SEAPAC®

FT8 Digital Mode
DX Fun with Modest Equipment

David Haworth

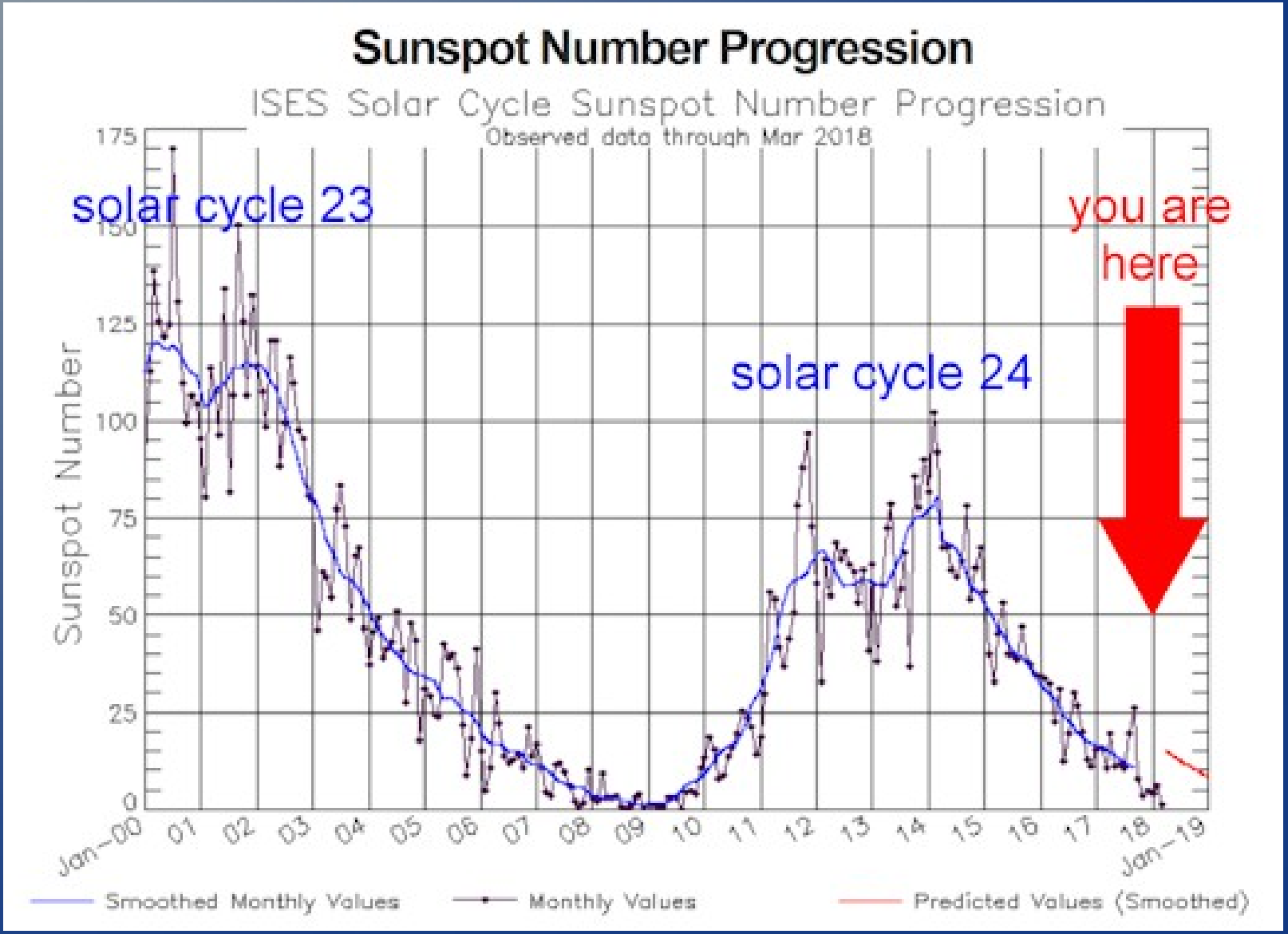
Agenda

- Introduction
- Software
- Setup
- Operation
- Email lists for getting help
- More FT8 information

Who has used FT8?

Sunspots Vanishing Faster than Expected

https://spaceweatherarchive.com/2018/05/01/sunspots-vanishing-faster-than-expected/



Joe Taylor K1JT

- Taylor would agree. As he sees it, FT8 won't replace modes such as CW or SSB. "Nevertheless, it's clear that — at least in the short term — many hams enjoy making rapid-fire minimal QSOs with other hams, all over the world, **using modest ham equipment**," he said. "For this purpose, FT8 shines."

http://www.arrl.org/news/new-digital-modes-changing-complexion-of-bands-and-perhaps-of-ham-radio

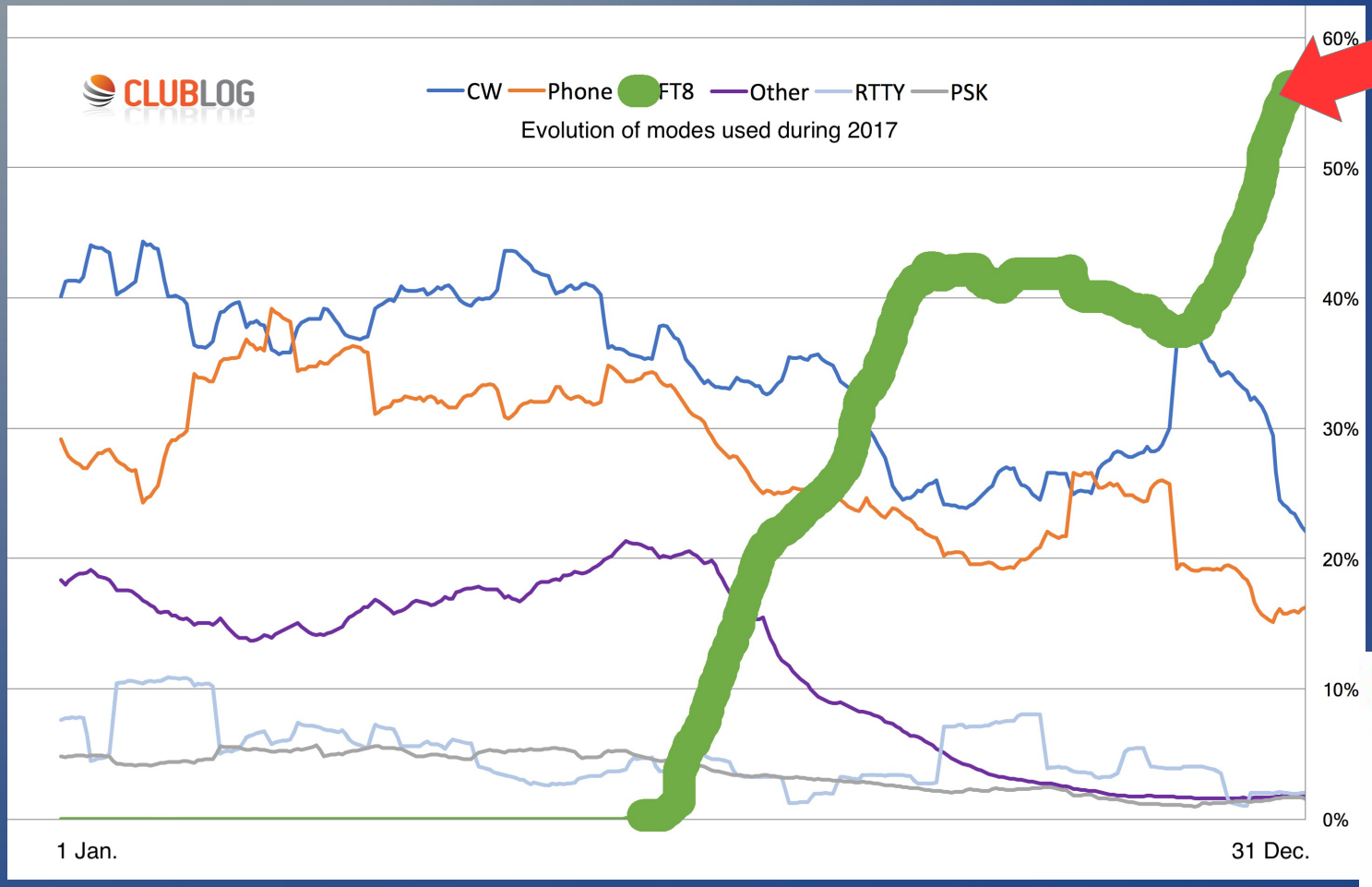
Joe Taylor K1JT

- “It is allowing people who have **smaller stations** the opportunity to get on and use their radios and a computer to **make contacts they never would have been able to make**. This is great for ham radio!”

http://www.arrl.org/news/new-digital-modes-changing-complexion-of-bands-and-perhaps-of-ham-radio

2017 Club Log Modes

https://g7vjr.org/2018/01/proportion-of-modes-used-on-the-air-2017-update/



Weak-Signal S/N Limits

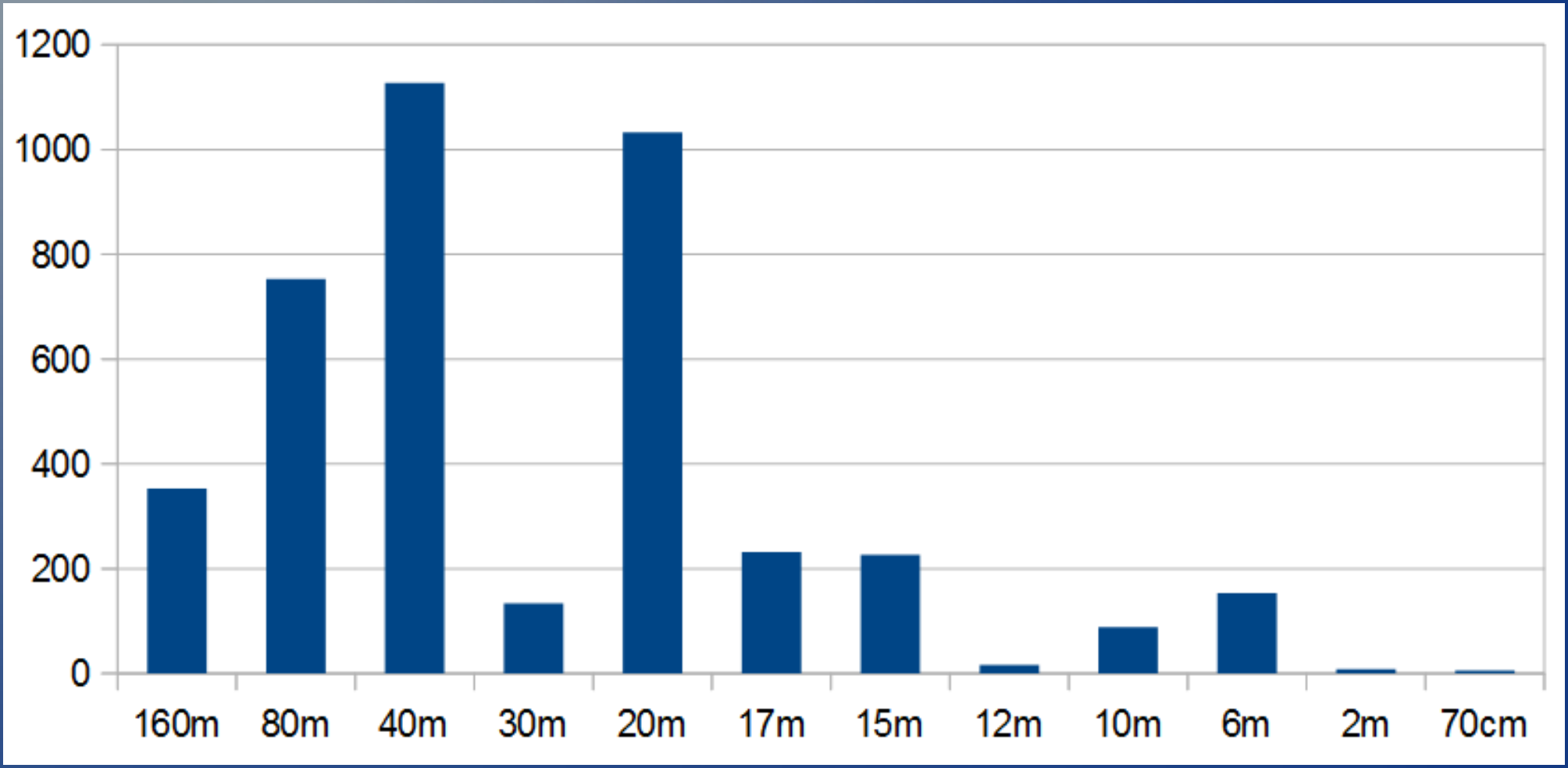
Mode	(B = 2500 Hz)
SSB	~+10 dB
MSK144	- 8
CW, "ear-and-brain"	-15
FT8	-21
JT4	-23
JT65	-25
JT9	-27
QRA64	-27
WSPR	-31

Work the World with WSJT-X Dr. Joe Taylor

WA9ONY

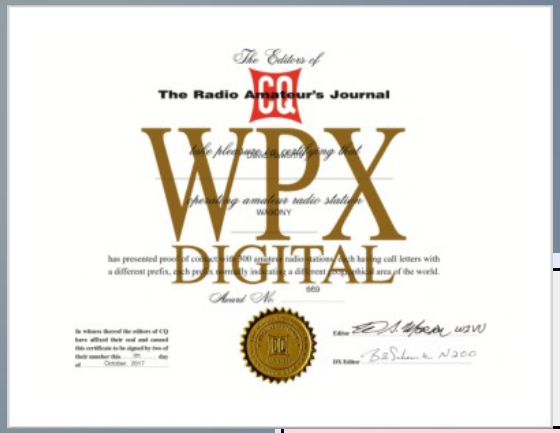
- CN85tq, Camas WA
- >4,100 FT8 QSOs since 2017/8/25
  - 160m to 70cm
  - No FT8 on 60m & 1.25m yet
- www.qrz.com/db/WA9ONY

QSOs / Band


1200
1000
800
600
400
200
0
160m
80m
40m
30m
20m
17m
15m
12m
10m
6m
2m
70cm

WA9ONY

- Many awards using FT8
- CQ WPX Digital using only FT8
  - 300 Dec. 2017, #669
  - Honor Roll 640 March 2018
    - Rank 49th
- www.qrz.com/db/WA9ONY



WPX LoTW Status

CQ WPX Award	New LoTW QSLs	LoTW QSLs in Process	CQ WPX Credits Awarded	Total
WPX Digital	48	0	653	701
WPX Digital 160M	69	0	53	122
WPX Digital 80M	85	0	188	273
WPX Digital 40M	58	0	296	354
WPX Digital 30M	58	0	22	80
WPX Digital 20M	27	0	306	333
WPX Digital 17M	87	0	55	142
WPX Digital 15M	85	0	39	124
WPX Digital 12M	10	0	3	13
WPX Digital 10M	29	0	11	40
WPX Digital 6M	51	0	1	52
WPX Digital North America	36	0	457	493
WPX Digital South America	6	0	46	52
WPX Digital Europe	0	0	2	2
WPX Digital Africa	0	0	2	2
WPX Digital Asia	5	0	75	80
WPX Digital Oceania	12	0	38	50

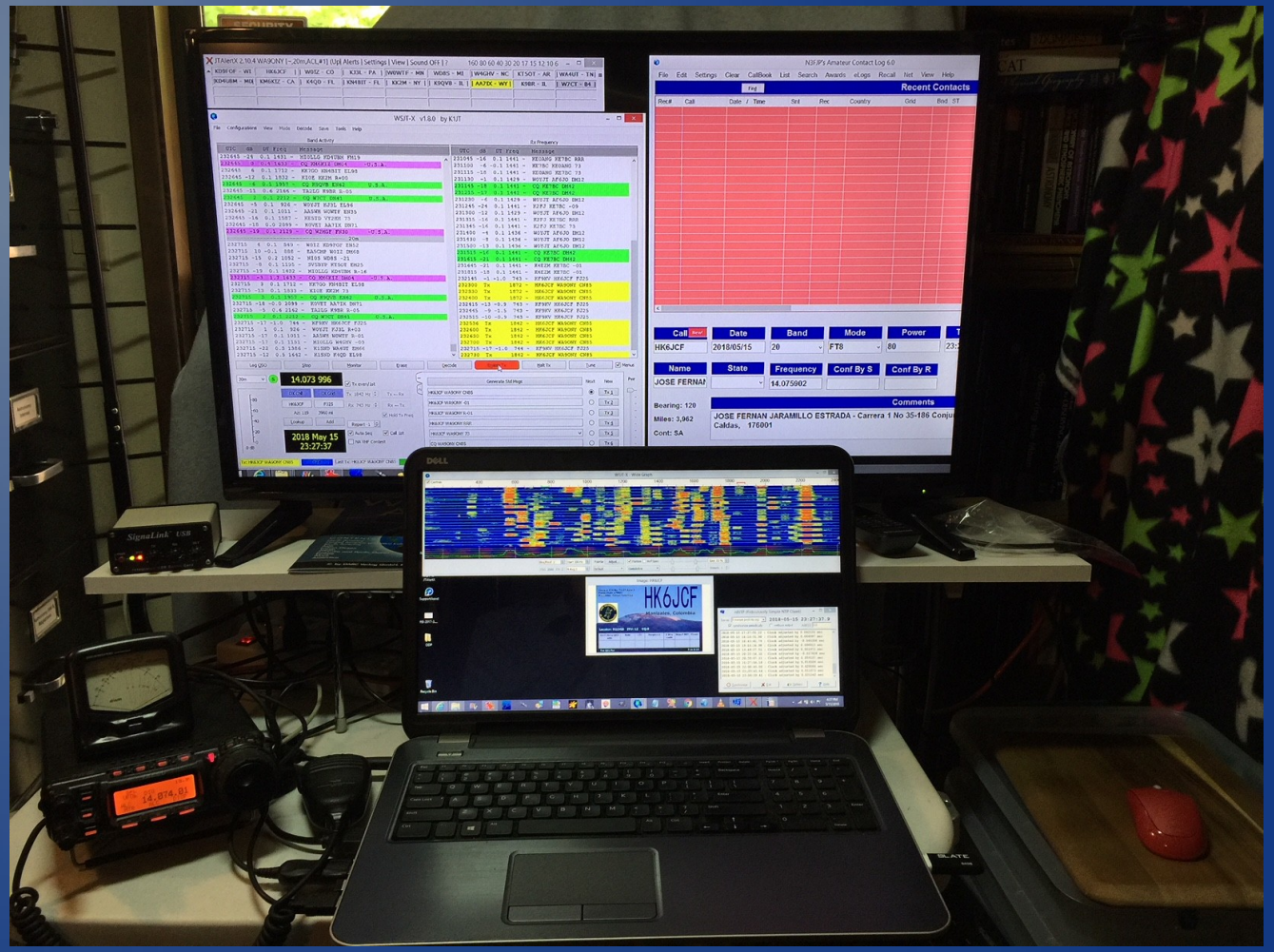
WAS LoTW Status

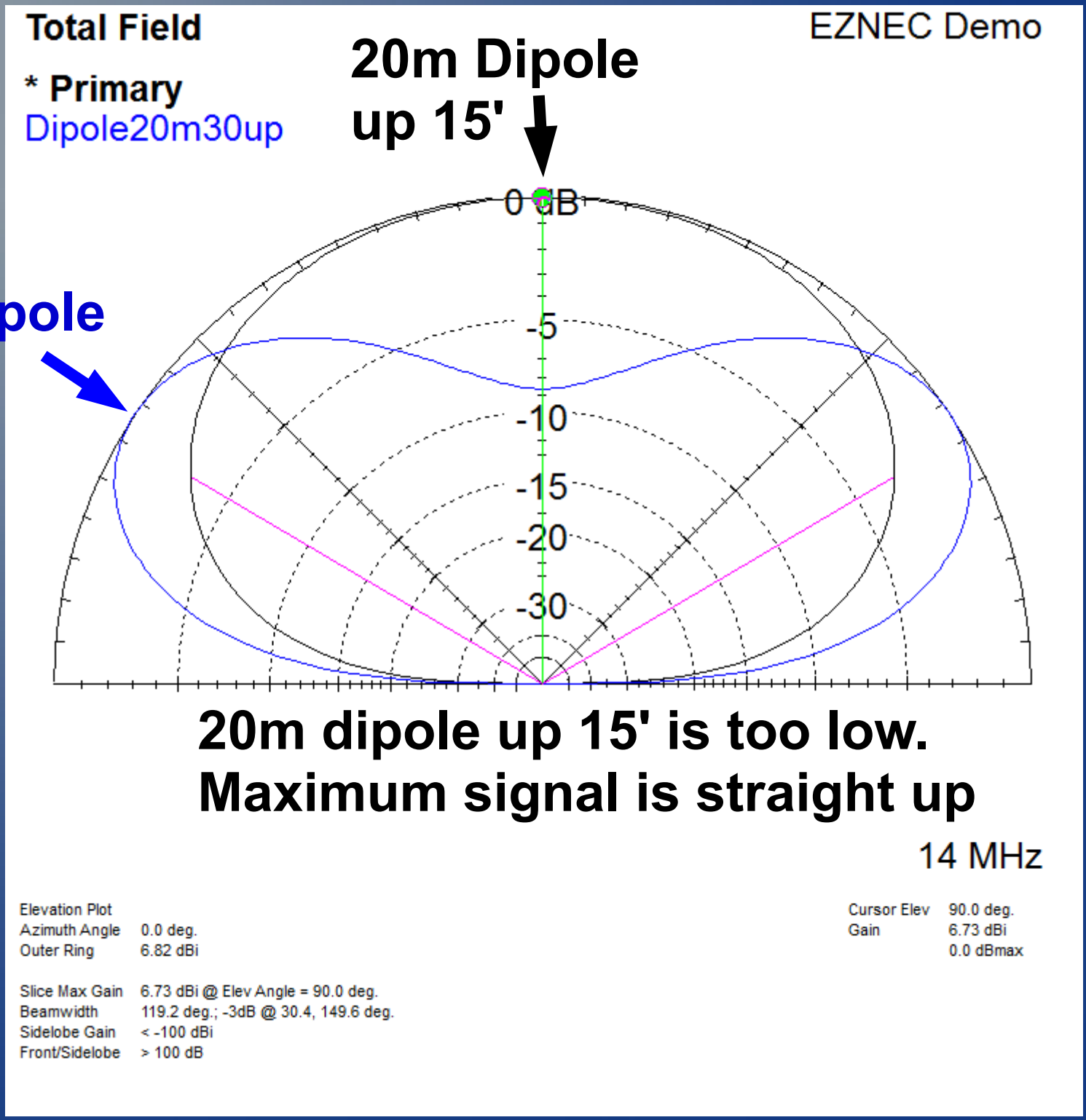
WAS Award	New LoTW QSLs	LoTW QSLs in Process	WAS Credits Awarded	Total
Digital *	0	0	50	50
FT8 *	0	0	50	50
Digital 160M	45	0	0	45
80M Digital	48	0	0	48
40M Digital	48	0	0	48
30M Digital	37	0	0	37
20M Digital	50	0	0	50
17M Digital	43	0	0	43
15M Digital	31	0	0	31
12M Digital	5	0	0	5
10M Digital	7	0	0	7
Phone 6M	1	0	0	1
Digital 6M	8	0	0	8
Digital 2M	2	0	0	2

WA9ONY

www.qrz.com/db/WA9ONY

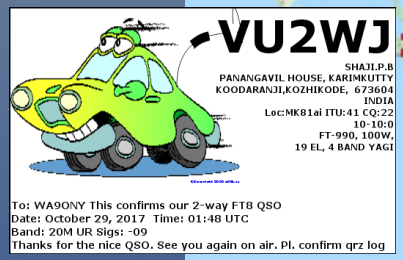
- Dipoles
- 6m up 22 ft
- 10m up 20 ft
- 15m up 22 ft
- 20m up 15 ft
- 40m up 22 ft
- 80m up 22 ft
- 180m up 22 ft

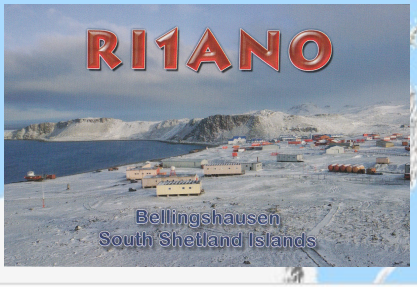



Total Field
* Primary
Dipole20m30up
EZNEC Demo
20m Dipole
up 15'
20m Dipole
up 30'
0 dB
-5
-10
-15
-20
-30
20m dipole up 15' is too low.
Maximum signal is straight up
14 MHz
Elevation Plot
Azimuth Angle 0.0 deg.
Outer Ring 6.82 dBi
Slice Max Gain 6.73 dBi @ Elev Angle = 90.0 deg.
Beamwidth 119.2 deg.; -3dB @ 30.4, 149.6 deg.
Sidelobe Gain < -100 dBi
Front/Sidelobe > 100 dB
Cursor Elev 90.0 deg.
Gain 6.73 dBi
0.0 dBmax

WA9ONY 616 FT8 Grid Squares

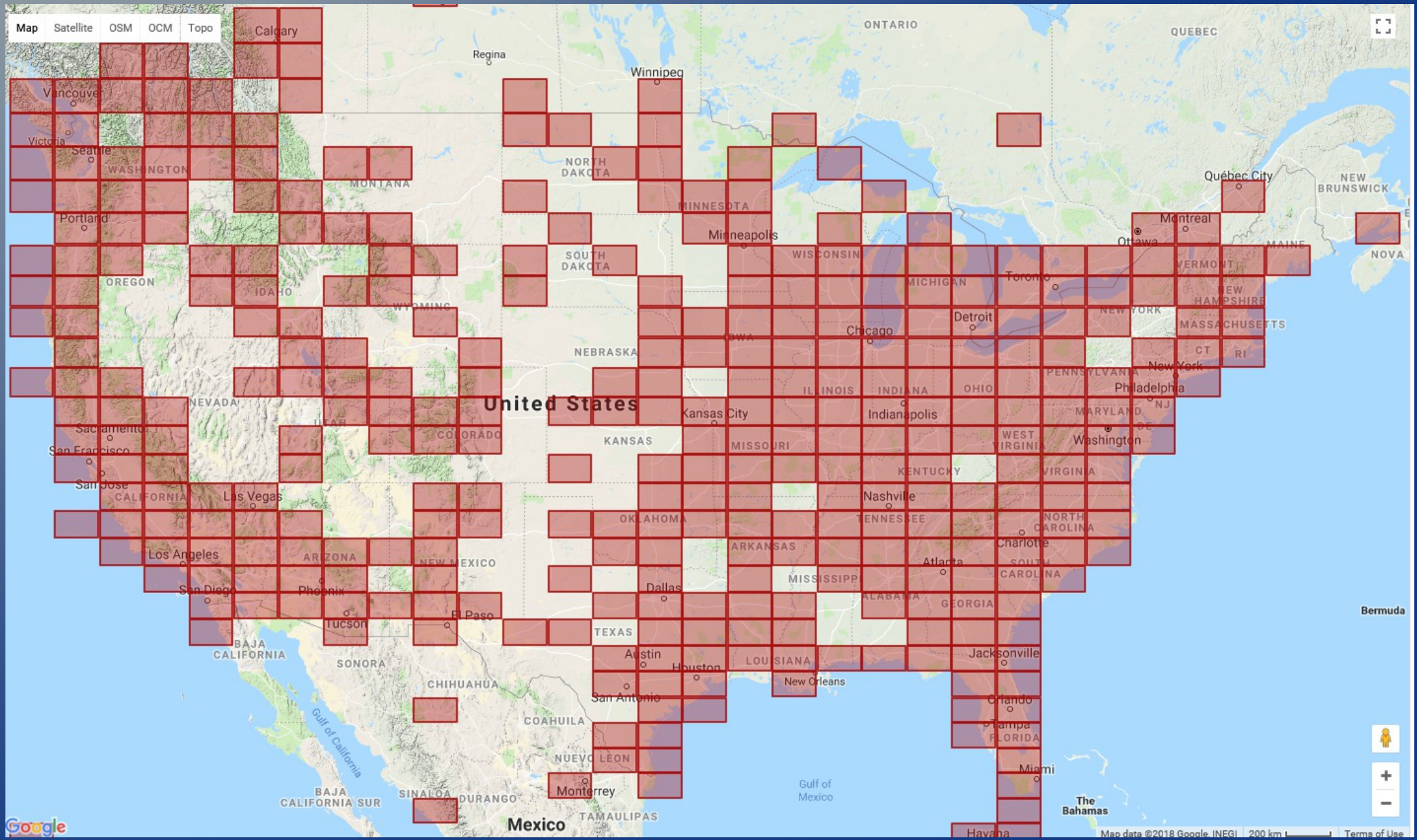
http://tools.adventureradio.de/analyzer/



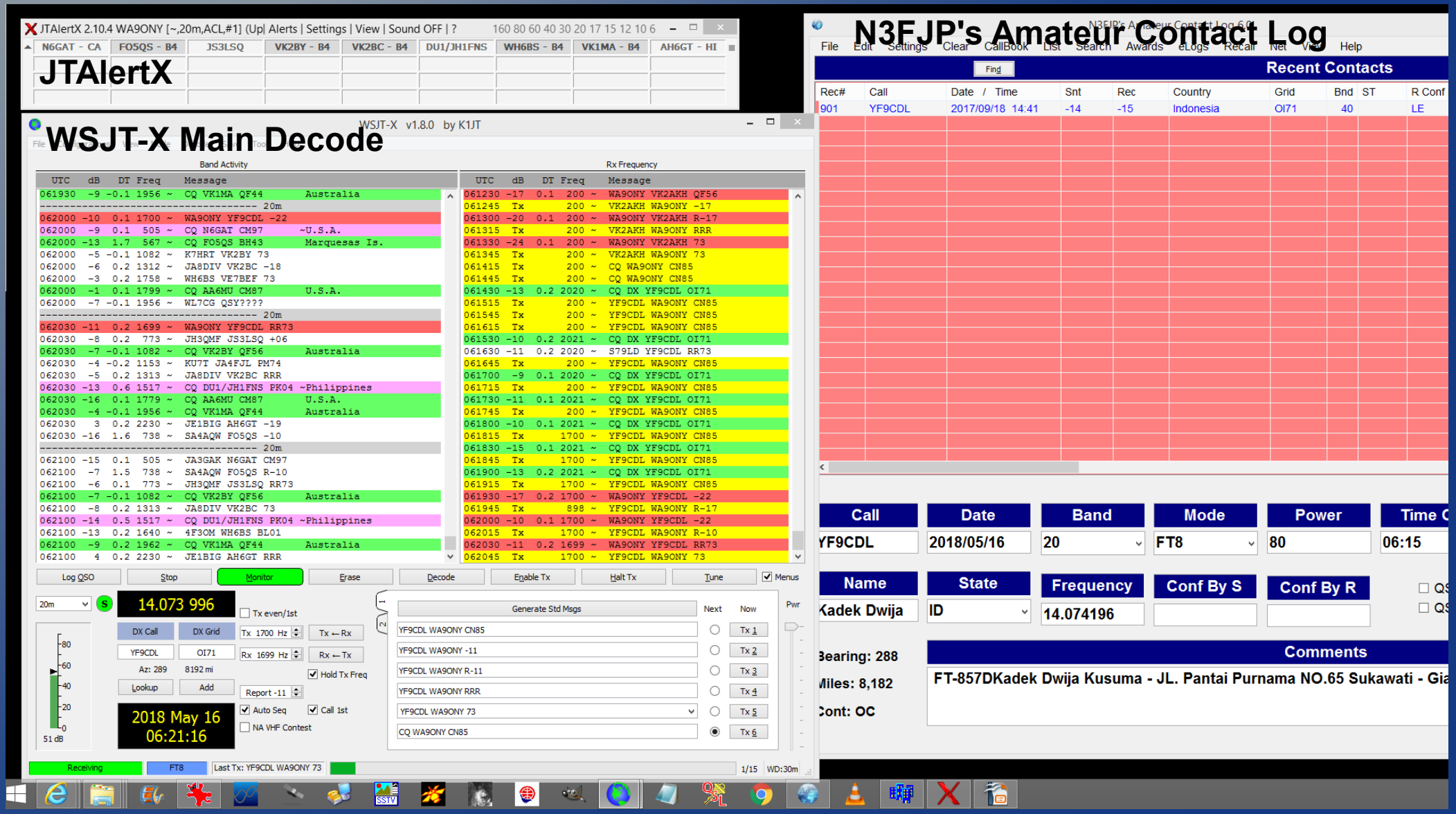


WA9ONY FT8 Grid Squares

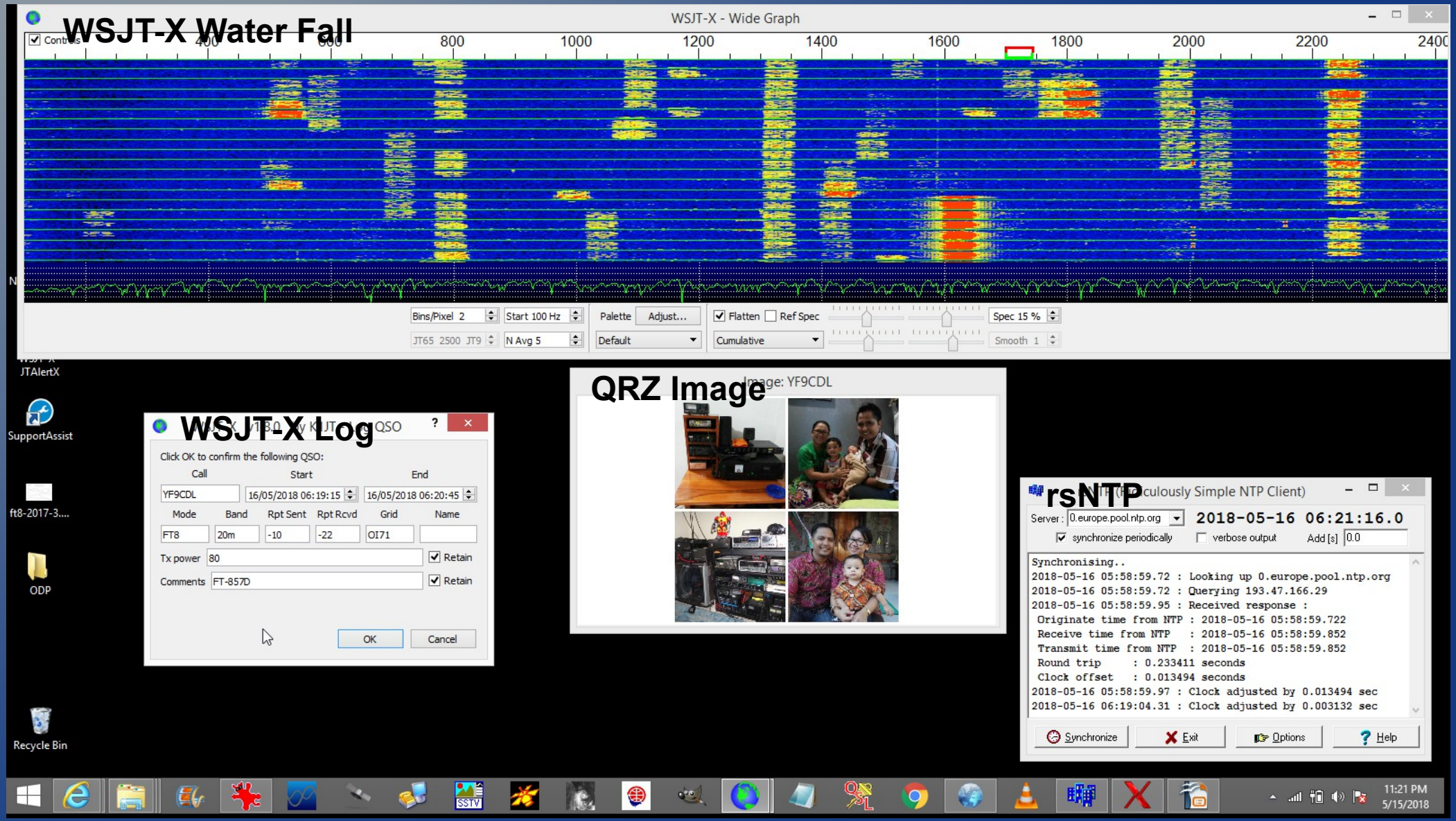
http://tools.adventureradio.de/analyzer/



Laptop HDMI to 32” TV Display



Laptop Display



WA9ONY FT8 Software Setup

WSJT-X

rsNTP

JTAlertX

QRZ Info & Image

Amateur Contact Log

eQSL

LoTW

Club Log

ADIF File

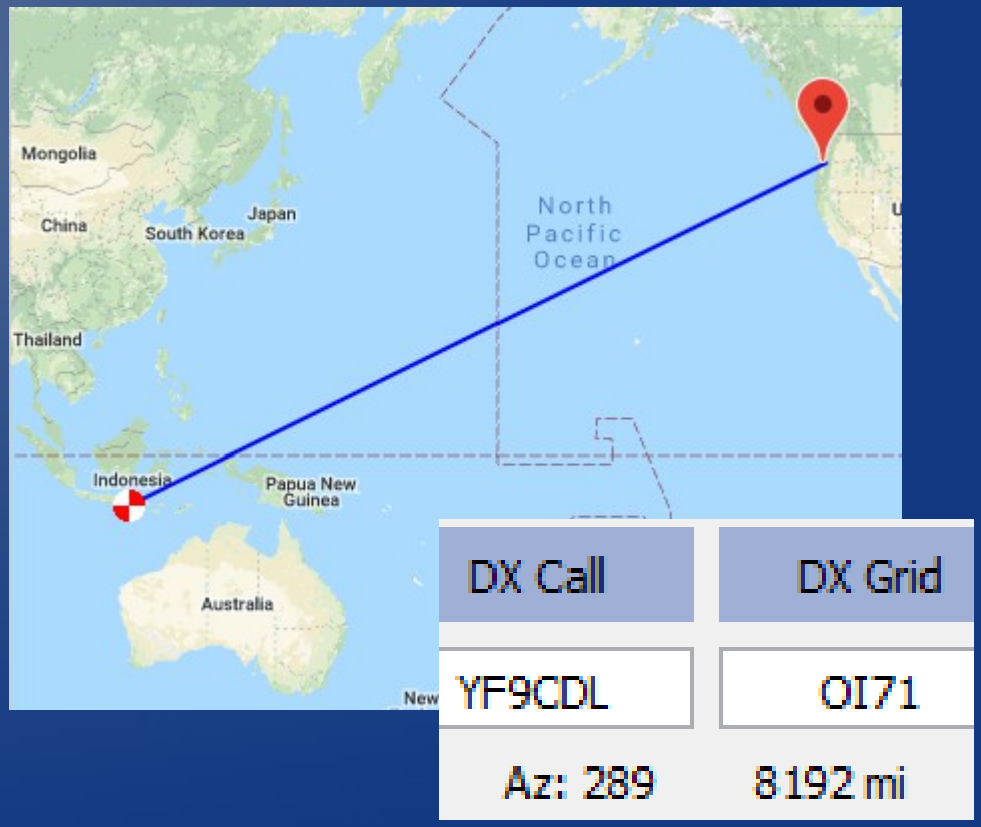
QRZ Log

PSK Reporter

IrfanView

Typical Evening on FT8 20m

- First contact CN85 KI7HMV
- ZL1BQD signal report R -11, S -10
- FK/JS3LSQ R-02 S-08
- Several CA stations
- VK2HCC R-12 S-09
- FK8CE R-03 S-08
- VK2AKH R-17 S-17
- YF9CDL R-22 S-10
- Last RA0LX R-18 S-21



Demo

FK8CE

Dominique HOARAU
PO BOX: 138
98870 BOURAIL
NEW CALEDONIA
Loc:RG28rj ITU:56 CQ:32
IOTA:OC-032
YAESU FT-950,100W. YAESU FT-450,100W.
VERTICAL CUSHCRAFT R-8 at 7 meters high.
BEGALI "STEALTH" KEYER.
ACOM 1010.

To: WA9ONY This confirms our 2-way FT8 QSO
Date: May 16, 2018 Time: 05:43 UTC
Band: 20M UR Sigs: -03

FT8 20m Log

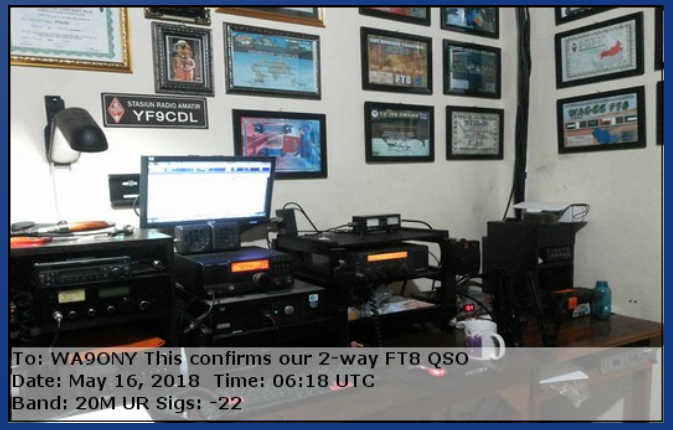
RAØLX

Sergej V. Goncharenko
Urickogo 7-92
Lesozavodsk, 692036
RUSSIA
Loc:PN65rl ITU:34 CQ:19
RDA:PK-10

To: WA9ONY This confirms our 2-way FT8 QSO
Date: May 16, 2018 Time: 06:30 UTC
Band: 20M UR Sigs: -18
TNX For QSO TU 73!.

an Electronic QSL from eQSL.cc

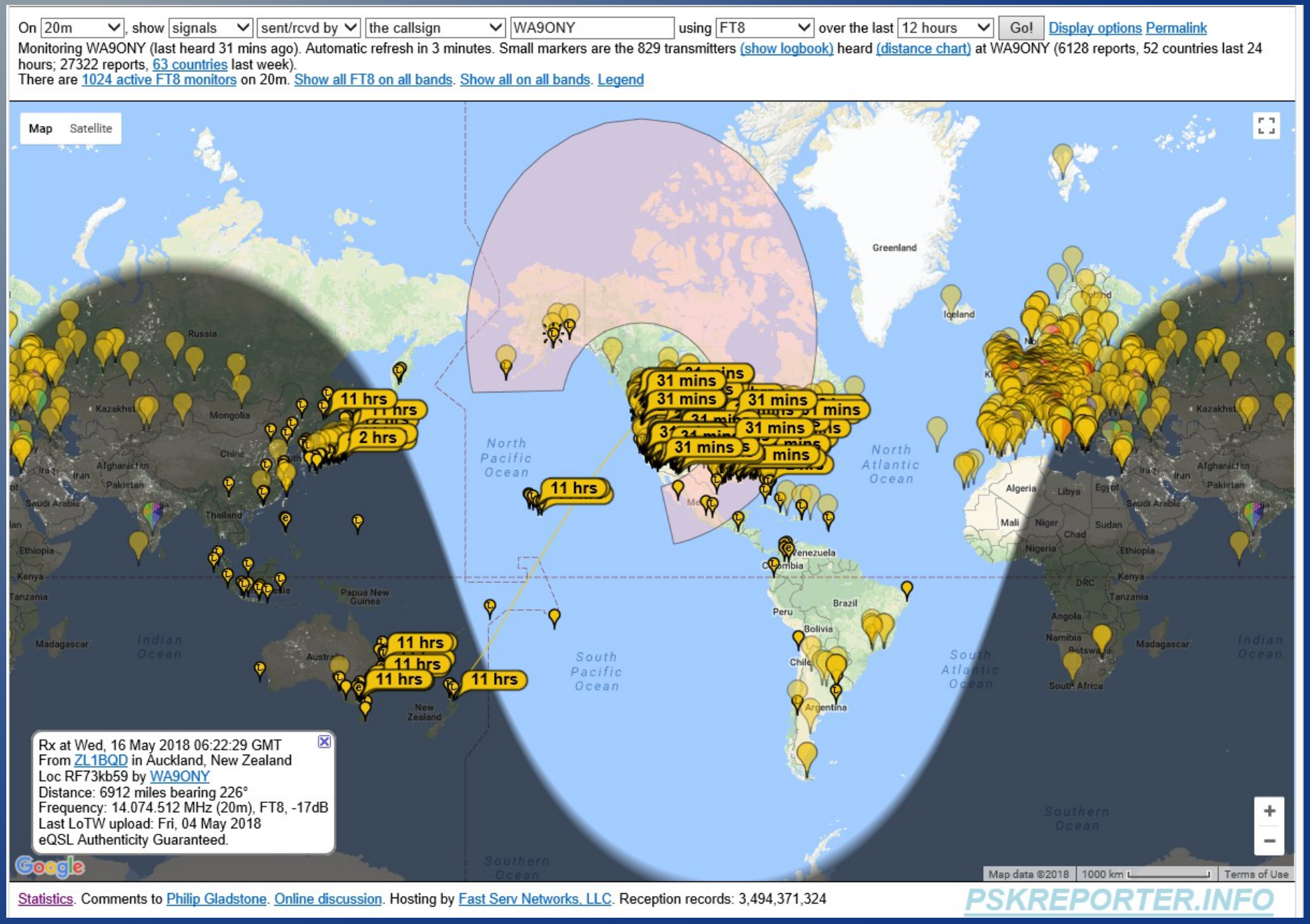
Rec#	Call	Date / Time	Snt	Rec	Country	Grid	Bnd	ST	R Conf
3917	RA0LX	2018/05/16 06:29	-21	-18	Asiatic Russia	PN65	20	PK	EL
3916	YF9CDL	2018/05/16 06:19	-10	-22	Indonesia	OI71	20		EL
3915	VK2AKH	2018/05/16 06:12	-17	-17	Australia	QF56	20		
3914	ND6H	2018/05/16 05:50	-08	-24	USA	CM97	20	CA	
3913	FK8CE	2018/05/16 05:43	-08	-03	New Caledonia	RG28	20		E
3912	VK2HCC	2018/05/16 05:41	-09	-12	Australia	QG61	20	NSW	EL
3911	N6GD	2018/05/16 05:25	-05	+06	USA	CM87	20	CA	
3910	W6JPG	2018/05/16 05:23	-05	-02	USA	DM04	20		
3909	KF6JXM	2018/05/16 05:20	-12	-03	USA	DM13	20	CA	EL
3908	W6JPG	2018/05/16 05:18	-01	+03	USA	DM04	20	CA	L
3907	K6NR	2018/05/16 05:15	-06	+01	USA	DM14	20	CA	L
3906	FK/JS3LSQ	2018/05/16 05:04	-08	-02	New Caledonia		20		
3905	ZL1BQD	2018/05/16 05:01	-10	-11	New Zealand	RF73	20		EL
3904	KI7HMV	2018/05/16 04:42	-04	-08	USA	CN85	20	OR	L



FT8 QSOs

054045	-10	0.1	1329	~	CQ VK2HCC QG61
054130	Tx		476	~	VK2HCC WA9ONY CN85
054145	-9	1.2	1328	~	WA9ONY VK2HCC -12
054200	Tx		476	~	VK2HCC WA9ONY R-09
054215	-11	0.1	1327	~	WA9ONY VK2HCC RRR
054230	Tx		476	~	VK2HCC WA9ONY 73
054245	-4	0.1	1327	~	WA9ONY VK2HCC 73
054245	-9	0.3	725	~	CQ FK8CE RG28
054315	-7	0.3	725	~	CQ FK8CE RG28
054330	Tx		476	~	FK8CE WA9ONY CN85
054345	-8	0.3	726	~	WA9ONY FK8CE -03
054400	Tx		476	~	FK8CE WA9ONY R-08
054415	-8	0.3	726	~	WA9ONY FK8CE RR73
054430	Tx		476	~	FK8CE WA9ONY 73
054445	-10	0.3	726	~	CQ FK8CE RG28

