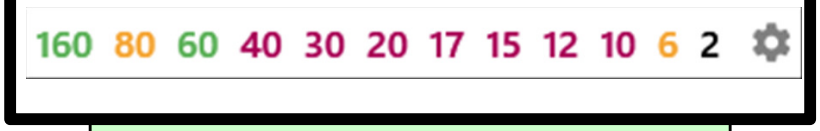
JTAlert ~ *The Windows I Use*

Callsigns Window



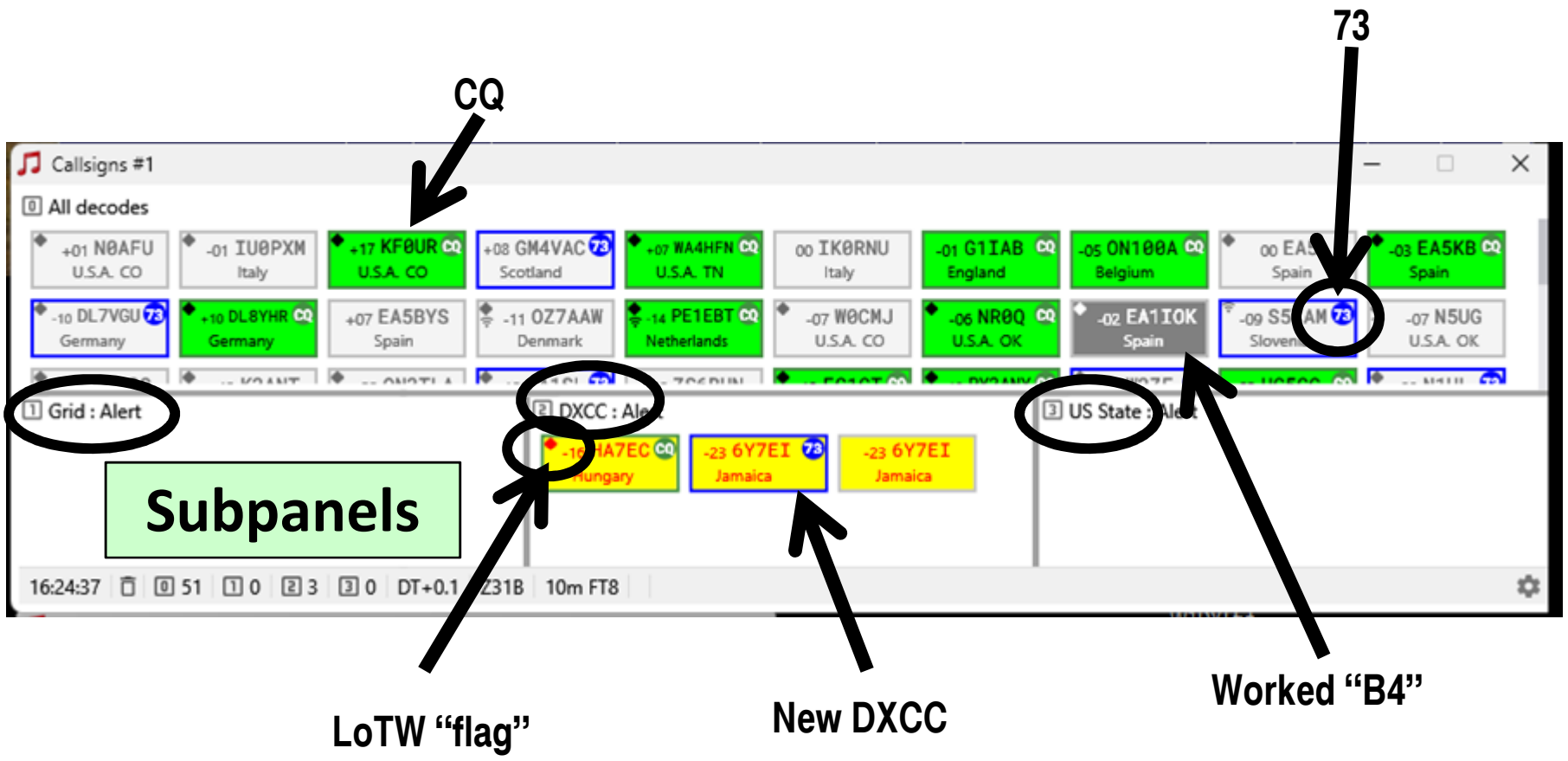


Control Window



Bandheat Window