Who Heard WA9ONY FT8 20m



DXCC Most Wanted List (Club Log)
USA is Last

Rank	Prefix	Entity Name
1.	P5	DPRK (NORTH KOREA)
2.	3Y/B	BOUVET ISLAND
3.	FT5/W	CROZET ISLAND
4.	BS7H	SCARBOROUGH REEF
5.	KH1	BAKER HOWLAND ISLANDS

337.	UA	EUROPEAN RUSSIA
338.	DL	FEDERAL REPUBLIC OF GERMANY
339.	I	ITALY
340.	K	UNITED STATES OF AMERICA

Exciting for DX Station VK7BO Reply to My CQ on 80m

DX Call	DX Grid
VK7BO	QE38
Az: 239	8186 mi

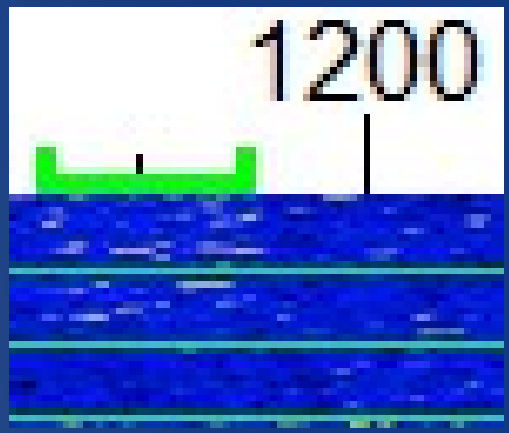

```
080015   Tx                 806 ~  CQ WA9ONY CN85
080045   Tx                 806 ~  CQ WA9ONY CN85
080115   Tx                 806 ~  CQ WA9ONY CN85
080130  -17   0.1 1724 ~  WA9ONY VK7BO -11
080145   Tx                 806 ~  VK7BO WA9ONY R-17
080200  -16   0.1 1724 ~  WA9ONY VK7BO RR73
080215   Tx                 806 ~  VK7BO WA9ONY 73
```

Exciting for DX Station ZL2RX Reply to My CQ on 160m

Station	
Call Sign	WA9ONY
DXCC	UNITED STATES OF AMERICA (291)
CQ Zone	03
ITU Zone	06
Grid	CN85TQ
State	Washington (WA)
County	Clark
Worked Station	
Worked	ZL2RX
DXCC	NEW ZEALAND (170)
CQ Zone	32
ITU Zone	60
IOTA	OC-134
Grid	RE68PR
Date/Time	2018-01-08 08:58:00
Mode	FT8 (DATA)
Band	160M
Frequency	1.84080
QSL	2018-01-08 09:49:02

Record ID 895012677 **Received:** 2018-01-08 09:20:03

DX Call	DX Grid
ZL2RX	RE68
Az: 224	7200 mi




```
---------------------------------- 160m
085330  -4  0.7  805 ~  WA9ONY W7USA DM33
085330  14 -0.1 1292 ~  CQ N7XS CN88          U.S.A.
---------------------------------- 160m
085400  -6  1.2  805 ~  WA9ONY W7USA R-09
085400  14 -0.1 1292 ~  CQ N7XS CN88          U.S.A.
---------------------------------- 160m
085430  -9  0.7  805 ~  WA9ONY W7USA 73
085430  14 -0.1 1292 ~  CQ N7XS CN88          U.S.A.
---------------------------------- 160m
085500  15 -0.1 1292 ~  CQ N7XS CN88          U.S.A.
---------------------------------- 160m
085530  14 -0.1 1292 ~  CQ N7XS CN88          U.S.A.
---------------------------------- 160m
085800 -19  0.3 1127 ~  WA9ONY ZL2RX RE68
---------------------------------- 160m
085900 -17  0.3 1127 ~  WA9ONY ZL2RX R-16
---------------------------------- 160m
090430 -19  0.3 1129 ~  WA9ONY ZL2RX 73
```

```
085745  Tx          805 ~  CQ WA9ONY CN85
085800 -19  0.3 1127 ~  WA9ONY ZL2RX RE68
085815  Tx          805 ~  ZL2RX WA9ONY -19
085845  Tx          805 ~  ZL2RX WA9ONY -19
085900 -17  0.3 1127 ~  WA9ONY ZL2RX R-16
085915  Tx          805 ~  ZL2RX WA9ONY RRR
085945  Tx          805 ~  ZL2RX WA9ONY RRR
090015  Tx          805 ~  ZL2RX WA9ONY RRR
090045  Tx          805 ~  ZL2RX WA9ONY RRR
090115  Tx          805 ~  ZL2RX WA9ONY RRR
090145  Tx          805 ~  ZL2RX WA9ONY RRR
090215  Tx          805 ~  ZL2RX WA9ONY RRR
090245  Tx          805 ~  ZL2RX WA9ONY RRR
090315  Tx          805 ~  ZL2RX WA9ONY RRR
090345  Tx          805 ~  ZL2RX WA9ONY RRR
090415  Tx          805 ~  ZL2RX WA9ONY RRR
090430 -19  0.3 1129 ~  WA9ONY ZL2RX 73
090445  Tx          805 ~  ZL2RX WA9ONY 73
```

Fun Being Chased on 80m

UTC	dB	DT	Freq		Message
105315	-16	0.1	2170	~	CQ KF9KV EN52
105330	Tx		600	~	KF9KV WA9ONY CN85
105400	Tx		600	~	KF9KV WA9ONY CN85
105430	Tx		600	~	KF9KV WA9ONY CN85
105500	Tx		600	~	KF9KV WA9ONY CN85
105515	-18	0.1	1170	~	WA9ONY KF9KV -06
105530	Tx		600	~	KF9KV WA9ONY R-18
105600	Tx		600	~	KF9KV WA9ONY R-18
105615	-18	0.1	1170	~	WA9ONY KF9KV RRR
105615	-5	0.1	1942	~	WA9ONY VK5PO PF95
105630	Tx		600	~	KF9KV WA9ONY 73
105645	3	1.6	1415	~	WA9ONY JA5BZL -07
105645	-4	0.1	1942	~	WA9ONY VK5PO PF95
105715	-6	0.1	1942	~	WA9ONY VK5PO PF95
105715	3	1.6	1415	~	WA9ONY JA5BZL -07
105730	Tx		600	~	VK5PO WA9ONY -06
105745	-8	0.1	1942	~	WA9ONY VK5PO R-09
105800	Tx		600	~	VK5PO WA9ONY RRR
105815	-6	0.1	1942	~	WA9ONY VK5PO 73
105830	Tx		600	~	VK5PO WA9ONY 73
105645	3	1.6	1415	~	WA9ONY JA5BZL -07
105845	3	1.6	1415	~	WA9ONY JA5BZL -07
105845	-11	0.1	600	~	WA9ONY JA9CHI PM86
105900	Tx		600	~	JA5BZL WA9ONY R+03
105915	2	1.5	1415	~	WA9ONY JA5BZL RR73
105915	-8	0.1	600	~	WA9ONY JA9CHI PM86
105930	Tx		600	~	JA5BZL WA9ONY 73
105945	1	1.6	1415	~	WA9ONY JA5BZL RR73
105945	1	0.1	600	~	WA9ONY JA9CHI PM86
105945	-9	0.0	1696	~	WA9ONY UA0ZEO QO93
110015	0	1.6	1415	~	WA9ONY JA5BZL 73
110015	2	0.1	600	~	WA9ONY JA9CHI PM86
110015	-8	0.0	1696	~	WA9ONY UA0ZEO QO93
110038	Tx		600	~	UA0ZEO WA9ONY -08
110045	3	0.1	600	~	WA9ONY JA9CHI PM86
110100	Tx		600	~	UA0ZEO WA9ONY -08
110115	-7	0.0	1696	~	WA9ONY UA0ZEO R-13
110130	Tx		600	~	UA0ZEO WA9ONY RRR

UTC	dB	DT	Freq		Message
110130	Tx		600	~	UA0ZEO WA9ONY RRR
110145	-3	0.0	1696	~	WA9ONY UA0ZEO 73
110200	Tx		600	~	UA0ZEO WA9ONY 73
110045	3	0.1	600	~	WA9ONY JA9CHI PM86
110230	Tx		600	~	JA9CHI WA9ONY +03
110245	3	0.1	600	~	WA9ONY JA9CHI PM86
110300	Tx		600	~	JA9CHI WA9ONY +03
110315	3	0.1	600	~	WA9ONY JA9CHI R-09
110330	Tx		600	~	JA9CHI WA9ONY RRR
110345	1	0.1	600	~	WA9ONY JA9CHI 73
110400	Tx		600	~	JA9CHI WA9ONY 73
110415	1	0.2	600	~	WA9ONY JH3QMF PM74
110415	-8	0.1	483	~	WA9ONY JH1APK -11
110415	1	0.2	600	~	WA9ONY JH3QMF PM74
110445	4	0.2	599	~	WA9ONY JH3QMF PM74
110445	-3	0.1	484	~	WA9ONY JH1APK -11
110500	Tx		600	~	JH3QMF WA9ONY +04
110515	1	0.2	599	~	WA9ONY JH3QMF R-16
110530	Tx		600	~	JH3QMF WA9ONY RRR
110545	1	0.2	599	~	WA9ONY JH3QMF 73
110600	Tx		600	~	JH3QMF WA9ONY 73
110445	-3	0.1	484	~	WA9ONY JH1APK -11
110615	-4	0.1	484	~	WA9ONY JH1APK -11
110630	Tx		600	~	JH1APK WA9ONY R-04
110645	-3	0.1	483	~	WA9ONY JH1APK RRR
110700	Tx		600	~	JH1APK WA9ONY 73
110715	-1	0.1	483	~	WA9ONY JH1APK 73

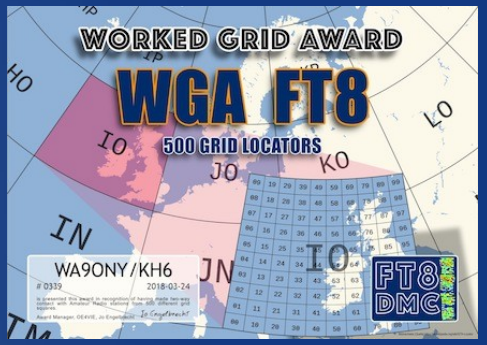
Fun Being Chased on 80m Log

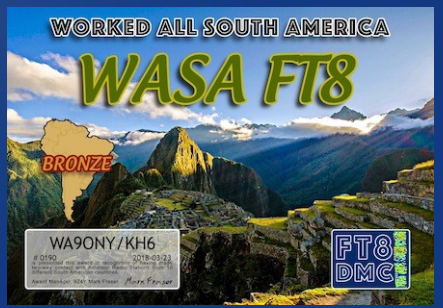
Rec#	Call	Date / Time	Snt	Rec	Country	Grid	Bnd	ST
4047	JA4UMN	2018/05/25 11:59	-03	-14	Japan	PM64	80	
4046	NC7B	2018/05/25 11:53	+07	+11	USA	DM43	80	AZ
4045	W5VOM/5	2018/05/25 11:46	-07	-07	USA		80	
4044	N4PT	2018/05/25 11:42	+11	+10	USA	DM42	80	AZ
4043	JR1XIS	2018/05/25 11:34	+07	-17	Japan	QM05	80	
4042	WB5OZA	2018/05/25 11:31	-13	-14	USA	EM30	80	LA
4041	KE5IRK	2018/ 11:24	-02	+00	USA	EM04	80	OK
4040	JH1APK	2018/05/25 11:06	-04	-11	Japan	PM95	80	
4039	JH3QMF	2018/05/25 11:04	+04	-16	Japan	PM74	80	
4038	JA9CHI	2018/05/25 11:02	+03	-09	Japan	PM86	80	
4037	UA0ZEO	2018/05/25 11:00	-08	-13	Asiatic Russia	QO93	80	
4036	JA5BZL	2018/ 10:58	+03	-07	Japan	PM63	80	
4035	VK5PO	2018/05/2 10:57	-06	-09	Australia	PF95	80	
4034	KF9KV	2018/05/25 10:55	-18	-06	USA	EN52	80	WI
4033	JH0EQN	2018/05/25 10:51	-05	-05	Japan	PM97	80	

9 minutes of hectic fun

WA9ONY/KH6
Feb. 2018 Kauai

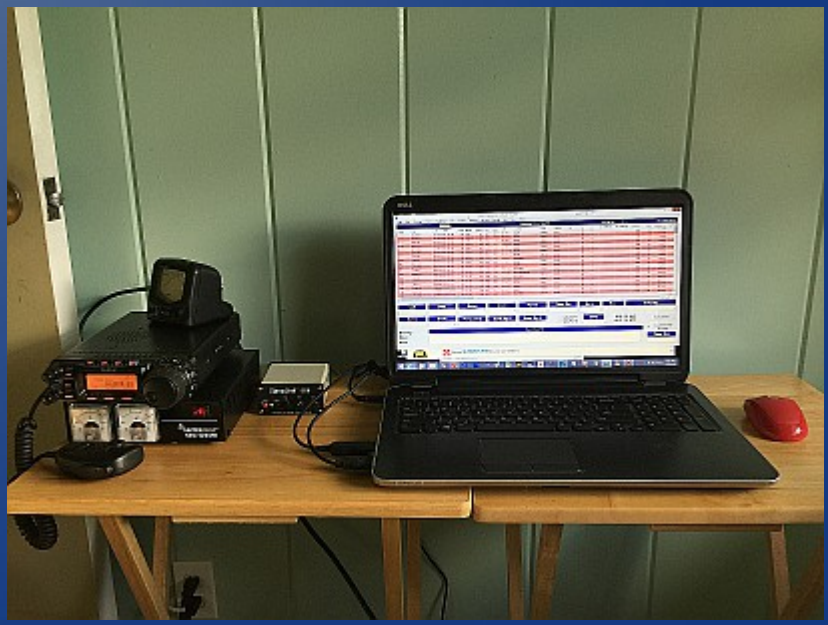
- 2,331 FT8 20m QSOs
  - LoTW 1,428 QSLs 61%
  - EQSL 1,287 55%
  - QRZ.com 653 28%
  - ~2/3 QSOs non USA stations
- 21 awards with 8 endorsements
  - WAS 20m FT8 took 13 days
- 3rd/9K ARRL IGC Feb. 20m FT8
- www.qrz.com/db/WA9ONY/KH6





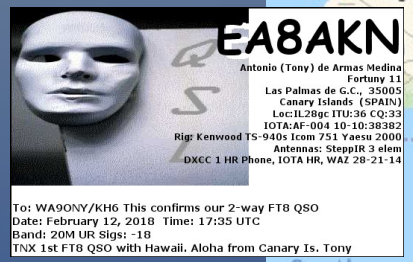
Kauai Vacation WA9ONY/KH6

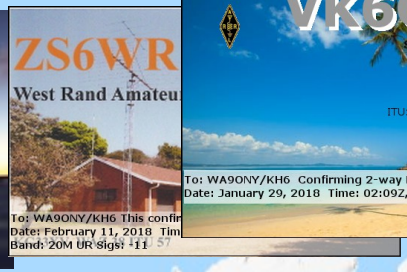
www.qrz.com/db/WA9ONY/KH6

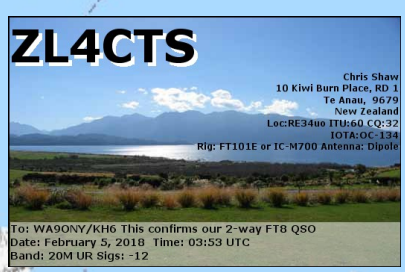


WA9ONY/KH6 551 Grid Squares

http://tools.adventureradio.de/analyzer/







FT8 is a Digital Mode
Released July 2017

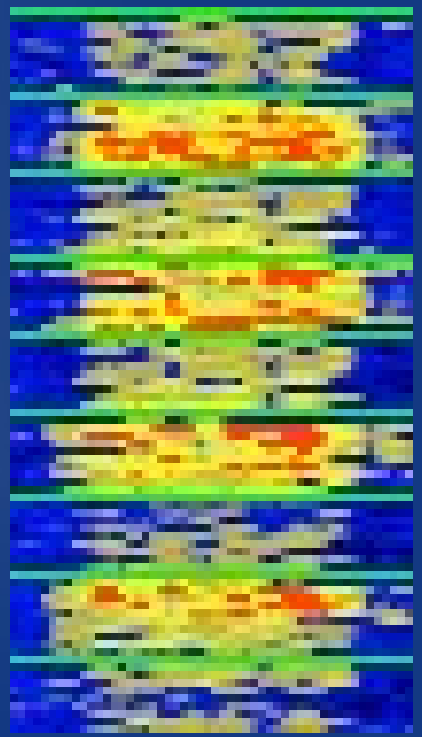
- Created by
  - Steve **F**ranke, K9AN
  - Joe **T**aylor, K1JT
  - **8** tones - FSK modulation
- Quick weak signal communication
  - “touch and go” DX contacts
  - Not for “chewing the rag”
- Typical contact
  - Call signs, location, signal report, 73

https://ece.illinois.edu/directory/profile/s-franke

https://en.wikipedia.org/wiki/Joseph_Hooton_Taylor_Jr.

FT8 Characteristics

- Decoding S/N threshold down to -24 dB
- Complete waterfall decode
  - Two pass decoding
- DSP & forward error correction (FEC)
  - Almost error free
- 50 Hz bandwith
- Fixed 72 bit payload
- 15 s transmit/receive sequence
  - 12.64 s transmit



FT8 Characteristics

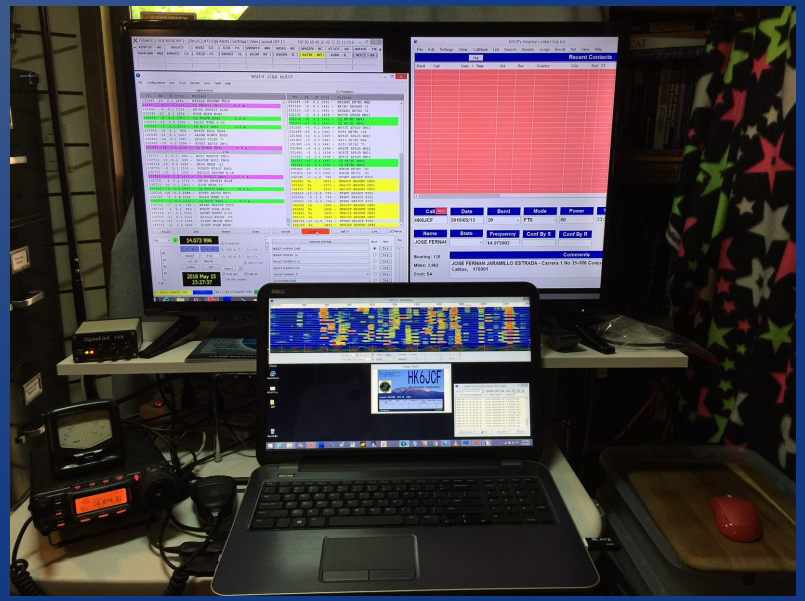
- DX expedition mode
  - Multi contacts at the same time
  - ~400 QSOs/hour, 6.7 QSOs/min.
    - Test #3 results
- NA VHF contest mode
  - Only grid square
  - No signal reports

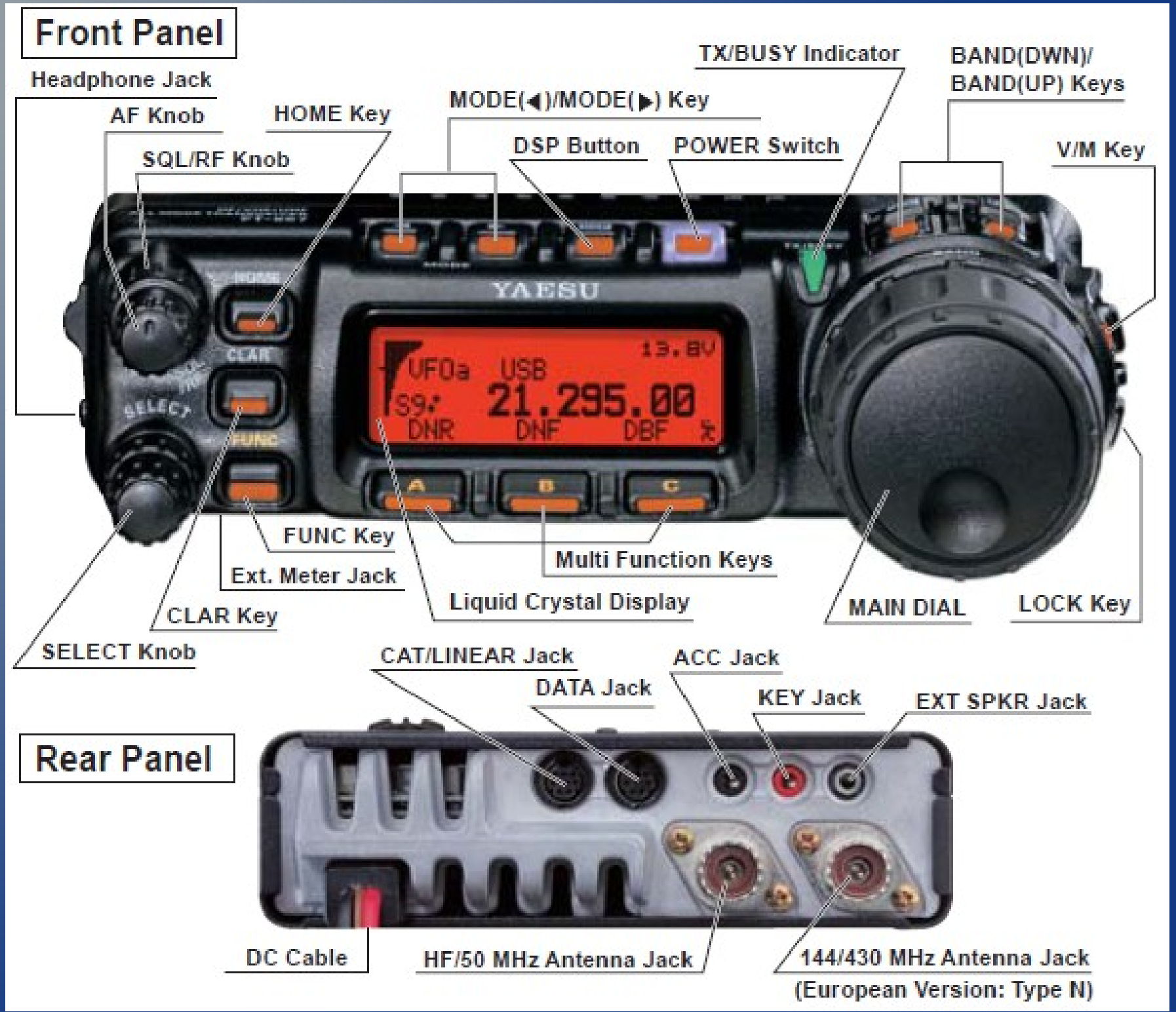
FT8 Messages Every 15 Seconds

```
------------------------------------- 160m
073130   -9   0.0   700 ~  CQ KF8YO EM88          U.S.A.
------------------------------------- 160m
073145  -14   0.2   701 ~  KF8YO W4RTT EM78
------------------------------------- 160m
073200   -9  -0.0   701 ~  W4RTT KF8YO +12
------------------------------------- 160m
073215  -12   0.2   894 ~  KF8YO W4RTT R+02
------------------------------------- 160m
073230   -8  -0.0   701 ~  W4RTT KF8YO RRR
------------------------------------- 160m
073245  -14   0.1   894 ~  KF8YO W4RTT 73
------------------------------------- 160m
073300   -9  -0.0   701 ~  W4RTT KF8YO 73
------------------------------------- 160m
```

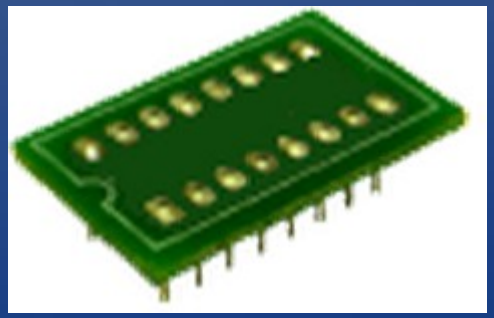
WA9ONY FT8 Equipment

- WSJT-X V1.8 software
- Dell i7 64-bit 8.1 Windows laptop
- Transceiver with data & CAT ports
  - Yaesu FT-857D, AGC set fast
- SignalLink USB with TX & RX controls
- PC to transceiver CAT interface
- Diamond SWR power meter
- Dipoles antennas




Front Panel
Headphone Jack
AF Knob
SQL/RF Knob
HOME Key
MODE(◀)/MODE(▶) Key
DSP Button
POWER Switch
TX/BUSY Indicator
BAND(DWN)/
BAND(UP) Keys
V/M Key
YAESU
13.8V
VFOa USB
S9:
21.295.00
DNR DNF DBF
CLAR
FUNC
A
B
C
FUNC Key
Ext. Meter Jack
CLAR Key
SELECT Knob
Multi Function Keys
Liquid Crystal Display
MAIN DIAL
LOCK Key
Rear Panel
CAT/LINEAR Jack
DATA Jack
ACC Jack
KEY Jack
EXT SPKR Jack
DC Cable
HF/50 MHz Antenna Jack
144/430 MHz Antenna Jack
(European Version: Type N)

SignaLink USB



www.amazon.com/gp/product/B01LWKQB7D/ref=oh_aui_detailpage_o05_s00?ie=UTF8&psc=1

MAXTOP

MAXTOP APCUSB-YM62 FTDI USB Programming Cable for Yaesu FT-100 FT-817 FT-857 FT-897 FT-100D FT-817ND FT-857D as CT-62

5 customer reviews

Price: $23.50 & **FREE Shipping**

Get $40 off instantly: Pay $0.00 upon approval for the Amazon.com Store Card.

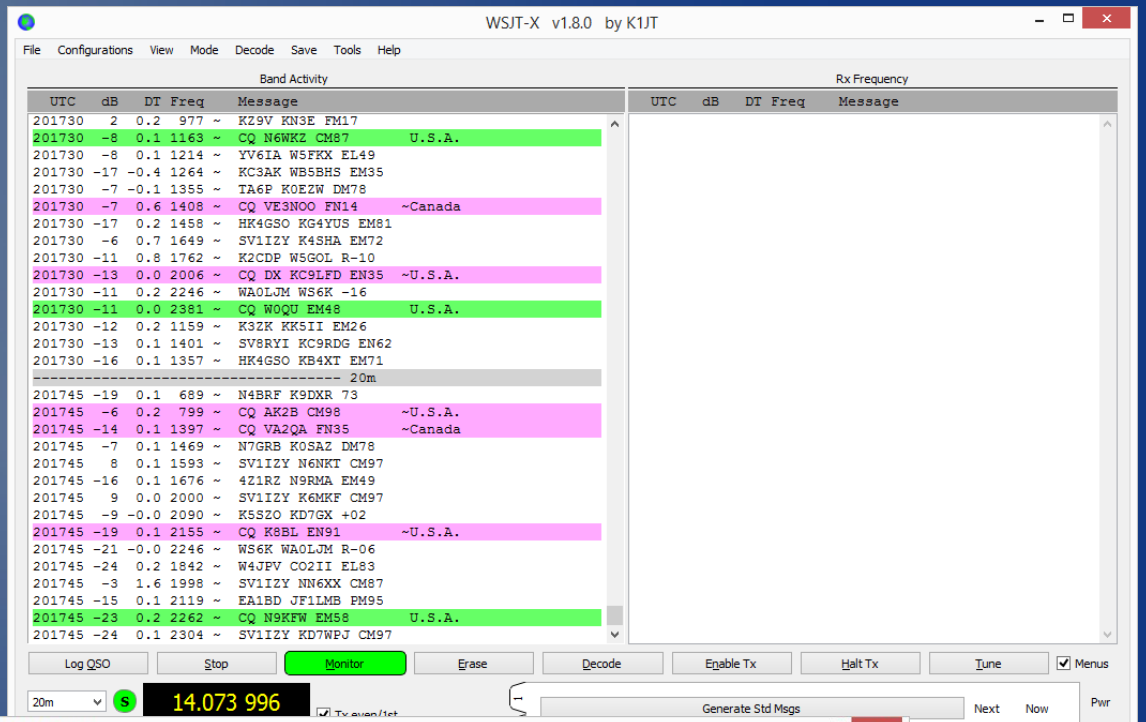
In Stock.

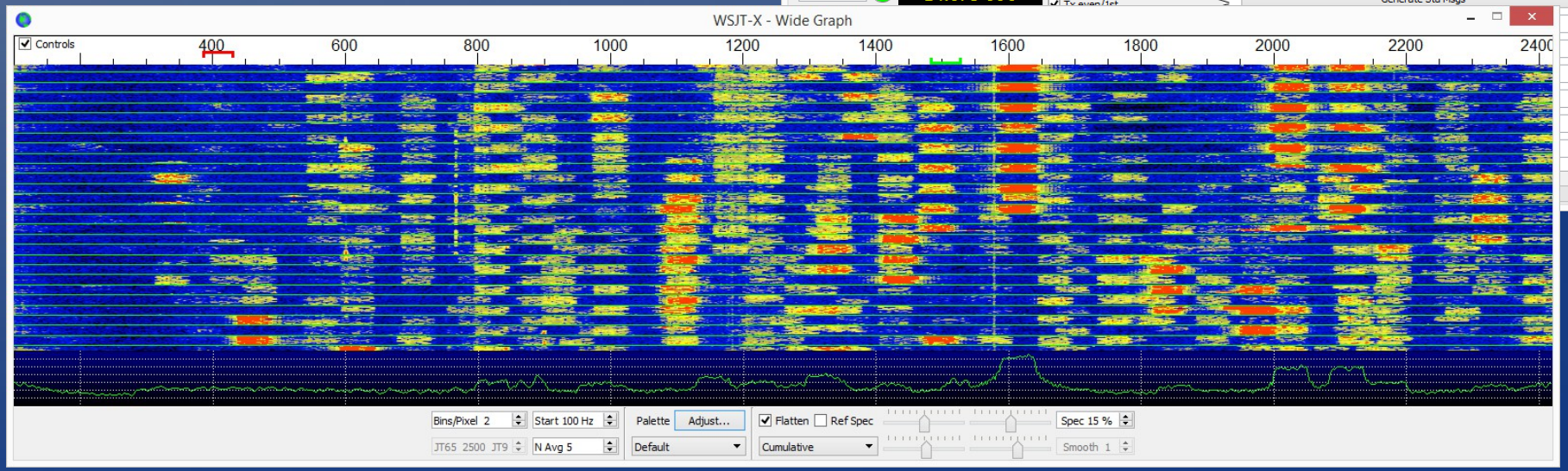
Get it as soon as May 18 - 25 when you choose **Economy Shipping** at checkout.
Ships from and sold by BOMMEOW Radio.

- Quality that sells itself: Built-in FTDI Chipset that offers unparalleled flexibility & assurance
- On-Board Activity LED light – it just helped making your job a lot more efficient!
- Ease of use with Plug-n-Play [internet connection must be present]
- OEM of Yaesu CT-62
- Specification: Yaesu FT-100 and similar sockets

Required FT8 Software

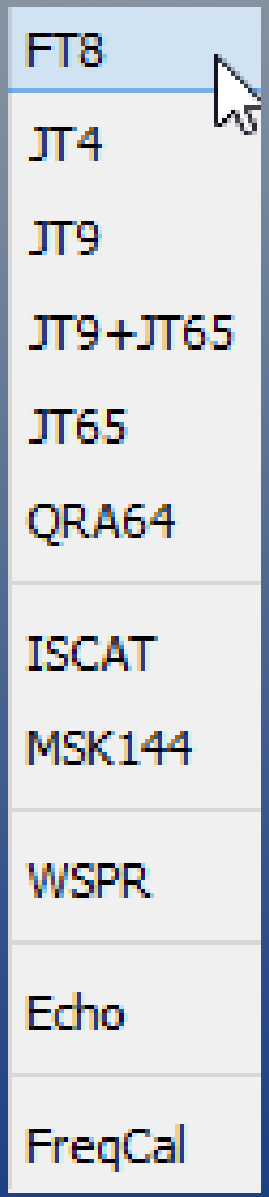
WSJT-X





WSJT-X Software 2001 to 2018

https://en.wikipedia.org/wiki/WSJT_(amateur_radio_software)



- Weak Signal Joe Taylor - eXtend
- >15,000 users in any given week
- Weak signal communications with DSP
- Block structure vs char. by char.
- Slow & fast communication modes
  - Moon bounce JT65
  - High speed meteor scatter MSK144
  - WSPR beacon
    - Weak Signal Propagation Reporter
- FT8 added in July 2017

FT8 WSJT-X Software

https://physics.princeton.edu/pulsar/k1jt/wsjtx.html

WSJT-X

Description

WSJT-X implements communication protocols or "modes" called **FT8, JT4**, **JT9**, **JT65**, **QRA64**, **ISCAT**, **MSK144**, and **WSPR**, as well as one called **Echo** for detecting and measuring your own radio signals reflected from the Moon. These modes were all designed for making reliable, confirmed QSOs under extreme weak-signal conditions. All but **ISCAT** use nearly identical message structure and "source encoding," the efficient compression of standard messages used to make minimal QSOs. **JT65** and **QRA64** were designed for EME ("moonbounce") on the VHF/UHF bands; **JT65** has also proved very popular and effective for worldwide QRP communication at HF. **JT9** is optimized for the LF, MF, and HF bands. It is about 2 dB more sensitive than **JT65** while using less than 10% of the bandwidth. With either **JT9** or **JT65**, world-wide QSOs are possible with power levels of a few watts and compromise antennas. **JT4** and **QRA64** are optimized for EME on the VHF and higher bands, and especially the microwave bands from 2.3 to 24 GHz. **FT8** is operationally similar to **JT65** but is much faster, using T/R cycles only 15 s long. **MSK144** is used for Meteor Scatter on the VHF bands. Finally, as described more fully on its own page, **WSPR** mode implements a protocol designed for probing potential propagation paths with low-power transmissions. **WSPR** is now fully implemented within *WSJT-X*, including automatic band-hopping.

FT8 WSJT-X Software

https://physics.princeton.edu/pulsar/k1jt/wsjtx.html

Windows

- Latest full release, Version 1.8: wsjtx-1.8.0-win32.exe. (runs on Win XP, Vista, Win 7, Win 8, Win10, both 32- and 64-bit).

Linux

Installation instructions for Linux can be found here in the User Guide. Download the package file appropriate for your system, from the list below. (Versions installable with "apt-get" and "yum" will be made available as soon as our package maintainers create the packages.)

- Latest full release, Version 1.8
  - Debian, Ubuntu, ... (32-bit): wsjtx_1.8.0_i386.deb
  - Debian, Ubuntu, ... (64-bit): wsjtx_1.8.0_amd64.deb
  - Fedora, RedHat, ... (32-bit): wsjtx-1.8.0.i686.rpm
  - Fedora, RedHat, ... (64-bit): wsjtx-1.8.0.x86_64.rpm
  - Raspbian Jessie, ARMv6 ... : wsjtx_1.8.0_armhf.deb

Macintosh OS X:

Installation instructions for version 1.8 can be found here in the User Guide. Download the package file appropriate for your system:

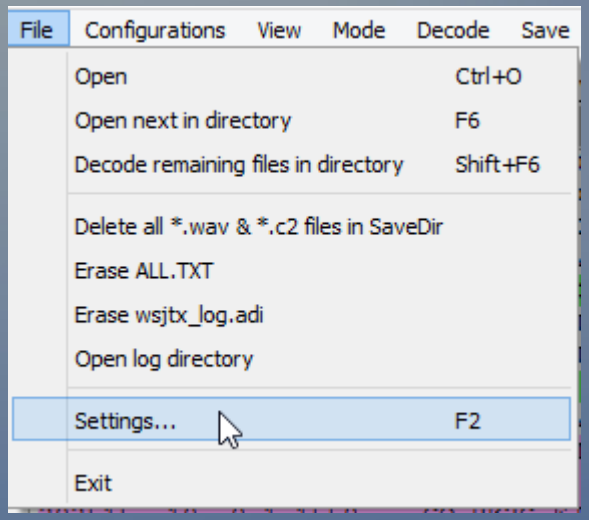
- Latest full release, Version 1.8
  - OS X 10.9 and later: wsjtx-1.8.0-Darwin.dmg

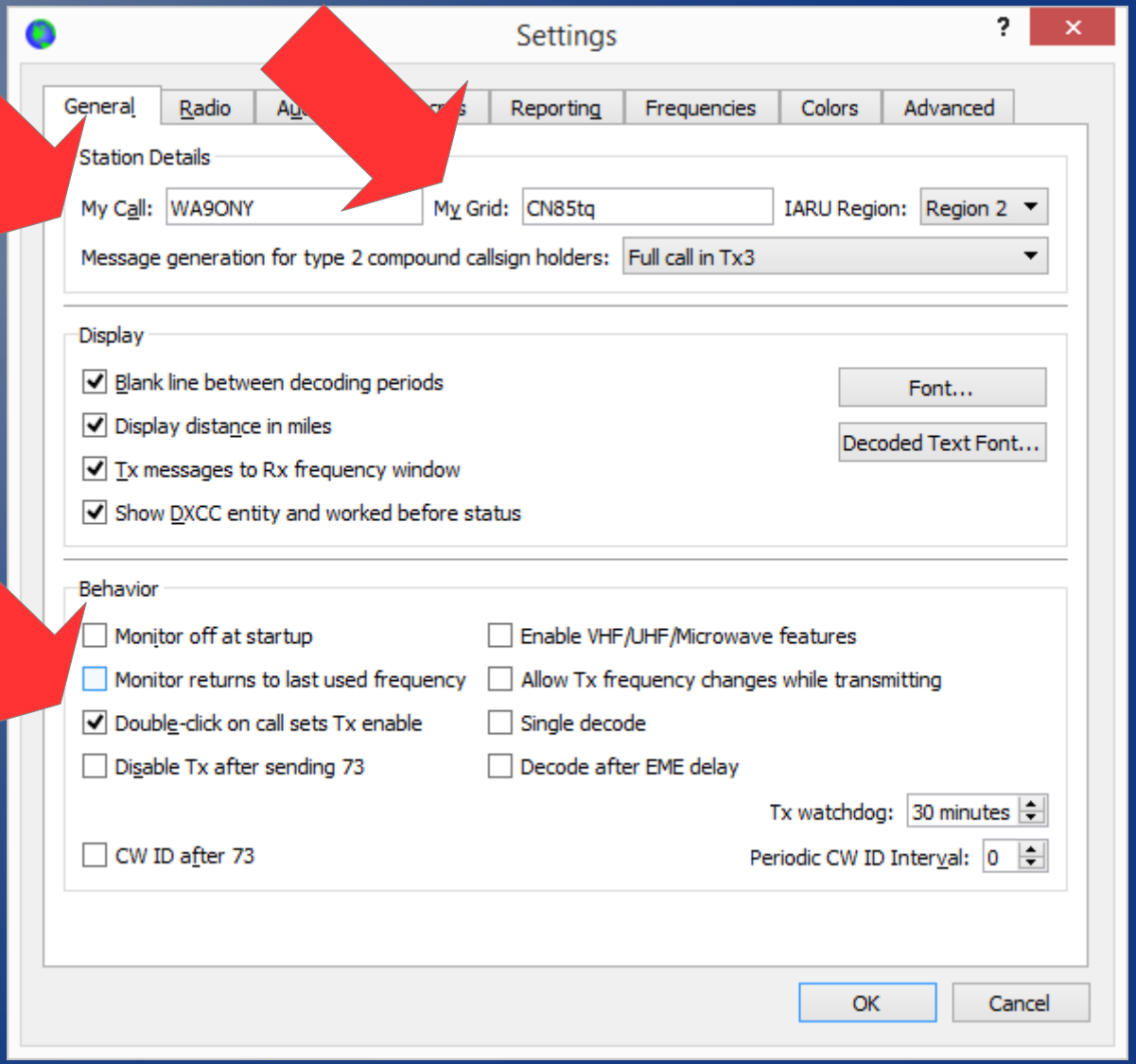
Source Code:

The package posted here contains all source code for *WSJT-X* as well as a snapshot of the Hamlib 3 sources and a CMake script to build *WSJT-X* on any supported platform.

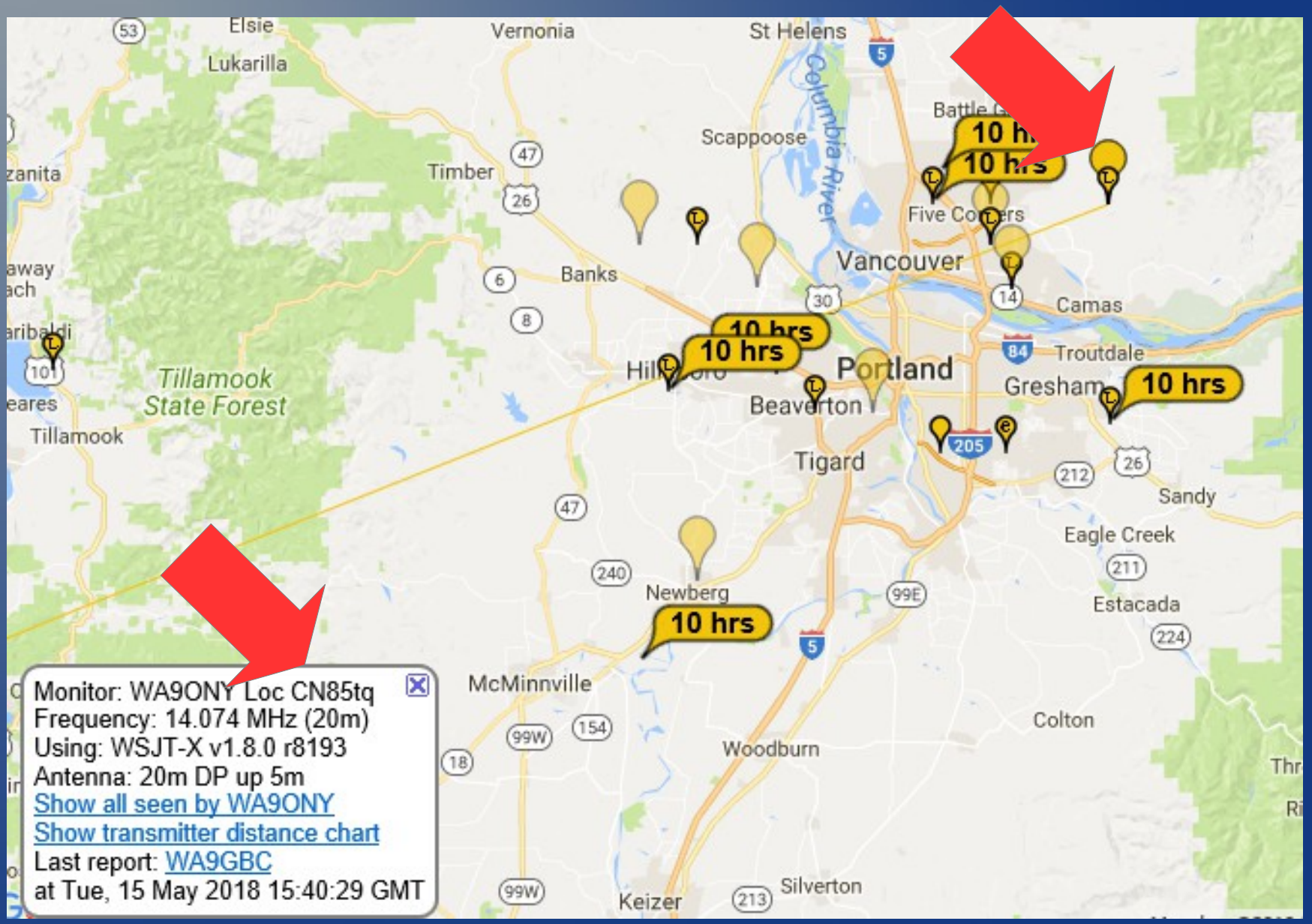
- Latest full release, Version 1.8: wsjtx-1.8.0.tgz