JTAlert ~ *Callsigns Windows*



Clicking on a call → Sets up WSJT-X

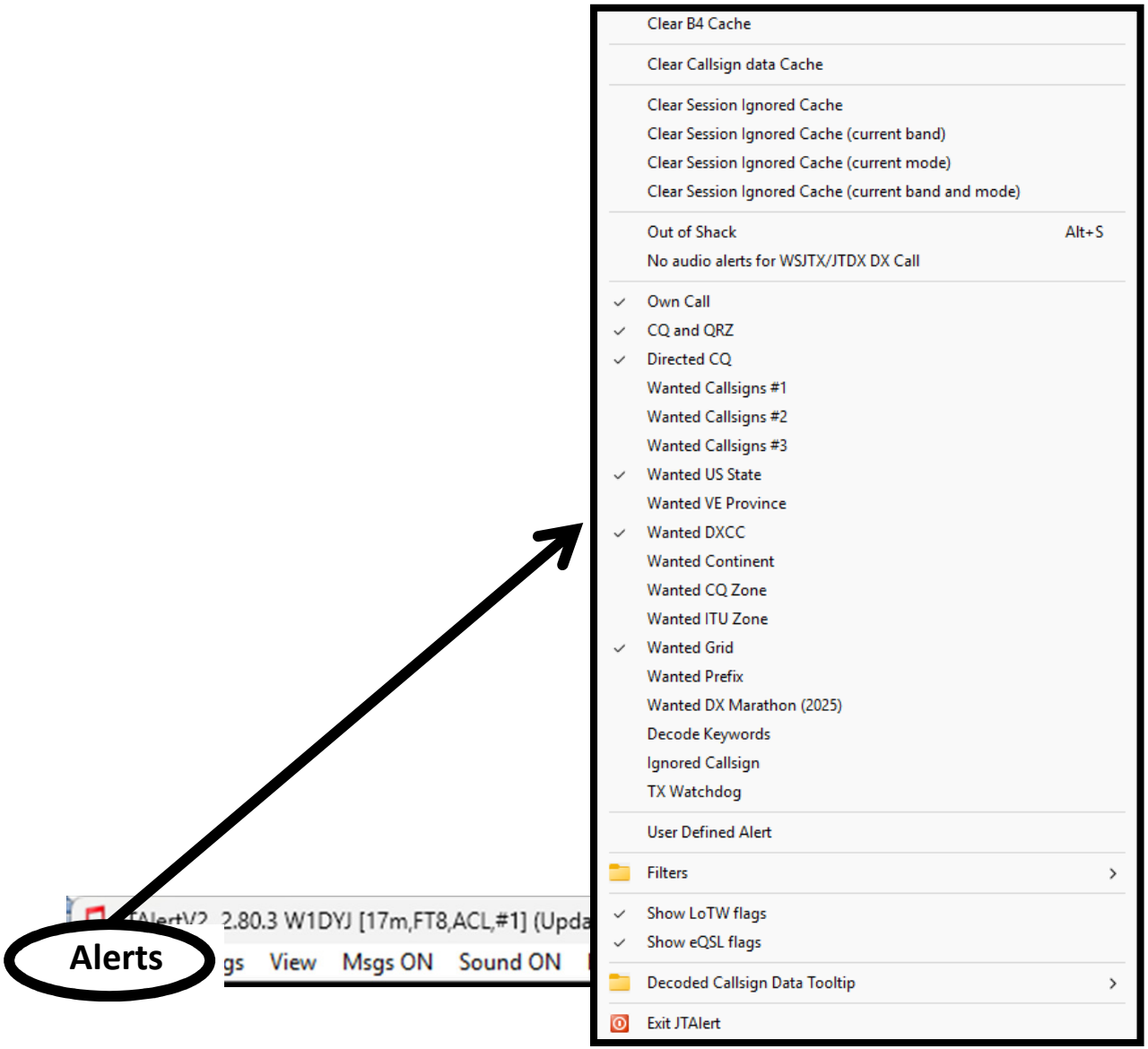
Also has Voice Annunciations: ***DX*** ***New State*** ***Calling You***

JTAlert ~ *Alert Types*

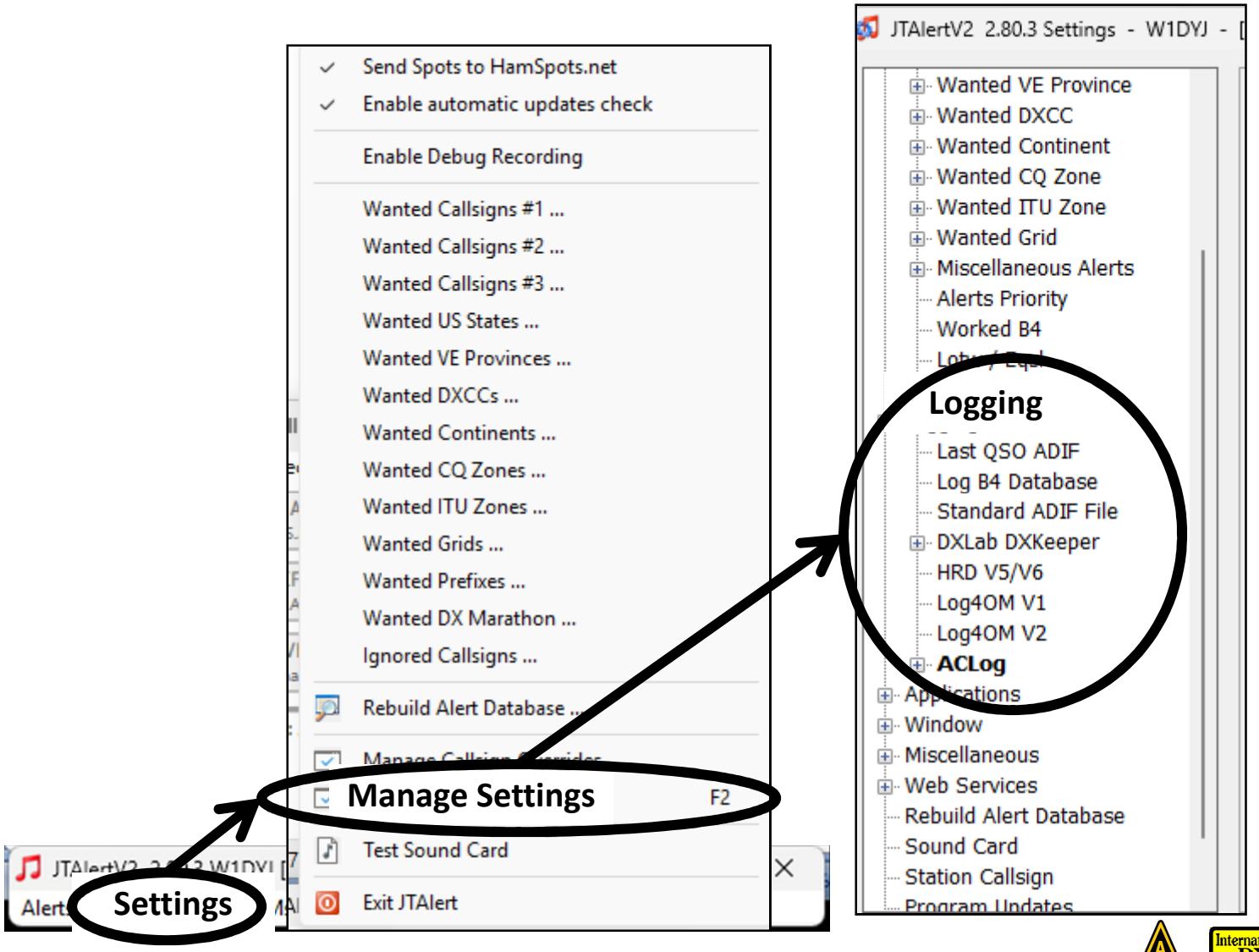
Audio and visual alerts for several alert conditions

- Your Callsign decoded (someone calling you)
- CQ
- Wanted Callsign
- All below by Band/Mode
  - Prefix
  - Grid
  - US State
  - VE Province
  - DXCC
  - CQ Zone
  - Continent
  - CQ Marathon