WSJT-X V1.8 General Setup



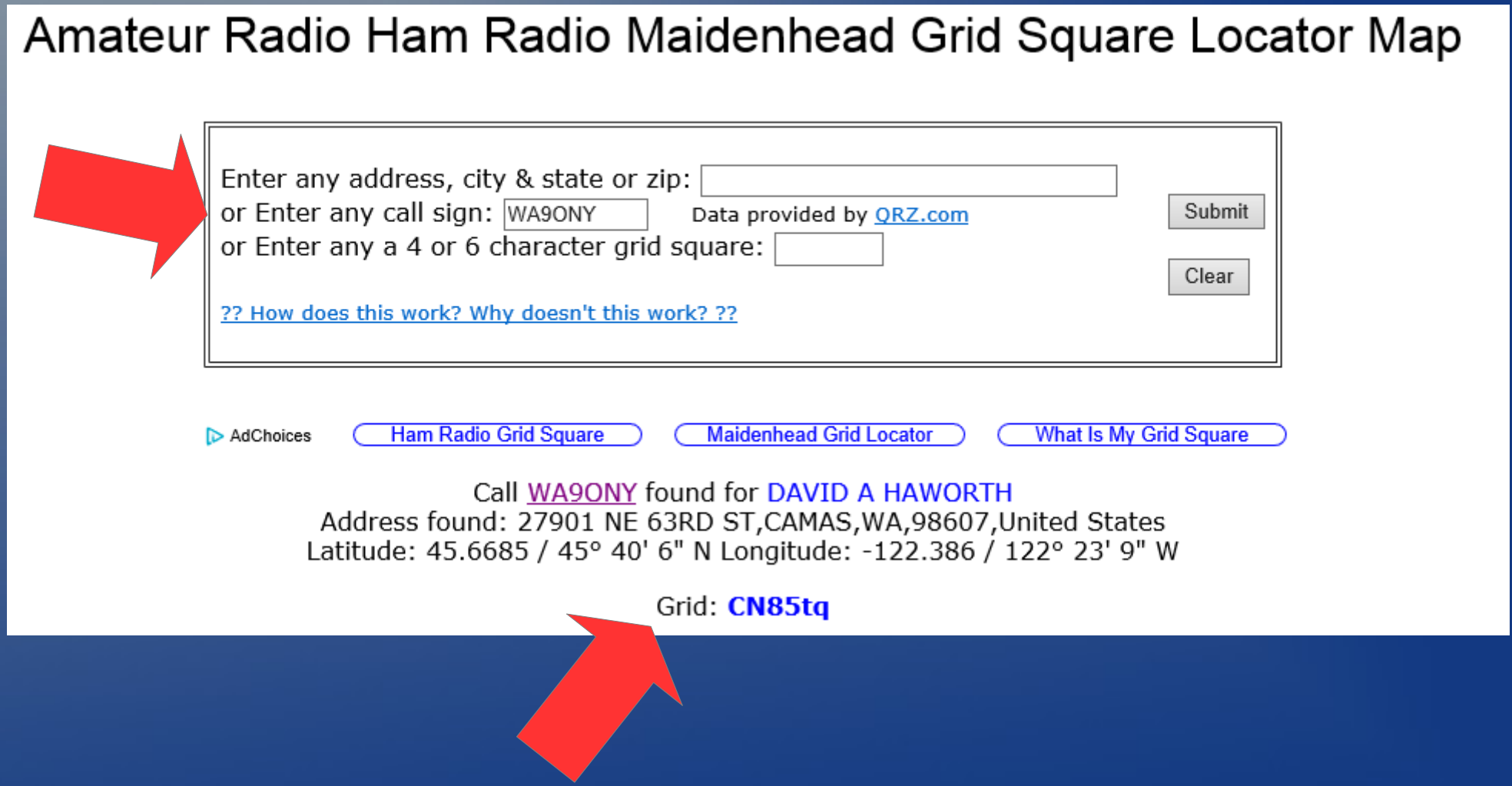


Use 6 Characters Grid Square
For PSK Reporter



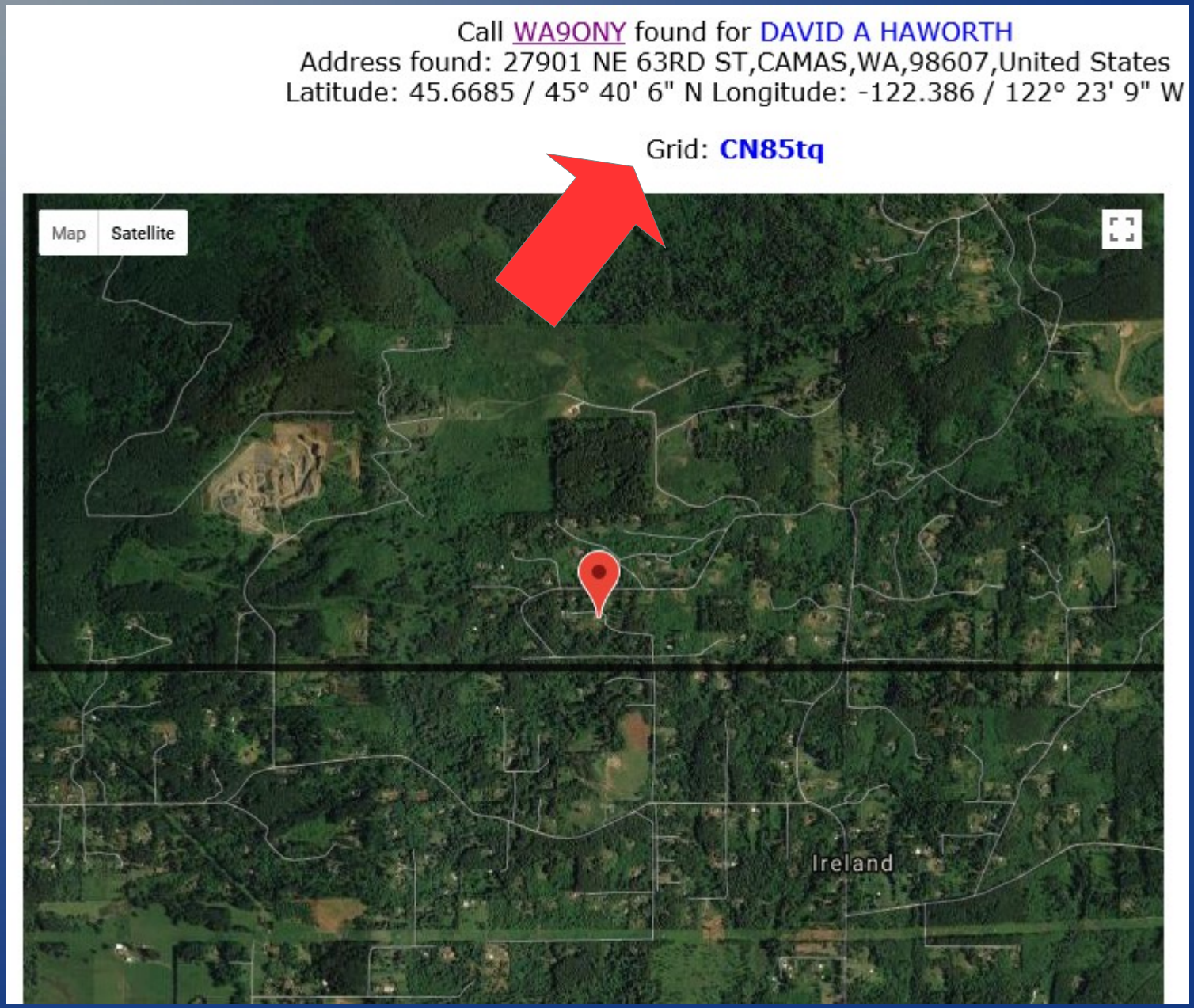
Find Your Grid Square

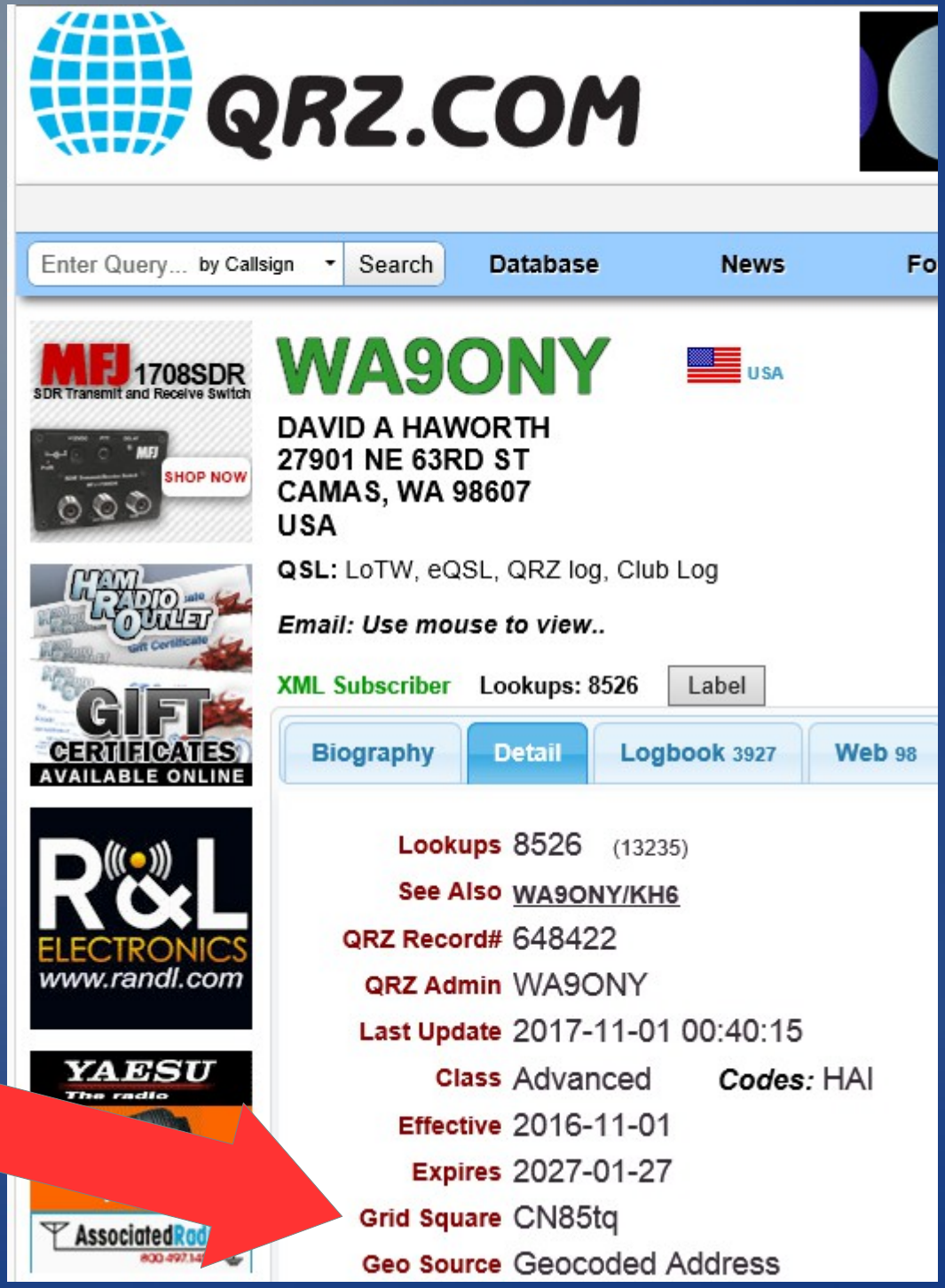
www.levinecentral.com/ham/grid_square.php



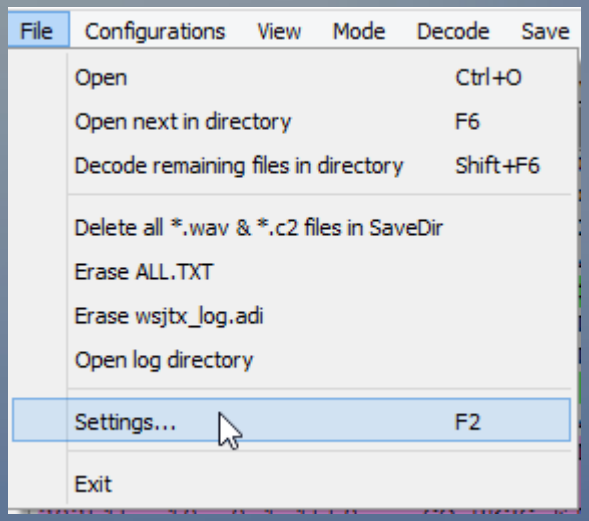
Find Your Grid Square

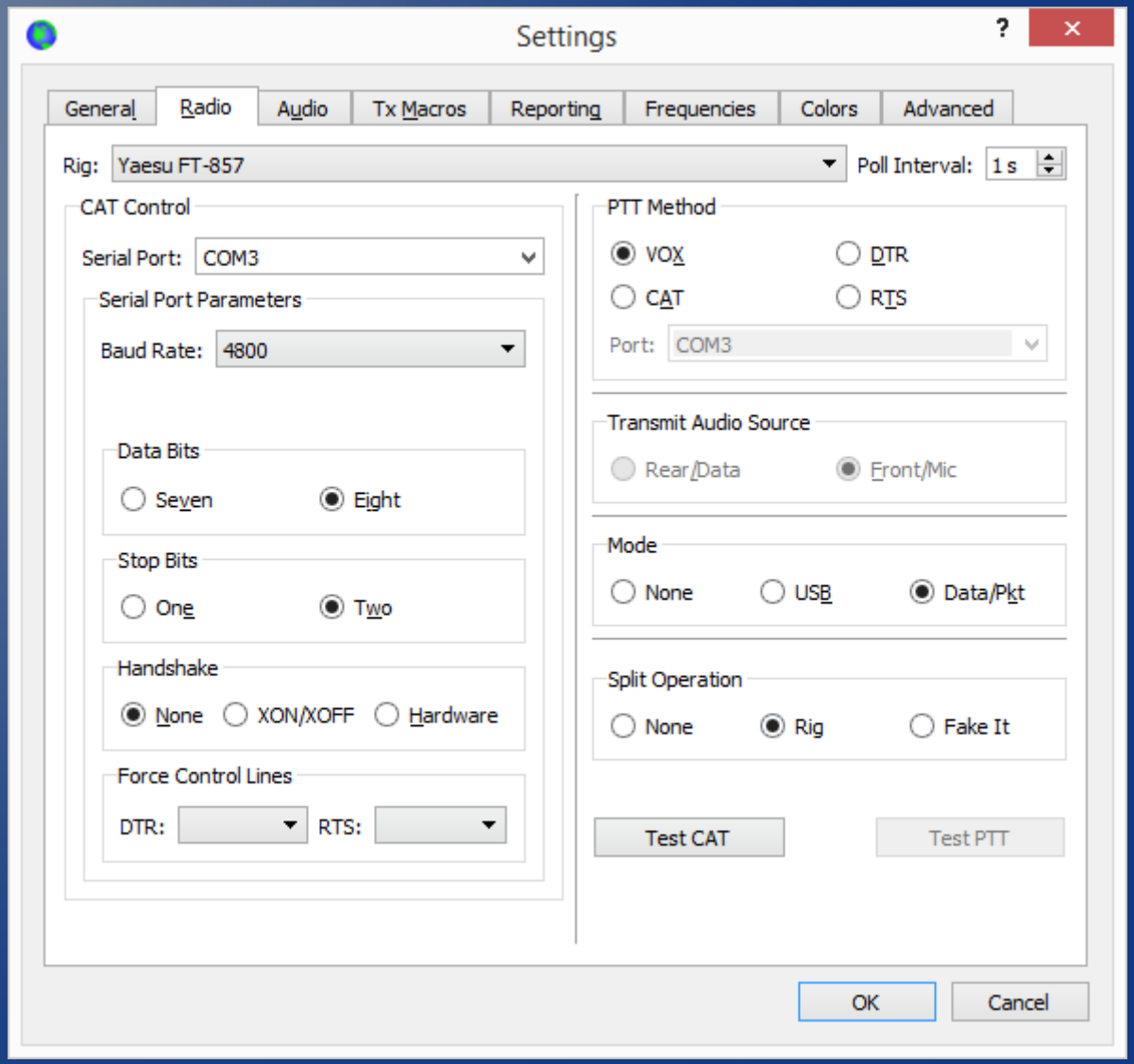
www.levinecentral.com/ham/grid_square.php



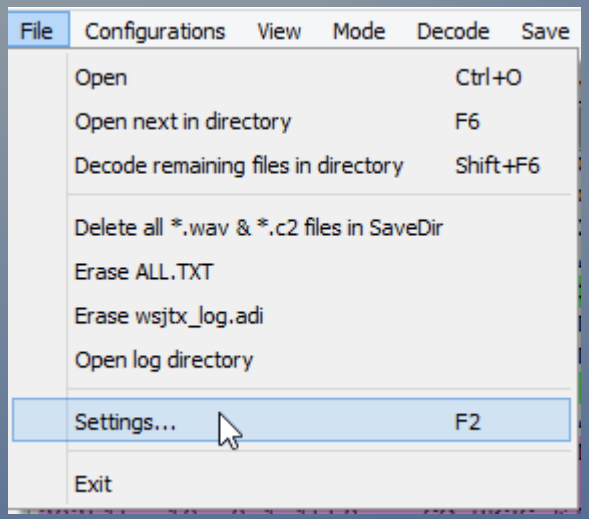

QRZ.COM
Enter Query... by Callsign
Search
Database
News
MFJ 1708SDR
SDR Transmit and Receive Switch
SHOP NOW
HAM RADIO OUTLET
GIFT CERTIFICATES
AVAILABLE ONLINE
R&L ELECTRONICS
www.randl.com
YAESU
The radio
AssociatedRad
WA9ONY
USA
DAVID A HAWORTH
27901 NE 63RD ST
CAMAS, WA 98607
USA
QSL: LoTW, eQSL, QRZ log, Club Log
Email: Use mouse to view..
XML Subscriber
Lookups: 8526
Label
Biography
Detail
Logbook 3927
Web 98
Lookups 8526 (13235)
See Also WA9ONY/KH6
QRZ Record# 648422
QRZ Admin WA9ONY
Last Update 2017-11-01 00:40:15
Class Advanced
Codes: HAI
Effective 2016-11-01
Expires 2027-01-27
Grid Square CN85tq
Geo Source Geocoded Address