JTAlert ~ *Selecting Alerts*

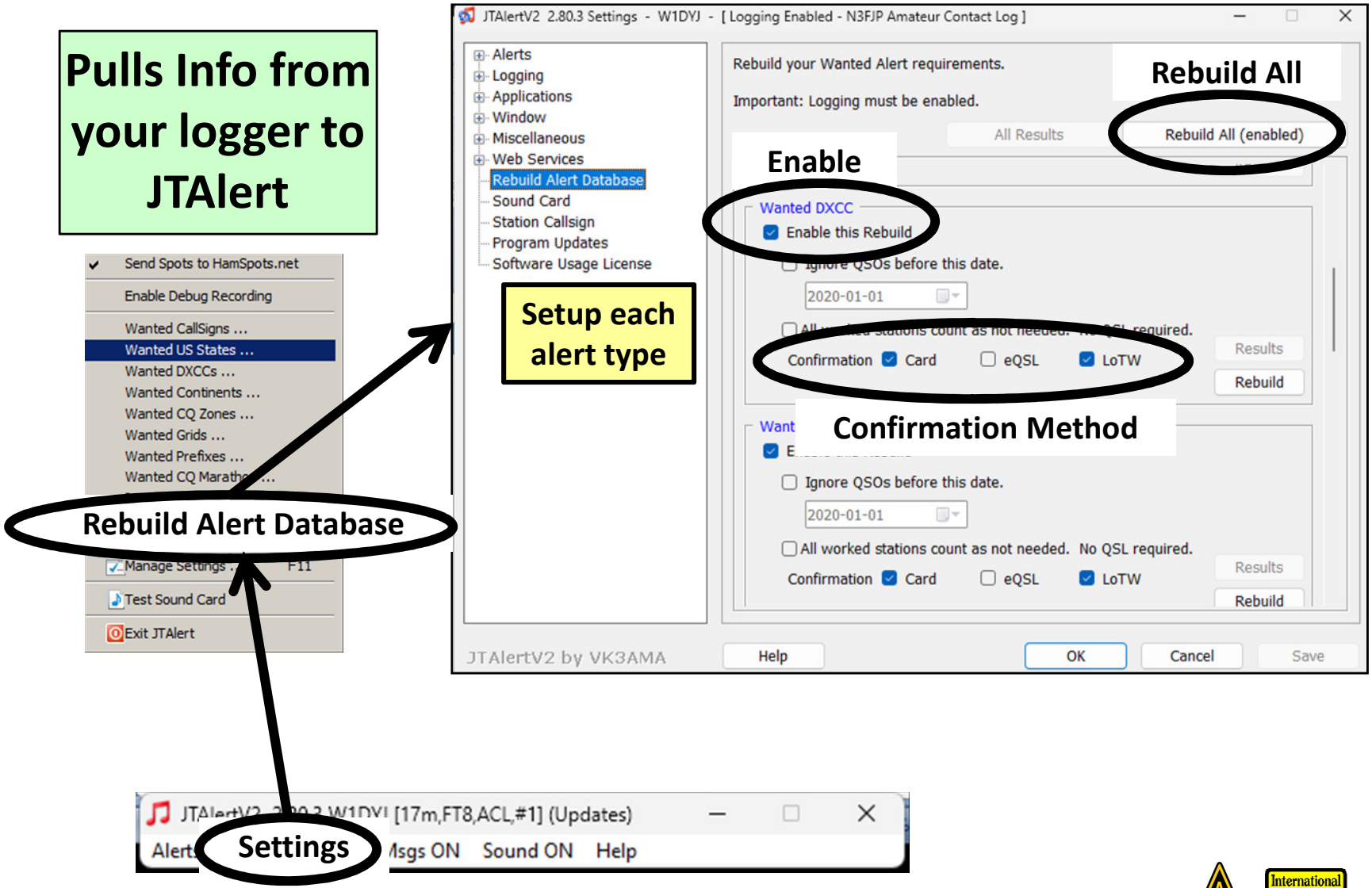


JTAlert ~ *Selecting Your Logger*



JTAlert ~ *Building Alert dB*

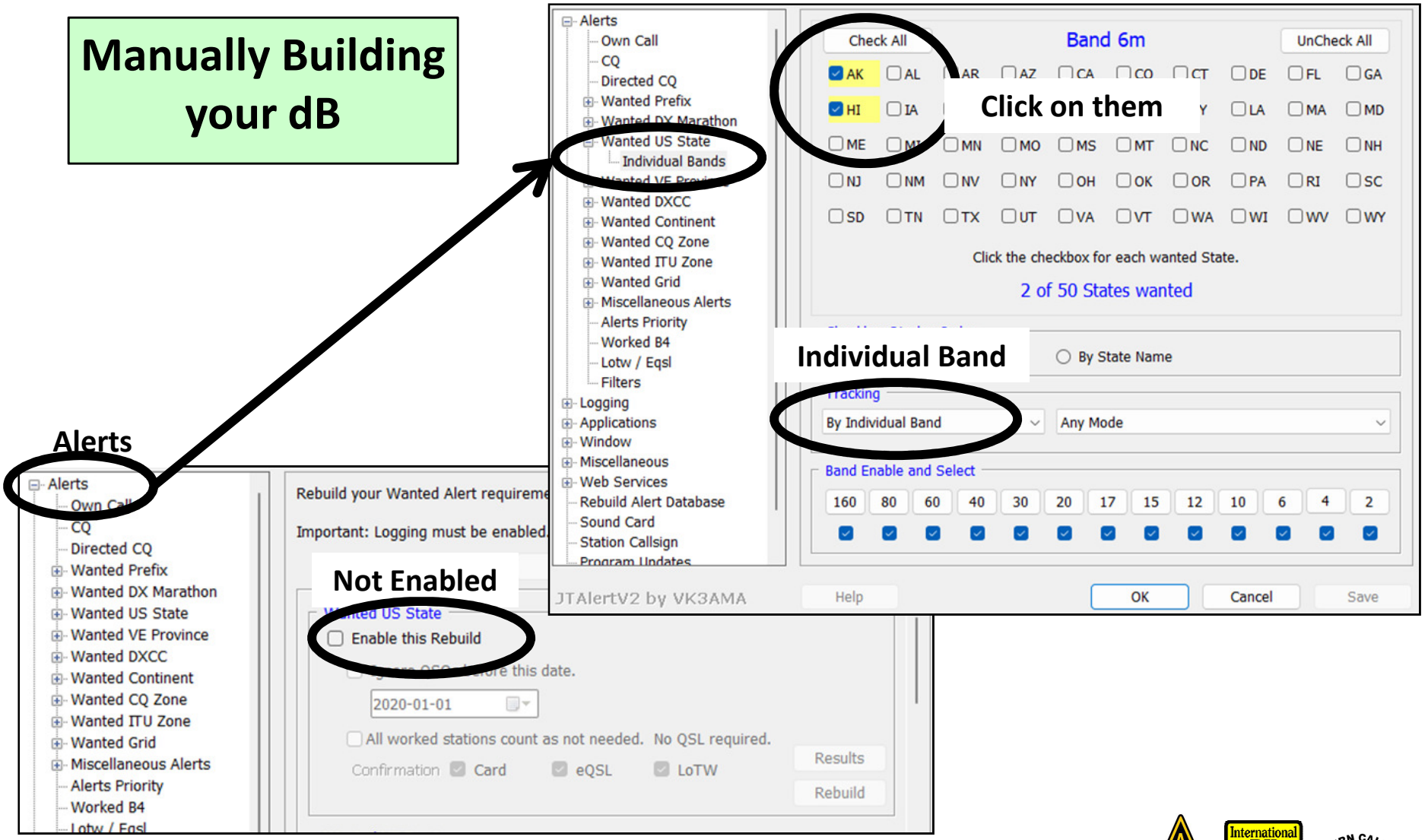
Pulls Info from your logger to JTAlert



JTAlert ~ *Building Alert dB*

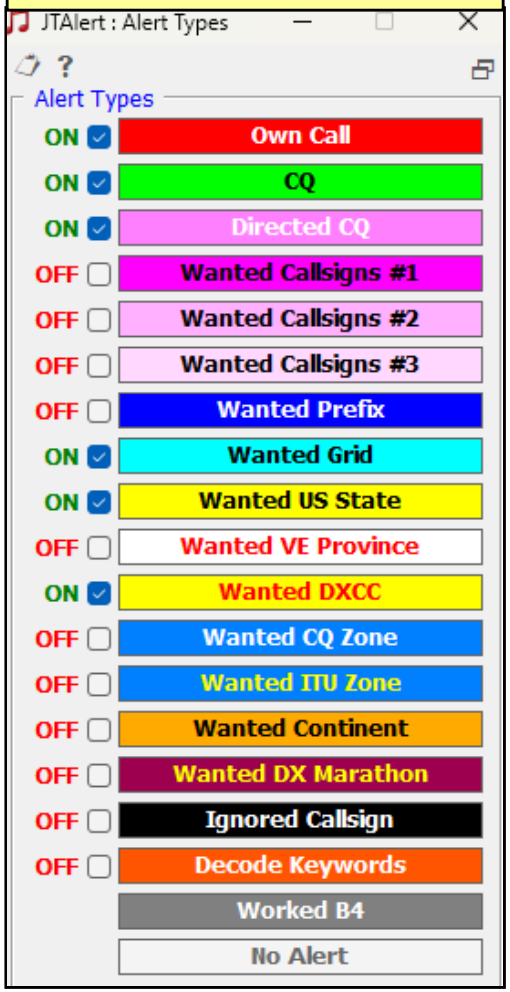
Manually Building your dB

Alerts