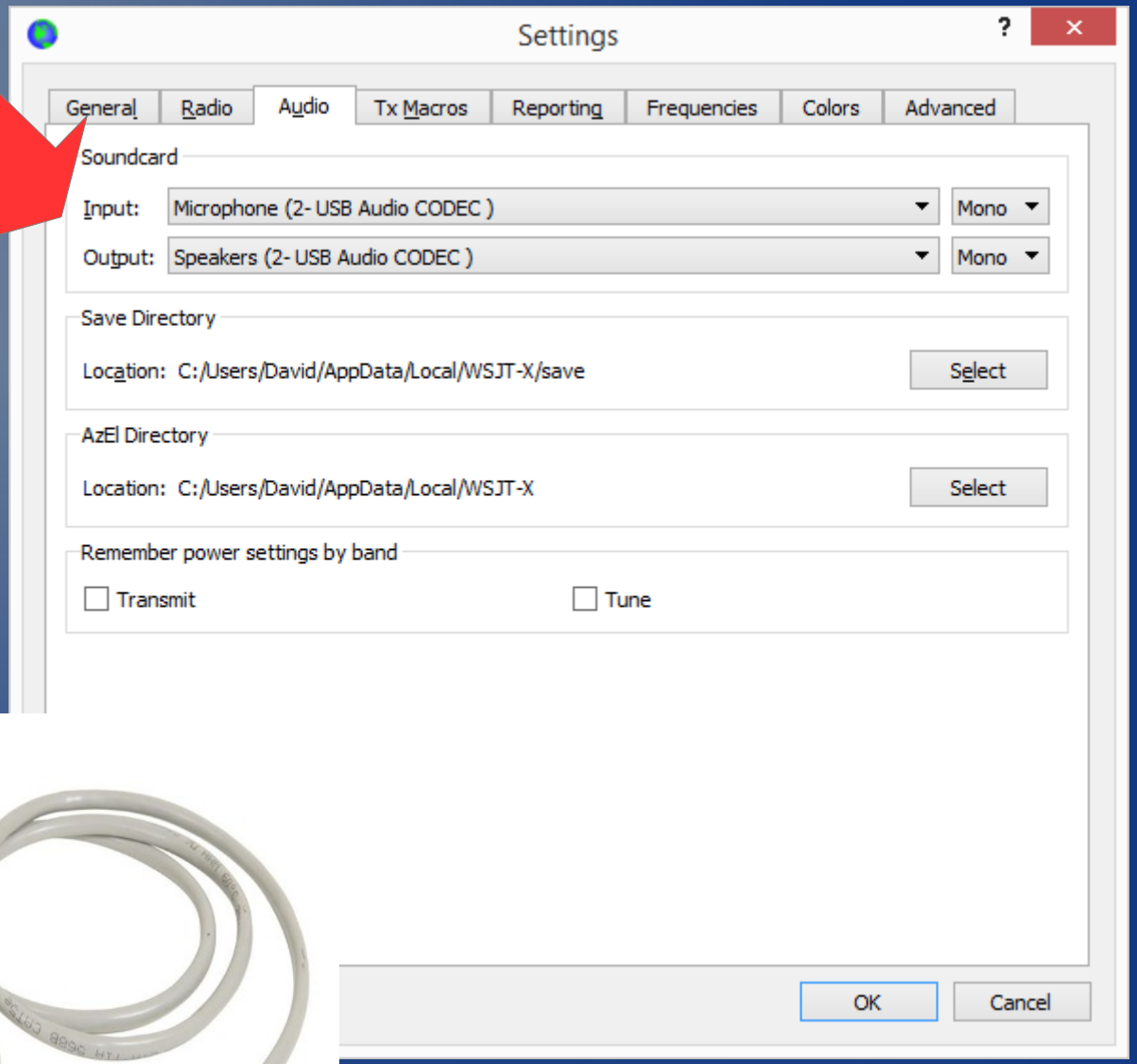
WSJT-X V1.8 Radio Setup



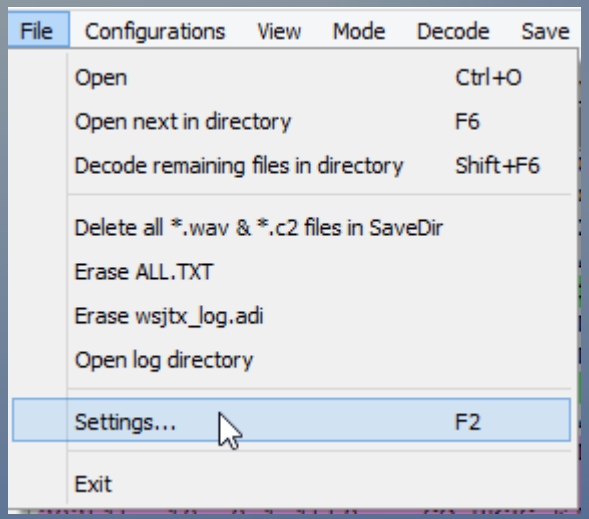


WSJT-X V1.8 Audio Setup





Free Text Messages Setup



TNX CLIFF 73G

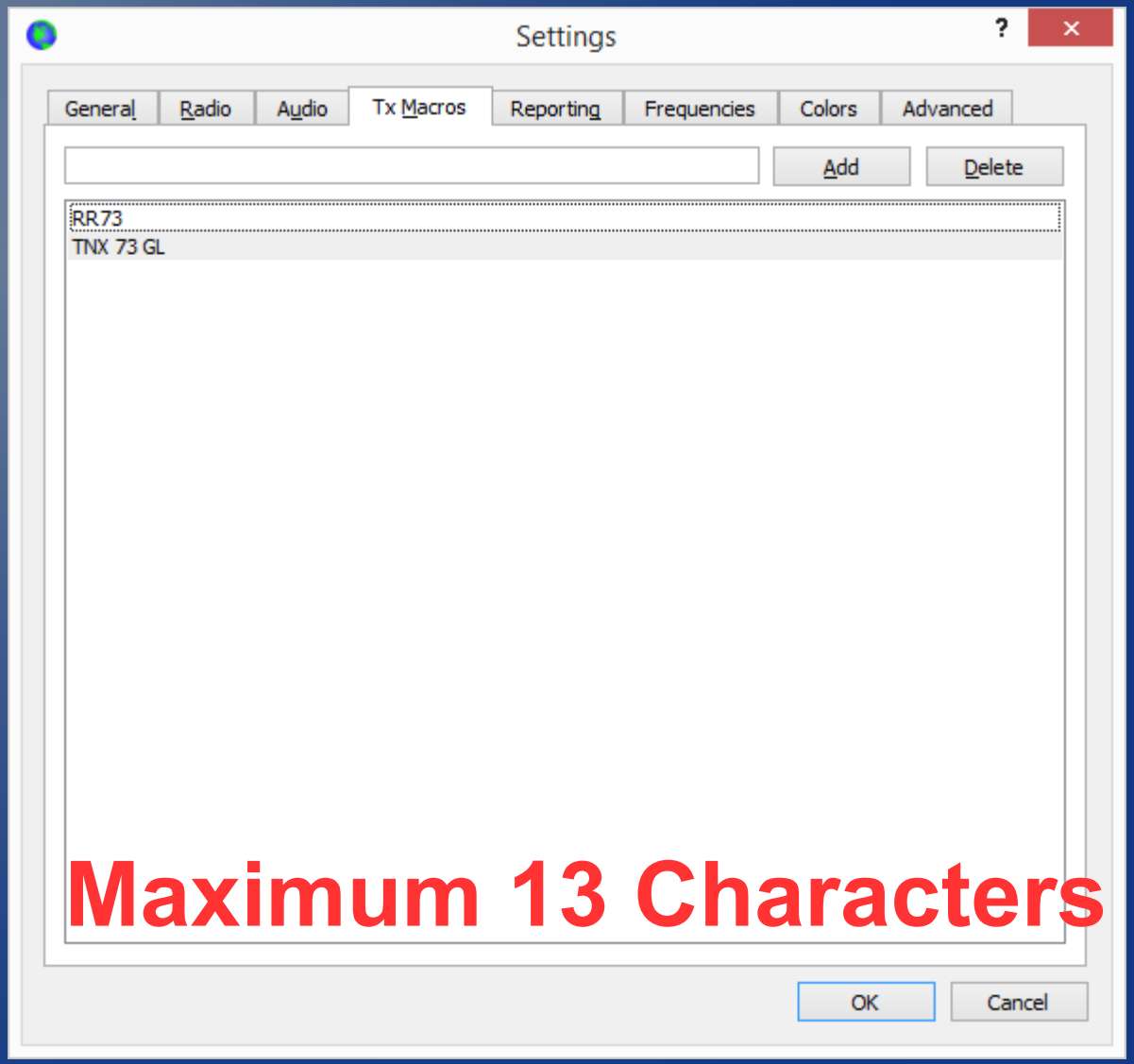
SRI US QRM

QSY JT65 323

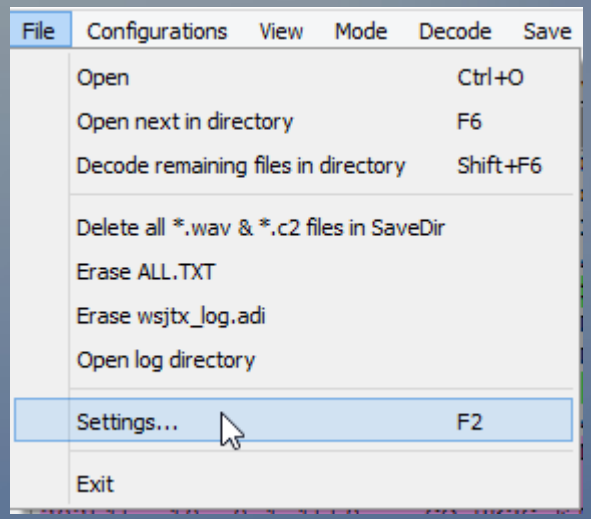
TNX LOTW 73

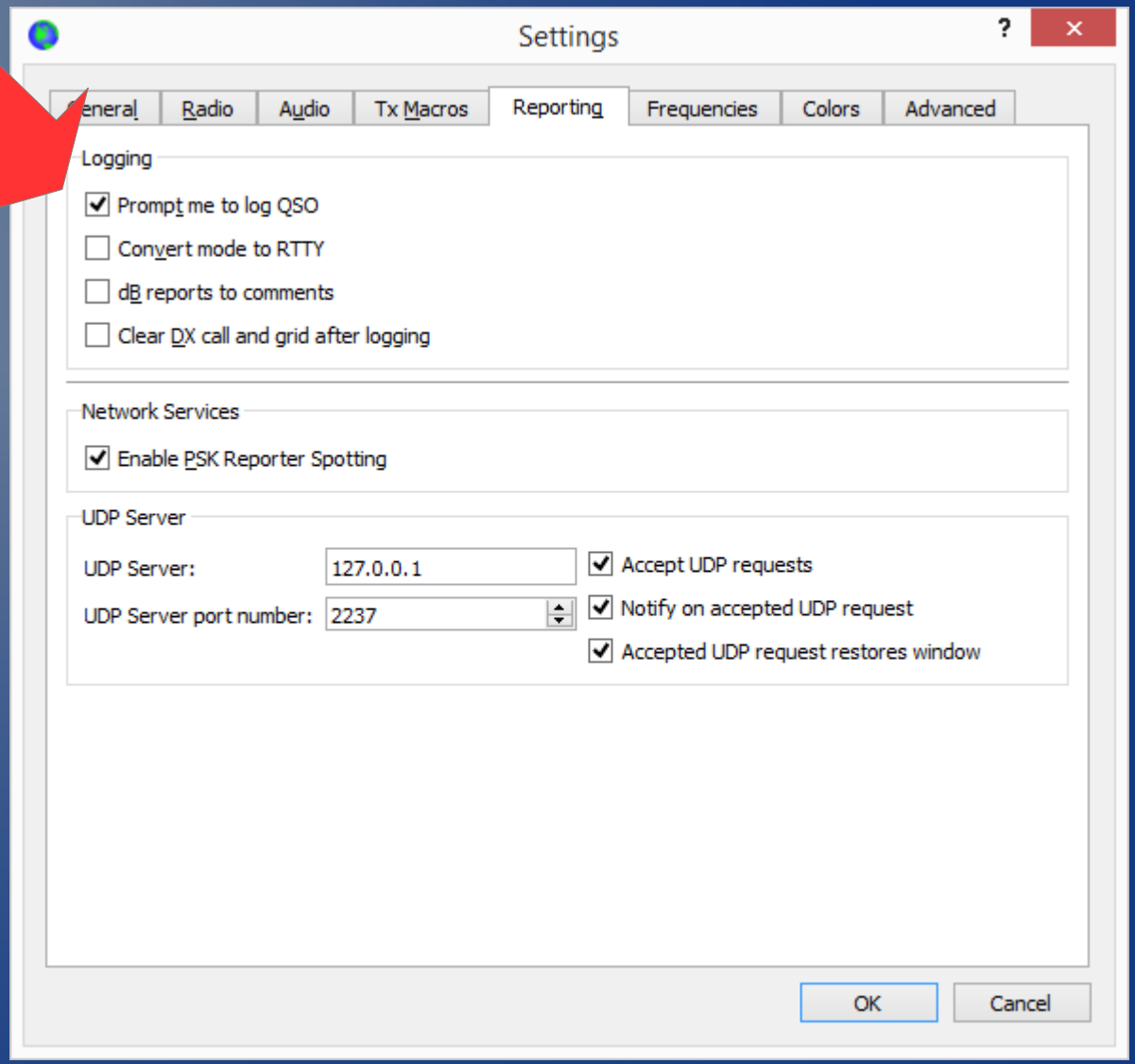
QSY AK TO FT9

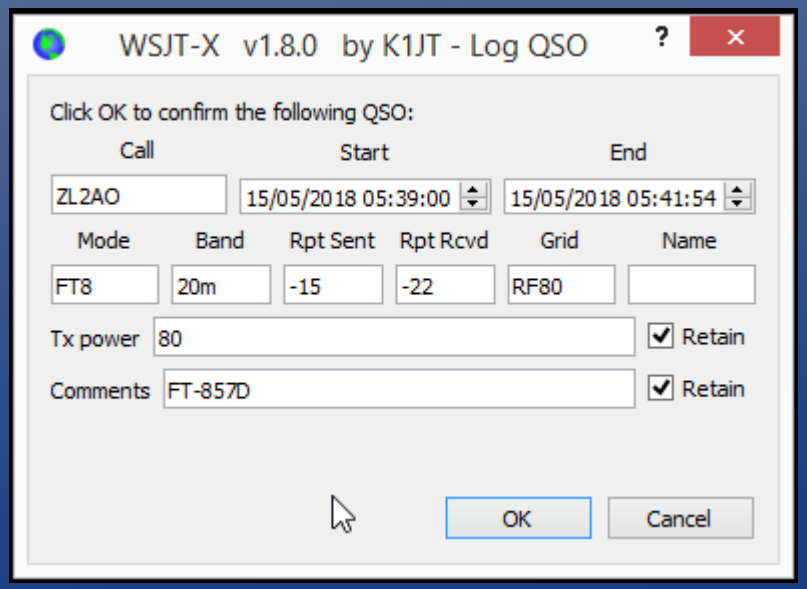
CHAI QSY 10M



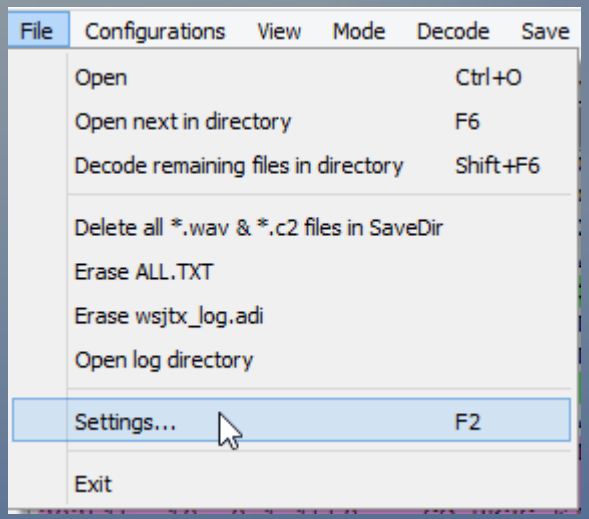
WSJT-X V1.8 Reporting Setup

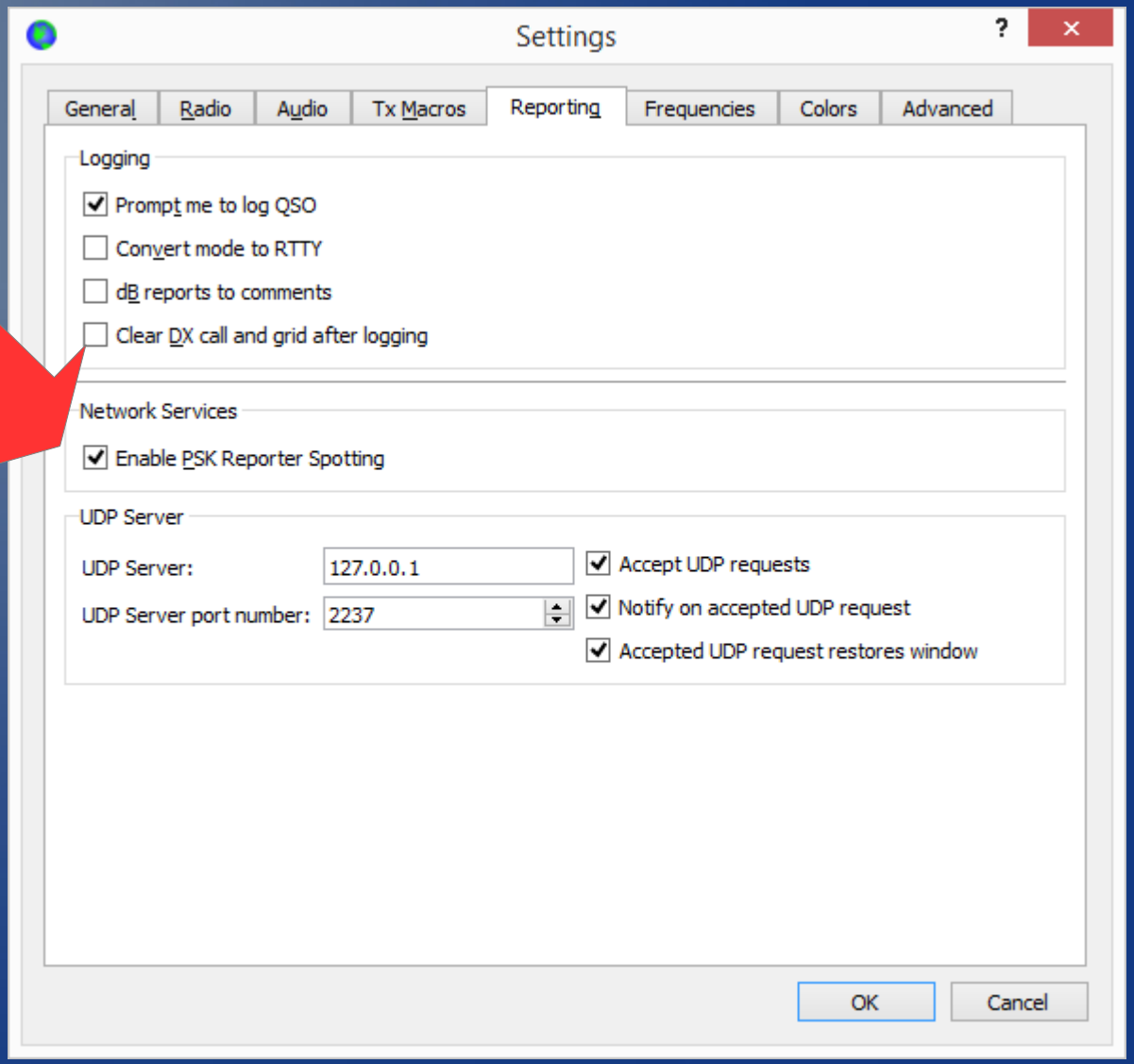


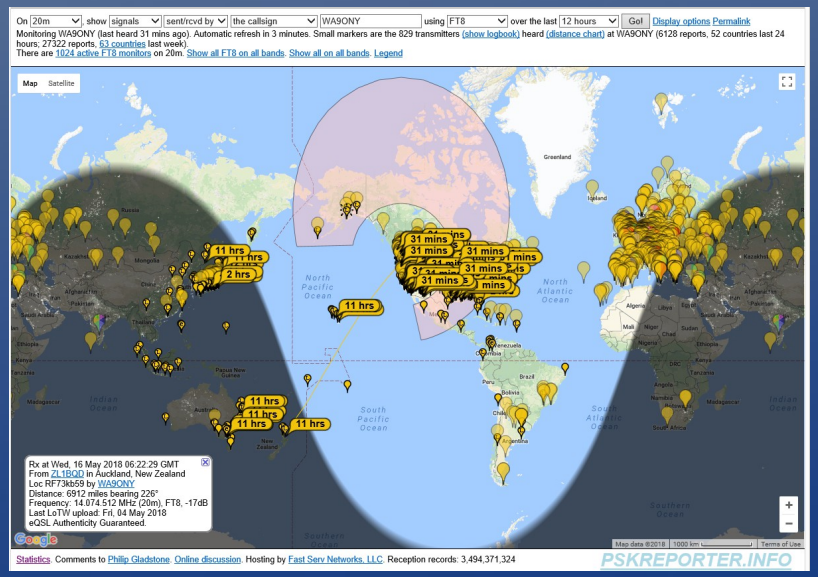




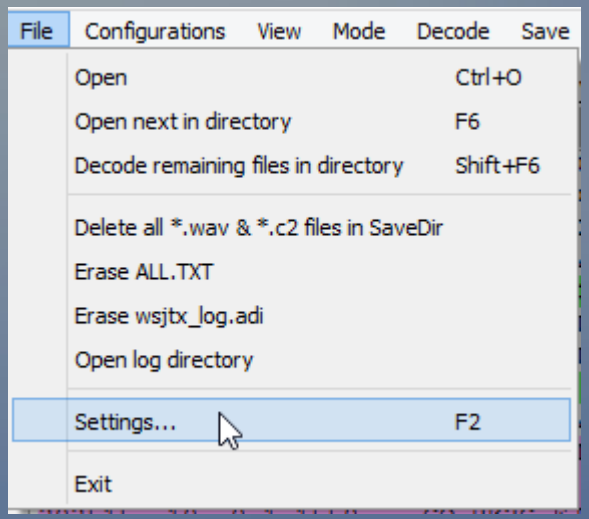
WSJT-X V1.8 Reporting Setup

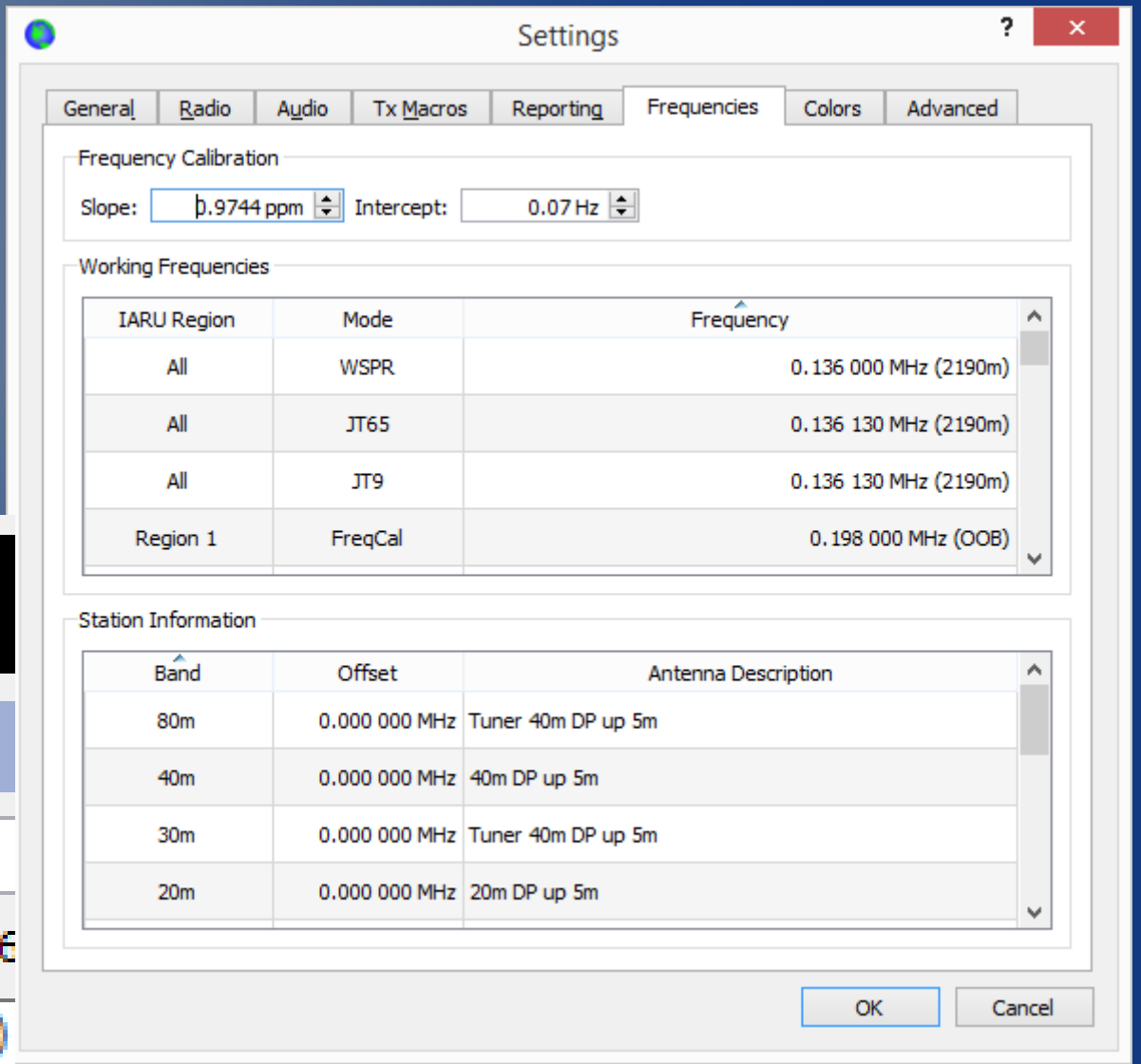


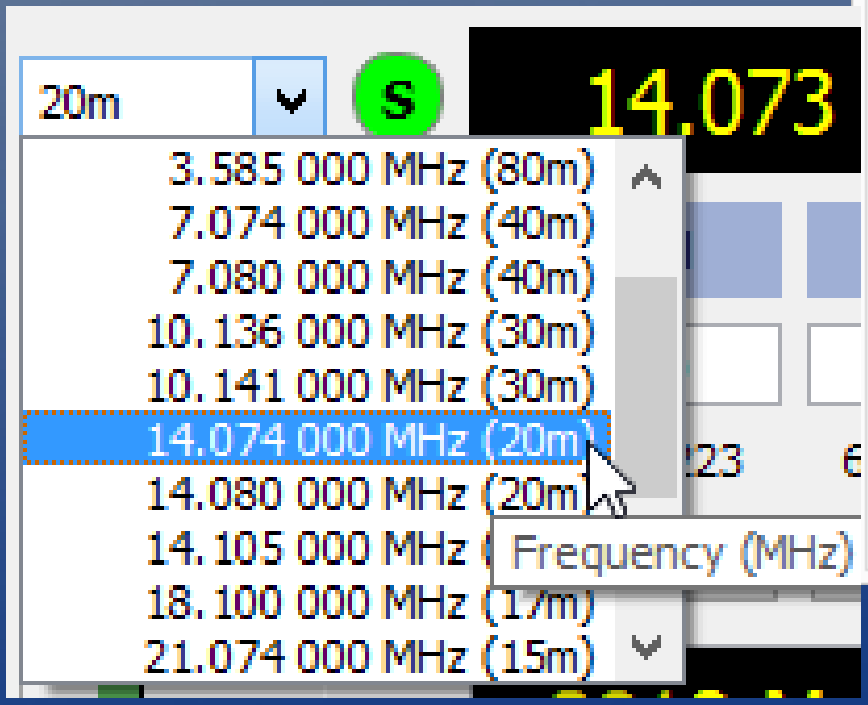




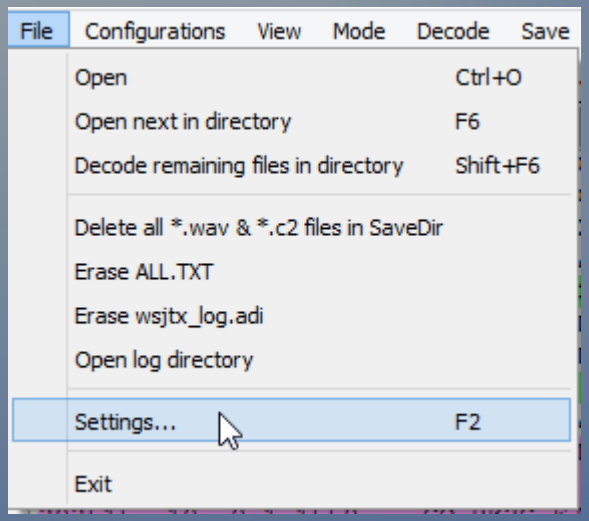
WSJT-X V1.8 Frequencies Setup

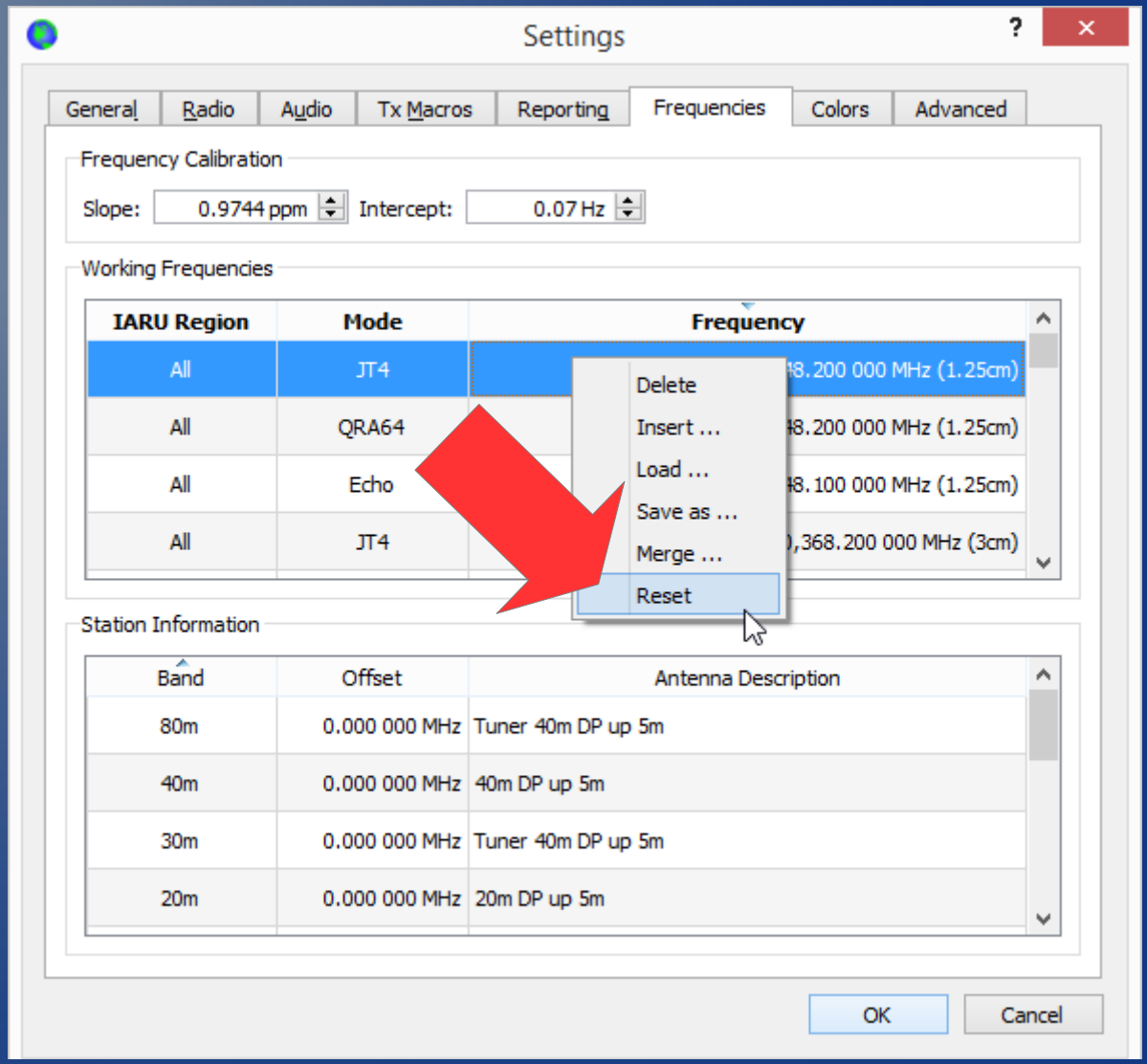




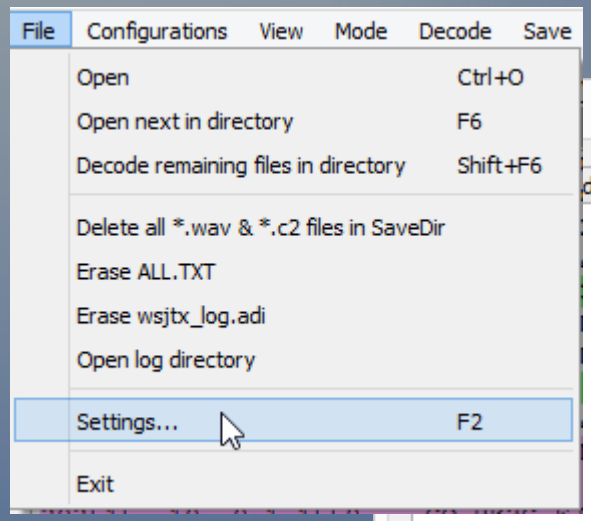


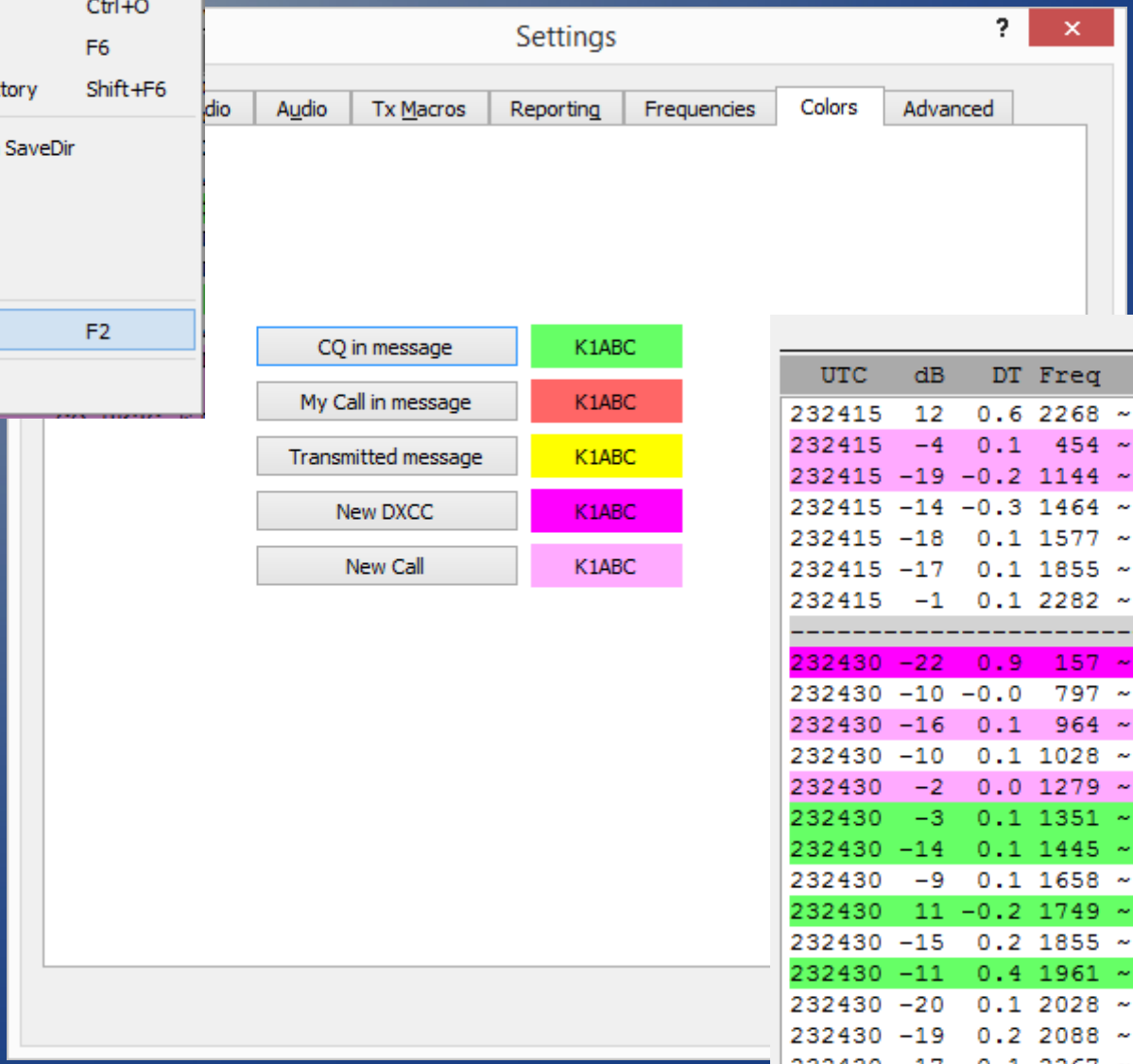
WSJT-X V1.8 Reset Frequencies

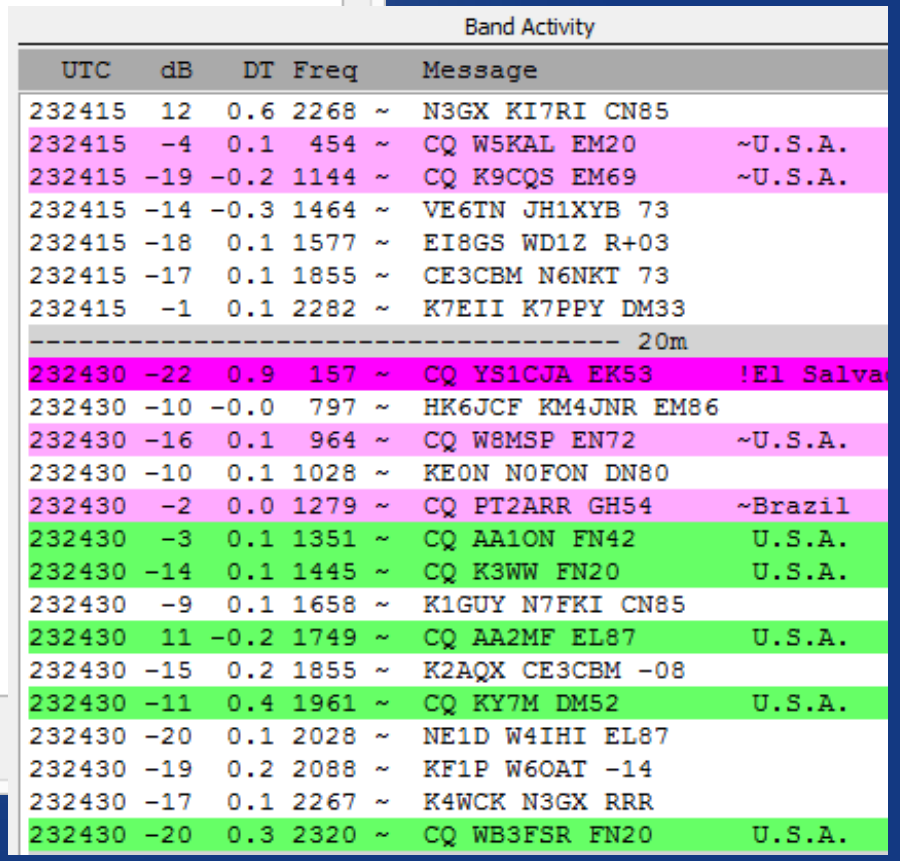




WSJT-X V1.8 Colors Setup

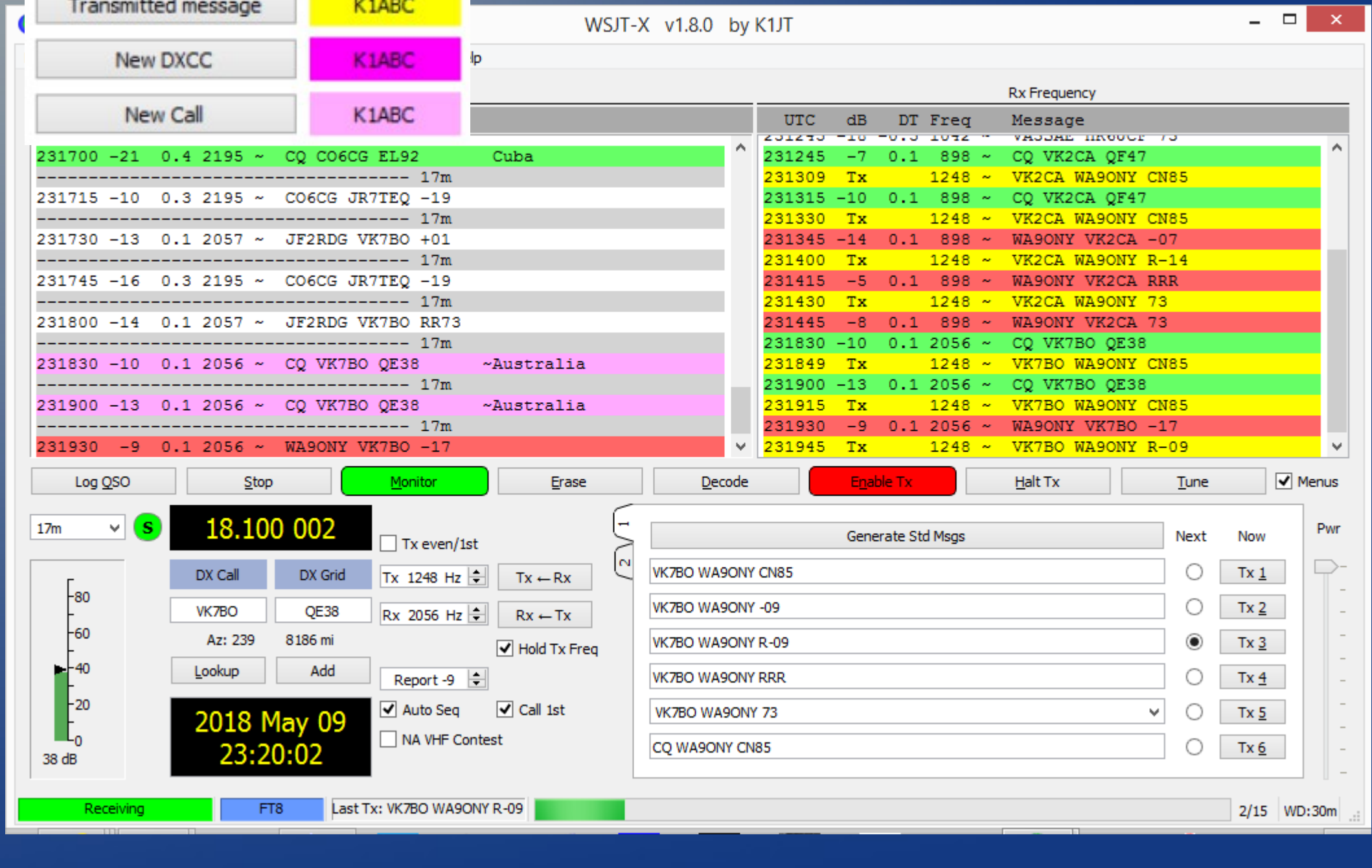




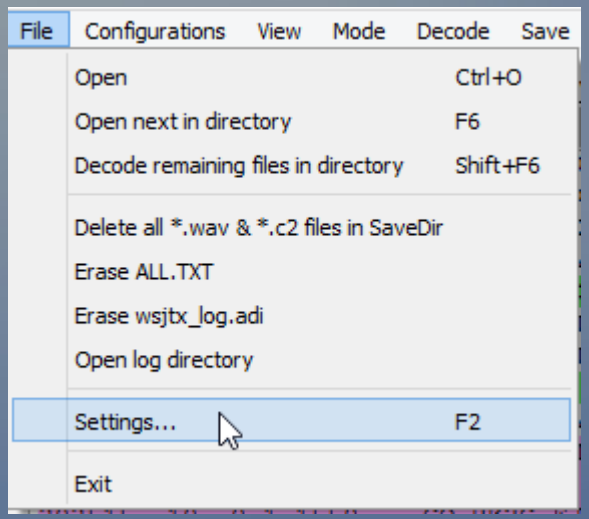


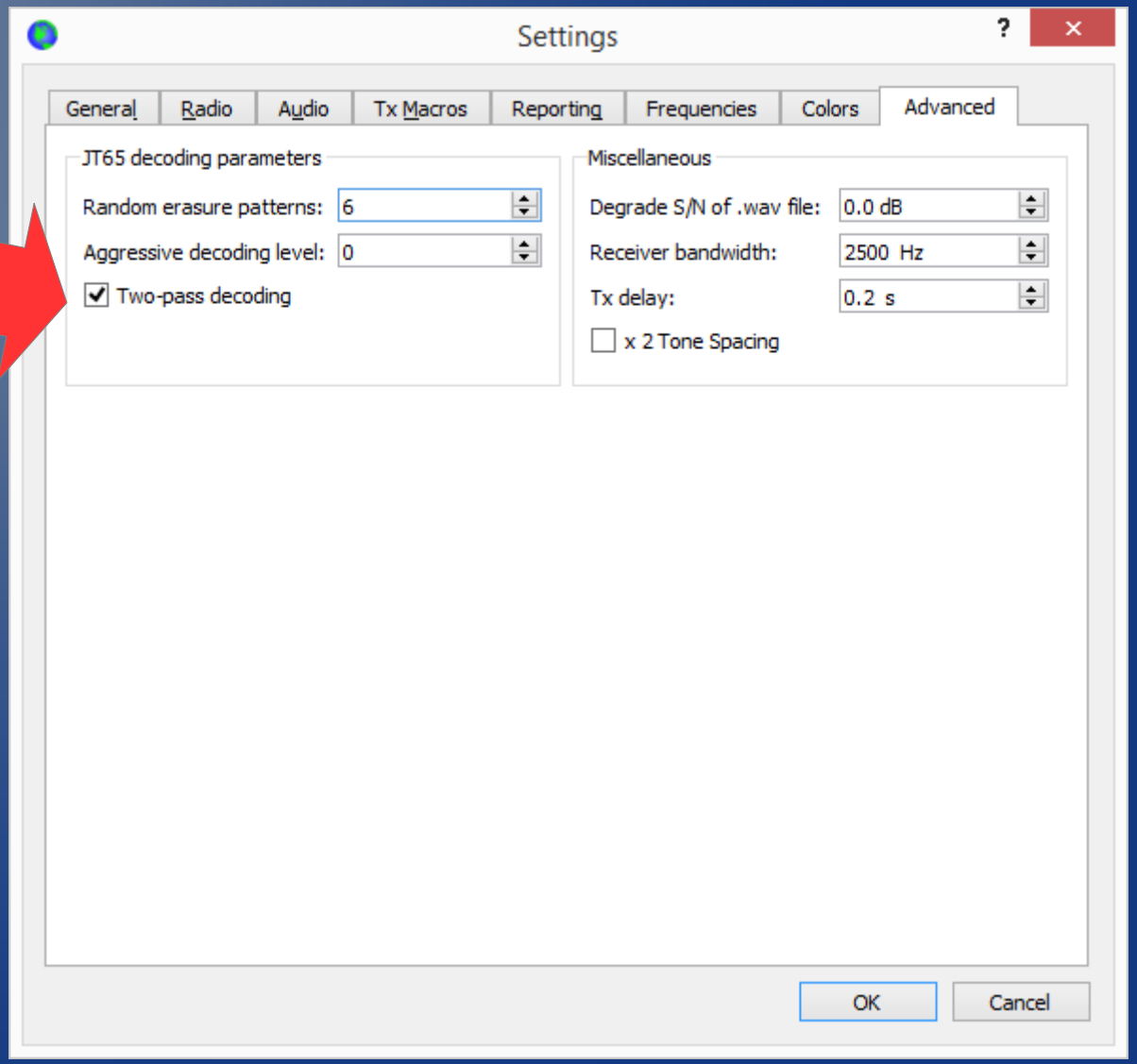
FT8 Color Decode

CQ in message	K1ABC
My Call in message	K1ABC
Transmitted message	K1ABC
New DXCC	K1ABC
New Call	K1ABC



WSJT-X V1.8 Advanced Setup
2 Pass Decode





WSJT-X 2 Pass Decode

1st Pass

2nd Pass

UTC	dB	DT	Freq		Message	
----------					---------- 20m	
015445	-15	0.1	462	~	VE2FCR W6NWS -01	
015445	-8	0.1	577	~	VU2IBI W8VS EN82	
015445	-1	0.1	707	~	CQ KF6JXM DM13	U.S.A.
015445	-1	0.1	839	~	AP2AM KF8PD -09	
015445	-6	-0.2	932	~	K9IJ K6PAD DM13	
015445	-10	0.1	1004	~	KD3K W5DTX EM12	
015445	-23	0.1	1094	~	K6ZVA WA2HIP 73	
015445	-6	0.8	1200	~	KB7RUQ AG4EX 73	
015445	-24	0.1	1251	~	NK2B N5RB EM54	
015445	-4	-0.2	1352	~	XP3A K9GL EN52	
015445	1	0.1	1461	~	AP2NK W4DXX -22	
015445	-12	0.1	1607	~	NK2B N9XHN EN50	
015445	-17	0.1	1712	~	KE0OVX K3WW -05	
015445	-16	0.1	1764	~	AP2NK WA3LAB FN20	
015445	-3	0.1	2013	~	RK4FF KB7MA R+01	
015445	-10	0.2	2243	~	CQ WB9VGJ DM34	U.S.A.
015445	6	0.2	2336	~	AP2NK W6MYN DM03	
015445	-19	0.9	285	~	WA4GBT TG9ADV -08	
015445	-24	0.1	363	~	AP2NK K1PTF FN22	
015445	-19	0.3	424	~	AP2NK KQ9H EN53	
015445	-18	0.1	481	~	K3UA K5MFP R-04	
015445	-19	0.3	866	~	VU2CPL N6AR 73	
015445	-11	0.1	1354	~	XP3A K9ATX EN53	
015445	-9	0.1	1437	~	VU2CPL W8ASA EM79	
015445	-19	-0.1	1664	~	VU2CPL K2YYY DM79	

Decoding 2 Stations K9GL & K9TX On Top of Each Other

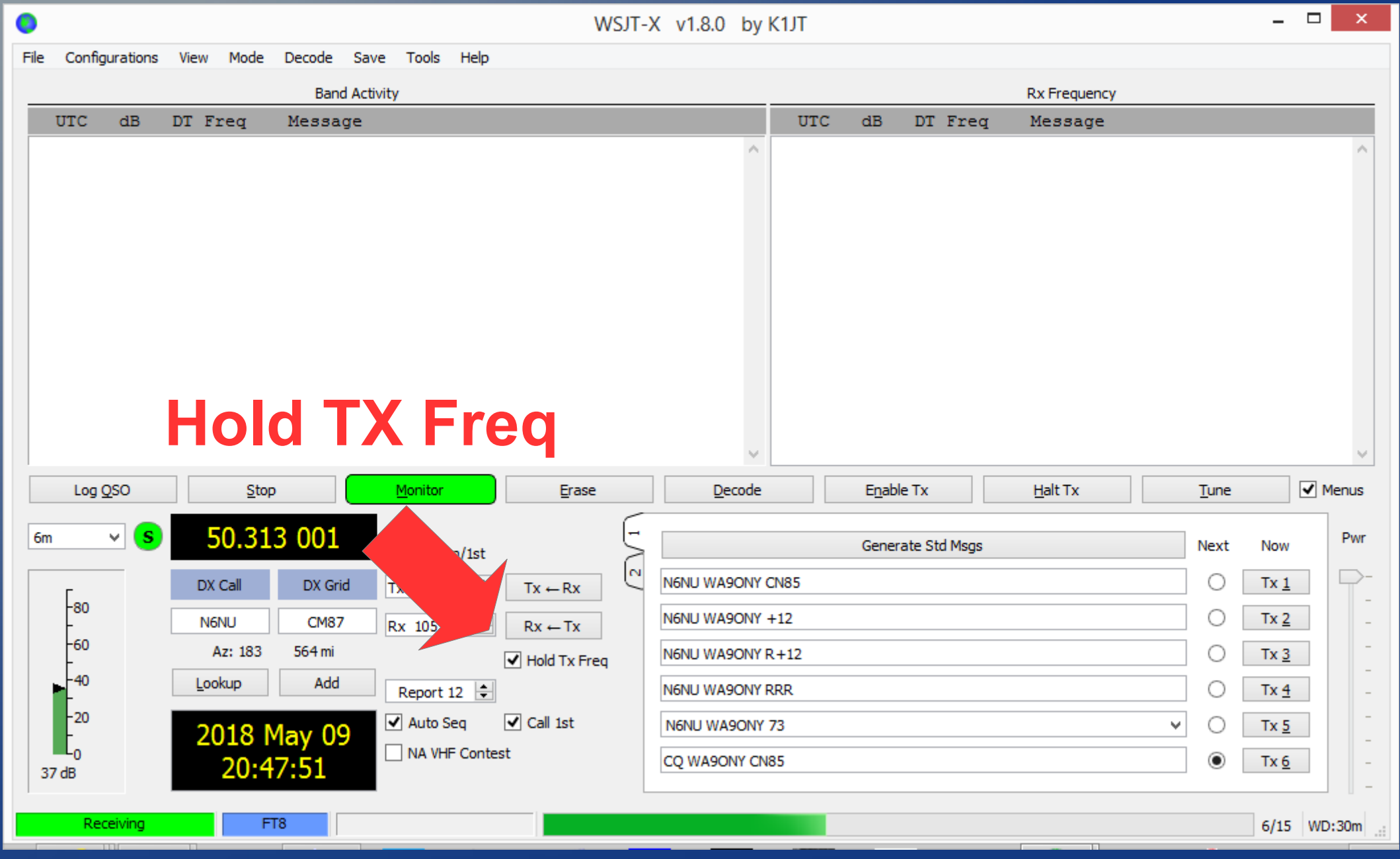
1st Pass

2nd Pass

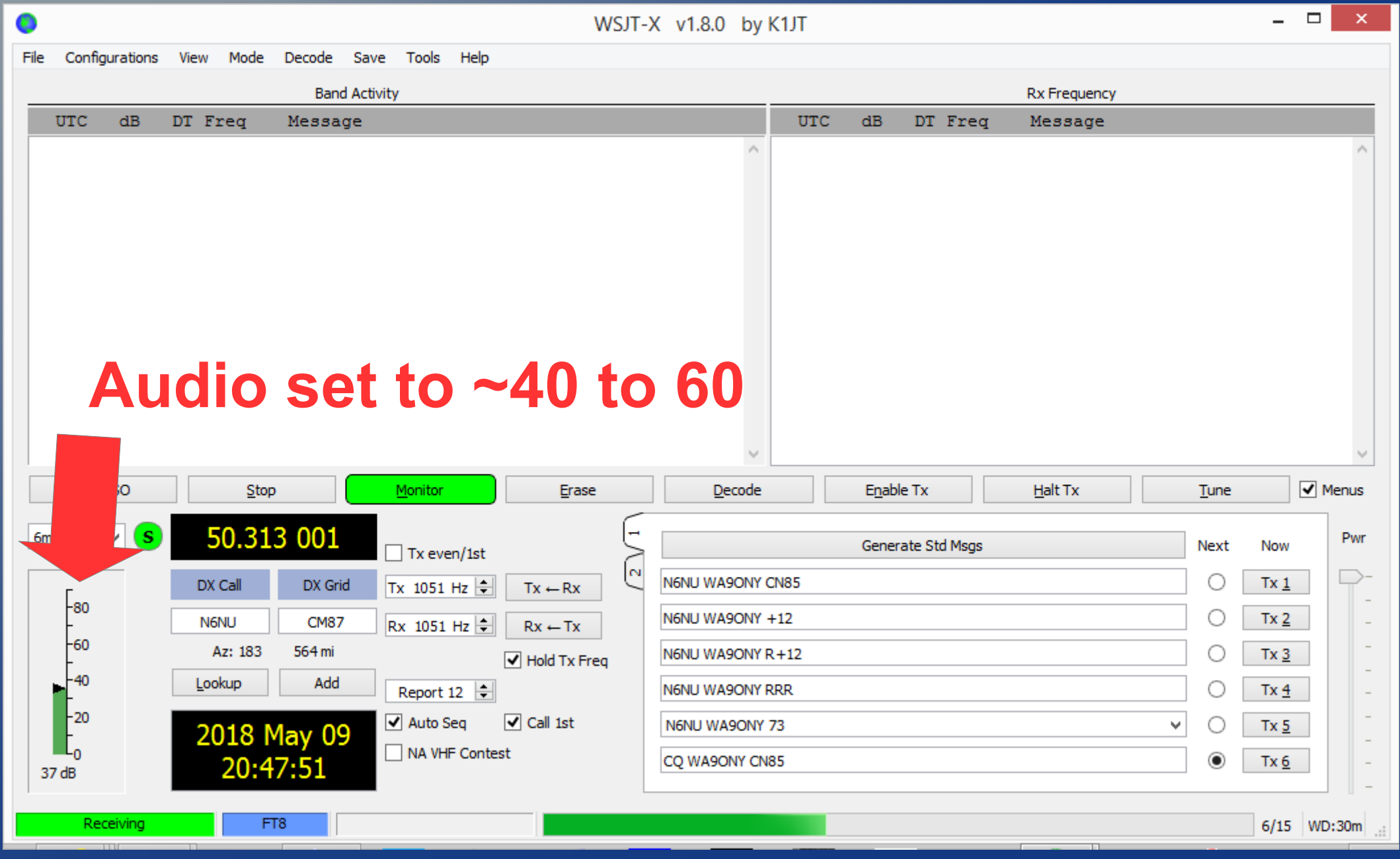
UTC	dB	DT	Freq		Message	
----------					---------- 20m	
015445	-15	0.1	462	~	VE2FCR W6NWS -01	
015445	-8	0.1	577	~	VU2IBI W8VS EN82	
015445	-1	0.1	707	~	CQ KF6JXM DM13	U.S.A.
015445	-1	0.1	839	~	AP2AM KF8PD -09	
015445	-6	-0.2	932	~	K9IJ K6PAD DM13	
015445	-10	0.1	1004	~	KD3K W5DTX EM12	
015445	-23	0.1	1094	~	K6ZVA WA2HIP 73	
015445	-6	0.8	1200	~	KB7RUQ AG4EX 73	
015445	-24	0.1	1251	~	NK2B N5RB EM54	
015445	-4	-0.2	1352	~	XP3A K9GL EN52	
015445	1	0.1	1461	~	AP2NK W4DXX -22	
015445	-12	0.1	1607	~	NK2B N9XHN EN50	
015445	-17	0.1	1712	~	KE0OVX K3WW -05	
015445	-16	0.1	1764	~	AP2NK WA3LAB FN20	
015445	-3	0.1	2013	~	RK4FF KB7MA R+01	
015445	-10	0.2	2243	~	CQ WB9VGJ DM34	U.S.A.
015445	6	0.2	2336	~	AP2NK W6MYN DM03	
015445	-19	0.9	285	~	WA4GBT TG9ADV -08	
015445	-24	0.1	363	~	AP2NK K1PTF FN22	
015445	-19	0.3	424	~	AP2NK KQ9H EN53	
015445	-18	0.1	481	~	K3UA K5MFP R-04	
015445	-19	0.3	866	~	VU2CPL N6AR 73	
015445	-11	0.1	1354	~	XP3A K9ATX EN53	
015445	-9	0.1	1437	~	VU2CPL W8ASA EM79	
015445	-19	-0.1	1664	~	VU2CPL K2YYY DM79	

WSJT-X V1.8 Main Window Setup

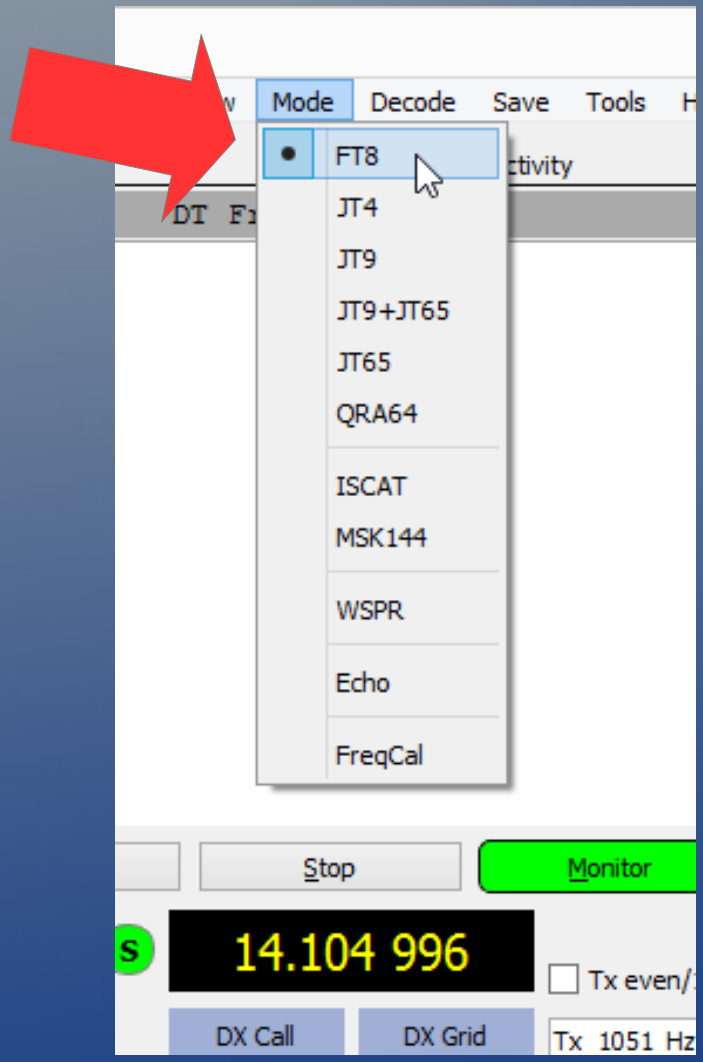
WSJT-X V1.8 Main Window Setup



WSJT-X V1.8 Main Window Setup



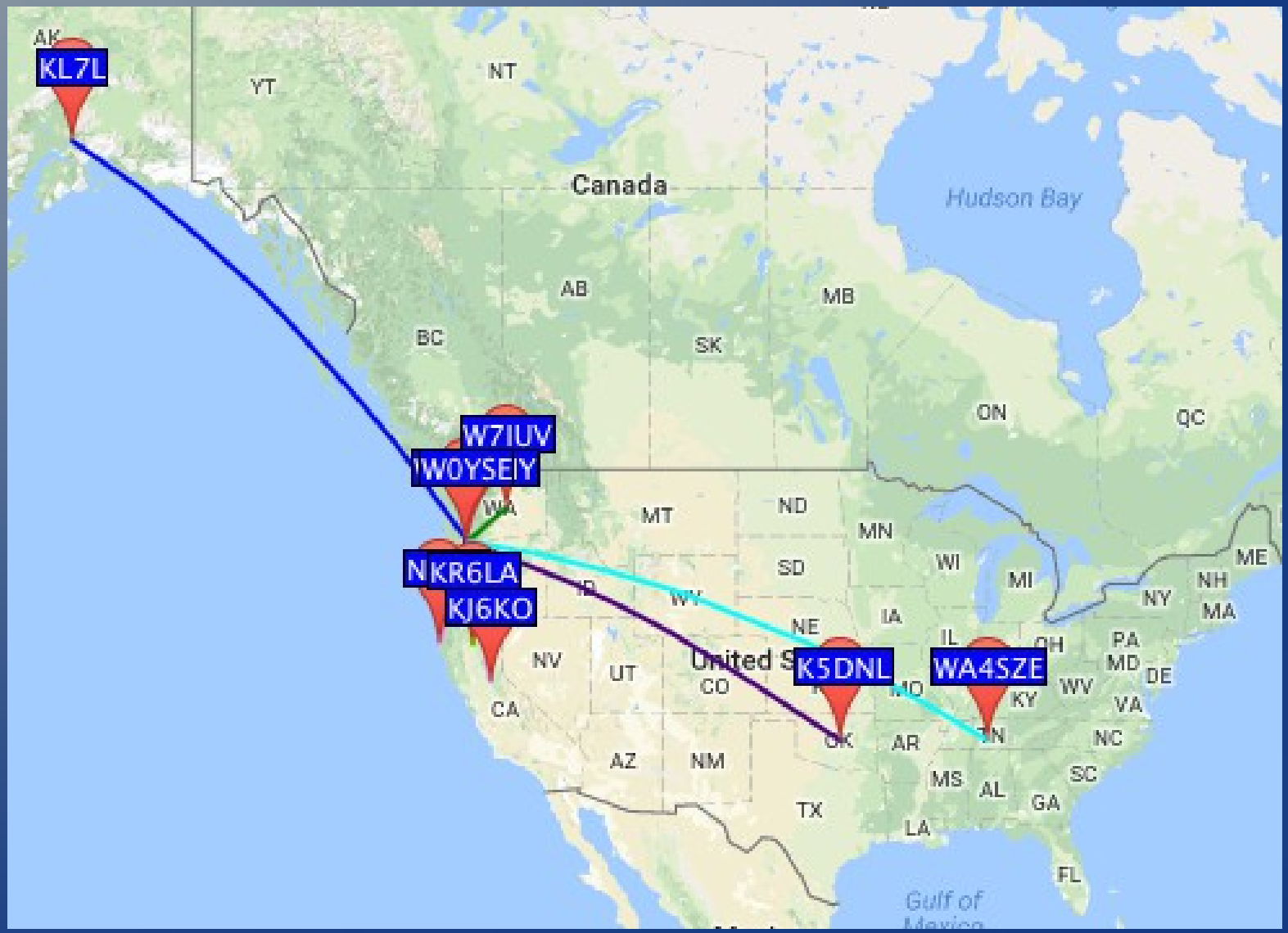
WSJT-X V1.8 Main Window Setup



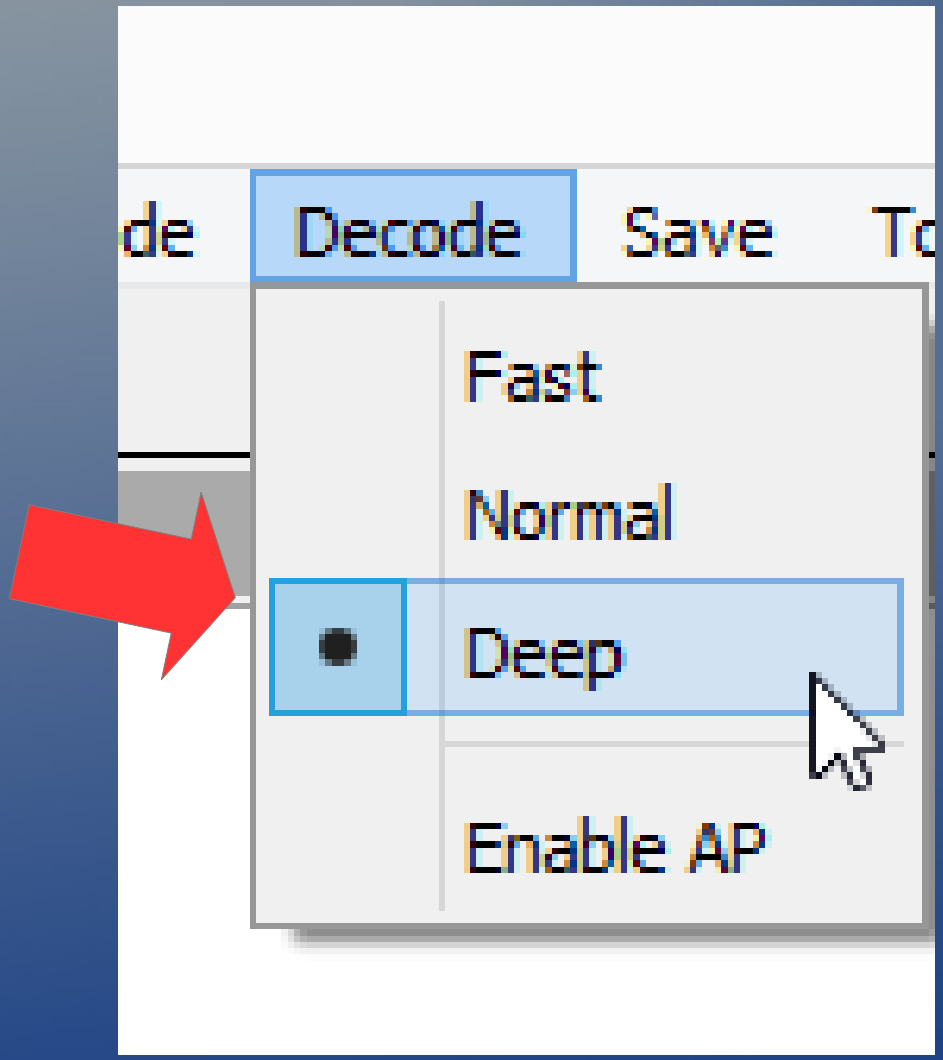
- WSJT-X has many digital modes of operation.
- After using FT8 try WSPR: Weak Signal Propagation Reporting

WSPR 630m Monitoring

WSPRnet wsprnet.org/drupal/

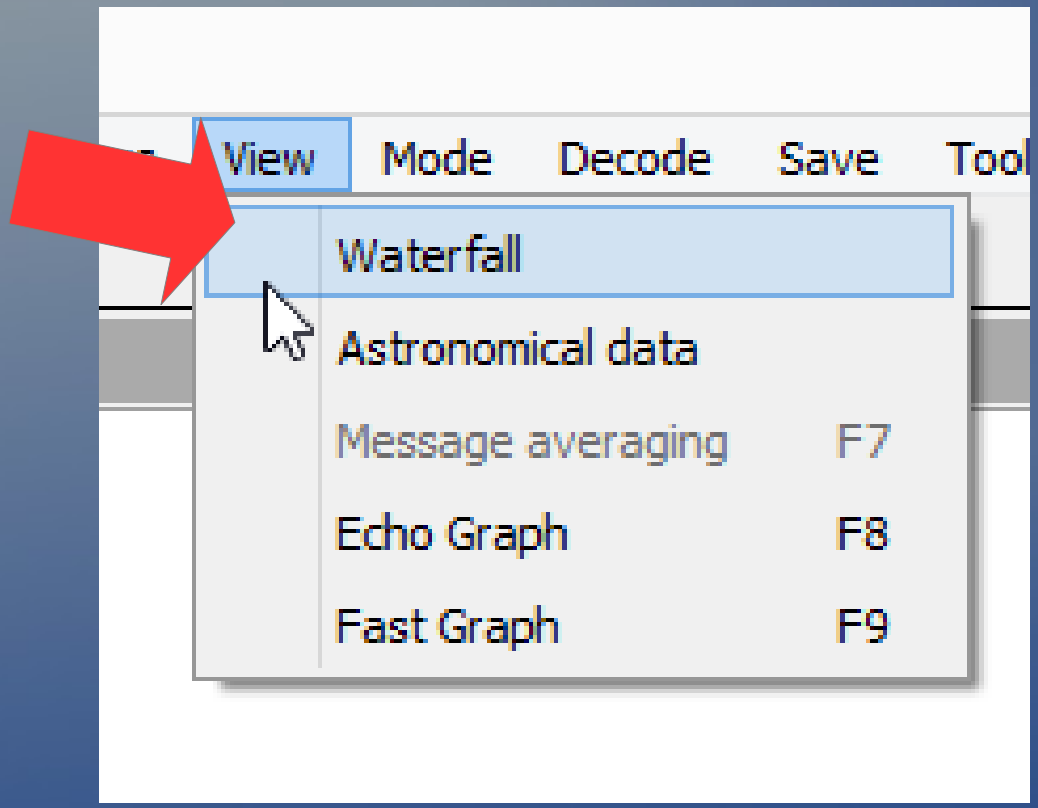


WSJT-X V1.8 Main Window Setup

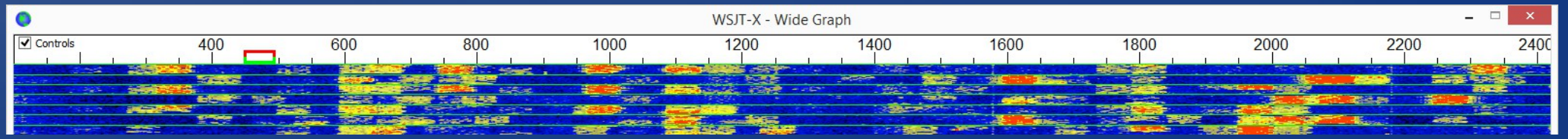


- Start with Deep
- Deep takes more computer processing power
- Select Normal or Fast if having decode problems with Deep

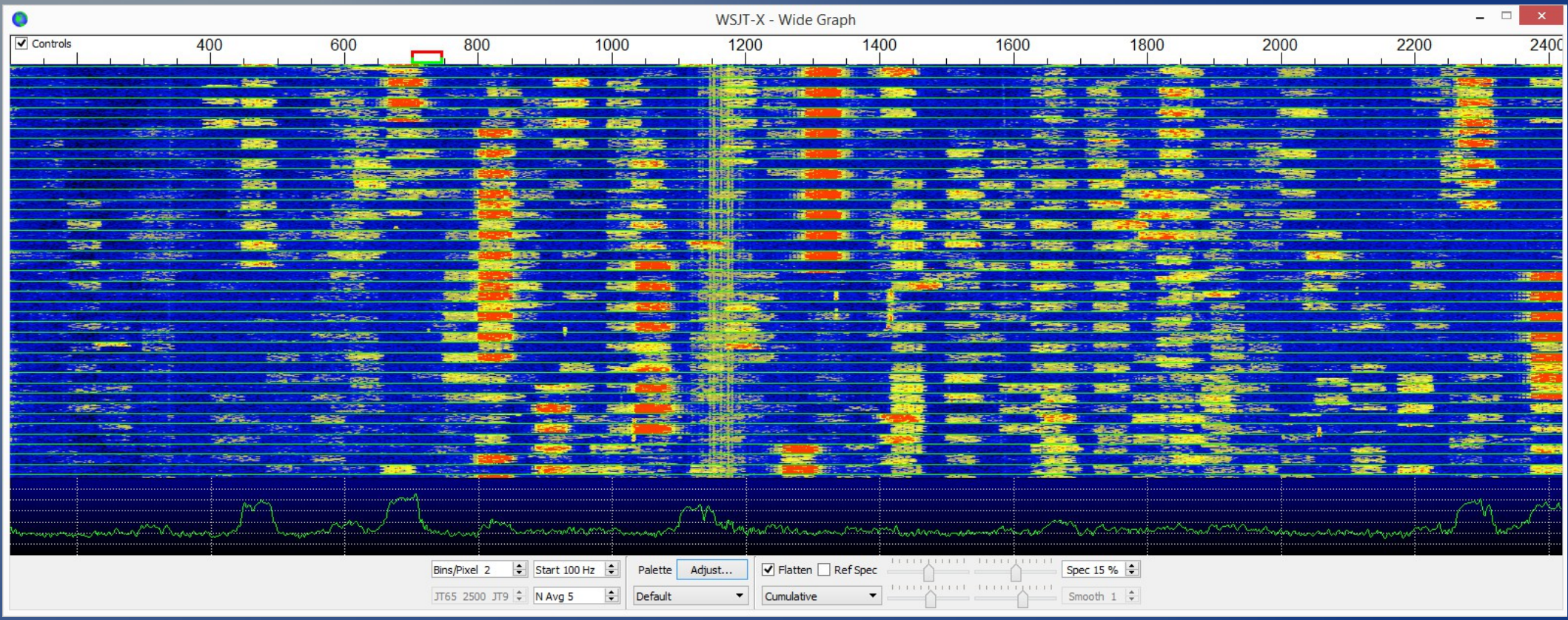
Turn On Waterfall Graph



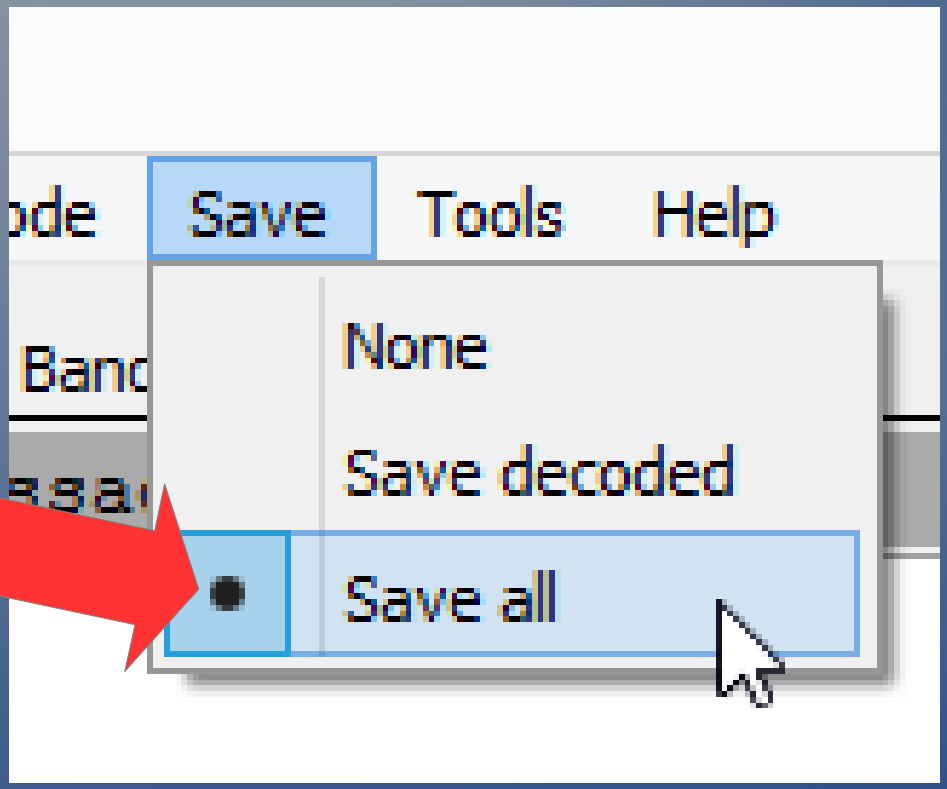
- Shows all signals in the bandpass versus time
- Shows received signals
- Used to select clear frequency to call stations or CQ