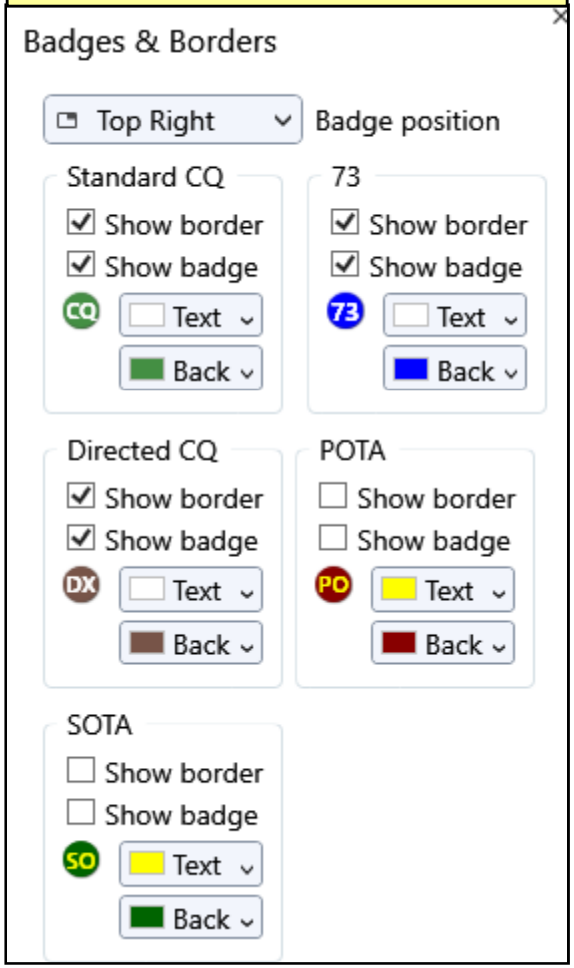


JTAlert ~ Some Additional Stuff

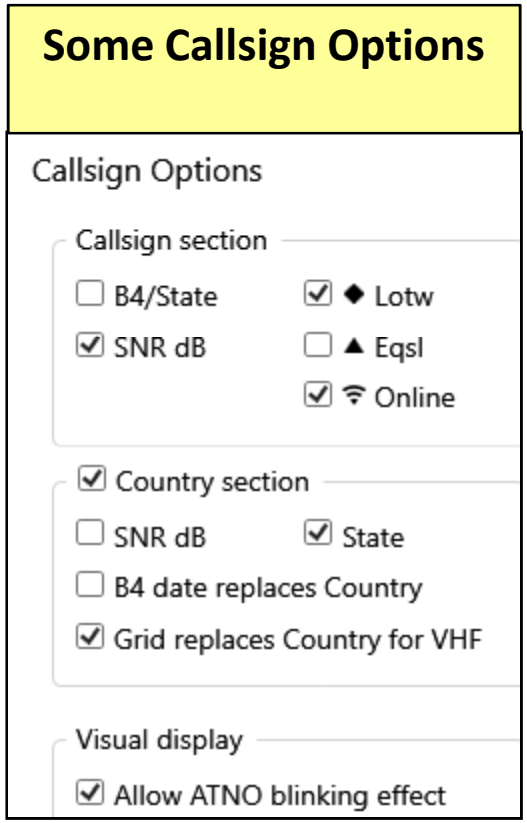
Alert Types Summary Window Setting colors