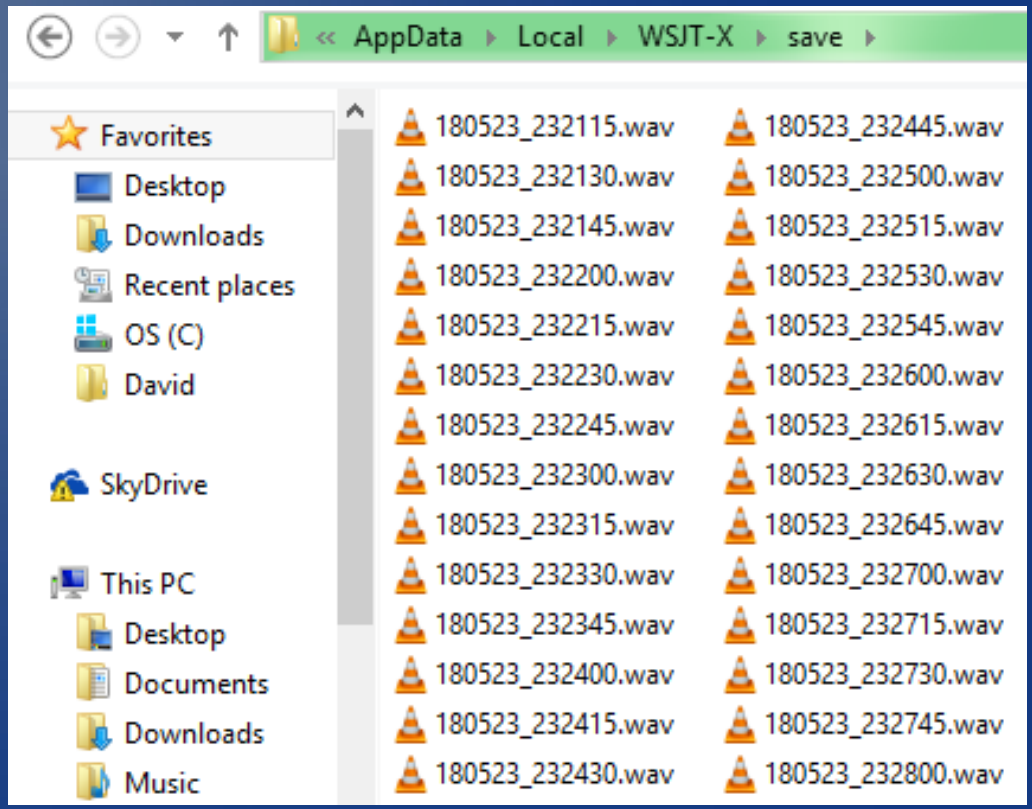
FT8 Waterfall Graph



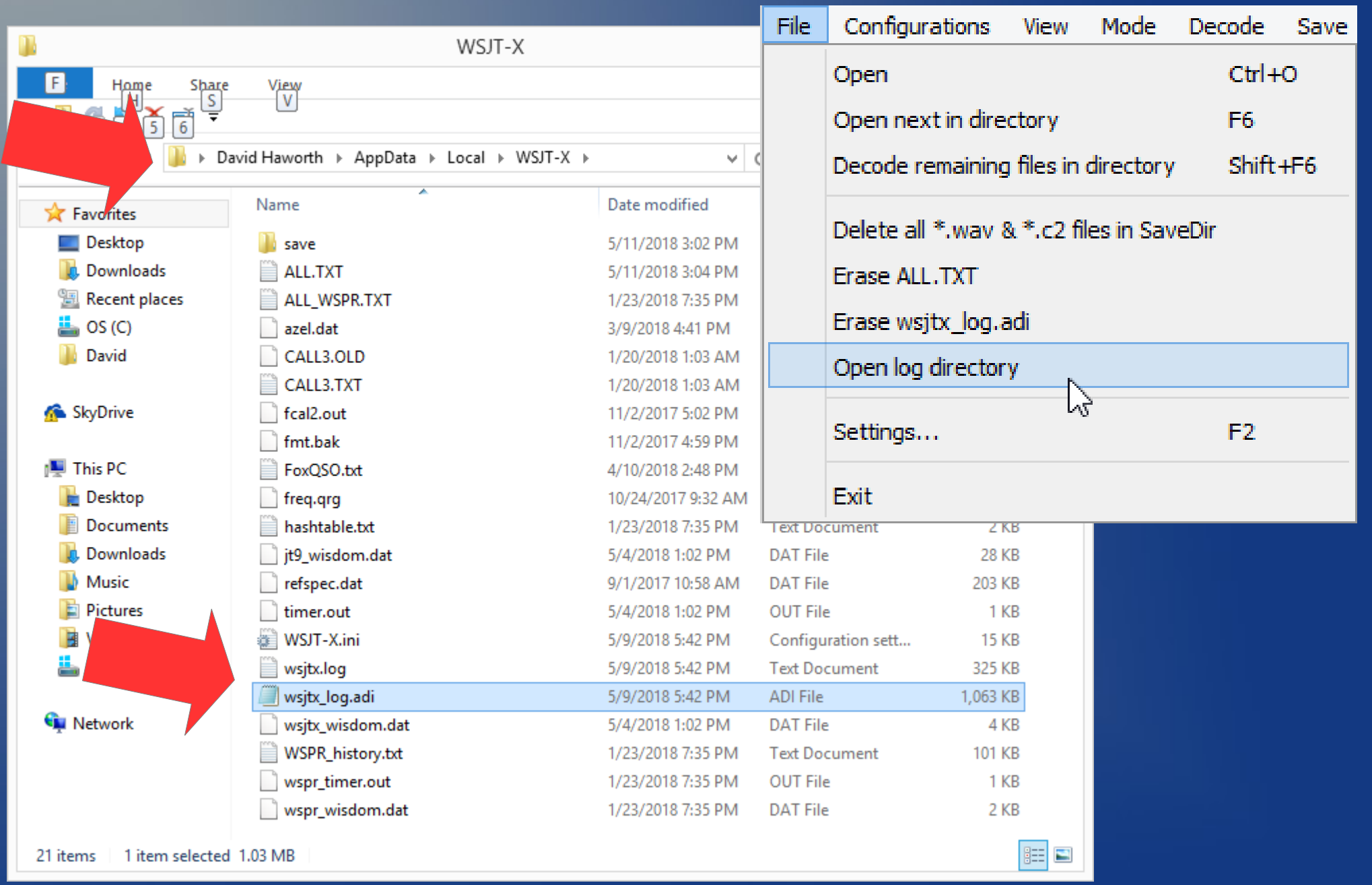
WSJT-X V1.8 Main Window Setup



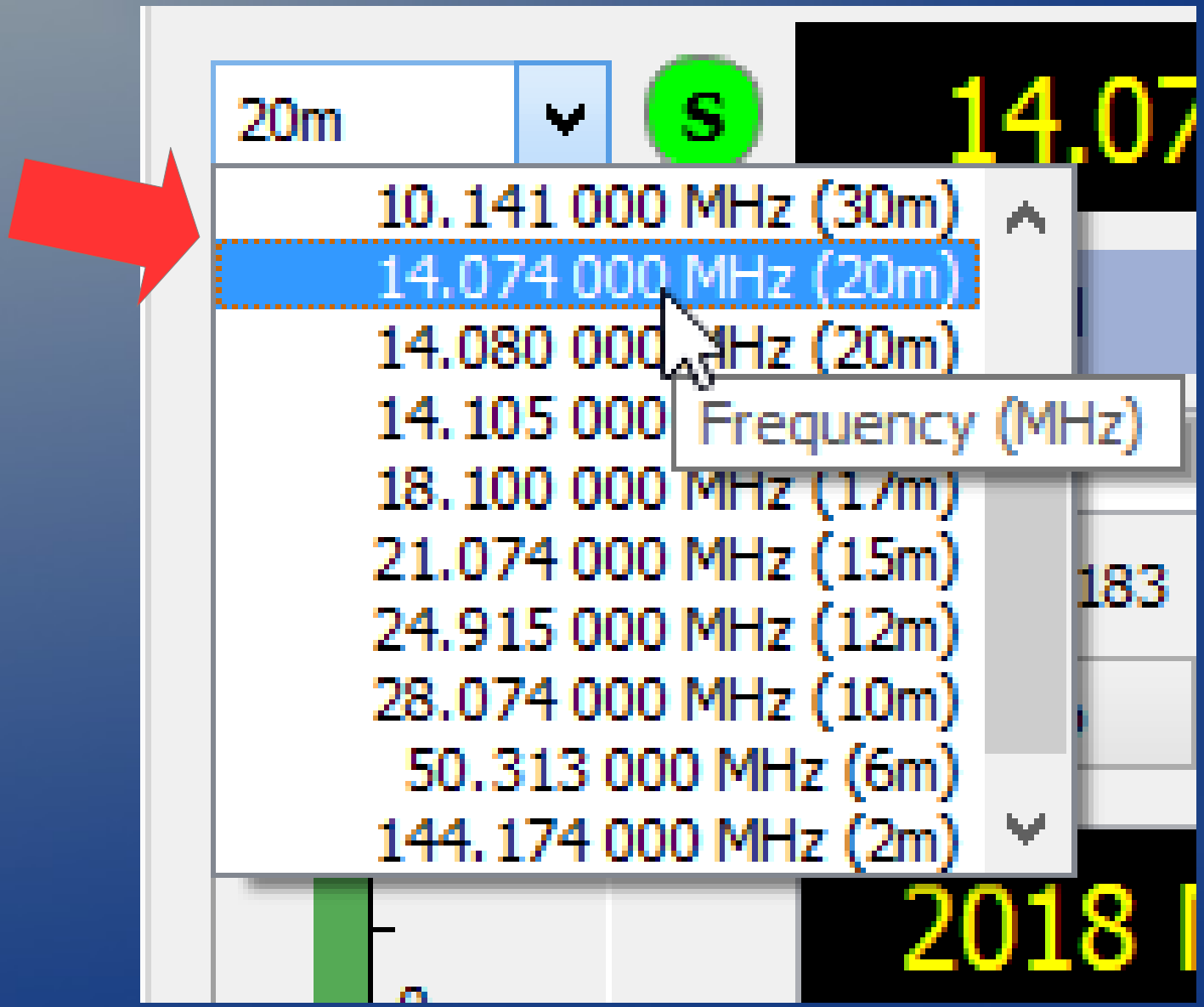
- Saves decode files
- Save audio files



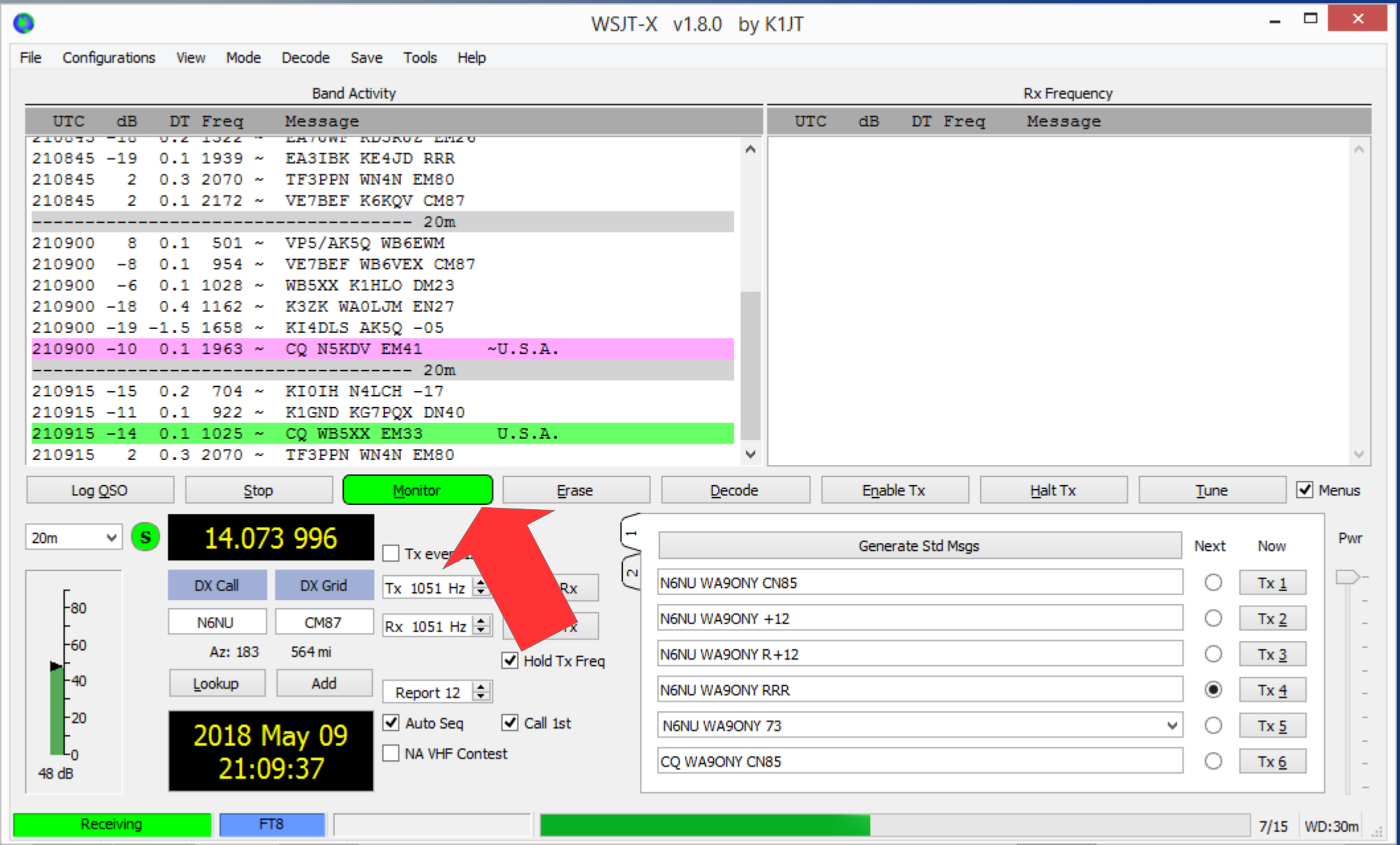
WSJT-X Saved Files



WSJT-X V1.8 Band Setup



FT8 Monitor Mode



Band Activity Window

- UTC: Coordinated Universal Time
- dB: S/N in decibels
- DT: Delta Time
  - No decode for DT > ~ >2 sec.
- Freq: Frequency in Hz
- Message

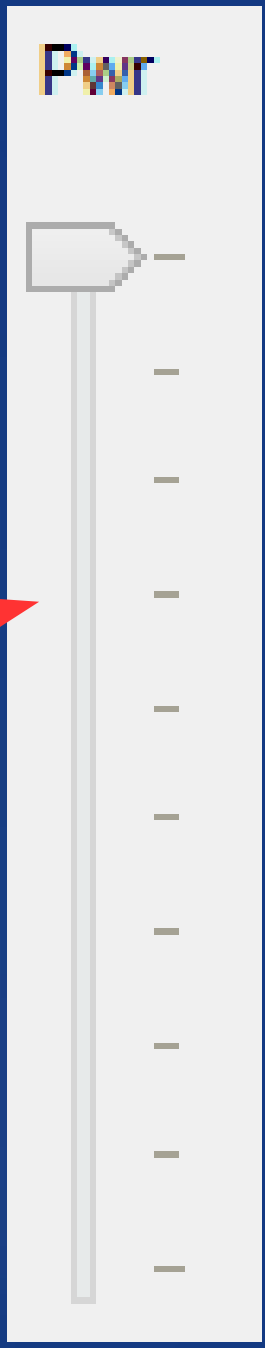
Band Activity

UTC	dB	DT	Freq		Message	
----------					20m	
182315	1	1.0	339	~	CQ N6IQY CM99	U.S.A.
182315	-11	1.0	605	~	CQ WB5DW EM30	~U.S.A.
182315	12	0.2	739	~	VA6MNT K7YVO CN85	

Tx Power

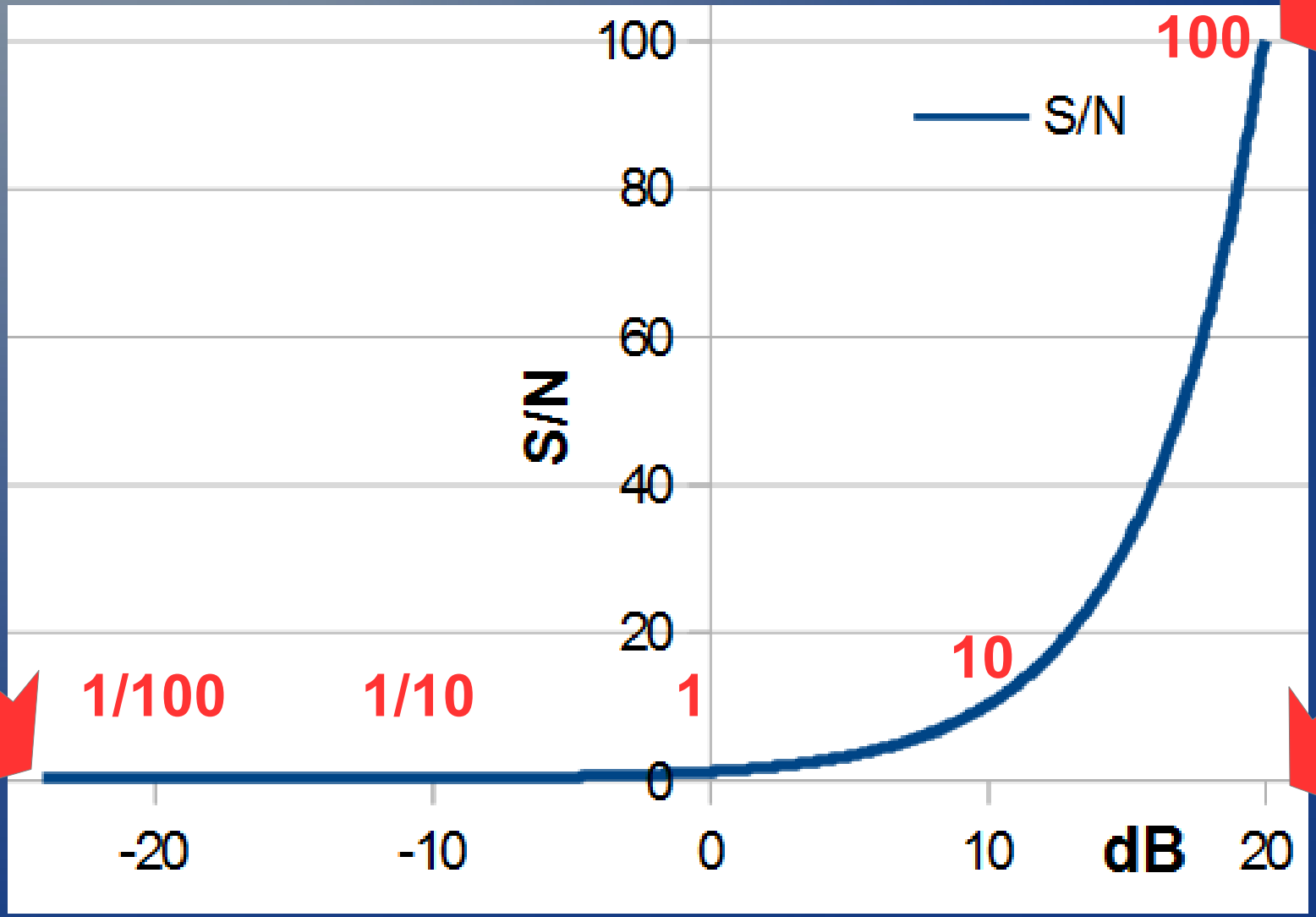
- Adjusted by transceiver
- Adjusted by SignalLink USB
  - SWR power meter

- Adjusted by WSJT-X
- Warning:
  Most transceivers are not designed for 100% duty cycle



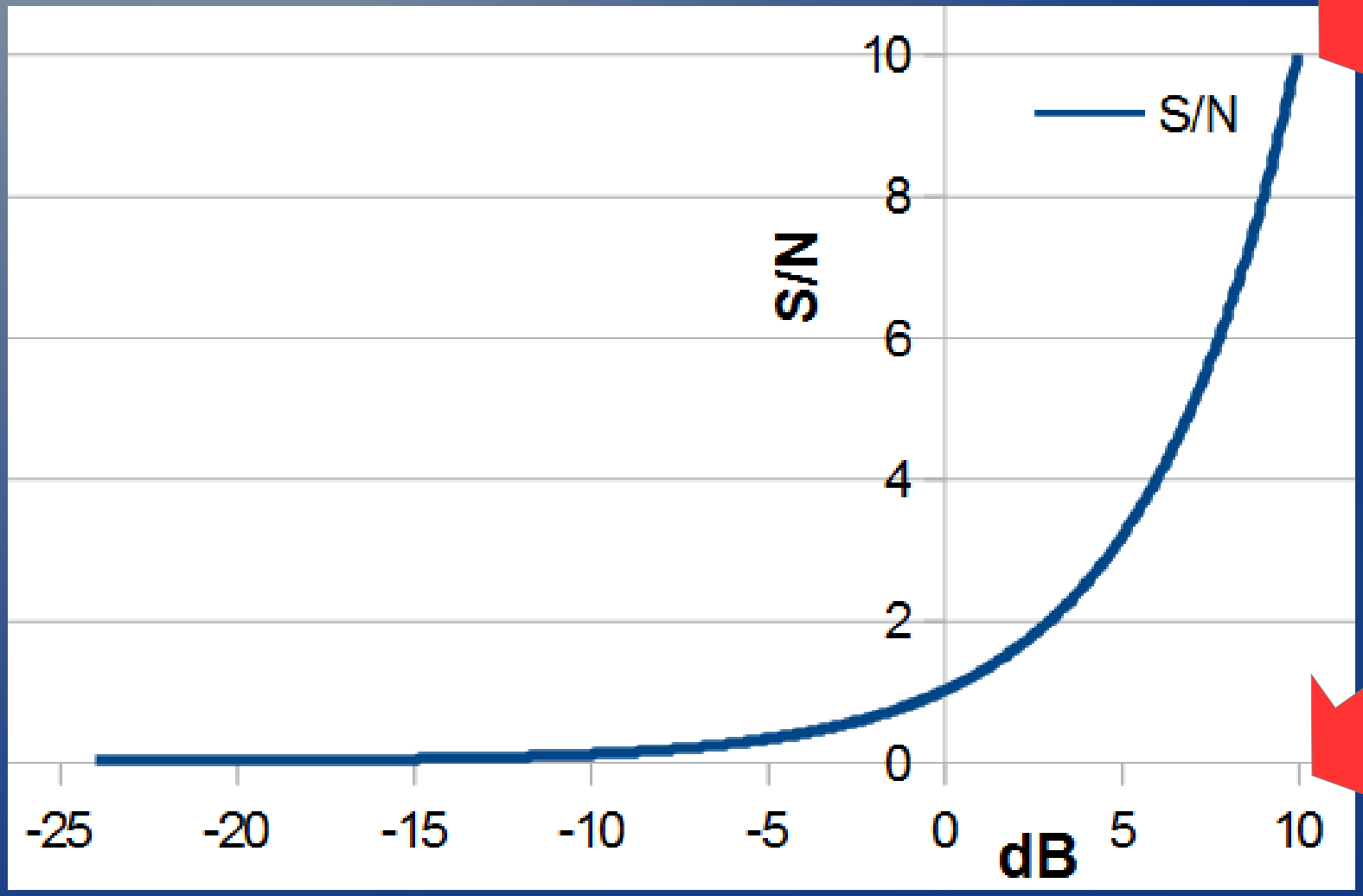
S/N: Signal Power/Noise Power

- S/N dB = 10 $\log_{10}$(Signal/Noise)



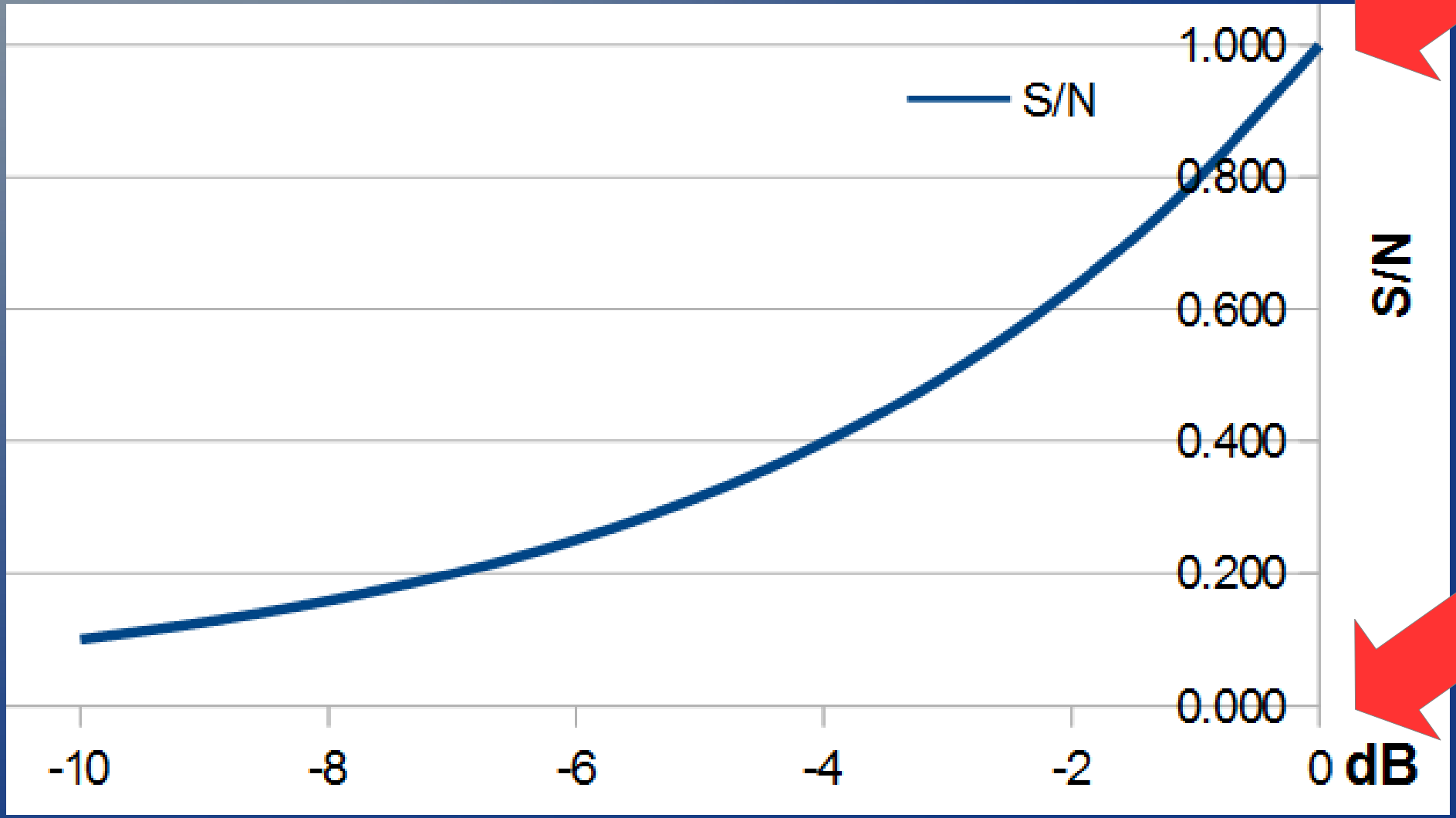
S/N: Signal Power/Noise Power

- S/N dB = 10 $\log_{10}$(Signal/Noise)



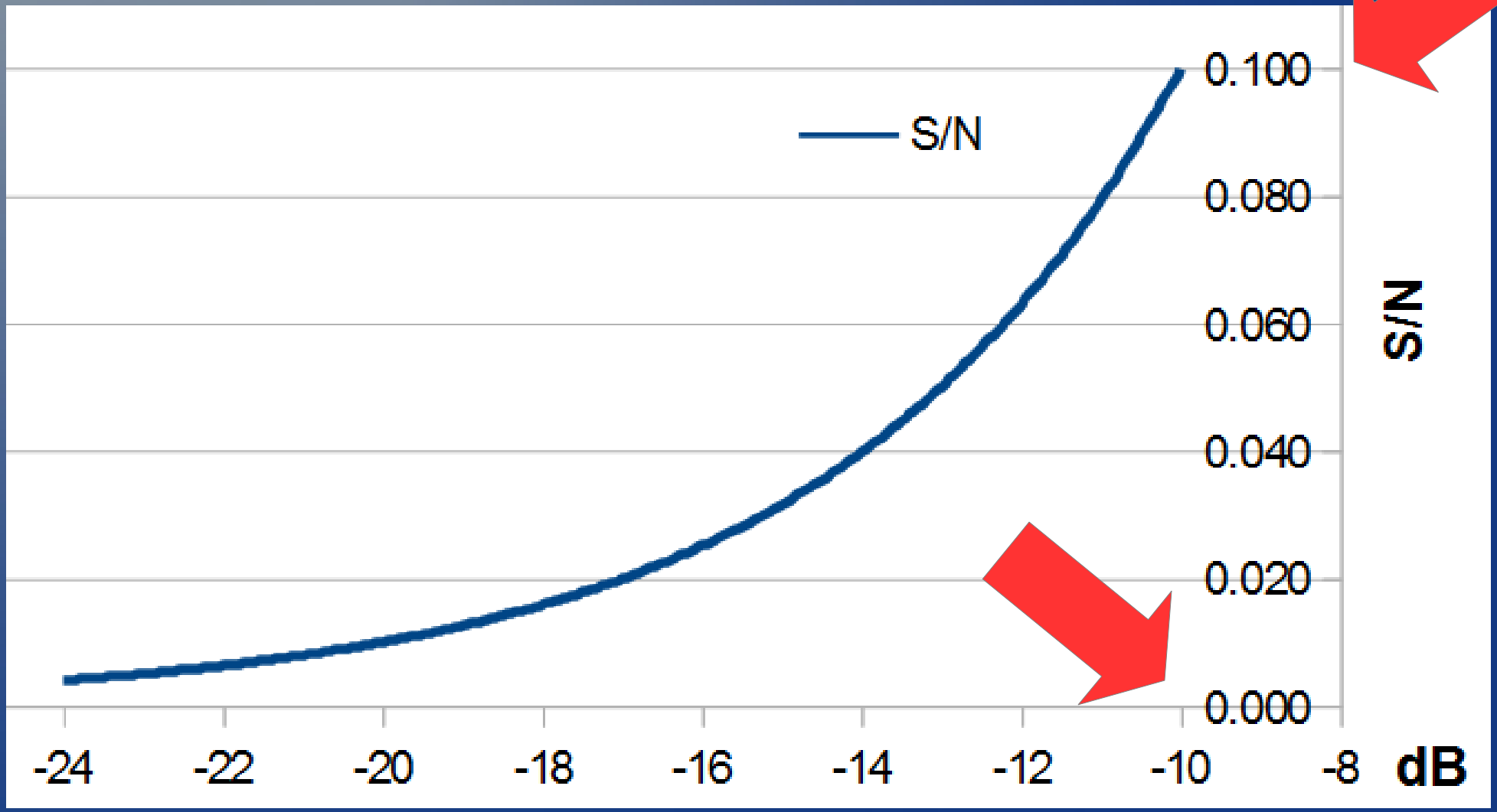
S/N: Signal Power/Noise Power

- S/N dB = 10 $\log_{10}$(Signal/Noise)



S/N: Signal Power/Noise Power

- S/N dB = 10 $\log_{10}$(Signal/Noise)



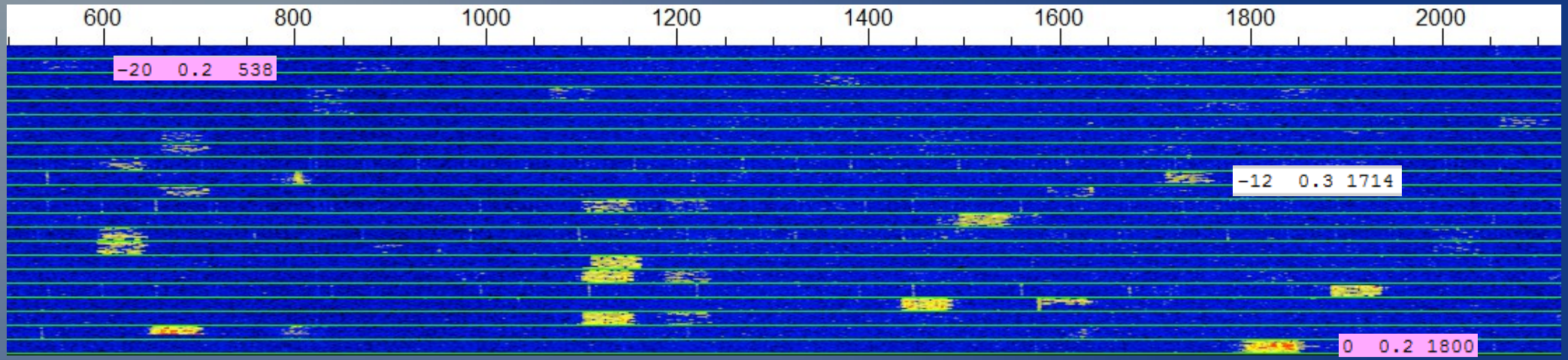
S/N: Signal Power/Noise Power

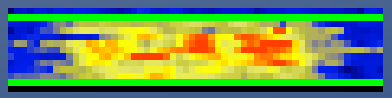
- S/N dB = 10 $\log_{10}$(Signal/Noise)

dB	S/N	dB	S/N	dB	S/N	dB	S/N	dB	S/N
20	100	10	10	0	1.000	-10	0.100	-20	0.010000
19	79.4	9	7.9	-1	0.794	-11	0.079	-21	0.007943
18	63.1	8	6.3	-2	0.631	-12	0.063	-22	0.006310
17	50.1	7	5.0	-3	0.501	-13	0.050	-23	0.005012
16	39.8	6	4.0	-4	0.398	-14	0.040	-24	0.003981
15	31.6	5	3.2	-5	0.316	-15	0.032	-25	0.003162
14	25.1	4	2.5	-6	0.251	-16	0.025	-26	0.002512
13	20.0	3	2.0	-7	0.200	-17	0.020	-27	0.001995
12	15.8	2	1.6	-8	0.158	-18	0.016	-28	0.001585
11	12.6	1	1.3	-9	0.126	-19	0.013	-29	0.001259

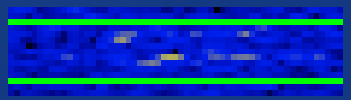
S/N on the Water Fall

Top: Noise -20 -19 -18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 :Bottom





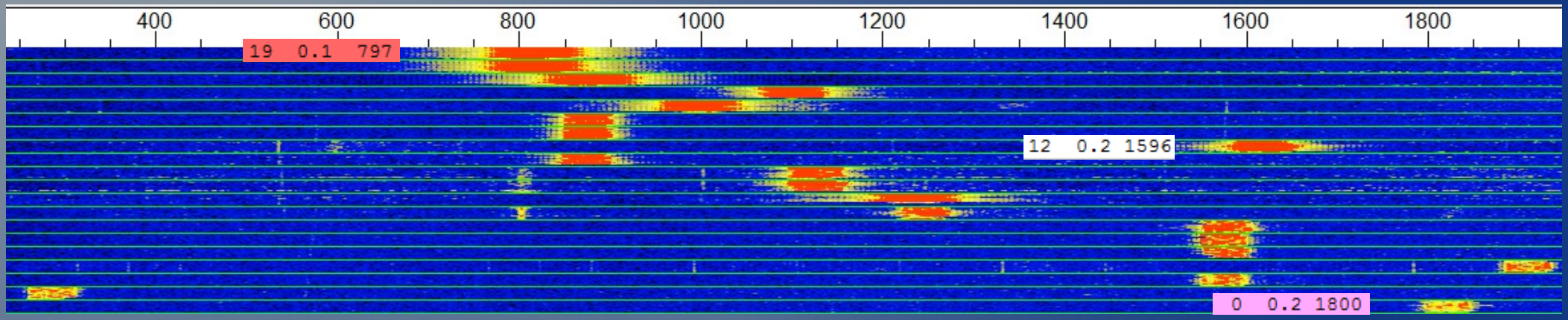
dB	DT	Freq
0	0.2	1800
-1	0.3	654
-2	0.2	1106
-3	0.1	1440
-4	-0.8	1888
-5	0.2	1105
-6	0.1	1114
-7	0.1	597
-8	0.1	597
-9	1.1	1500
-10	0.2	1106
-11	0.2	663
-12	0.3	1714
-13	0.1	598
-14	0.2	663
-15	0.2	663
-16	0.1	2064
-17	0.1	815
-18	0.1	815
-19	0.1	1345
-20	0.2	538



Demo

S/N on the Water Fall

Top: 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 :Bottom



dB	DT	Freq
0	0.2	1800
1	0.0	264
2	0.1	1553
3	-0.9	1888
4	0.0	1556
5	-0.0	1553
6	0.3	1557
7	-0.1	1225
8	0.1	1214
9	0.2	1106
10	0.1	1106
11	0.1	852
12	0.2	1596
13	-0.2	854
14	-0.2	854
15	0.7	978
16	0.0	1080
17	0.1	855
18	0.1	796
19	0.1	797

Demo

QSO Success

Very Easy ⟷ Very Hard

dB	S/N	dB	S/N	dB	S/N	dB	S/N	dB	S/N
20	100	10	10	0	1.000	-10	0.100	-20	0.010000
19	79.4	9	7.9	-1	0.794	-11	0.079	-21	0.007943
18	63.1	8	6.3	-2	0.631	-12	0.063	-22	0.006310
17	50.1	7	5.0	-3	0.501	-13	0.050	-23	0.005012
16	39.8	6	4.0	-4	0.398	-14	0.040	-24	0.003981
15	31.6	5	3.2	-5	0.316	-15	0.032		
14	25.1	4	2.5	-6	0.251	-16	0.025		
13	20.0	3	2.0	-7	0.200	-17	0.020		
12	15.8	2	1.6	-8	0.158	-18	0.016		
11	12.6	1	1.3	-9	0.126	-19	0.013		

FT8 is Weak Signal Mode

FT8 80m Log

Rec#	Call	Date / Time	Snt	Rec
4117	KB8MAF	2018/05/28 05:05	-11	-17
4116	W4JPV	2018/05/28 05:00	-07	-21
4115	W0JMP	2018/05/28 04:58	-07	-21
4114	K4GPC	2018/05/28 04:55	-14	-24
4113	AC4GW	2018/05/28 04:53	-14	-24

23 dB Difference In Signal Reports
WA9ONY 200 X Weaker Signal

231215	1	-1.3	1904	~	CQ KK4FZN EM64
231230	Tx		370	~	KK4FZN WA9ONY CN85
231245	-1	-1.3	1905	~	WA9ONY KK4FZN -24
231300	Tx		370	~	KK4FZN WA9ONY R-01
231315	-1	-1.3	1904	~	WA9ONY KK4FZN RRR
231330	Tx		370	~	KK4FZN WA9ONY 73
231345	-1	-1.3	1904	~	WA9ONY KK4FZN 73

Signal Reports Sent

Histogram

2,652 Stations <0

1,232 Stations >0

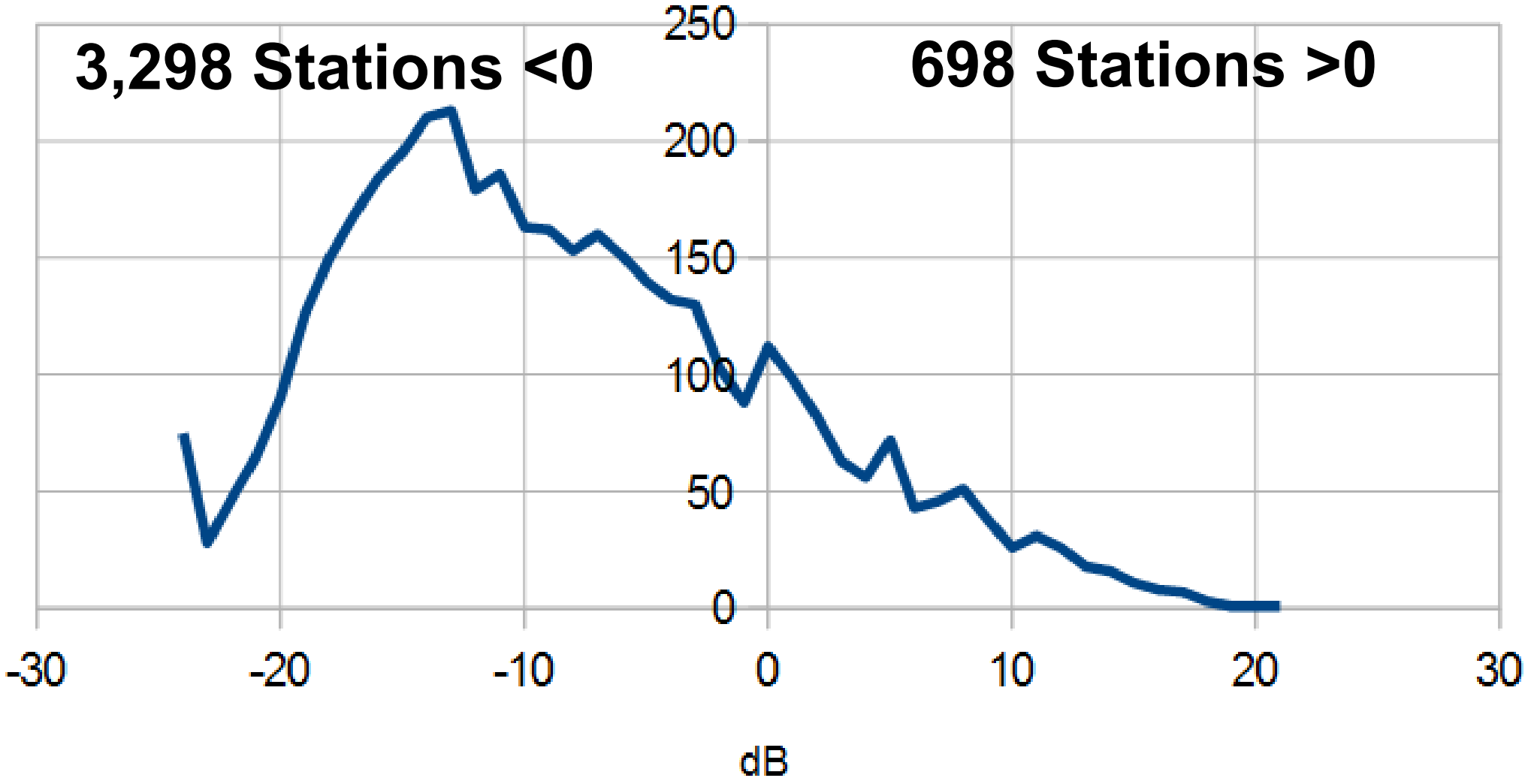
250
200
150
100
50
0

-30 -20 -10 0 10 20

dB

Signal Reports Received

Histogram



Signal Reports: 20m

My Signal is Weaker tham ~3/4 Stations on 20m

I am stronger than 253 Stations

I am weaker than 742 Stations

20m QSOs

70
60
50
40
30
20
10
0

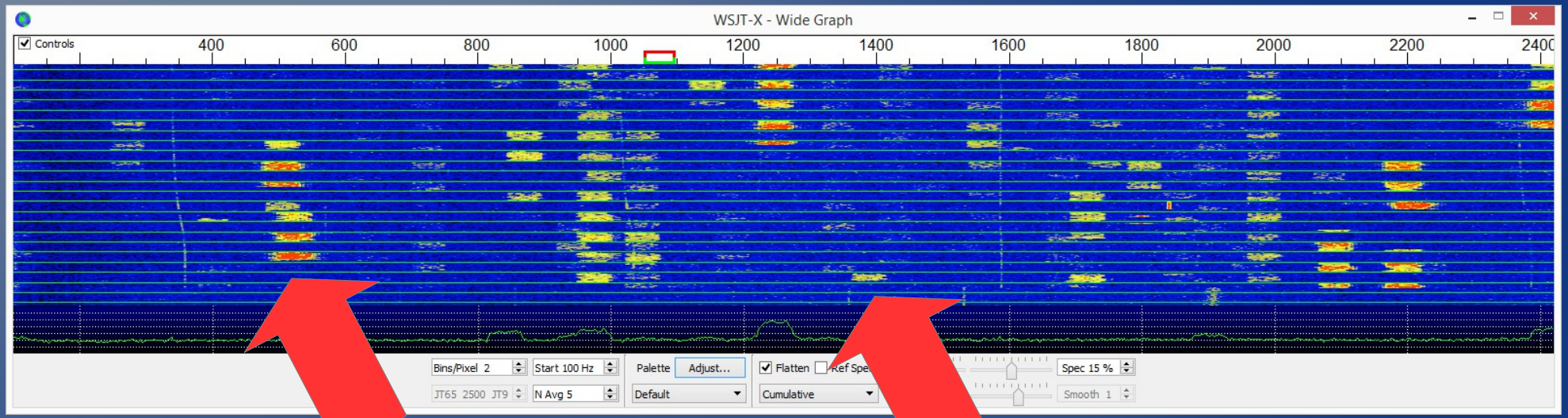
-40 -30 -20 -10 0 10 20 30 40

Signal Report Sent - Received in dB

FT8 Signals on Water Fall

0 Hz **< Frequency in Hz >** **2400 Hz**

< Time >



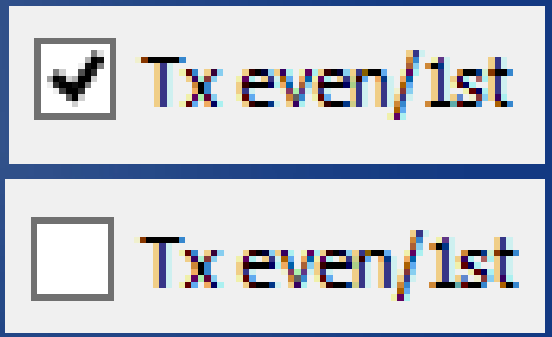
50 Hz Bandwidth

15 sec time marks

Decoded signals to 2500 Hz

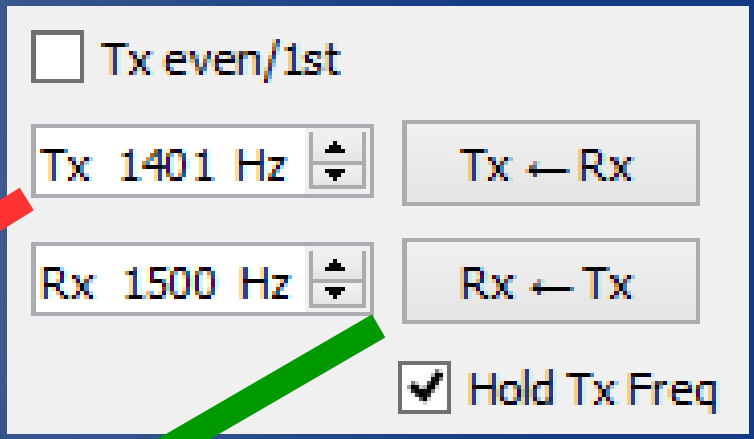
FT8 Signals on Water Fall

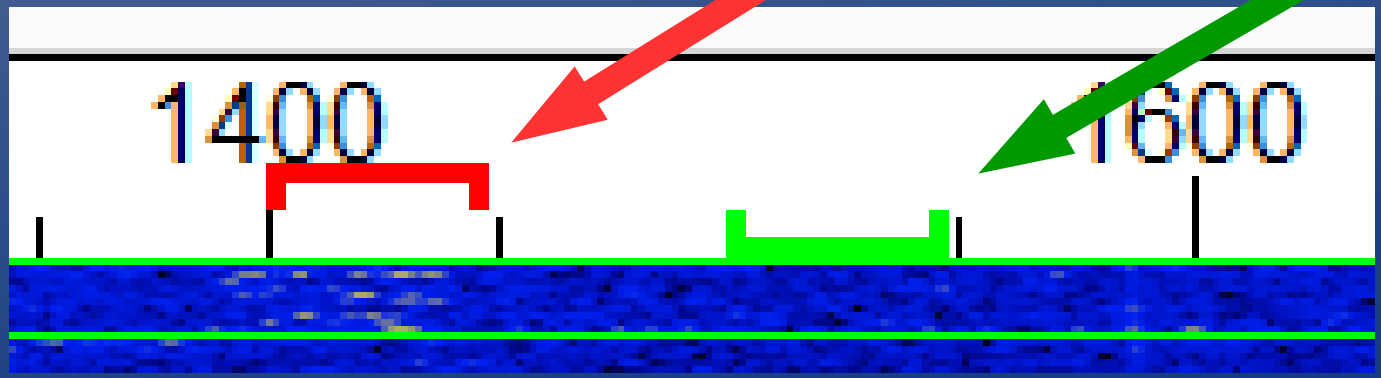
- See all FT8 signals in band pass vs time
- Select clear Tx freq.
- Strong signals are red, weak are faint white
- Rx shows all FT8 signals
- When Tx no received signals
  - Even/1st: 00 & 30 seconds
  - Odd/2nd: 15 & 45 seconds



FT8 Tx & Rx Frequencies

Ctrl-mouse click moves Tx & Rx
Shift-mouse click moves Tx
Alt-mouse click or mouse click moves Rx





Typical FT8 Contact

- Yellow WA9ONY xmit to K8BBE
- Red WA9ONY receiving K8BBE

071615	Tx		898	~	CQ WA9ONY CN85
071630	-15	0.9	898	~	WA9ONY K8BBE EN90
071645	Tx		898	~	K8BBE WA9ONY -15
071700	-15	0.9	899	~	WA9ONY K8BBE R-11
071715	Tx		898	~	K8BBE WA9ONY RRR
071730	-13	0.9	898	~	WA9ONY K8BBE 73
071745	Tx		898	~	K8BBE WA9ONY 73

RRR & 73 vs RR73 QSO

105 Sec
34 QSOs
Per hour

90 Sec
40 QSOs
Per hour

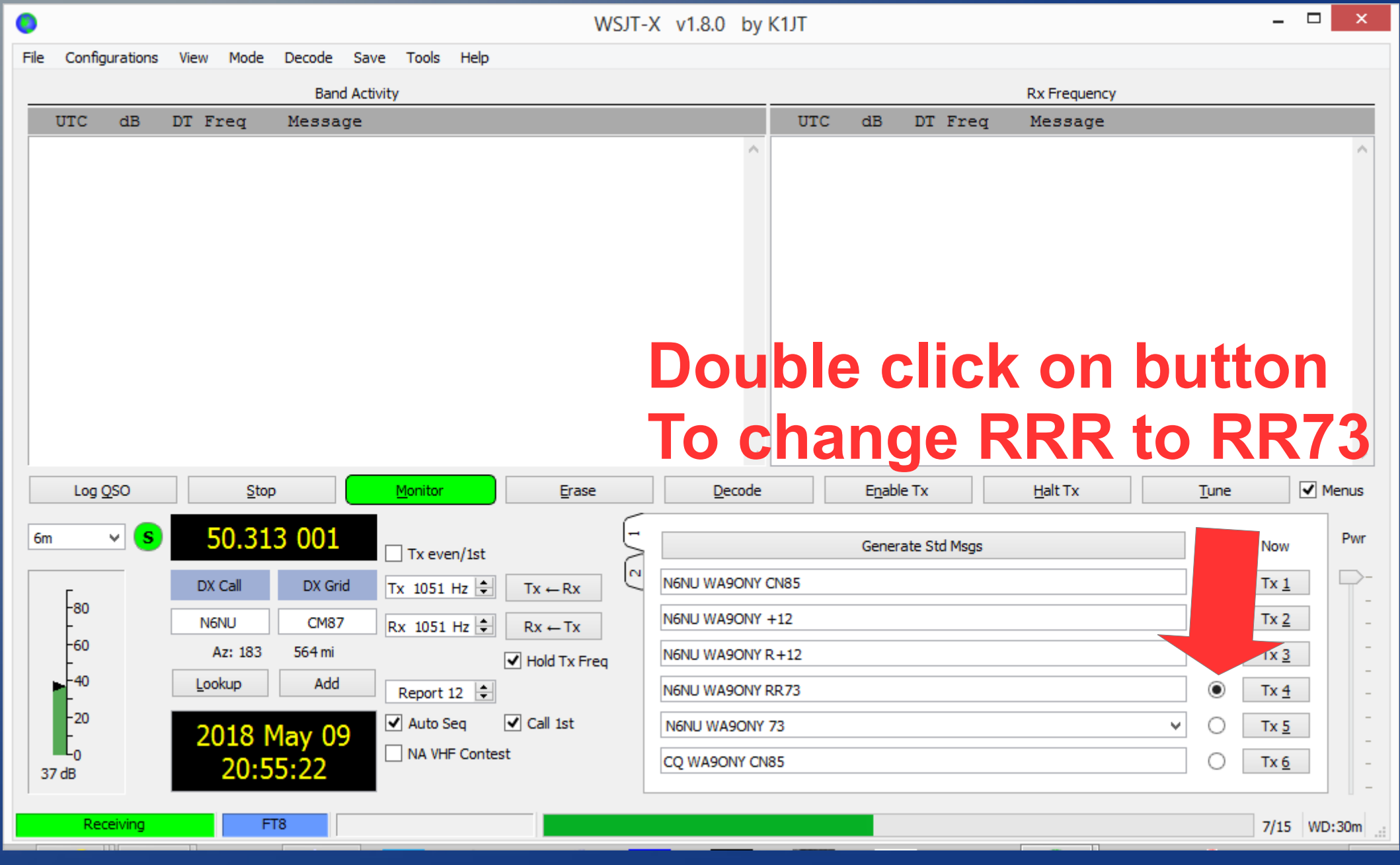
Rx Frequency

UTC	dB	DT	Freq		Message
231315	-10	0.1	898	~	CQ VK2CA QF47
231330	Tx		1248	~	VK2CA WA9ONY CN85
231345	-14	0.1	898	~	WA9ONY VK2CA -07
231400	Tx		1248	~	VK2CA WA9ONY R-14
231415	-5	0.1	898	~	WA9ONY VK2CA RRR
231430	Tx		1248	~	VK2CA WA9ONY 73
231445	-8	0.1	898	~	WA9ONY VK2CA 73
231830	-10	0.1	2056	~	CQ VK7BO QE38
231849	Tx		1248	~	VK7BO WA9ONY CN85
231900	-13	0.1	2056	~	CQ VK7BO QE38
231915	Tx		1248	~	VK7BO WA9ONY CN85
231930	-9	0.1	2056	~	WA9ONY VK7BO -17
231945	Tx		1248	~	VK7BO WA9ONY R-09
232000	-15	0.1	2056	~	WA9ONY VK7BO RR73
232015	Tx		1248	~	VK7BO WA9ONY 73

RRR, 73 & RR73 Std Messages

VK7BO WA9ONY CN85	VK7BO WA9ONY CN85
VK7BO WA9ONY -15	VK7BO WA9ONY -15
VK7BO WA9ONY R-15	VK7BO WA9ONY R-15
VK7BO WA9ONY RRR	VK7BO WA9ONY RR73
VK7BO WA9ONY 73	VK7BO WA9ONY 73
CQ WA9ONY CN85	CQ WA9ONY CN85

Using RR73 Message



QSO Repeat of 73 Message

005415	10	0.3	1749	~	NU8B	KB7RUQ	73
005430	Tx		2198	~	KB7RUQ	WA9ONY	CN85
005500	Tx		2198	~	KB7RUQ	WA9ONY	CN85
005530	Tx		844	~	KB7RUQ	WA9ONY	CN85
005600	Tx		844	~	KB7RUQ	WA9ONY	CN85
005615	0	0.3	1749	~	WA9ONY	KB7RUQ	-10
005630	Tx		844	~	KB7RUQ	WA9ONY	R+00
005645	10	0.3	844	~	WA9ONY	KB7RUQ	RRR
005700	Tx		844	~	KB7RUQ	WA9ONY	73
005715	6	0.3	844	~	WA9ONY	KB7RUQ	RRR
005735	Tx		844	~	KB7RUQ	WA9ONY	73
005745	4	0.3	844	~	WA9ONY	KB7RUQ	73

YB8TK QSO Repeat 73

075830	-3	0.6	1230	~	CQ NA YB8TK PJ21
075845	Tx		356	~	YB8TK WA9ONY CN85
075900	-1	0.5	1230	~	CQ NA YB8TK PJ21
075915	Tx		356	~	YB8TK WA9ONY CN85
075930	-2	0.6	1230	~	CQ NA YB8TK PJ21
075945	Tx		356	~	YB8TK WA9ONY CN85
080000	-5	0.5	1230	~	CQ NA YB8TK PJ21
080015	Tx		450	~	YB8TK WA9ONY CN85
080030	-4	0.6	1230	~	WA9ONY YB8TK -11
080045	Tx		450	~	YB8TK WA9ONY R-04
080100	-3	0.5	1230	~	WA9ONY YB8TK RRR
080115	Tx		450	~	YB8TK WA9ONY 73
080130	-4	0.6	1230	~	WA9ONY YB8TK RRR
080151	Tx		450	~	YB8TK WA9ONY 73
080158	Tx		450	~	YB8TK WA9ONY 73
080200	-4	0.6	1230	~	WA9ONY YB8TK 73
080215	Tx		450	~	YB8TK WA9ONY 73
080230	-2	0.7	1231	~	KB6C YB8TK -01

DX Call	DX Grid
YB8TK	PJ21
Az: 288	7220 mi

CQ & Tail Ending QSO

163115	Tx		1508	~	CQ WA9ONY CN85
163145	Tx		1508	~	CQ WA9ONY CN85
163200	10	0.1	1508	~	WA9ONY WJ6T DM05
163215	Tx		1508	~	WJ6T WA9ONY +10
163230	13	0.2	1508	~	WA9ONY WJ6T R+10
163245	Tx		1508	~	WJ6T WA9ONY RRR
163300	13	0.1	1508	~	WA9ONY WJ6T 73
163315	Tx		1508	~	WJ6T WA9ONY 73
163330	-3	0.6	1507	~	WA9ONY KF6LYF DM13
163345	Tx		1508	~	KF6LYF WA9ONY -03
163400	-7	0.6	1507	~	WA9ONY KF6LYF R-10
163415	Tx		1508	~	KF6LYF WA9ONY RRR
163430	-15	0.6	1508	~	WA9ONY KF6LYF 73
163445	Tx		1508	~	KF6LYF WA9ONY 73

2nd Pass Decode Works When Two Stations are Top of Each Other

215430	-9	1.0	1505	~	CQ KI7VGZ DM43
215454	Tx		339	~	KI7VGZ WA9ONY CN85
215500	-6	1.0	1506	~	CQ KI7VGZ DM43
215515	Tx		339	~	KI7VGZ WA9ONY CN85
215545	Tx		339	~	KI7VGZ WA9ONY CN85
215600	-7	1.0	1506	~	WA9ONY KI7VGZ -13
215600	-15	0.5	1511	~	CQ KM5LY EM12
215615	Tx		339	~	KI7VGZ WA9ONY R-07
215630	-7	1.0	1506	~	WA9ONY KI7VGZ RRR
215645	Tx		339	~	KI7VGZ WA9ONY 73
215630	-16	0.5	1512	~	CQ KM5LY EM12
215700	-10	1.0	1506	~	WA9ONY KI7VGZ 73
215700	-19	0.5	1512	~	CQ KM5LY EM12
215715	-6	0.1	584	~	WA9ONY N5AVF -18
215735	Tx		339	~	N5AVF WA9ONY -06
215800	Tx		339	~	N5AVF WA9ONY -06
215804	Tx		339	~	N5AVF WA9ONY R-06
215830	Tx		339	~	N5AVF WA9ONY R-06
215900	Tx		339	~	N5AVF WA9ONY R-06
215930	Tx		584	~	N5AVF WA9ONY R-06
215945	-12	0.1	584	~	WA9ONY N5AVF RRR
220000	Tx		584	~	N5AVF WA9ONY 73
220015	-5	0.1	584	~	WA9ONY N5AVF 73

Change Frequency if No Response
Tx 1868 Hz to 204 Hz

233315	Tx		1868	~	N7SCT WA9ONY CN85
233330	-7	-0.4	599	~	CQ N7SCT DN50
233345	Tx		1868	~	N7SCT WA9ONY CN85
233400	-15	-0.3	599	~	CQ N7SCT DN50
233415	Tx		1868	~	N7SCT WA9ONY CN85
233430	-10	-0.3	598	~	CQ N7SCT DN50
233445	Tx		204	~	N7SCT WA9ONY CN85
233500	-10	-0.3	598	~	WA9ONY N7SCT -11
233515	Tx		204	~	N7SCT WA9ONY R-10
233545	Tx		204	~	N7SCT WA9ONY R-10
233530	-10	-0.3	597	~	WA9ONY N7SCT RRR
233545	Tx		204	~	N7SCT WA9ONY 73
233600	-19	-1.1	597	~	WA9ONY N7SCT 73

Change Frequency if No Response
Tx 456 Hz to 953 Hz

234530	-4	0.1	2101	~	CQ KG5Y EM20
234545	Tx		456	~	KG5Y WA9ONY CN85
234600	-1	0.1	2101	~	CQ KG5Y EM20
234615	Tx		456	~	KG5Y WA9ONY CN85
234630	-4	0.1	2100	~	CQ KG5Y EM20
234645	Tx		456	~	KG5Y WA9ONY CN85
234700	-6	0.1	2100	~	CQ KG5Y EM20
234715	Tx		456	~	KG5Y WA9ONY CN85
234730	-5	0.1	2100	~	CQ KG5Y EM20
234745	Tx		953	~	KG5Y WA9ONY CN85
234800	-5	0.1	2100	~	WA9ONY KG5Y -15
234815	Tx		953	~	KG5Y WA9ONY R-05
234830	0	0.1	2100	~	WA9ONY KG5Y RRR
234845	Tx		953	~	KG5Y WA9ONY 73
234900	-3	0.1	2100	~	WA9ONY KG5Y 73

No Grid Location Received Contact

- ND4Q starts QSO with signal report
- ND4Q does not send grid location
- Causes problems when working complex call signs

003245	Tx		767	~	CQ WA9ONY CN85
003300	4	0.1	753	~	WA9ONY ND4Q -11
003315	Tx		767	~	ND4Q WA9ONY R+04
003330	10	0.1	753	~	WA9ONY ND4Q RR73
003345	Tx		767	~	ND4Q WA9ONY 73

75 Sec per QSO, 48 QSOs per hour

Tail Ending QSO
Get Grid When Station Calls CQ

004430	14	0.1	1400	~	W9YSX AK2L 73	
004457	Tx		317	~	AK2L WA9ONY CN85	
004515	Tx		317	~	AK2L WA9ONY CN85	
004530	-6	0.1	1399	~	WA9ONY AK2L -24	
004545	Tx		317	~	AK2L WA9ONY R-06	
004600	-2	0.1	1399	~	WA9ONY AK2L RRR	
004615	Tx		317	~	AK2L WA9ONY 73	
004630	-5	0.1	1399	~	WA9ONY AK2L RRR	
004648	Tx		317	~	AK2L WA9ONY 73	
004700	10	0.1	1399	~	WA9ONY AK2L 73	
004715	Tx		317	~	AK2L WA9ONY 73	
004730	-5	0.1	1399	~	CQ AK2L DM42	

RA0LX QSO No Grid Send

062815	-19	0.1	2176	~	JA5BJS RA0LX 73	
062900	Tx		381	~	RA0LX WA9ONY CN85	
062930	Tx		381	~	RA0LX WA9ONY CN85	
062945	-21	0.1	380	~	WA9ONY RA0LX -18	
063000	Tx		381	~	RA0LX WA9ONY R-21	
063015	-22	0.1	380	~	WA9ONY RA0LX RR73	
063030	Tx		381	~	RA0LX WA9ONY 73	

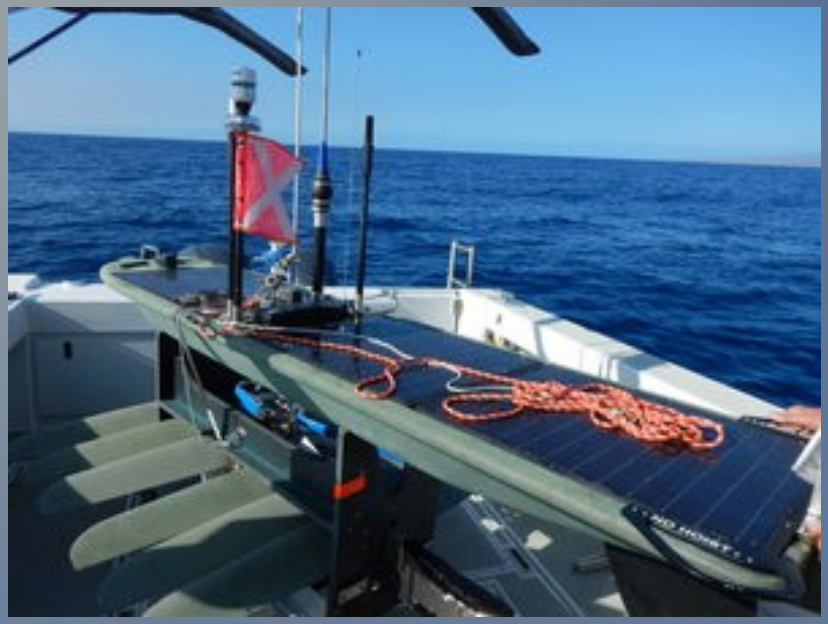
DX Call	DX Grid
RA0LX	PN65
Az: 313	4657 mi

FK/JS3LSQ Missing Message

050300	-4	0.0	913	~	CQ FK/JS3LSQ
050330	-8	0.0	912	~	KW7M JS3LSQ +03
050345	Tx		353	~	FK/JS3LSQ WA9ONY
050400	-5	0.0	912	~	KW7M JS3LSQ RR73
050415	Tx		307	~	FK/JS3LSQ WA9ONY
050445	Tx		307	~	FK/JS3LSQ WA9ONY
050500	-9	0.0	912	~	WA9ONY JS3LSQ -02
050515	Tx		331	~	JS3LSQ WA9ONY R-09
050530	-8	0.0	913	~	WA9ONY JS3LSQ -02
050545	Tx		331	~	JS3LSQ WA9ONY R-08
050615	Tx		331	~	JS3LSQ WA9ONY R-08
050630	-9	0.0	912	~	WA9ONY JS3LSQ RR73
050645	Tx		331	~	JS3LSQ WA9ONY 73
050700	-8	0.0	913	~	CQ FK/JS3LSQ
050715	-22	0.1	916	~	FK/JS3LSQ VK4NJR

VE7/LB9YH Secondary Prefix QSO

085445	7	0.1	1891	~	CQ VE7/LB9YH DN19
085500	Tx		598	~	LB9YH WA9ONY CN85
085515	10	0.1	1891	~	WA9ONY LB9YH +11
085530	Tx		598	~	LB9YH WA9ONY R+10
085545	11	0.1	1891	~	WA9ONY LB9YH RRR
085600	Tx		598	~	VE7/LB9YH 73
085615	11	0.1	1891	~	DE VE7/LB9YH 73



KH6JF/MM 20m QSO
Wave Glider Drone

182200	-8	0.0	1012	~	CQ KH6JF/MM BK59
182221	Tx		1648	~	KH6JF WA9ONY CN85
182245	Tx		654	~	KH6JF WA9ONY CN85
182300	-7	0.0	1012	~	WA9ONY KH6JF -06
182315	Tx		654	~	KH6JF WA9ONY R-07
182330	-12	0.0	1013	~	WA9ONY KH6JF RRR
182345	Tx		654	~	KH6JF/MM 73
182400	-10	0.0	1013	~	DE KH6JF/MM 73

YF9CDL QSO Repeat Signal

DX Call	DX Grid	Az: 289	8192 mi
YF9CDL	OI71		

```
)0   -9   0.1 2020 ~  CQ DX YF9CDL OI71
.5   Tx        200 ~  YF9CDL WA9ONY CN85
30  -11   0.1 2021 ~  CQ DX YF9CDL OI71
:5   Tx        200 ~  YF9CDL WA9ONY CN85
061800 -10   0.1 2021 ~  CQ DX YF9CDL OI71
061815   Tx       1700 ~  YF9CDL WA9ONY CN85
061830 -15   0.1 2021 ~  CQ DX YF9CDL OI71
061845   Tx       1700 ~  YF9CDL WA9ONY CN85
061900 -13   0.2 2021 ~  CQ DX YF9CDL OI71
061915   Tx       1700 ~  YF9CDL WA9ONY CN85
061930 -17   0.2 1700 ~  WA9ONY YF9CDL -22
061945   Tx        898 ~  YF9CDL WA9ONY R-17
062000 -10   0.1 1700 ~  WA9ONY YF9CDL -22
062015   Tx       1700 ~  YF9CDL WA9ONY R-10
062030 -11   0.2 1699 ~  WA9ONY YF9CDL RR73
062045   Tx       1700 ~  YF9CDL WA9ONY 73
```

YC2TTM QSO Repeat Signal Report

DX Call	DX Grid
YC2TTM	OI53
Az: 294	8269 mi

```
30   -6   0.1 2043 ~  CQ YC2TTM OI53
57   Tx       2231 ~  YC2TTM WA9ONY CN85
00   -3   0.1 2044 ~  CQ YC2TTM OI53
15   Tx       2231 ~  YC2TTM WA9ONY CN85
30   -4   0.1 2044 ~  CQ YC2TTM OI53
095145   Tx       2231 ~  YC2TTM WA9ONY CN85
095200   -4   0.1 2045 ~  N5DG JH8ISO QN03
095200   -5   0.1 2230 ~  WA9ONY YC2TTM -14
095215   Tx       2231 ~  YC2TTM WA9ONY R-05
095230   -6   0.1 2229 ~  WA9ONY YC2TTM -14
095245   Tx       2231 ~  YC2TTM WA9ONY R-06
095300  -11   0.1 2229 ~  WA9ONY YC2TTM -14
095315   Tx       2231 ~  YC2TTM WA9ONY R-11
095330   -5   0.1 2230 ~  WA9ONY YC2TTM RR73
095345   Tx       2231 ~  YC2TTM WA9ONY 73
```

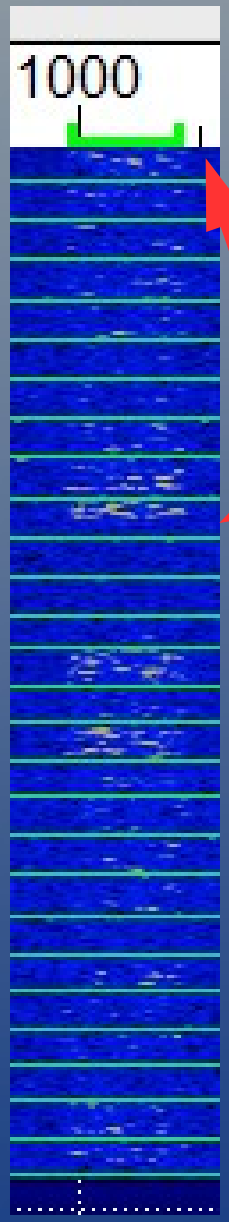
KH2L Pile Up

```
------------------------------------------- 80m
103115   -4   0.1   608 ~   KH2L N4TB EL97
103115  -12  -0.3   804 ~   KH2L KV4PO EM93
103115   -3   0.0   888 ~   KH2L K9DT EN51
103115  -14   0.2  1015 ~   KH2L VK4SN QG62
103115    9   0.0  1556 ~   KH2L NL8F AO63
103115  -20   0.1  1749 ~   N6HC WA3SFR FM19
103115    1   0.2  2158 ~   KH2L WD6R DM04
103115  -18   0.1   455 ~   N6HC JH2GZY 73
------------------------------------------- 80m
103130    9   0.2   456 ~   JH2GZY N6HC 73
103130   -4   0.1   888 ~   CQ KH2L QK23          Guam
```

Rec#	Call	Date / Time	Snt	Rec	Country	Grid	Bnd	ST	R Conf By
3771	KH2L	2018/04/26 11:41	-02	-10	Guam	QK23	80		L

Demo

Weak Sig. QSB Needs Repeats



070000	-17	0.2	997	~	W4UAT JA5RA 73
070027	Tx		452	~	JA5RA WA9ONY CN85
070045	Tx		452	~	JA5RA WA9ONY CN85
070115	Tx		452	~	JA5RA WA9ONY CN85
070145	Tx		452	~	JA5RA WA9ONY CN85
070200	-16	0.2	997	~	WA9ONY JA5RA -24
070215	Tx		452	~	JA5RA WA9ONY R-16
070245	Tx		452	~	JA5RA WA9ONY R-16
070315	Tx		452	~	JA5RA WA9ONY R-16
070345	Tx		452	~	JA5RA WA9ONY R-16
070415	Tx		452	~	JA5RA WA9ONY R-16
070445	Tx		452	~	JA5RA WA9ONY R-16
070515	Tx		452	~	JA5RA WA9ONY R-16
070545	Tx		452	~	JA5RA WA9ONY R-16
070600	-18	0.2	997	~	WA9ONY JA5RA RRR
070615	Tx		452	~	JA5RA WA9ONY 73
070630	-20	0.2	997	~	WA9ONY JA5RA 73
070645	Tx		452	~	JA5RA WA9ONY 73

Messy QSO with QSB & QRM

101845	-12	0.1	1702	~	CQ VK4FB QG62
101943	Tx		851	~	VK4FB WA9ONY CN85
102000	Tx		851	~	VK4FB WA9ONY CN85
102030	Tx		851	~	VK4FB WA9ONY CN85
102100	Tx		851	~	VK4FB WA9ONY CN85
102115	-15	0.1	1702	~	WA9ONY VK4FB -19
102130	Tx		851	~	VK4FB WA9ONY R-15
102145	-16	0.3	1710	~	N6HC W8ARE EN80
102200	Tx		851	~	VK4FB WA9ONY R-15
102230	Tx		851	~	VK4FB WA9ONY R-15
102300	Tx		851	~	VK4FB WA9ONY R-15
102315	-15	0.1	1702	~	WA9ONY VK4FB RRR
102330	Tx		851	~	VK4FB WA9ONY 73
102345	-15	0.1	1702	~	WA9ONY VK4FB RRR
102408	Tx		851	~	VK4FB WA9ONY 73
102410	Tx		851	~	VK4FB WA9ONY 73
102412	Tx		851	~	VK4FB WA9ONY 73
102415	-15	0.1	1702	~	WA9ONY VK4FB RR73
102430	Tx		851	~	VK4FB WA9ONY 73
102500	7	0.4	1704	~	CQ N6HC DM13

Messy TG9AJR QSO

UTC	dB	DT	Freq		Message
003445	-3	0.2	2007	~	WG8S TG9AJR R+10
003500	Tx		652	~	TG9AJR WA9ONY CN85
003530	Tx		652	~	TG9AJR WA9ONY CN85
003545	-6	0.2	2006	~	CQ TG9AJR EK44
003600	Tx		652	~	TG9AJR WA9ONY CN85
003615	-5	0.2	2006	~	WG8S TG9AJR R+09
003630	Tx		652	~	TG9AJR WA9ONY CN85
003645	-8	0.2	2006	~	WG8S TG9AJR 73
003700	Tx		753	~	TG9AJR WA9ONY CN85
003715	-7	0.2	2006	~	WA9ONY TG9AJR -17
003730	Tx		753	~	TG9AJR WA9ONY R-07
003745	-8	0.2	2006	~	WA9ONY TG9AJR -17
003800	Tx		753	~	TG9AJR WA9ONY R-08
003815	-7	0.2	2006	~	CQ TG9AJR EK44
003830	Tx		753	~	TG9AJR WA9ONY R-08
003845	-5	0.2	2006	~	W4MC TG9AJR +05
003900	Tx		753	~	TG9AJR WA9ONY R-08
003915	-9	0.2	2005	~	W4MC TG9AJR RR73
003930	Tx		753	~	TG9AJR WA9ONY CN85
003936	Tx		753	~	TG9AJR WA9ONY R-09
003945	-11	0.2	2005	~	WA9ONY TG9AJR -18
004000	Tx		753	~	TG9AJR WA9ONY R-11
004015	-6	0.2	2005	~	WA9ONY TG9AJR -18
004030	Tx		753	~	TG9AJR WA9ONY R-06
004045	-6	0.2	2005	~	WA9ONY TG9AJR R-18
004100	Tx		753	~	TG9AJR WA9ONY RRR
004115	-4	0.2	2005	~	WA9ONY TG9AJR RR73
004130	Tx		753	~	TG9AJR WA9ONY 73
004145	-5	0.2	2005	~	WA9ONY TG9AJR 73
004215	-9	0.2	2005	~	CQ TG9AJR EK44

Station	
Call Sign	WA9ONY
DXCC	UNITED STATES OF AMERICA (291)
CQ Zone	03
ITU Zone	06
Grid	CN85TQ
State	Washington (WA)
County	Clark
Worked Station	
Worked	TG9AJR
DXCC	GUATEMALA (76)
CQ Zone	07
ITU Zone	11 (Inferred; user did not specify zone)
Grid	EK44SL
Date/Time	2018-05-10 00:39:00
Mode	FT8 (DATA)
Band	17M
Frequency	18.10075
QSL	2018-05-11 06:22:01

Move to Other Station Freq

113300	7	0.1	1131	~	CQ JR1XIS QM05
113321	Tx		600	~	JR1XIS WA9ONY CN85
113330	7	0.0	1131	~	CQ JR1XIS QM05
113345	Tx		600	~	JR1XIS WA9ONY CN85
113415	Tx		600	~	JR1XIS WA9ONY CN85
113430	5	0.0	1131	~	WA9ONY JR1XIS -17
113445	Tx		600	~	JR1XIS WA9ONY R+05
113500	7	0.0	1131	~	WA9ONY JR1XIS -17
113515	Tx		600	~	JR1XIS WA9ONY R+07
113530	6	0.1	1131	~	WA9ONY JR1XIS -17
113545	Tx		600	~	JR1XIS WA9ONY R+06
113600	7	0.0	1131	~	WA9ONY JR1XIS -17
113615	Tx		600	~	JR1XIS WA9ONY R+07
113645	Tx		1131	~	JR1XIS WA9ONY R+07
113700	5	0.1	1131	~	WA9ONY JR1XIS RR73
113715	Tx		1131	~	JR1XIS WA9ONY 73
113730	5	0.0	1131	~	WA9ONY JR1XIS 73
113800	6	0.1	1131	~	CQ JR1XIS QM05

Persistence Pays Off
7 Minutes Contact

050415	-9	0.1	615	~	KV4N KB8MAF 73
050442	Tx		701	~	KB8MAF WA9ONY CN85
050500	Tx		701	~	KB8MAF WA9ONY CN85
050530	Tx		701	~	KB8MAF WA9ONY CN85
050545	-10	0.1	701	~	WA9ONY KB8MAF -17
050600	Tx		701	~	KB8MAF WA9ONY R-10
050615	-9	0.1	701	~	WA9ONY KB8MAF -17
050630	Tx		701	~	KB8MAF WA9ONY R-09
050645	-9	0.1	701	~	WA9ONY KB8MAF -17
050700	Tx		701	~	KB8MAF WA9ONY R-09
050715	-11	0.1	701	~	WA9ONY KB8MAF -17
050730	Tx		701	~	KB8MAF WA9ONY R-11
050800	Tx		701	~	KB8MAF WA9ONY R-11
050830	Tx		701	~	KB8MAF WA9ONY R-11
050900	Tx		701	~	KB8MAF WA9ONY R-11
050930	Tx		701	~	KB8MAF WA9ONY R-11
051000	Tx		701	~	KB8MAF WA9ONY R-11
051015	-8	0.1	701	~	WA9ONY KB8MAF RRR
051030	Tx		701	~	KB8MAF WA9ONY 73
051045	-10	-0.1	701	~	WA9ONY KB8MAF 73
051100	Tx		701	~	KB8MAF WA9ONY 73

	Call sign	Worked	Date/Time	Band	Mode	Freq	QSL
Details	WA9ONY	KW7E	2018-05-28 01:13:00	17M	FT8	18.10040	UNITED STATES OF AMERICA

19 Minute Contact

```
005230   -6   0.1 1399 ~  NC4AB AK2L 73
005300  -12   0.1 1399 ~  CQ AK2L DM42
005330   -8   0.1 1399 ~  CQ AK2L DM42
005400  -10   0.1 1399 ~  VK4BRT AK2L -24
005430   -3  -0.2 1399 ~  VK4BRT AK2L RRR
005445   -7   0.1 1333 ~  CQ KW7E DM33
005513   Tx         317 ~  KW7E WA9ONY CN85
005515  -12   0.1 1334 ~  CQ KW7E DM33
005530   Tx         317 ~  KW7E WA9ONY CN85
005545  -15   0.1 1335 ~  KQ0J KW7E +01
005600   Tx         317 ~  KW7E WA9ONY CN85
005615  -13   0.1 1337 ~  KQ0J KW7E RRR
005630  -16   0.1 1334 ~  KW7E KQ0J 73
005645   -8   0.1 1340 ~  KQ0J KW7E 73
005700   Tx         317 ~  KW7E WA9ONY CN85
005715  -16   0.1 1343 ~  CQ KW7E DM33
005730   Tx         317 ~  KW7E WA9ONY CN85
005745  -15   0.1 1353 ~  WA9ONY KW7E -21
005800   Tx         317 ~  KW7E WA9ONY CN85
005811   Tx         317 ~  KW7E WA9ONY R-07
005815  -13   0.1 1370 ~  WA9ONY KW7E -21
005830   Tx         317 ~  KW7E WA9ONY R-13
005900   Tx         317 ~  KW7E WA9ONY R-13
005930   Tx         317 ~  KW7E WA9ONY R-13
010000   Tx         317 ~  KW7E WA9ONY R-13
010030   Tx         317 ~  KW7E WA9ONY R-13
010100   Tx         317 ~  KW7E WA9ONY R-13
```

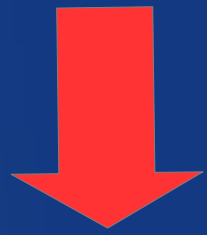
```
010730   Tx         317 ~  KW7E WA9ONY R-09
010800   Tx         317 ~  KW7E WA9ONY R-09
010830   Tx         317 ~  KW7E WA9ONY R-09
010900   Tx         317 ~  KW7E WA9ONY R-09
010815  -14   0.1 1220 ~  CQ KW7E DM33
010913   Tx         317 ~  KW7E WA9ONY CN85
010930   Tx         317 ~  KW7E WA9ONY R-14
010945  -18   0.1 1221 ~  KK0CQ KW7E R-21
011000   Tx         317 ~  KW7E WA9ONY CN85
011015  -13   0.1 1222 ~  KK0CQ KW7E R-21
011030   Tx         317 ~  KW7E WA9ONY CN85
011033   Tx         317 ~  KW7E WA9ONY R-14
011045  -13   0.1 1222 ~  KK0CQ KW7E R-21
011100   Tx         317 ~  KW7E WA9ONY R-14
011115  -10   0.1 1222 ~  KK0CQ KW7E R-21
011130   Tx         317 ~  KW7E WA9ONY R-14
011145  -13   0.1 1222 ~  KK0CQ KW7E R-21
011200   Tx         317 ~  KW7E WA9ONY R-14
011215  -16   0.1 1221 ~  KK0CQ KW7E R-21
011230   Tx         317 ~  KW7E WA9ONY R-14
011245   -9   0.1 1221 ~  KK0CQ KW7E DM33
011300   Tx         317 ~  KW7E WA9ONY R-14
011315   -6   0.1 1222 ~  KK0CQ KW7E R-20
011330   Tx         317 ~  KW7E WA9ONY R-14
011345  -15   0.1 1222 ~  KK0CQ KW7E 73
011400   Tx         396 ~  KW7E WA9ONY CN85
011406   Tx         396 ~  KW7E WA9ONY R-15
011430   Tx         396 ~  KW7E WA9ONY R-15
011500   Tx         396 ~  KW7E WA9ONY R-15
011515   -8   0.1 1226 ~  WA9ONY KW7E RRR
011530   Tx         396 ~  KW7E WA9ONY 73
011545   -9   0.1 1227 ~  WA9ONY KW7E RRR
011600   Tx         396 ~  KW7E WA9ONY 73
011615  -11   0.1 1123 ~  WA9ONY KW7E 73
011630   Tx         396 ~  KW7E WA9ONY 73
```

Contact or No Contact?

UTC	dB	DT	Freq		Message
191730	-11	0.3	1487	~	CQ KG6PH EM13
191745	Tx		1793	~	KG6PH WA9ONY CN85
191800	-11	0.3	1487	~	WA9ONY KG6PH -20
191815	Tx		1793	~	KG6PH WA9ONY R-11
191830	-13	0.3	1487	~	WA9ONY KG6PH -20
191845	Tx		1793	~	KG6PH WA9ONY R-13
191900	-14	0.3	1487	~	WA9ONY KG6PH -20
191915	Tx		1793	~	KG6PH WA9ONY R-14
191930	-9	0.4	1487	~	WA9ONY KG6PH -20
191945	Tx		1793	~	KG6PH WA9ONY R-09
192000	-12	0.3	1487	~	WA9ONY KG6PH -20
192015	Tx		1793	~	KG6PH WA9ONY R-12
192030	-12	0.3	1487	~	WA9ONY KG6PH -20
192045	Tx		1793	~	KG6PH WA9ONY R-12
192100	-18	0.3	1487	~	WA9ONY KG6PH -20
192115	Tx		1793	~	KG6PH WA9ONY R-18
192145	Tx		1793	~	KG6PH WA9ONY R-18
192200	-15	0.2	1487	~	WA9ONY KG6PH -20
192215	Tx		1793	~	KG6PH WA9ONY R-15
192230	-18	0.3	1487	~	WA9ONY KG6PH -20
192245	Tx		1793	~	KG6PH WA9ONY R-18
192300	-17	0.3	1487	~	WA9ONY KG6PH -20
192315	Tx		1793	~	KG6PH WA9ONY R-17
192330	-17	1.3	1487	~	WA9ONY KG6PH -20
192345	Tx		1793	~	KG6PH WA9ONY R-17
192400	-19	0.3	1488	~	CQ KG6PH EM13

Be Careful Changing CQ

Only 2 letters: NA, SA, AS, OC, OR, WA, etc

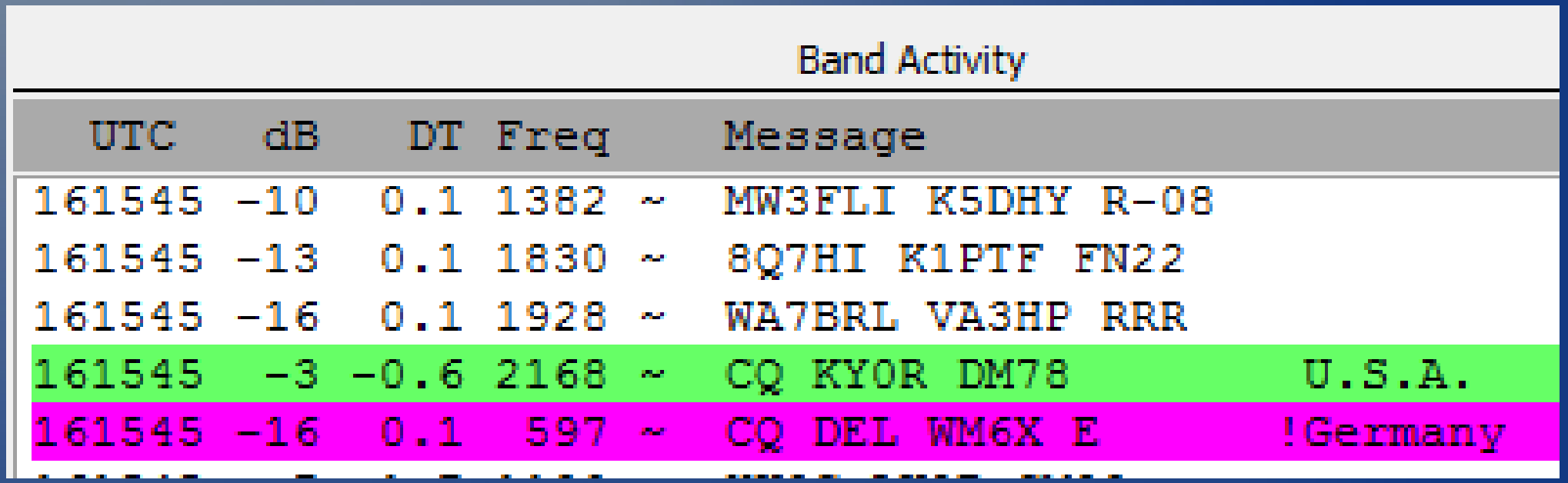


```
233215 -24   0.1 1105 ~  CQ AQP NE9K          !Pakistan

030030   2   0.2  671 ~  CQ ASIA W8GC         !Pakistan
```

Use Standard 2 Letter State Codes

- Cannot double click on WM6X



Band Activity

UTC	dB	DT	Freq		Message	
161545	-10	0.1	1382	~	MW3FLI K5DHY R-08	
161545	-13	0.1	1830	~	8Q7HI K1PTF FN22	
161545	-16	0.1	1928	~	WA7BRL VA3HP RRR	
161545	-3	-0.6	2168	~	CQ KY0R DM78	U.S.A.
161545	-16	0.1	597	~	CQ DEL WM6X E	!Germany

Valid CQs to Regions

Only 2 letters: NA, SA, AS, OC, OR, WA, etc

```
045545    7 -0.3 1051 ~   CQ DX NF7E DM45      ~U.S.A.
052615  -10  0.1   573 ~   CQ EU K6FOD DM04     ~U.S.A.
151545   -2  0.3   255 ~   CQ MD WB4NFG EM82    ~U.S.A.
151745   -8  0.3   256 ~   CQ IN WB4NFG EM82    ~U.S.A.
153330  -15  0.0  1587 ~   CQ VT KB3HHA FM19    ~U.S.A.
202730    4  0.1  1452 ~   CQ ND K7SWF DM24     ~U.S.A.
171130  -12  0.1  1163 ~   CQ WV W4KCM EM95     ~U.S.A.
```

3 letters become a free form text message

Defective Grid Square QE3

- Cannot double click on VK7GL

```
053015 -10   0.1 1627 ~  CQ VK7GL QE3          ~Australia
```

KT7V on 2 Frequencies
Could be Receiver Overload

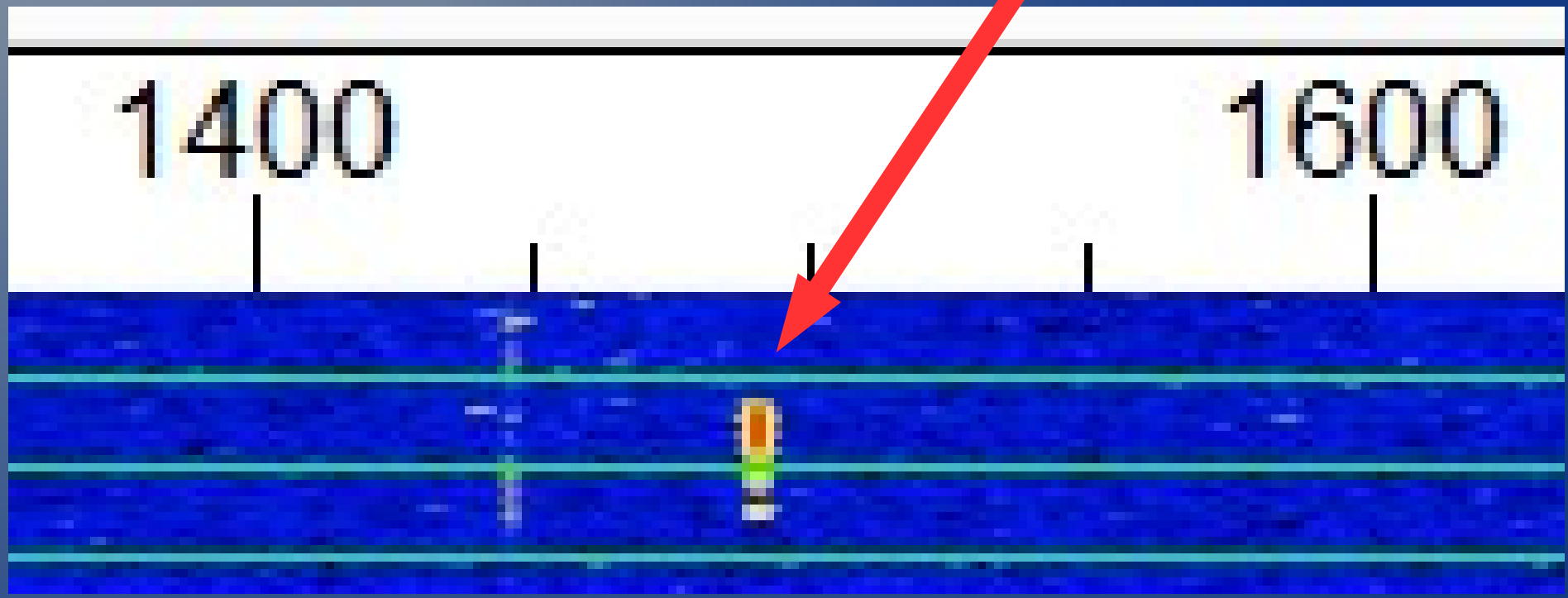
UTC	dB	DT	Freq		Message	
121315	-2	-0.0	649	~	CQ 7N4SJX PM95	
121315	-24	0.1	2084	~	VK7AP KT7V	CN85
121315	12	0.1	2204	~	VK7AP KT7V	CN85

Warning: FT8 Decode Errors
Sometimes Noise Signals are Decoded

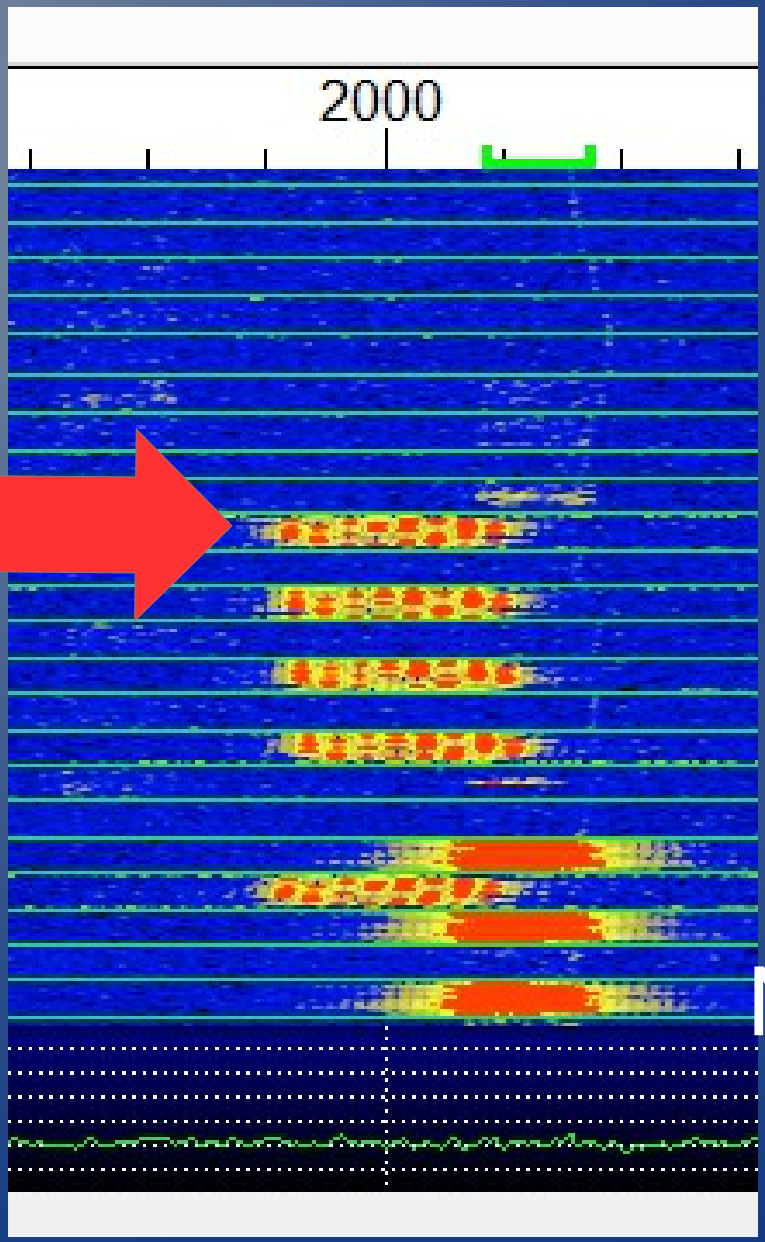
Band Activity

UTC	dB	DT	Freq		Message	
----------						6m
103700	-24	2.3	1221	~	253ECM 1Z0GPG	EP06
----------						6m
130030	-24	1.7	1634	~	Q05CVS XR0IEE	IH88