Setting Badges and Borders

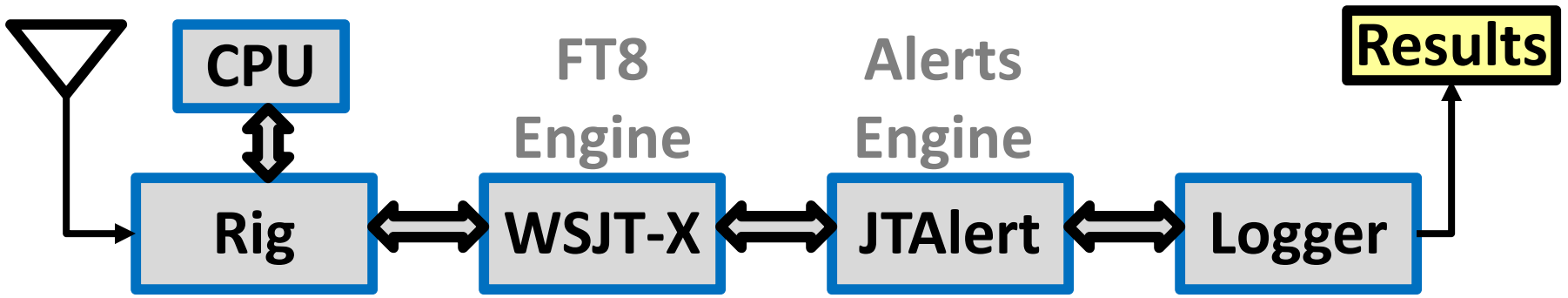


Some Callsign Options



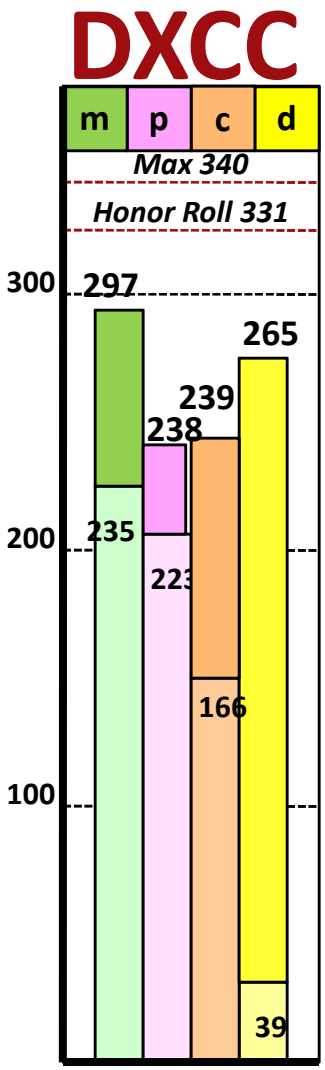
FT8 and JTAlert ~ Agenda

- Basics of WSJT-X & FT8
- HW / SW Setup
- JTAlert
- **W1DYJ results**



FT8 and JTAlert ~ W1DYJ Results — DXCC

As of 20 March 2025



DXCC

Count of overall Entities

Minimum = 100

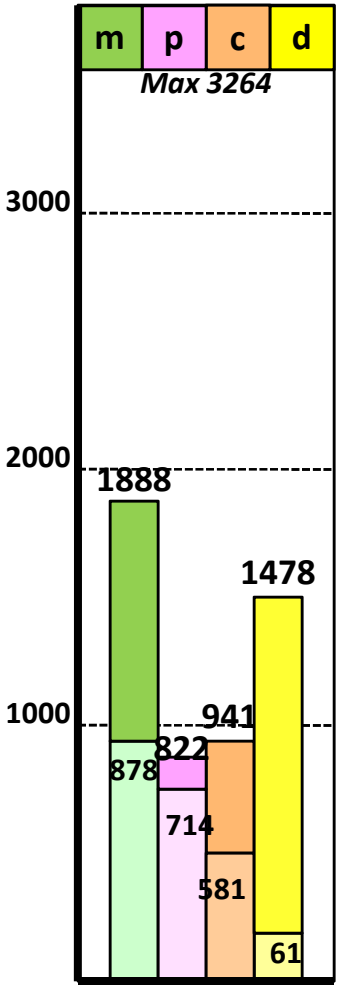
Endorsements by band and mode

2025	mixed	phone	cw	digital
2017	mixed	phone	cw	digital

FT8 and JTAlert ~ W1DYJ Results — DX Challenge

As of 20 March 2025

DX Challenge



DX Challenge

Count of overall Band-Entities

Minimum = 1000

2025	mixed	phone	cw	digital
2017	mixed	phone	cw	digital

FT8 and JTAlert ~ W1DYJ Results — DXCC Details

As of 20 March 2025

DXCC by Band

	2017	2025
Mixed:	4 bands	9
Phone:	4 bands	4
CW:	3 bands	4
Digital:	0 bands	9

DXCC by Band

		m	p	c	d		m	p	c	d
2017	160					17				
2025	160	92	7	60	68	17		50	38	
2017	80					15				
2025	80		74	96		15				
2017	60					12				
2025	60		0	0		12		26	33	
2017	40					10				
2025	40					10				
2017	30					6				
2025	30		na	90		6	86	27	13	78
2017	20									
2025	20									

2017	mixed	phone	cw	digital
2025	mixed	phone	cw	digital

Some Final Thoughts

- ***Be sure your computer clock is accurate***
  - ***WINDOWS clock is not!***
- ***Be aware of different FTx modes:***
  - ***Contests, Fox/Hound, etc.***
- **SPLIT is good** ***[Fake It / Hold TX Freq]***
- ***Don't allow extraneous audio in audio chain***
- ***How much power???***
  - ***"Keep received reports to ~ -5 dB" (Joe T.)***

Some Resources

Web Sites

This talk: *https://www.qsl.net/w1dyj/FT8%20for%20web.pdf*

WSJT-X: *https://wsjt.sourceforge.io/*

JTAlert: *http://hamapps.com/*

Email Reflectors

WSJT-X: *wsjtgroup@groups.io*

WSJT-X <u>AND</u> all other forks or add-ons to the program. *The "official" email reflector.*

WSJT-X: *main@WSJTX.groups.io*

WSJTX.group.io is a private forum and is NOT operated by the Core WSJT Group! Messages MUST include a hashtag. *Moderator very strict!*

JTAlert: *Support@HamApps.groups.io*

Thank you!

www.qsl.net/w1dyj

Appendix

Abstract

FT8: An Update

Larry first gave this talk in 2019. Since then a lot has changed and FT8 is now very popular. This talk will review the 2019 talk which discusses how to use WSJT-X and FT8, and will add some insights that Larry has discovered with the nearly 6000 contacts he has logged on FT8.