Example of FT8 Tx Tune



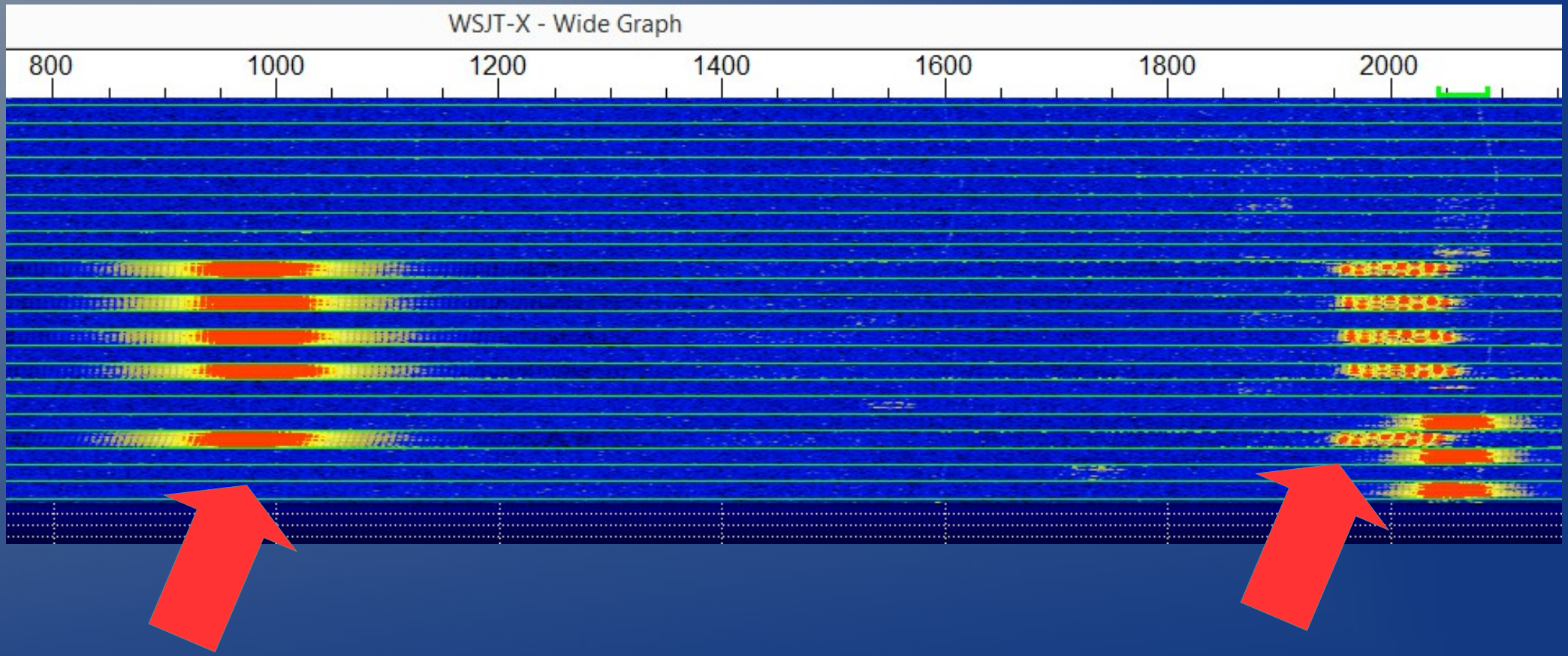
Strange 100 Hz Wide Signals



Normal FT8

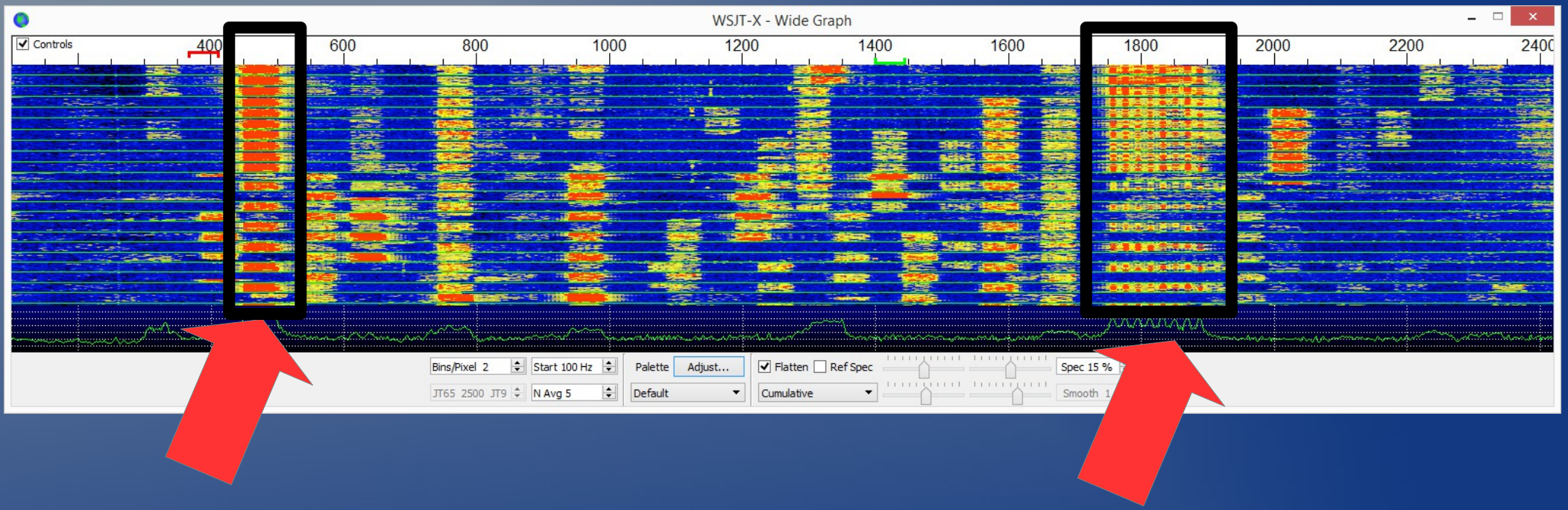
Transmitter Needs Adjustment

- Most likely the ALC needs to be reduced



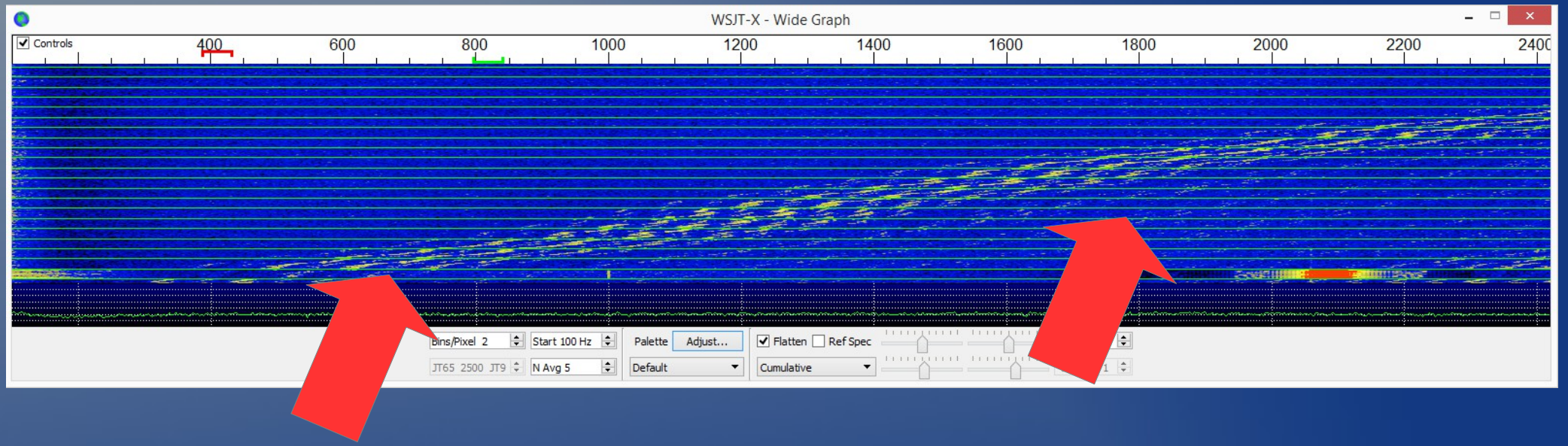
Transmitter Needs Adjustment

- Most likely the ALC needs to be reduced



QRN Drifting in Frequency

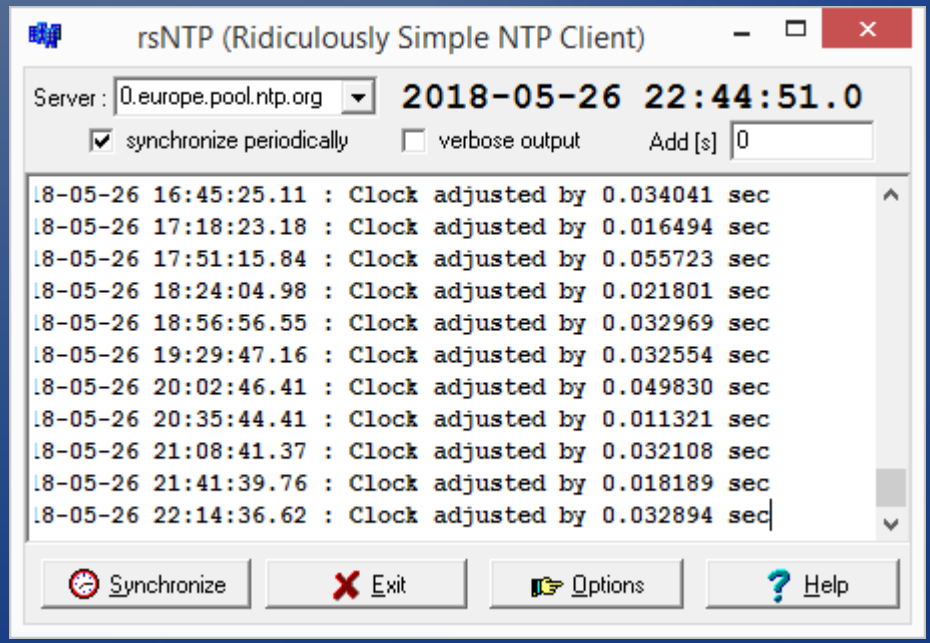
- Most likely AC/DC adapter power supply



FT8 Time Keeping

WSJT-X

rsNTP



rsNTP Software

www.qsl.net/dl4yhf/rsNTP/rsNTP.htm

Ridiculously Simple NTP Client

File: ?\rsNTP\rsNTP.htm
Web: www.qsl.net/dl4yhf/rsNTP/rsNTP.htm
Author: Wolfgang 'Wolf' DL4YHF
Date: 2016-05-29

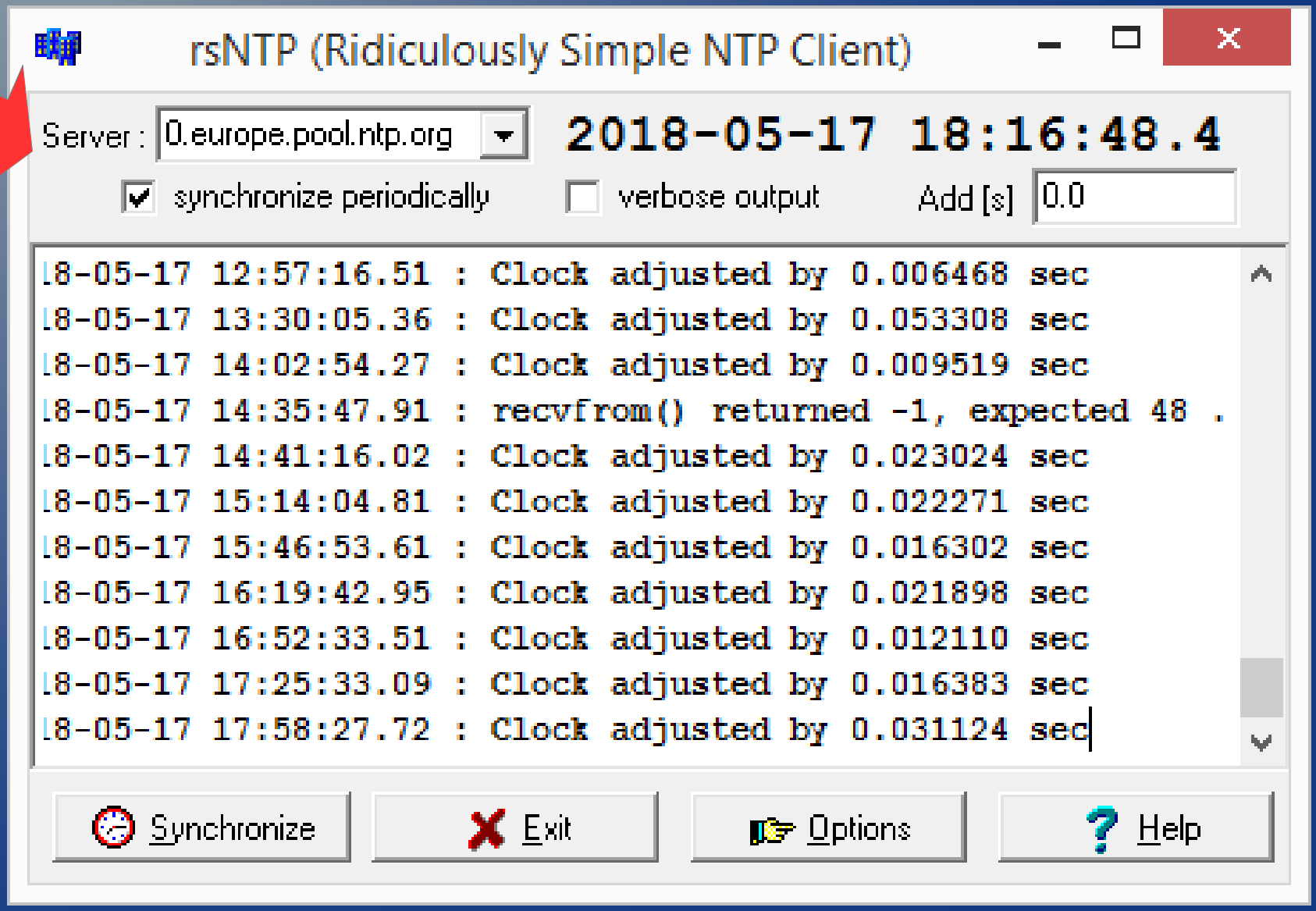
Certain applications (like WSPR, a weak-signal digital mode for amateur radio) require a precise timing, and thus a precisely set system clock (date and time).
Since the available 'Internet Time' service provided by windows itself didn't work reliably, and other time-keeping software packages were difficult to install (and gave no indication of what they were doing, all they did was running as a blackbox aka 'service' in the background), the author wrote this implementation of a 'ridiculously simple NTP (Network Time Protocol) client'.
It needs no installation, doesn't install drivers, services, and other obscure stuff.
There is only one catch (Windows 7 / 8 / Vista users beware):
To successfully adjust the PC's system time to eliminate the clock error (offset in seconds) measured by NTP, it must be run 'as administrator'. The internet is full of how-to's about running a program 'as administator', so there's no need for details here. Just in short form: After unpacking the software into a directory of your choice,
right-click on 'NtpClient.exe',
select 'properties', 'compatibility',
set the checkmark 'run as administrator'.
This way, the program will be run 'as administrator' whenever you double-click its icon. The dreadful UAC may still prompt you with a warning whenever starting it this way - any suggestions how to get rid of this annoyance are most welcome.

When starting the program for the first time, select an NTP server in your country, or at least on your continent. The combo box in the upper left corner contains a list of popular servers, but you can type the hostname or numeric IP address ('dotted address') into that field.
For most parts of the world (and if you don't have access to an NTP server in your *local* network), it is recommended to use one of the NTP Pool addresses. By virtue of a DNS trick, the pool automatically picks the 'best' NTP server currently available for you.
The rsNTP window shows the current date and time ***in UTC***, formatted according to ISO 8601, in the upper part.
To keep it simple, rsNTP doesn't care for 'local time' and national preferrences to format date and time.

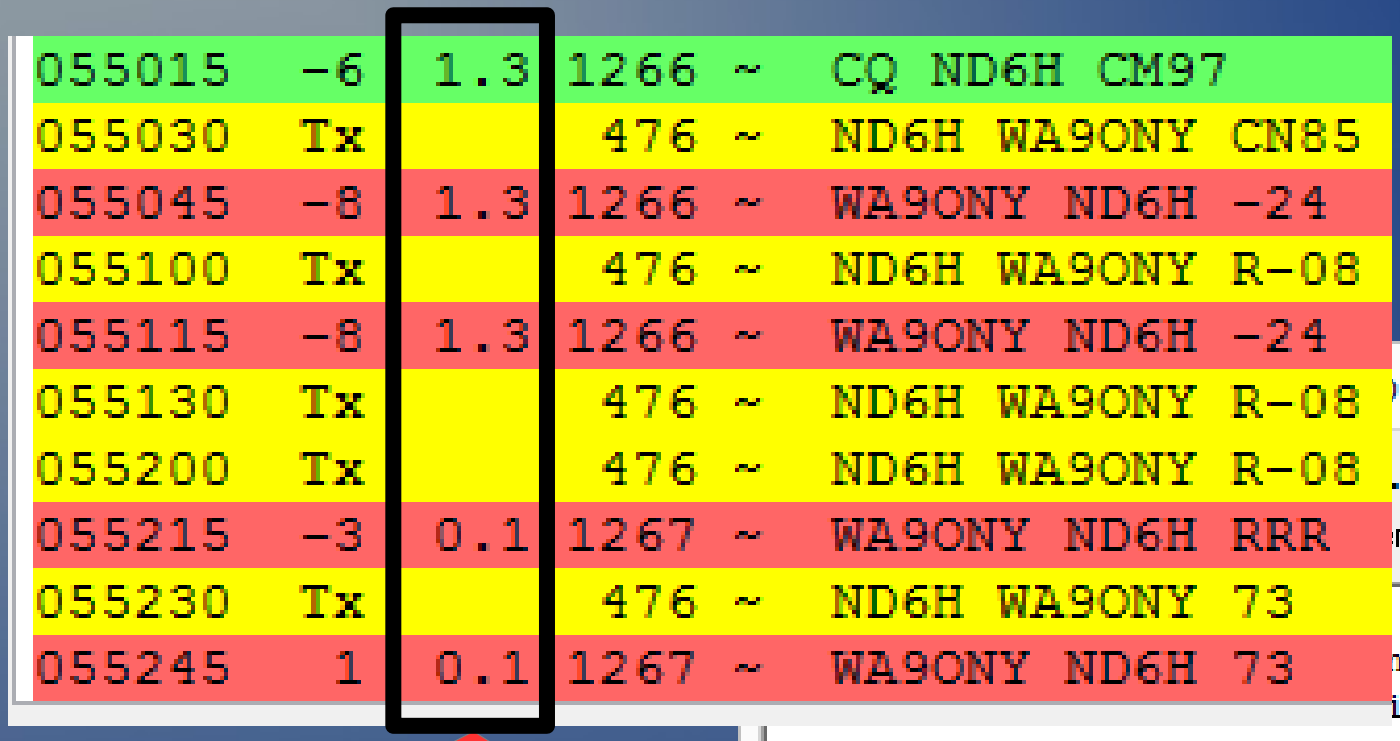
The program doesn't need an installer. It is provided together with the sourcecode (written in an ancient version of Borland C++Builder), which can be downloaded from here.

Enjoy !
73, Wolfgang "Wolf" Buescher DL4YHF .

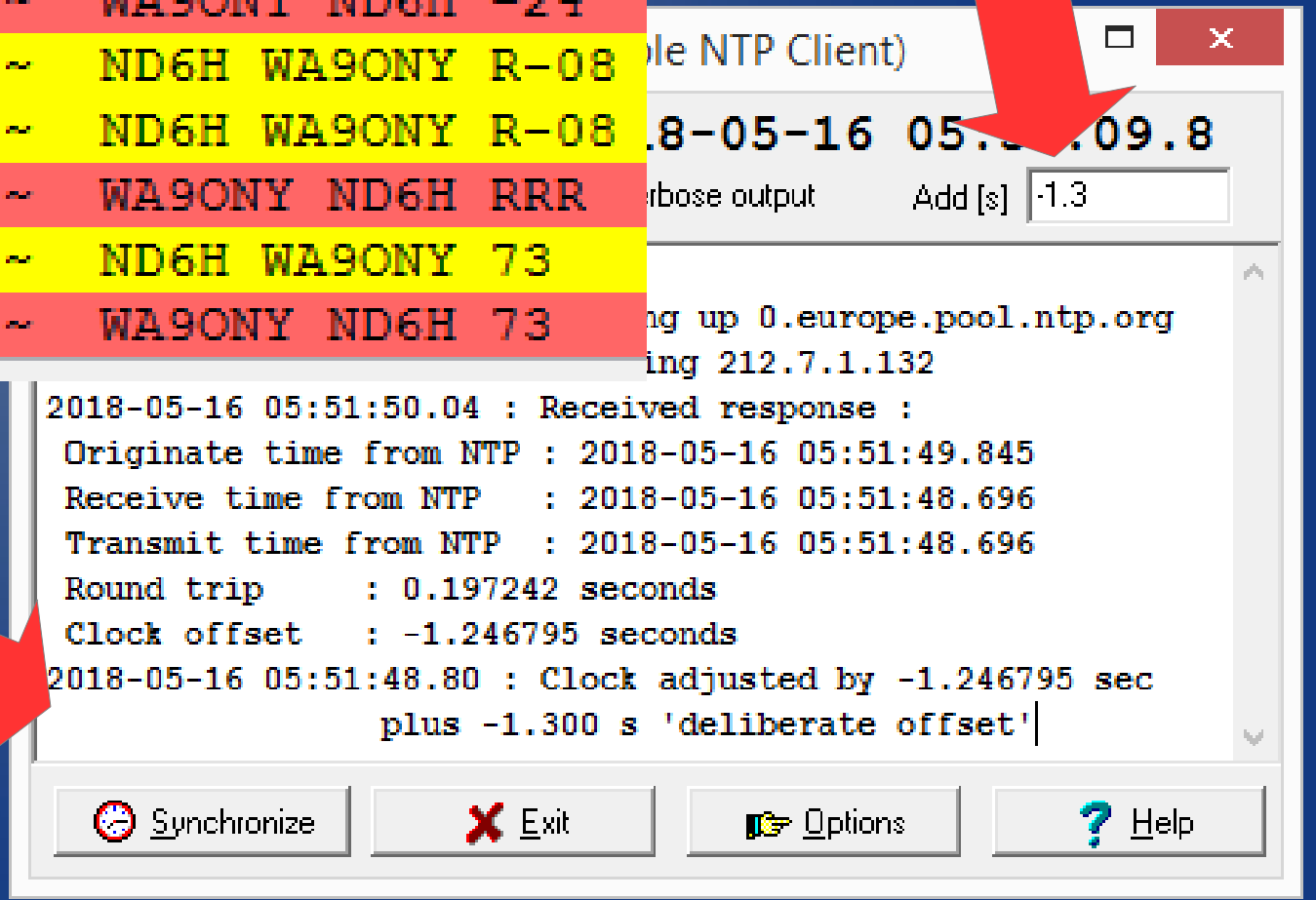
RsNTP Accurate Time
www.qsl.net/dl4yhf/rsNTP/rsNTP.htm



Adjust DT to 0.1 Match ND6H



055015	-6	1.3	1266	~	CQ ND6H CM97
055030	Tx		476	~	ND6H WA9ONY CN85
055045	-8	1.3	1266	~	WA9ONY ND6H -24
055100	Tx		476	~	ND6H WA9ONY R-08
055115	-8	1.3	1266	~	WA9ONY ND6H -24
055130	Tx		476	~	ND6H WA9ONY R-08
055200	Tx		476	~	ND6H WA9ONY R-08
055215	-3	0.1	1267	~	WA9ONY ND6H RRR
055230	Tx		476	~	ND6H WA9ONY 73
055245	1	0.1	1267	~	WA9ONY ND6H 73



Adjust DT to 0.0 to Match VK2MZ

130315	Tx		353	~	CQ WA9ONY CN85
130330	-24	1.6	354	~	WA9ONY VK2HDZ QF57
130345	Tx		353	~	VK2HDZ WA9ONY -24
130415	Tx		353	~	VK2HDZ WA9ONY -24
130445	Tx		353	~	VK2HDZ WA9ONY -24
130515	Tx		353	~	VK2HDZ WA9ONY -24
130530	-20	-0.0	348	~	WA9ONY VK2HDZ R-18
130530	-9	-1.5	1318	~	WA9ONY JI1AJO PM95
130545	Tx		353	~	VK2HDZ WA9ONY RRR
130600	-17	0.0	348	~	WA9ONY VK2HDZ 73
130615	Tx		353	~	VK2HDZ WA9ONY 73
130530	-9	-1.5	1318	~	WA9ONY JI1AJO PM95
130646	Tx		353	~	JI1AJO WA9ONY -09
130700	-7	0.1	1318	~	WA9ONY JI1AJO R-13
130715	Tx		353	~	JI1AJO WA9ONY RRR
130730	-6	0.2	1319	~	WA9ONY JI1AJO 73
130745	Tx		353	~	JI1AJO WA9ONY 73

(Ridiculously Simple NTP Client)

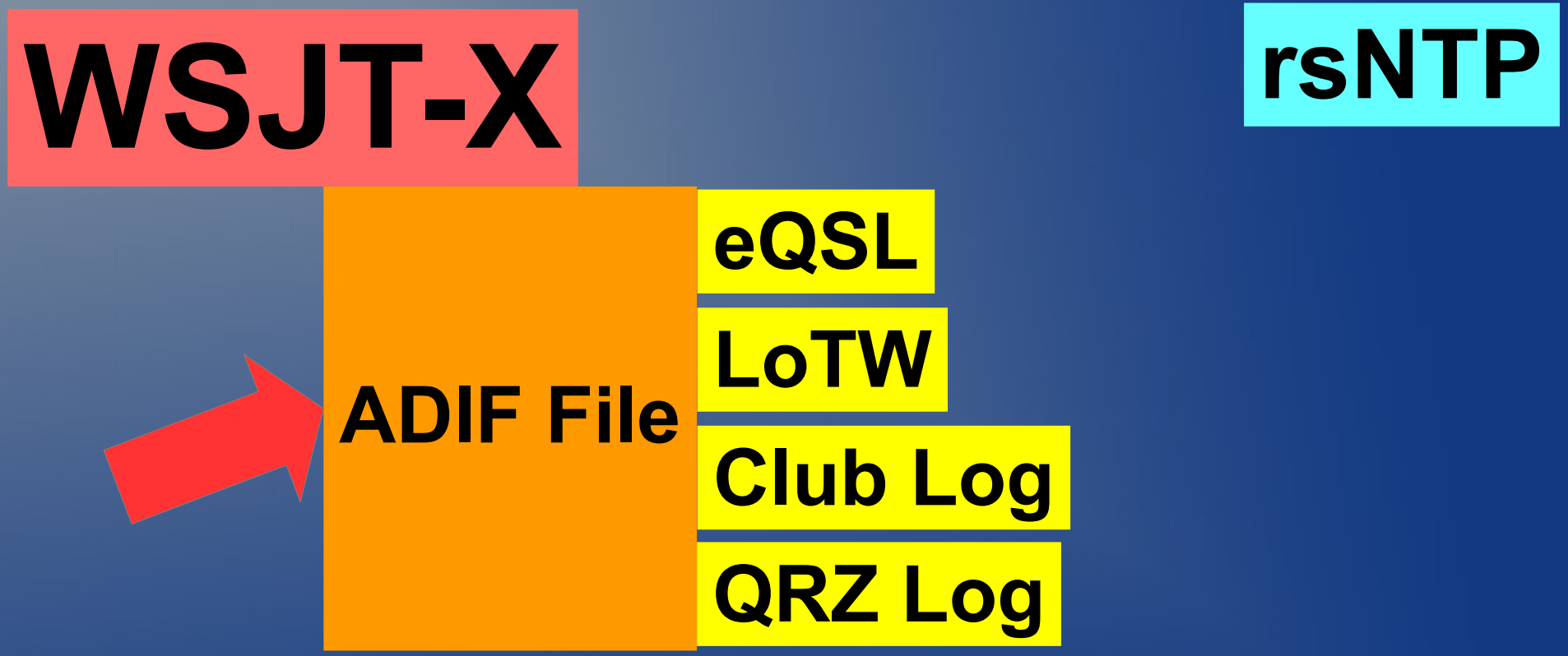
pool.ntp.org 2018-05-27 13:[illegible]32.4

ize periodically verbose output Add [s] -1.6

..
:05:11.72 : Looking up 0.europe.pool.ntp.org
:05:11.76 : Querying 212.83.158.83
2018-05-27 13:05:11.92 : Received response :
Originate time from NTP : 2018-05-27 13:05:11.765
Receive time from NTP : 2018-05-27 13:05:10.301
Transmit time from NTP : 2018-05-27 13:05:10.301
Round trip : 0.163097 seconds
Clock offset : -1.545552 seconds
2018-05-27 13:05:10.38 : Clock adjusted by -1.545552 sec
plus -1.600 s 'deliberate offset'

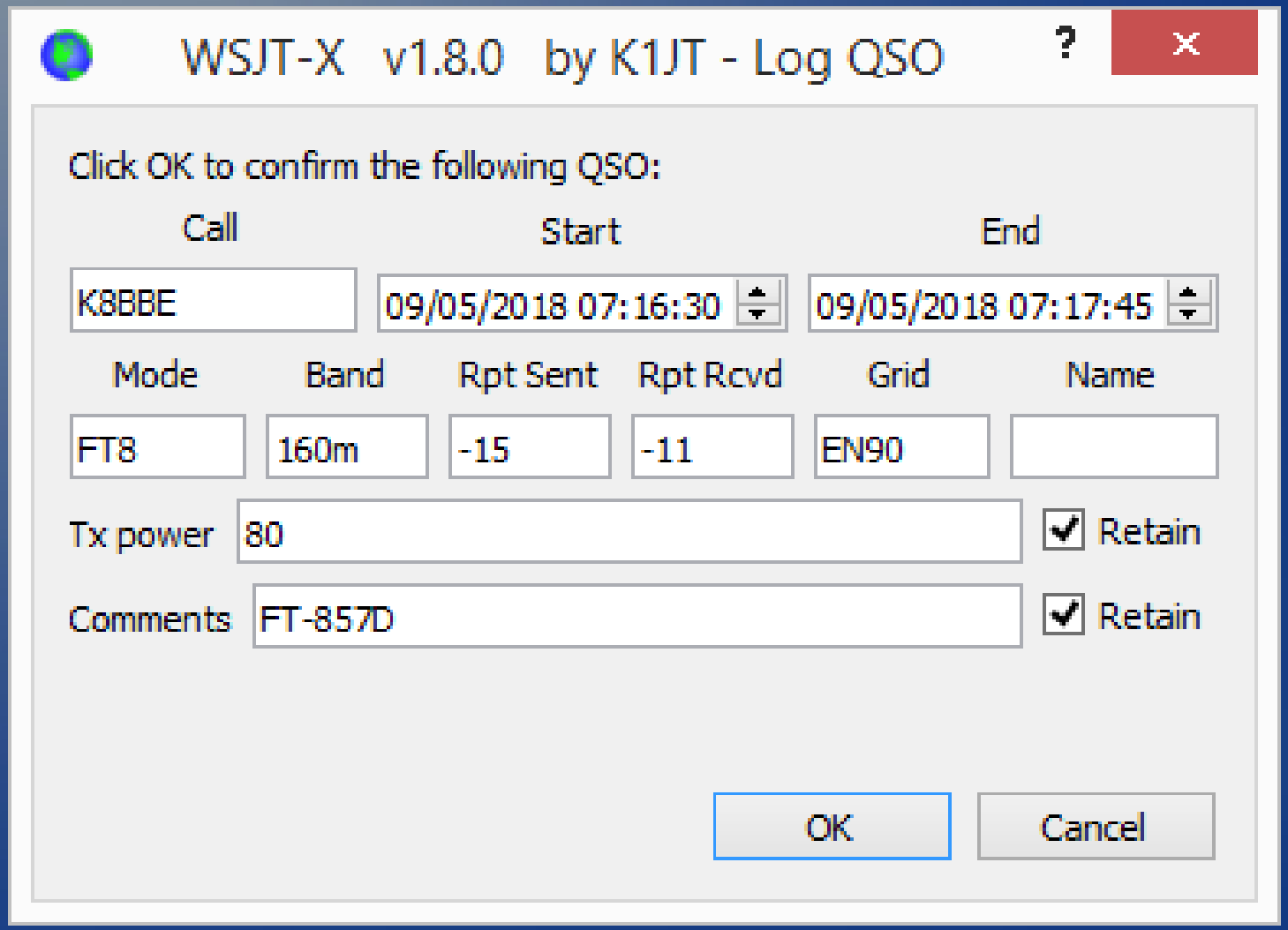
Synchronize Exit Options Help

FT8 Basic eLogging

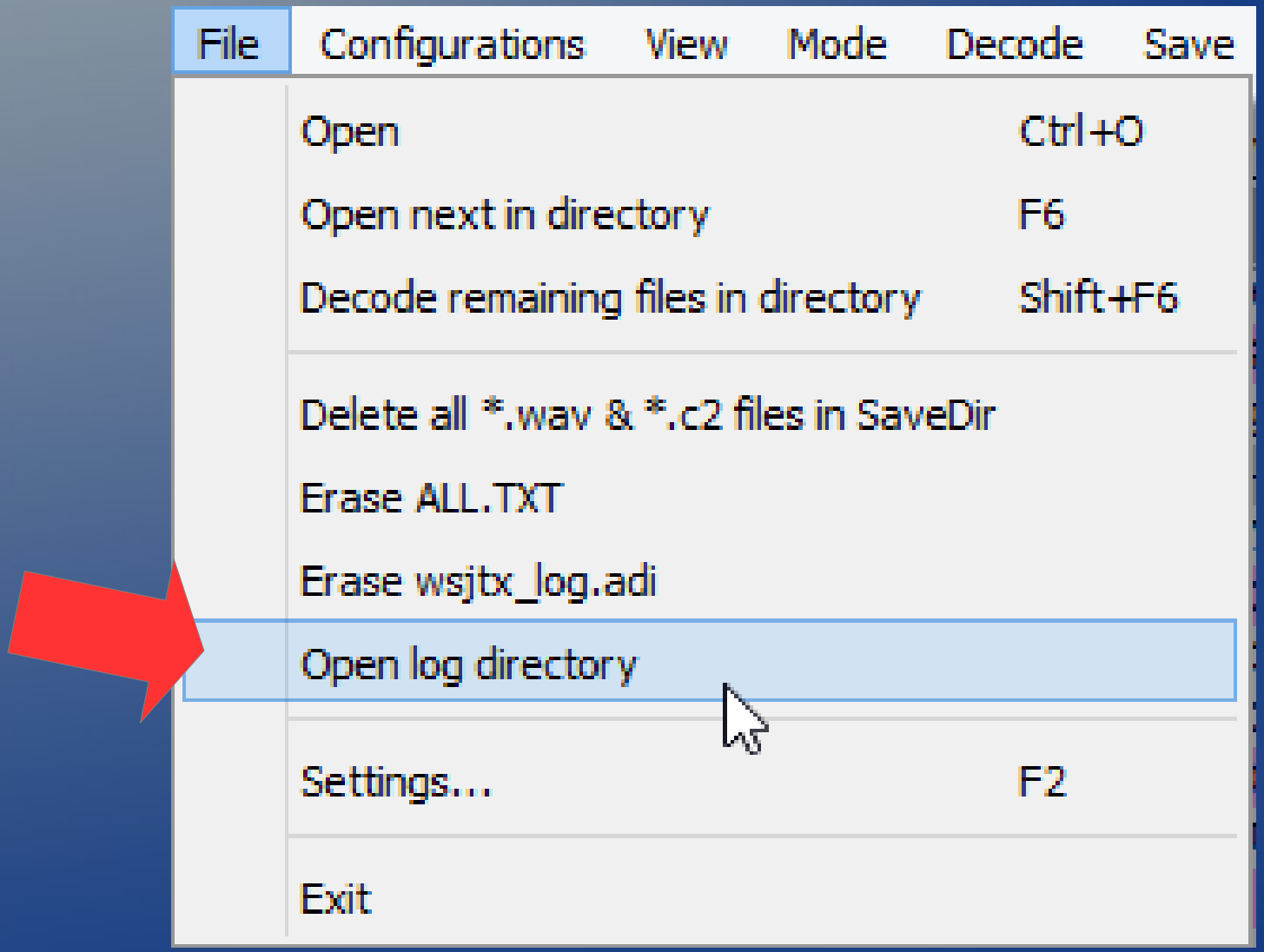


WSJT-X Logging FT8 QSO

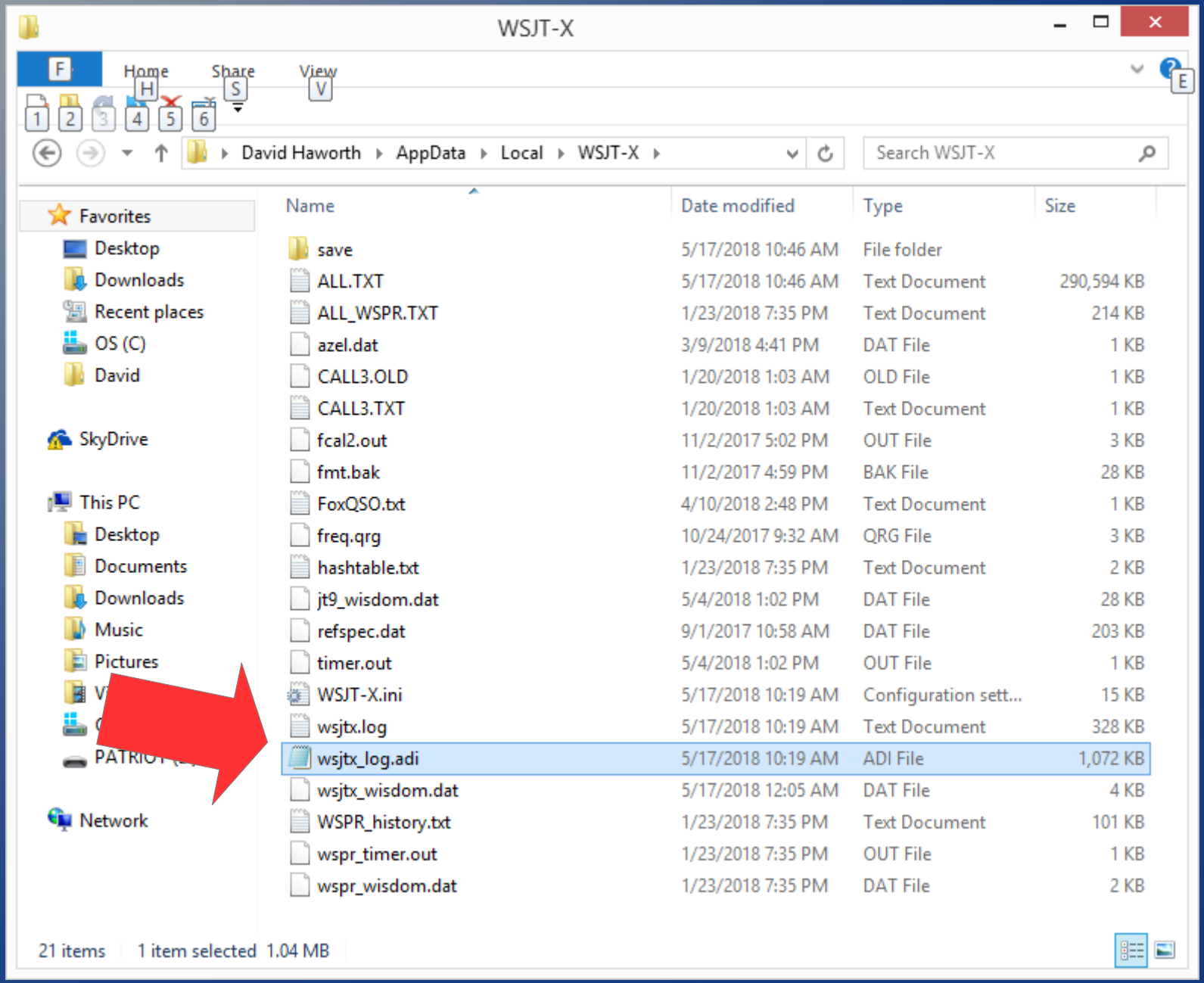
- Will automatically pop up at end of QSO



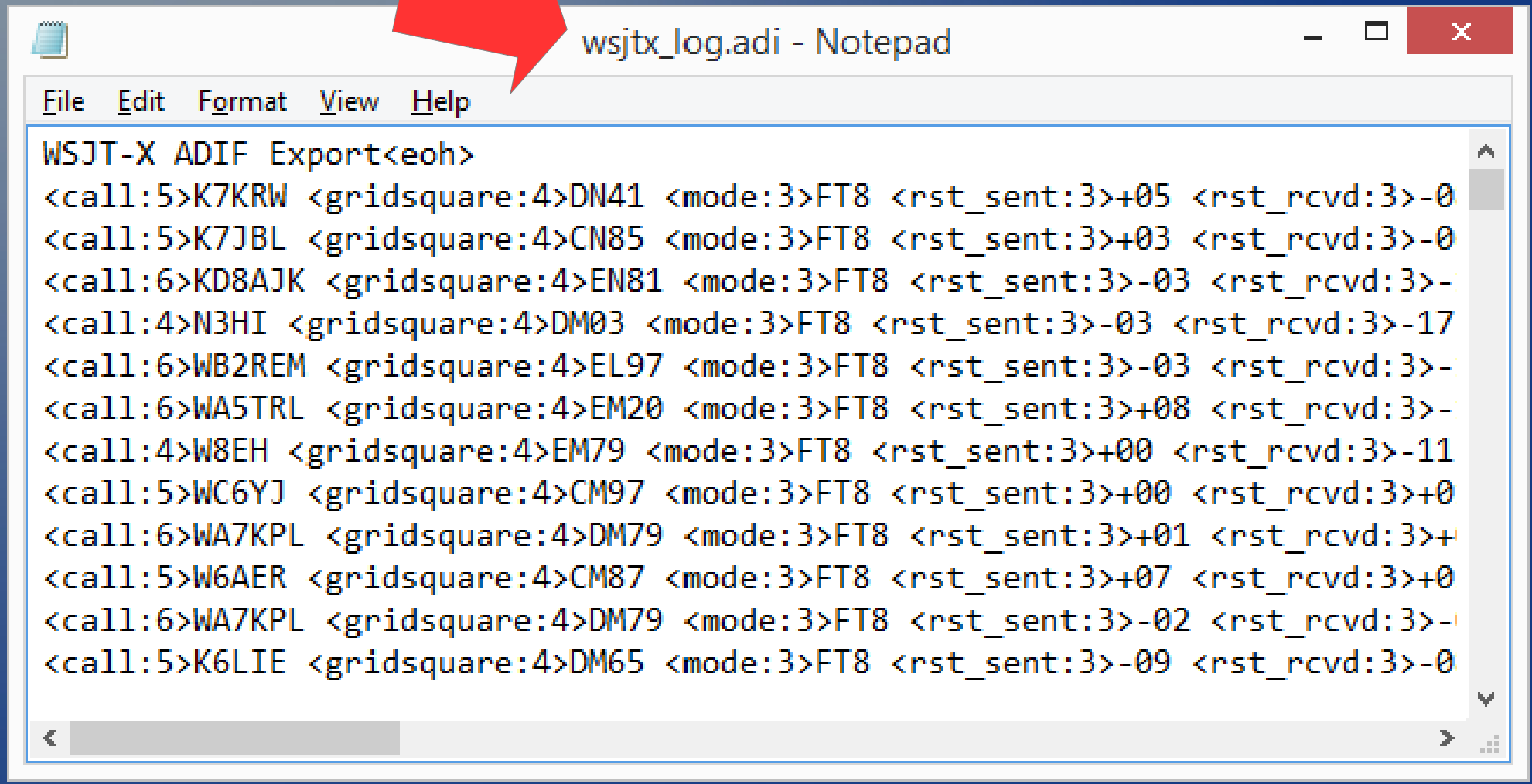
WSJT-X ADIF Directory



WSJT-X ADIF Log File



WSJT-X ADIF Log File



ADIF Log File QSO

- <call:5>K7KRW
  <gridsquare:4>DN41
  <mode:3>FT8
  <rst_sent:3>+05
  <rst_rcvd:3>-08
  <qso_date:8>20170827
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  <band:3>40m
  <freq:8>7.074842
  <station_callsign:6>WA9ONY
  <my_gridsquare:4>CN85
  <eor>