Licensed in 1961 as novice KN1VFX, Larry became W1DYJ in 1966. After acquiring three degrees in EE from MIT, Larry was hired in 1969 by Hewlett-Packard Medical's Cardiac lab in Waltham, MA, working on Electrocardiographs and then Cardiac Ultrasound systems. He moved to HP Medical Education in 1993, responsible for technical and project management training. When HP split apart, he became Agilent Technology's global program manager for their Learning Management System. "Retiring" in 2005, he consulted for Avago (now Broadcom) on eLearning technologies through 2012. He now spends his time chasing DX and contesting in Woburn, traveling with his wife Maren, and attending many jazz and classical concerts. He is the net manager and newsletter editor for the MMRA, publications editor for HamXposition, and a member of the YCCC.

Ham Radio ~ Who Am I?

- Mom was a high School cafeteria worker. Dad was an electrician and had a dual workshop: ***woodworking*** and ***electronics*** (my two continuing favorite hobbies). They both highly valued education.
- As a kid: I "played" in his workshop, had an erector set,
  and read all the Tom Swift books…
- Built a crystal radio when I was 12 (1958) –the first station heard was the BBC
  and I was hooked on radio.
- Obtained my ham radio license at 15 in 1961 (a junior in HS).
- Went to MIT (SBEE'67, SMEE'69, EE'70)
  in part because of my ham radio experience.
- Hired (1969) by HP Medical (Waltham/Andover) developing hospital cardiac instrumentation (electrocardiographs, then real-time cardiac ultrasound)
  in part because of my practical experience with ham radio.
- Moved to HP/Agilent Corp Ed (project management experience) in 1993
- "Retired" in 2005; then part-time consulted for Avago (now Broadcom) as their eLearning platform WW PM
- Finally retired (for real) in 2012 – now play with ham radio

Ham Radio ~ What have I logged...

What I have logged, as of 25 February 2025:

Mode	#	1st Q
FT4	268	8/2019
FT8	5848	8/2017 >>>>>>>>>>>
JT65	97	6/2017
MSK144	1	5/2017
PSK31	64	5/2003
PSK63	1	3/2017
Q65	1	8/2024
RTTY	10336	1/2017
==========		
Total digital	16616	
SSB	27642	7/1994
CW	18528	9/2014
FM	86	11/1993

Confirmed			
BND	#Qs	#WAS	#DXCC
160	426	48	68
80	449	48	87
60	329	49	106
40	365	41	105
30	512	50	136
20	738	43	99
17	432	50	182
15	424	48	143
12	411	50	167
10	384	50	90
6	1481	48	77
2	342	17	2
0.7	45	7	1

Total Qs 63215

Use Split

From the WSJT-X online manual:

"To avoid QRM from competing callers, it is usually best to answer a CQ on a different frequency from that of the CQing station. The same is true when you tail-end another QSO. Choose a Tx frequency that appears to be not in use. You might want to check the box Hold Tx Freq. "

From the Hinson document linked from same:

"The CQing station doesn't need to say up 3 or anything else. He will decode all stations in the audio spectrum. You can call him at 300Hz or 2300Hz and it won't make any difference. They all display. You don't have to (and don't want to) move to his frequency. If there is more than one station calling him, they will hopefully be spread all over the audio spectrum, not causing QRM to the station trying to make a QSO or each other. If a bunch call on his frequency, they just QRM each other and the guy CQing will be working those who are split. Additionally, if he starts a QSO with someone close to your transmit frequency, your transmitter will be disabled so you don't cause him QRM. If you are transmitting further away, you can keep calling him and he should pick you up as he works through the list of callers."

Random stuff

In the v2.0 FT8 and MSK144 protocols there are 2^77 = 151,115,727,451,828,646,838,272 (about 1.5 x 10^23) possible messages. If AP is not enabled, the decoder's job of finding the correct message is equally difficult for every one of these integers. The inner-most layer of the decoder knows nothing about what type of user-meaningful message may emerge from the process. At this stage, "F6ABC ON4KHG 73", "73 XYZ TU", and "ABCDEFGHIJK" are all nothing more than different integer numbers between 0 and 51,115,727,451,828,646,838,271.

Hash codes are a one-way function, a.k.a. lossy compression. Many callsigns can have the same hash code, the point is to represent a callsign using less bits that necessary to exactly represent the callsign, which is necessary if the callsign is non-standard, or the other callsign is non-standard. A standard callsign requires 28 bits to store, a non-standard callsign in WSJT-X v2.0.0 FT8 and MSK144 modes can take up to 58 bits to store.