Advanced Logging

WSJT-X

rsNTP

JTAlertX

QRZ Info & Image

Amateur Contact Log

eQSL

LoTW

Club Log

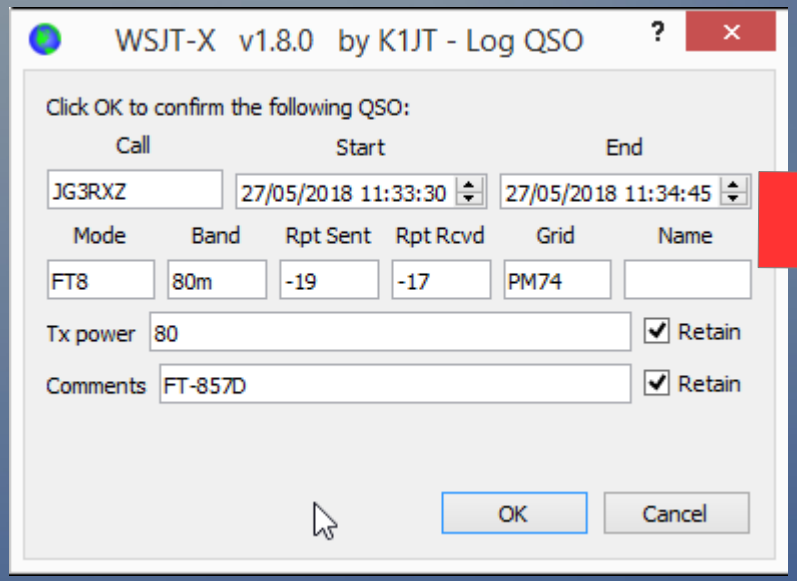
ADIF File

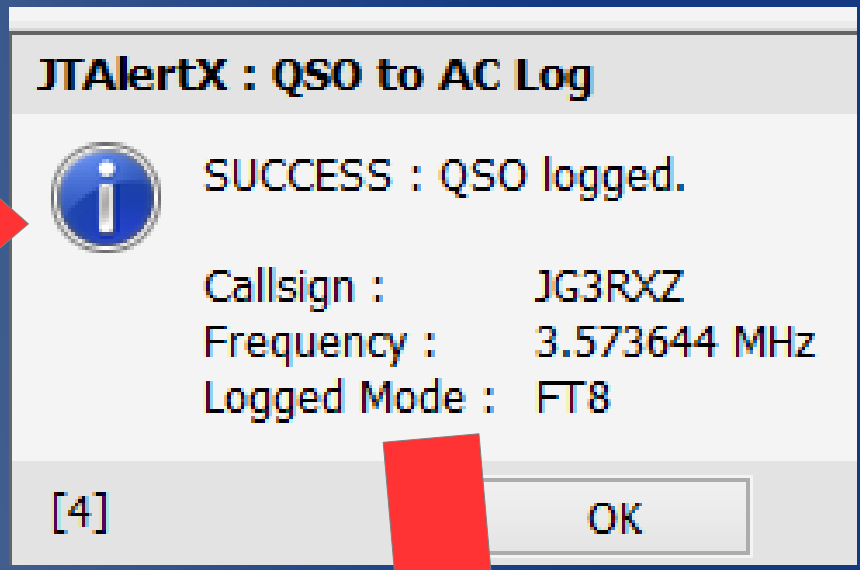
QRZ Log

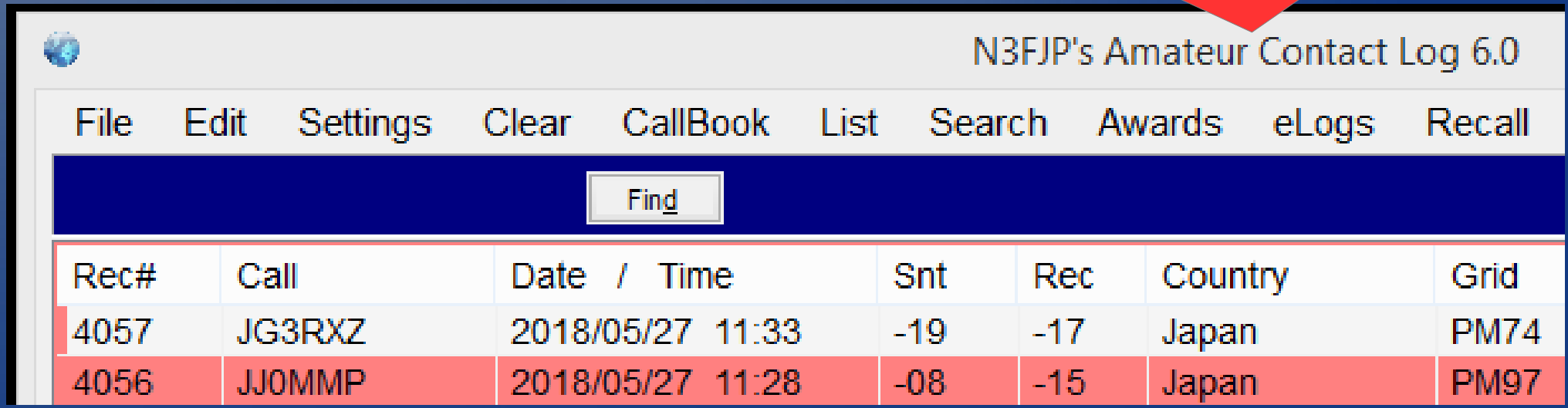
PSK Reporter

IrfanView

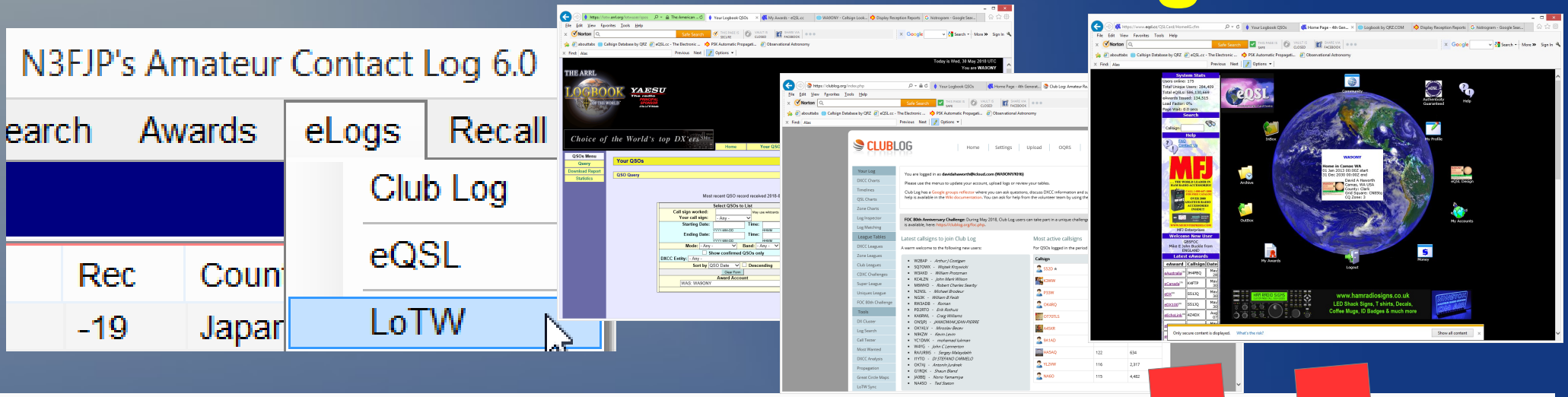
Advanced Logging
JTAlertX & Amateur Contact Log







eLog
Amateur Contact Log



N3FJP's Amateur Contact Log 6.0 www.n3

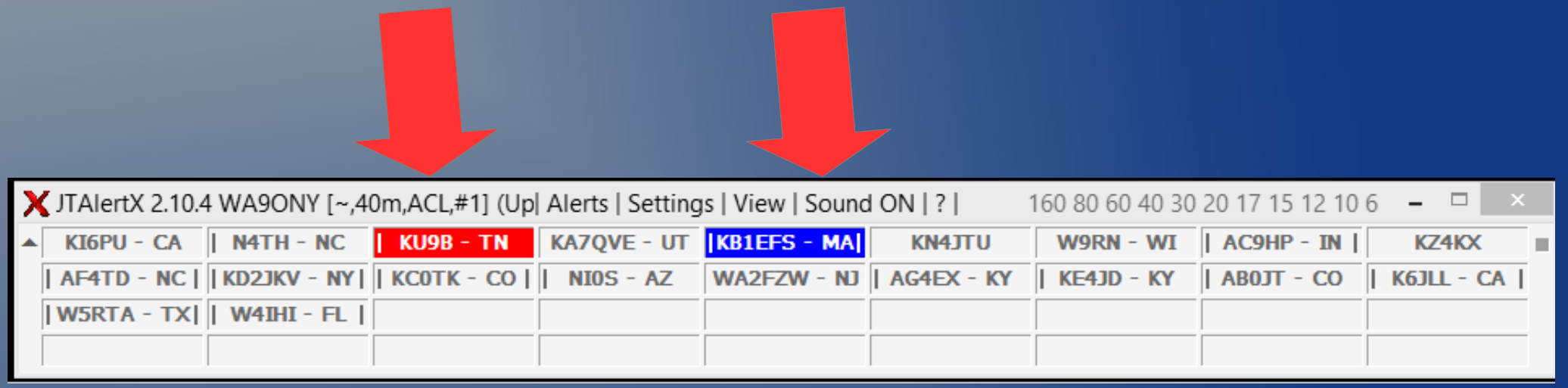
File Edit Settings Clear CallBook List Search Awards eLogs Recall Net View He

Find

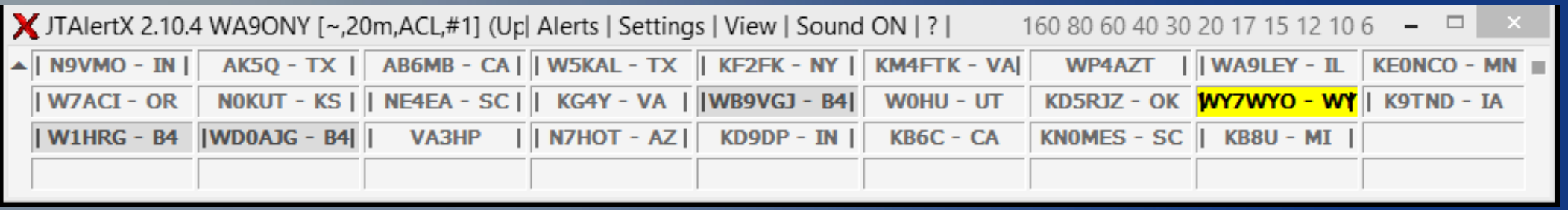
Recent Co...s

Rec#	Call	Date / Time	Snt	Rec	Country	Grid	Bnd	ST	R Conf By	S Conf By	S	R
3959	WD6DBM	2018/05/19 10:12	-09	-22	USA	CM97	40	CA		EBL	Y	N
3958	K8LS	2018/05/19 10:08	+04	-15	USA	EM10	40	TX	EL	EBL	Y	Y
3957	YC2TTM	2018/05/19 09:51	-11	-14	Indonesia	OI53	40	TX	L	EBL	Y	Y
3956	JA1BAZ	2018/05/19 09:48	-01	-12	Japan	PM95	40		E	EBL	Y	N
3955	AA5AU	2018/05/19 09:39	-02	-11	USA	EL49	40	LA	EL	EBL	Y	Y
3954	VK2ALS	2018/05/19 09:33	-16	-03	Australia	QF57	40		E	EBL	Y	N
3953	LU5VV	2018/05/19 09:09	-14	-11	Argentina	FE48	40		L	EBL	Y	Y
3952	W4DOW	2018/05/19 09:03	-23	-08	USA	EM96	40	VA	EL	EBL	Y	Y
3951	KD6ELK	2018/05/19 08:54	-06	-02	USA	DM06	40	CA	EL	EBL	Y	Y
3950	VK2TTP	2018/05/19 08:50	-07	-09	Australia	QF56	40	NSW	EL	EBL	Y	Y
3949	VK2XAX	2018/05/19 08:38	-13	-13	Australia	QF56	40	NSW	EL	EBL	Y	Y
3948	AB5HA	2018/05/19 08:36	-13	-15	USA	EM32	40	LA		EBL	Y	N

JTAlertX


JTAlertX 2.10.4 WA9ONY [~,40m,ACL,#1] (Up| Alerts | Settings | View | Sound ON | ? |
160 80 60 40 30 20 17 15 12 10 6
KI6PU - CA
| N4TH - NC
| KU9B - TN
KA7QVE - UT
|KB1EFS - MA|
KN4JTU
W9RN - WI
| AC9HP - IN |
KZ4KX
| AF4TD - NC |
| KD2JKV - NY |
| KC0TK - CO |
| NI0S - AZ
WA2FZW - NJ
| AG4EX - KY
| KE4JD - KY
| AB0JT - CO
| K6JLL - CA |
| W5RTA - TX|
| W4IHI - FL |

JTAlertX QSL Status



LoTW | N9VMO - IN | eQSL

| AK5Q - TX | eQSL

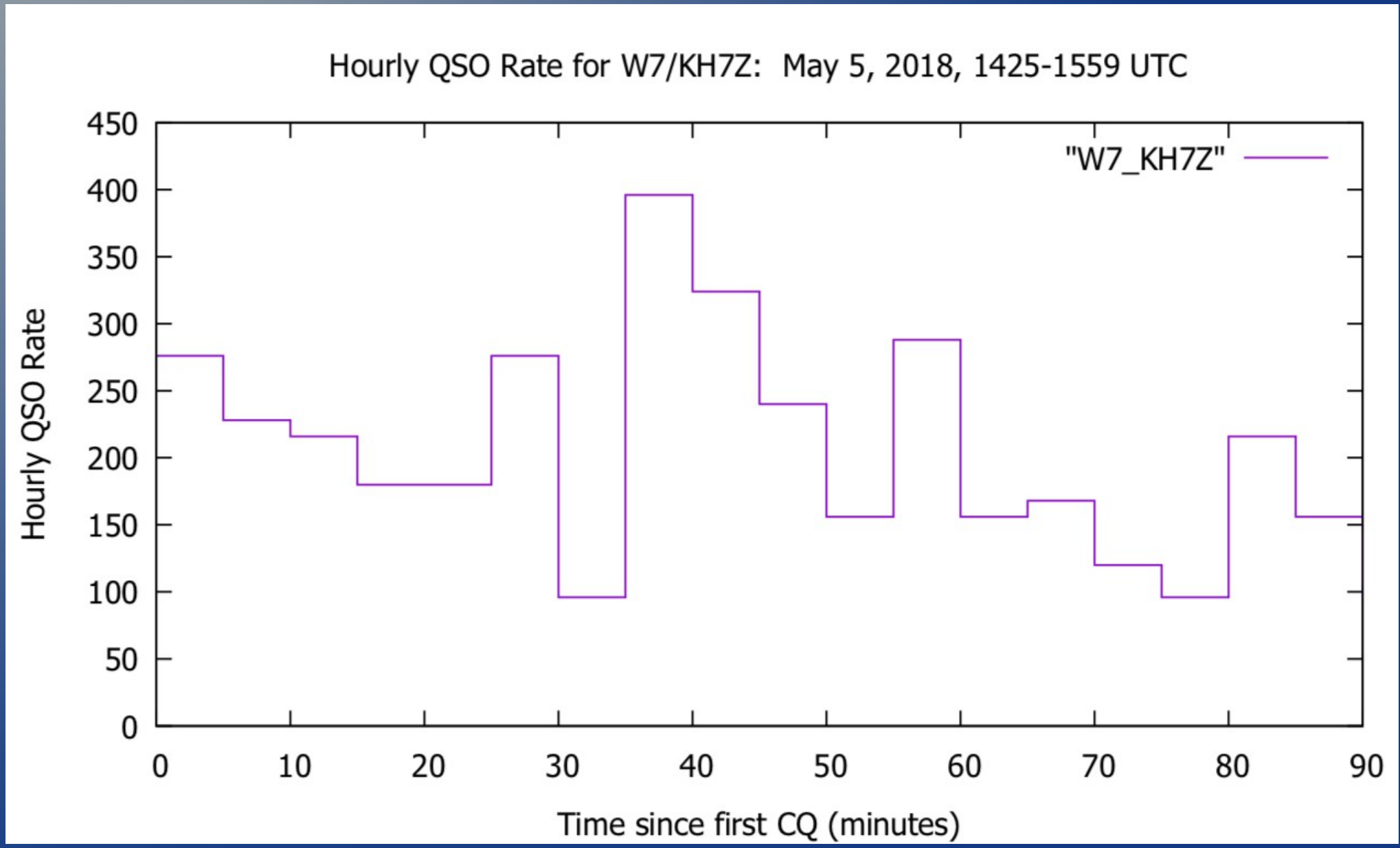
LoTW | W7ACI - OR

W0HU - UT

DX Expedition Mode

- Created for KH1/KH7Z Baker Island
  - June 27 – July 7, 2018
- Fox is DX station
  - Special FT8 frequencies for Fox
- Hound is you
- Fox works up to 5 hounds at once
- Fox is in low part (<1kHz) of the band
- Calling hounds are >1kHz to 4kHz
- Working hounds are auto QSY to <1kHz
- Requires WSJT-X v1.9

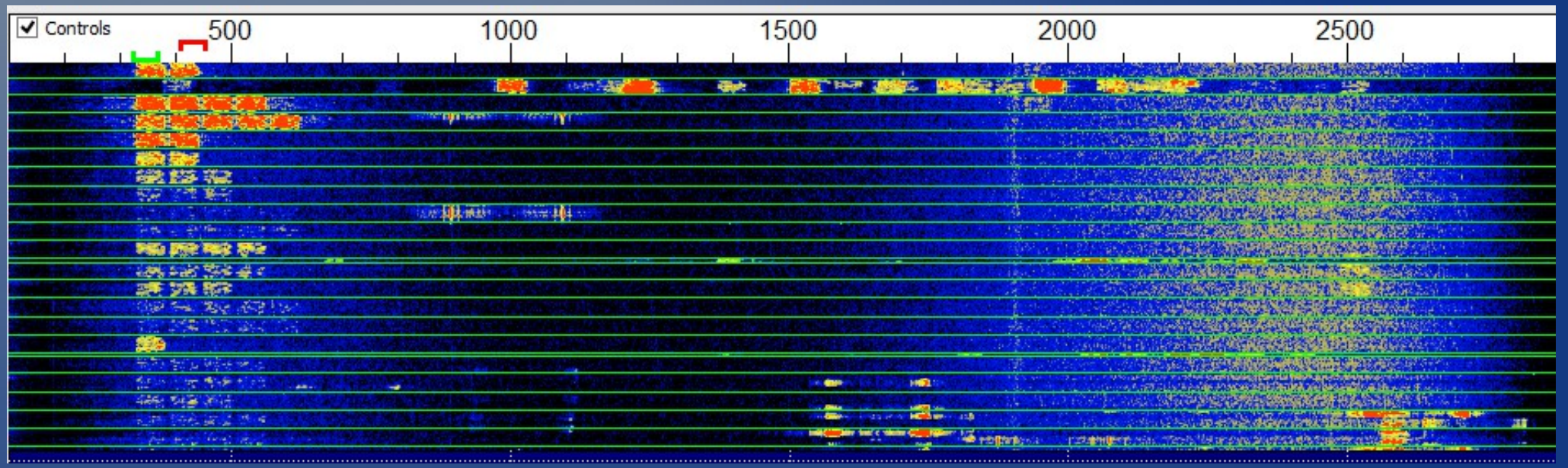
DX Expedition Mode Test #3
W7/KH7Z



KH7Z -08 dB to WA9ONY

```
----------------------------------- 20m
155830  -3  0.1  333 ~  WA8CLT RR73; WA9ONY <W7/KH7Z> -08
155830  -3  0.1  393 ~  WA8CLT RR73; W4AS <W7/KH7Z> -08
155830 -15  0.1 1924 ~  V47KA W6NT +01
```

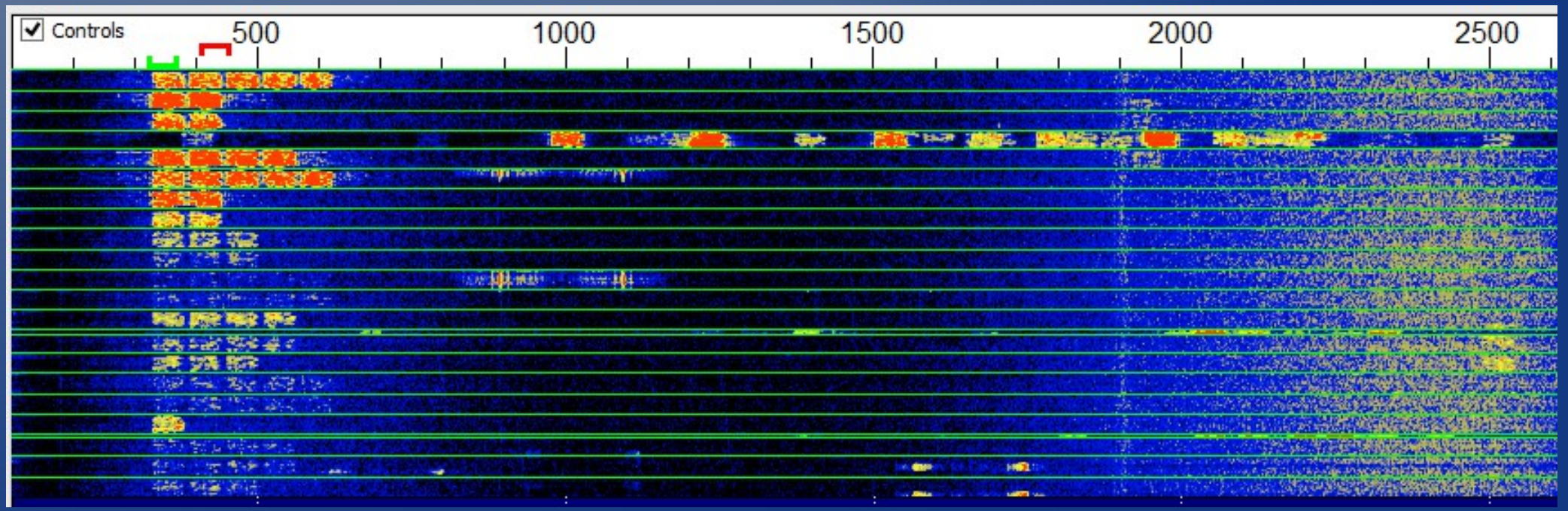
```
155745  Tx       1301 ~  KH7Z WA9ONY CN85
155800  -2  0.1  333 ~  VE3ERX RR73; M0GXM <W7/KH7Z> -07
155830  -3  0.1  333 ~  WA8CLT RR73; WA9ONY <W7/KH7Z> -08
155845  Tx       409 ~  KH7Z WA9ONY R-18
```



WA9ONY R-18 to KH7Z

```
------------------------------------ 20m
155830  -3  0.1  333 ~  WA8CLT RR73; WA9ONY <W7/KH7Z> -08
155830  -3  0.1  393 ~  WA8CLT RR73; W4AS <W7/KH7Z> -08
155830 -15  0.1 1924 ~  V47KA W6NT +01
------------------------------------ 20m
155900   4  0.1  333 ~  HH2AA KH7Z RR73
155900   6  0.1  393 ~  W4AS KH7Z RR73
------------------------------------ 20m
155930  -2  0.1  333 ~  W1SSN KH7Z +02
155930  -1  0.1  394 ~  WD9HSY KH7Z -02
155930   0  0.1  454 ~  W3DLQ KH7Z -04
155930   0  0.1  514 ~  UB7K KH7Z -04
155930  -1  0.1  574 ~  KC9MEG KH7Z -05
```

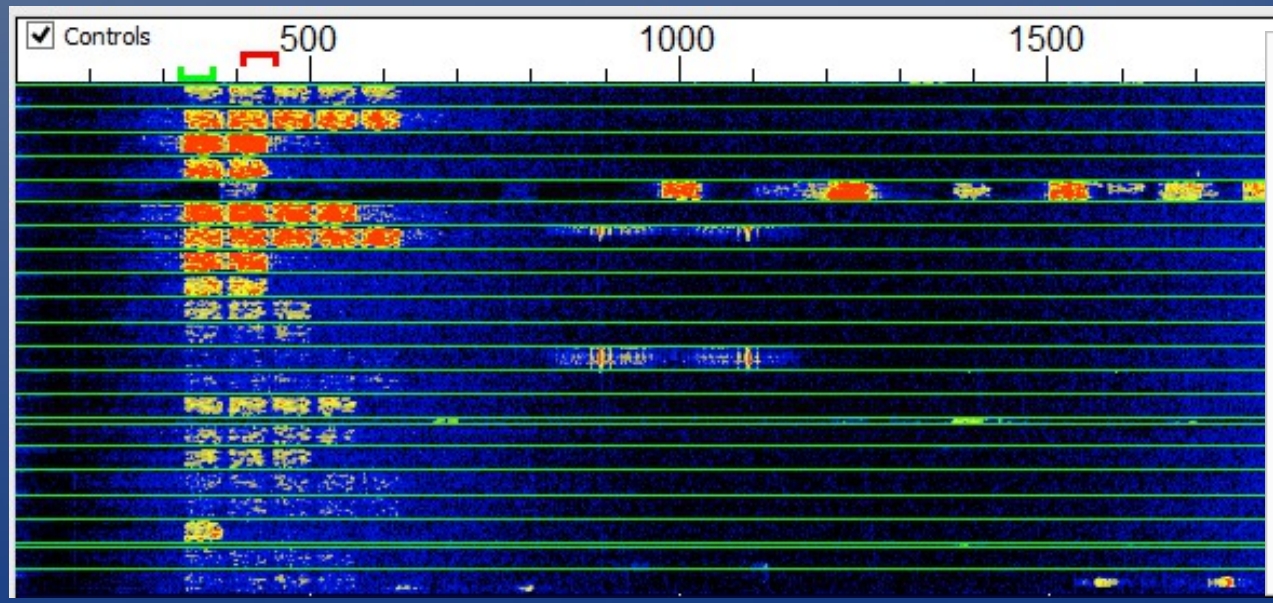
```
155630  -7  0.1  333 ~  K4JJW RR73; PA0WRS <W7/KH7Z> -02
155645  Tx       1301 ~  KH7Z WA9ONY CN85
155700   1  0.1  333 ~  PA0WRS KH7Z RR73
155715  Tx       1301 ~  KH7Z WA9ONY CN85
155730  -2  0.1  333 ~  CQ W7/KH7Z
155745  Tx       1301 ~  KH7Z WA9ONY CN85
155800  -2  0.1  333 ~  VE3ERX RR73; M0GXM <W7/KH7Z> -07
155830  -3  0.1  333 ~  WA8CLT RR73; WA9ONY <W7/KH7Z> -08
155845  Tx       409 ~  KH7Z WA9ONY R-18
155900   4  0.1  333 ~  HH2AA KH7Z RR73
155915  Tx       409 ~  KH7Z WA9ONY R-18
155930  -2  0.1  333 ~  W1SSN KH7Z +02
155945  Tx       409 ~  KH7Z WA9ONY R-18
```



KH7Z RR73 to WA9ONY

```
----------------------------------- 20m
155830  -3  0.1  333 ~  WA8CLT RR73; WA9ONY <W7/KH7Z> -08
155830  -3  0.1  393 ~  WA8CLT RR73; W4AS <W7/KH7Z> -08
155830 -15  0.1 1924 ~  V47KA W6NT +01
----------------------------------- 20m
155900   4  0.1  333 ~  HH2AA KH7Z RR73
155900   6  0.1  393 ~  W4AS KH7Z RR73
----------------------------------- 20m
155930  -2  0.1  333 ~  W1SSN KH7Z +02
155930  -1  0.1  394 ~  WD9HSY KH7Z -02
155930   0  0.1  454 ~  W3DLQ KH7Z -04
155930   0  0.1  514 ~  UB7K KH7Z -04
155930  -1  0.1  574 ~  KC9MEG KH7Z -05
----------------------------------- 20m
160000  -9  0.1  334 ~  WA9ONY KH7Z RR73
160000  -8  0.1  394 ~  W1SSN KH7Z RR73
160000  -8  0.1  454 ~  KC9MEG KH7Z RR73
160000  -9  0.1  514 ~  UB7K KH7Z RR73
160000  -8  0.1  574 ~  W3DLQ KH7Z RR73
```

```
155515  Tx        1301 ~  KH7Z WA9ONY CN85
155530 -16  0.1   333 ~  VE3KOI RR73; W5MO <W7/KH7Z> -05
155545  Tx        1301 ~  KH7Z WA9ONY CN85
155600 -14  0.1   333 ~  KF5KK RR73; KM4HQE <W7/KH7Z> -05
155615  Tx        1301 ~  KH7Z WA9ONY CN85
155630  -7  0.1   333 ~  K4JJW RR73; PA0WRS <W7/KH7Z> -02
155645  Tx        1301 ~  KH7Z WA9ONY CN85
155700   1  0.1   333 ~  PA0WRS KH7Z RR73
155715  Tx        1301 ~  KH7Z WA9ONY CN85
155730  -2  0.1   333 ~  CQ W7/KH7Z
155745  Tx        1301 ~  KH7Z WA9ONY CN85
155800  -2  0.1   333 ~  VE3ERX RR73; M0GXM <W7/KH7Z> -07
155830  -3  0.1   333 ~  WA8CLT RR73; WA9ONY <W7/KH7Z> -08
155845  Tx         409 ~  KH7Z WA9ONY R-18
155900   4  0.1   333 ~  HH2AA KH7Z RR73
155915  Tx         409 ~  KH7Z WA9ONY R-18
155930  -2  0.1   333 ~  W1SSN KH7Z +02
155945  Tx         409 ~  KH7Z WA9ONY R-18
160000  -9  0.1   334 ~  WA9ONY KH7Z RR73
```



WSJT-X v1.9.0-rc3 by K1JT - Log QSO

Click OK to confirm the following QSO:

Call	Start	End
W7/KH7Z	07/04/2018 15:58:15	07/04/2018 16:00:14

Mode	Band	Rpt Sent	Rpt Rcvd	Grid	Name
FT8	20m	-18	-08		

Tx power: 90 — Retain

Comments: FT-857D — Retain

Operator:

OK Cancel

FT8 Digital Club
www.ft8dmc.eu/

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- Arrange schedule contacts
- Colorful awards
- Q&A on FT8 installations & operating
- Band conditions
- Post your awards and QSLs

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Established July 2017...more than 5000 members!

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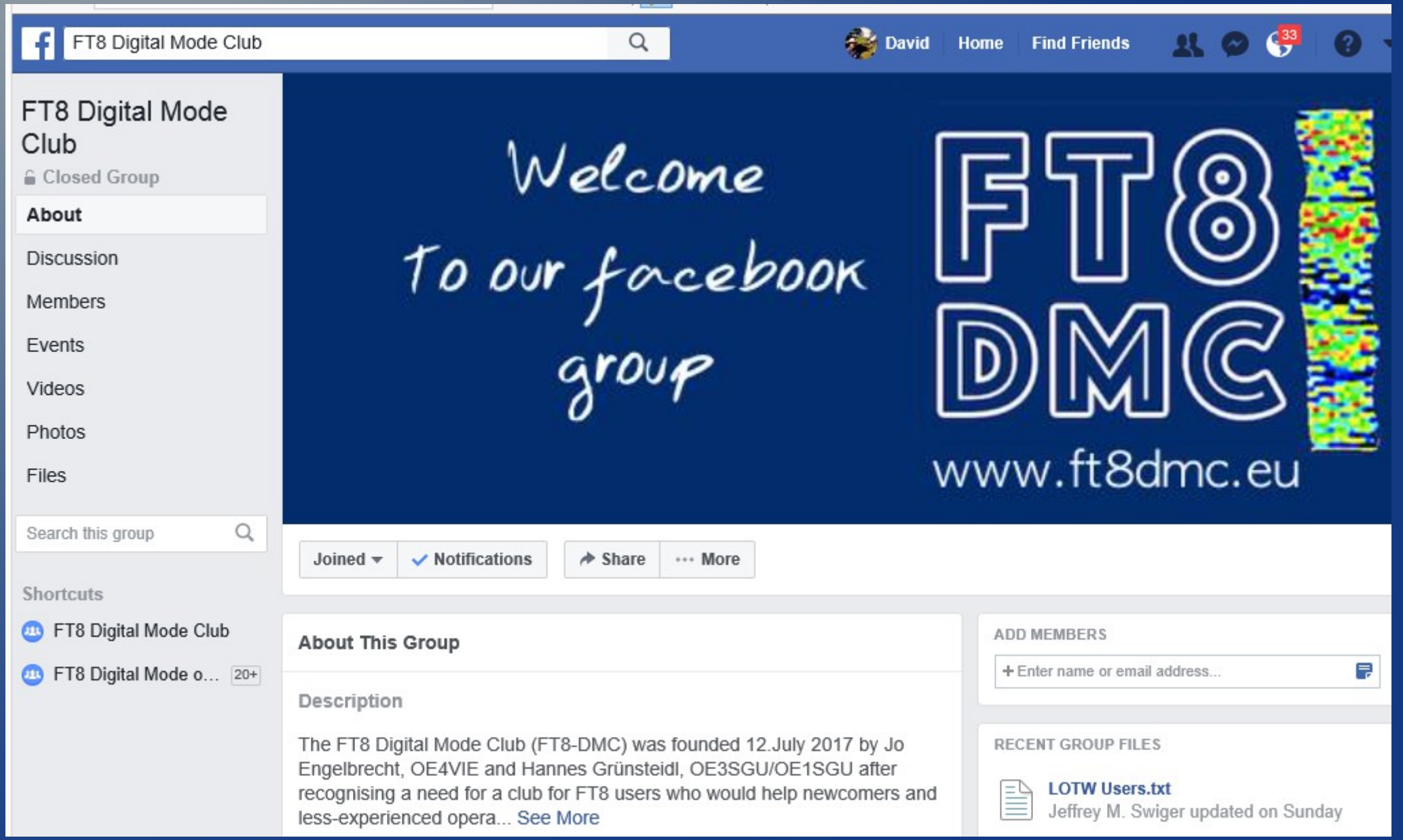
FT8 Digital Club on Facebook

www.facebook.com/groups/685845101611130/about/



FT8 Digital Club Awards

https://ft8dmc.eu/AWARDS

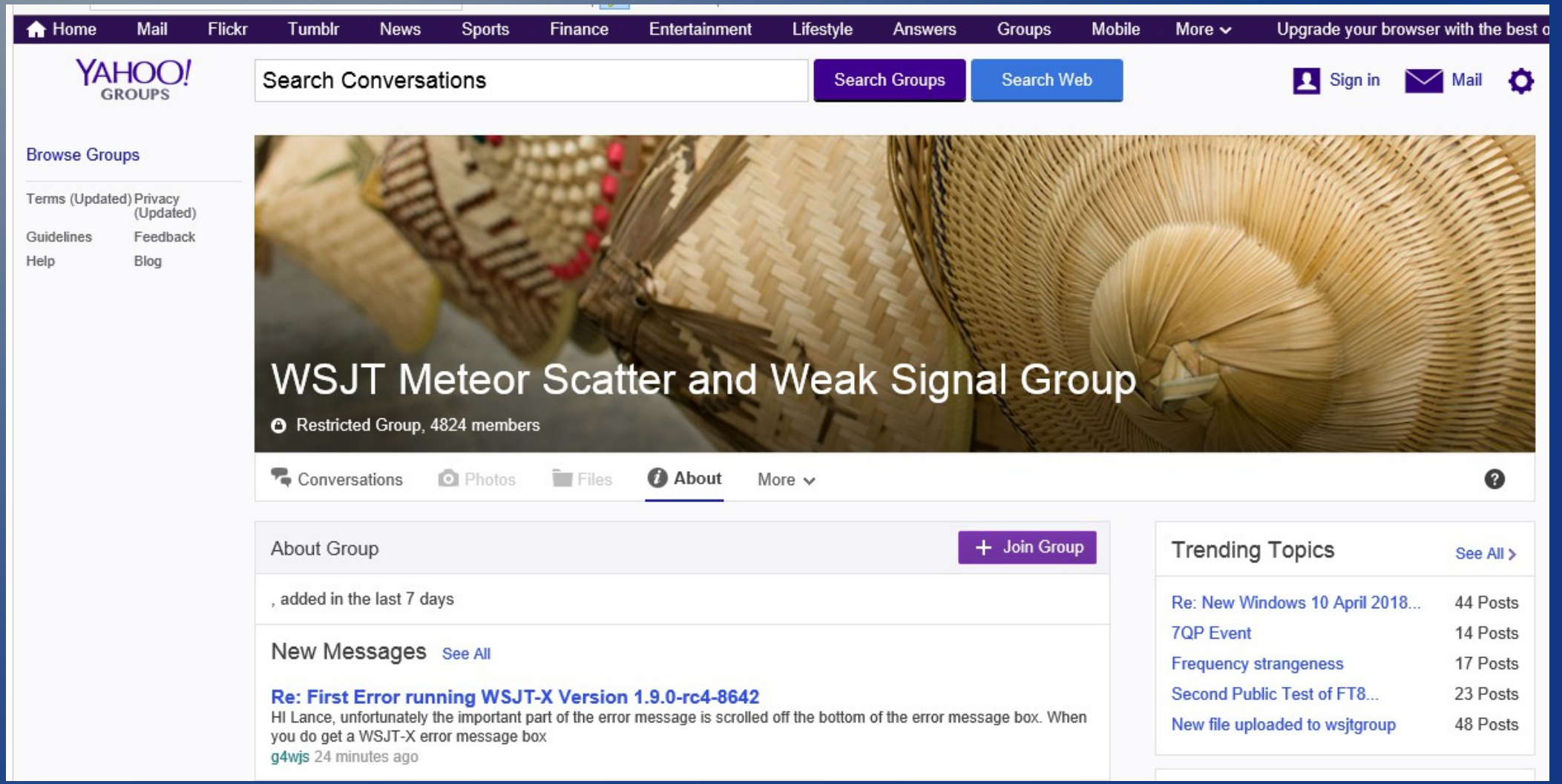
WSJT Meteor Scatter and Weak Signal Yahoo! Group

https://groups.yahoo.com/neo/groups/wsjtgroup/info?guccounter=1

- Joe Taylor K1JT
- Other WSJT-X SW developers
- Bug reports
- New features requests
- New reversions releases
- DX Expedition mode testing

WSJT Meteor Scatter and Weak Signal Group

https://groups.yahoo.com/neo/groups/wsjtgroup/info?guccounter=1



Work the World with WSJT-X - Dr. Joe Taylor

https://youtu.be/233HQs_8JGQ

WSJT-X User Guide

https://physics.princeton.edu/pulsar/k1jt/wsjtx-doc/wsjtx-main-1.8.0.html

Table of Contents

WSJT-X User Guide

Joseph H Taylor, Jr, K1JT – Version 1.8.0

1. Introduction

WSJT-X is a computer program designed to facilitate basic amateur radio communication using very weak signals. The first four letters in the program name stand for "**W**eak **S**ignal communication by K1**JT**," while the suffix "-X" indicates that *WSJT-X* started as an extended and experimental branch of the program *WSJT*.

WSJT-X Version 1.8 offers nine different protocols or modes: **FT8**, **JT4**, **JT9**, **JT65**, **QRA64**, **ISCAT**, **MSK144**, **WSPR**, and **Echo**. The first five are designed for making reliable QSOs under extreme weak-signal conditions. They use nearly identical message structure and source encoding. JT65 and QRA64 were designed for EME ("moonbounce") on the VHF/UHF bands and have also proven very effective for worldwide QRP communication on the HF bands. QRA64 has a number of advantages over JT65, including better performance on the very weakest signals. We imagine that over time it may replace JT65 for EME use. JT9 was originally designed for the LF, MF, and lower HF bands. Its submode JT9A is 2 dB more sensitive than JT65 while using less than 10% of the bandwidth. JT4 offers a wide variety of tone spacings and has proven highly effective for EME on microwave bands up to 24 GHz. These four "slow" modes use one-minute timed sequences of alternating transmission and reception, so a minimal QSO takes four to six minutes — two or three transmissions by each station, one sending in odd UTC minutes and the other even. FT8 is operationally similar but four times faster (15-second T/R sequences) and less sensitive by a few dB. On the HF bands, world-wide QSOs are possible with any of these modes using power levels of a few watts (or even milliwatts) and compromise antennas. On

WSJT-X References

https://physics.princeton.edu/pulsar/k1jt/refs.html

Home
WSJT-X
WSJT
MAP65
WSPR
SimJT
Program Development
References
Support

Additional Reading

1. "WSJT: New Software for VHF Meteor-Scatter Communication." (QST, December 2001)
2. "JT44: New Digital Mode for Weak Signals." (QST, June 2002)
3. "EME with JT65" (QST, June 2005)
4. "The JT65 Communications Protocol" (QEX, September-October 2005).
5. "WSJT: Meteors, Moonbounce, and More." (Mid-Atlantic States VHF Conference, September 2005)
6. "Open Source WSJT: Status, Capabilities, and Future Evolution." (12th International EME Conference, Wurzburg, August 2006)
7. "Open Source WSJT." (PowerPoint presentation)
8. "How Many Bits are Copied in a JT65 Transmission?" (Dubus, 3/2006)
9. "Recommended Procedures for Random Digital EME." (Dubus, 3/2006)
10. "MAP65: A Panoramic, Polarization-Matching Receiver for JT65." (Microwave Update, October 2007)
11. "Quest for Optimum Coding and Modulation Schemes for EME." (13th International EME Conference, Florence, August 2008)
12. Earth-Moon-Earth (EME) Communication (from ARRL Handbook, 2010)
13. "Moonbounce from Arecibo Observatory" (QST, August 2010)
14. "Frequency-Dependent Characteristics of the EME Path" (14th International EME Conference, Dallas, August 2010)
15. "Frequency-Dependent Characteristics of the EME Path" (PowerPoint slides: 14th International EME Conference, Dallas, August 2010)
16. "WSPRing Around the World" (QST, November 2010)
17. "Meteor Scatter: How Much Antenna is Too Much?", ARRL Antenna Book, 22nd Edition (2011)
18. "MAP65 Version 2: A Panoramic, Polarization-Matching Receiver for JT65" (15th International EME Conference, Cambridge, August 2012)
19. "MAP65 Version 2: A Panoramic, Polarization-Matching Receiver for JT65" (PowerPoint Slides: 15th International EME Conference, Cambridge, August 2012)
20. "Small Station EME at 10 and 24 GHz: GPS Locking, Doppler Correction, and JT4" (Dubus, 2/2013).
21. "Optimized Small-Station EME: X-pol at 432 MHz" (16th International EME Conference, Pleumeur-Bodou, France, August 2014)
22. "Optimized Small-Station EME: X-pol at 432 MHz" (PowerPoint Slides: 16th International EME Conference, Pleumeur-Bodou, France, August 2014)
23. "Moonbounce at W2PU", (Mid-Atlantic States VHF Conference, September 2014).
24. "EME with Adaptive Polarization at 432 MHz" (Dubus, 4/2014).
25. "Open Source Soft-Decision Decoder for the JT65 (63,12) Reed-Solomon Code" (QEX, May/June 2016)
26. "*WSJT-X:* New Codes, Modes, and Tools for Weak-Signal Communication" (PowerPoint Slides: 17th International EME Conference, Venice, August 2016)
27. "High-Accuracy Prediction and Measurement of Lunar Echoes" (QEX, November-December 2016, pp. 36-40)
28. "The MSK144 Protocol for Meteor-Scatter Communication" (QEX, September/October, 2017, pp. 8-14)
29. "Work the World with WSJT-X, Part 1: Operating Capabilities", (QST, October 2017, pp. 30-36)
30. "Work the World with WSJT-X, Part 2: Codes, Modes, and Cooperative Software Development", (QST, November 2017, pp. 34-39)

QST WSJT-X Articles Oct. & Nov. 2017

https://physics.princeton.edu/pulsar/k1jt/refs.html

Work the World with *WSJT-X*, Part 1: Operating Capabilities

The first of a two-part tutorial about the most popular digital software in use today, from the people who designed and developed it.

Joe Taylor, K1JT; Steve Franke, K9AN, and Bill Somerville, G4WJS

One of the greatest pleasures in Amateur Radio is the thrill of establishing two-way communication with like-minded hobbyists far away, using one's own equipment. We enjoy making such contacts on our own, without recourse to commercial carriers or infrastructure. Since the 1930s, amateurs have known that worldwide communication is possible on the HF bands (at least some of the time) with power levels no more than 100 W and antennas as simple as half-wave dipoles. Twenty-first century digital communication techniques based on information theory make these things possible at much lower power levels, even with compromise antennas. Optimized methods of coding and modulation enable these and many other surprising feats — for example, DXCC using low power and an indoor antenna; two-way contacts on the 6- and 2-meter bands at any time over distances of 500 – 1,300 miles (800 – 2,100 kilometers) using reflections from ionized meteor trails; and Earth-Moon-Earth ("moonbounce") contacts over worldwide distances, whenever the Moon is up at both ends of a path.

Starting in 2001, the software program *WSJT* has facilitated making two-way contacts with extremely weak signals. The latest version of this open-source, multiple-author software package is called *WSJT-X*. It supports nine distinct protocols or modes, each optimized for a different frequency range or type of propagation. These modes

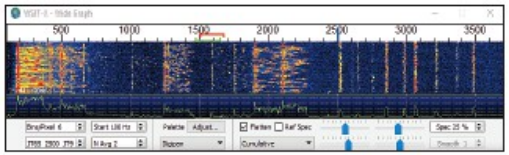


Figure 1 — Waterfall spectrogram recorded by *WSJT-X* at 14.076 MHz on September 19, 2015. The frequency scale gives audio frequencies in hertz above the transceiver dial frequency. Of the 23 decodable signals in this 1-minute recording, eight are so weak that they would be inaudible to a human — even if they were the only signal in the passband.

are not designed for long conversations, or "ragchewing." Rather, they concentrate on efficient exchange of such basic information as call signs, Maidenhead grid locators, signal reports, and acknowledgments at the lowest possible signal-to-noise ratios, in the space of a few minutes or less. Short user messages are encoded into audio-frequency waveforms that can be transmitted and received with standard SSB transceivers. At the receiving end, recovered audio is converted back to digital samples and the software carries out a reverse transformation to decode the message. All transmissions are timed and synchronized with Coordinated Universal Time (UTC). Information required for a minimal valid QSO (contact) is typically exchanged and acknowledged after two or three successful transmissions from each station.

This mathematically sophisticated method of encoding information ensures that with very high probability, messages displayed by the decoding software will be exactly those that were originally encoded.

The first publicly available version of *WSJT*[1] was designed for meteor scatter on the VHF bands. The software has been in continual development since 2001, with improved performance, added user-convenience features, and new operating modes. The current program version supports four modes that use 1-minute transmit/receive (T/R) sequences. Each of these "slow" modes — JT4, JT9, JT65, and QRA64 — uses a distinct coding and modulation scheme designed to optimize weak-signal communication on a particular type of propagation path, with high reliability and good bandwidth efficiency. The most recently introduced slow mode is

Work the World with *WSJT-X*, Part 2: Codes, Modes, and Cooperative Software Development

Here's how the weak-signal digital protocols in *WSJT-X* work, and an overview of how their software is developed.

Joe Taylor, K1JT, Steve Franke, K9AN, and Bill Somerville, G4WJS

Part 1 of this two-part article covered topics that highlight the capabilities of weak-signal communication program *WSJT-X*.[1] This software package provides tools for a wide range of Amateur Radio activities including low-power DXing, meteor scatter, moonbounce, and precise frequency measurement — all of them possible with relatively modest station equipment. Based on modern communication and information theory, the *WSJT-X* protocols and software can boost your signal's effective reach by the rough equivalent of 10 – 15 dB of added signal strength.

This concluding Part 2 outlines some digital communication theory fundamentals, including examples to make the discussion accessible to most amateurs. We compare the eight weak-signal protocols in *WSJT-X* and explain how their impressive performance is achieved. Finally, we describe the tools and informal cooperative practices used for creating the *WSJT-X* software. We think it's important that dedicated enthusiasts devote their algorithmic and programming skills and interests to the good of the hobby. We have found that many other hams would like to have a deeper understanding of how these weak-signal protocols work, and how they were developed. We hope this article satisfies that desire.

Digital Communication Fundamentals

Digital communication conveys digital information from an originating source to one or more destinations. Here the digital information is modulated onto a carrier and transferred over a radio channel. The basic unit of transmitted data is a *channel symbol*. The symbols represent numbers, in turn comprised of bits. The modulator may transmit m information bits in each symbol, using 2^m different waveforms to represent symbol values from 0 up to $2^m - 1$.

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The different waveforms might have distinct amplitudes, phases, frequencies, or shapes. The *WSJT-X* waveforms are made of sinusoids with constant amplitude. The MSK144 protocol uses *Offset Quadrature Phase-Shift Keying* (OQPSK) with waveforms shaped to maintain a constant envelope. All other modes use frequency-shift keying (FSK), with a different tone frequency to represent each allowed symbol value. Binary modulation ($m = 1$) implies transmitting one bit at a time. Modulation schemes with larger m are used to an advantage in all but one of the *WSJT-X* modes.

Important benefits can be gained by adding controlled redundancy to a digital message so that transmission errors can be recognized and corrected. Simple repetition of each symbol is a trivial form of redundancy. But much more powerful redundancy can be arranged by mapping each sequence of k message symbols in a controlled way into a unique and longer sequence of n symbols called a codeword. This technique is called forward error correction (FEC). The *WSJT-X* protocols use block codes in which the values of n and k are fixed, and labeled as (n,k) codes. An integer parameter q can be used to define the range of available symbol values for a code, analogous to the m we used for modulation schemes. Parameter $Q = 2q$ is then referred to as the *alphabet size* of the code. The code symbol values range from 0 up to $Q - 1$, and each codeword conveys kq message bits. The amount of redundancy is characterized by the ratio n/k, and its reciprocal k/n is the *code rate*. The mathematics underlying design of such k-to-n mapping schemes and their corresponding n-to-k reverse transformations forms a major branch of modern communication theory.

Reception of transmitted symbols requires accurate synchronization of time and frequency between transmitting and receiving stations. To make this possible with typical amateur station equipment, each *WSJT-X* protocol includes a unique synchronizing pat-

FT8 Operating Guide
by Gary Hinson ZL2iFB
http://www.g4ifb.com/

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ZL2iFB & ZM4G

ZM4G

Home
Antennas
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Pileups
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Kia ora from Aotearoa (73 from New Zealand). Hi, I'm Gary and I'm a radio amateur. My main hobby interest is HF CW DXing and HF CW ragchewing. I also enjoy the odd HF CW contest.

Lately I've been busy HF DXing with FT8. I've written an **FT8 Operating Guide** to help others having fun with the digimode. Click the cover to download the PDF:

Hawke's Bay
North Island
New Zealand

39° 39' South x
176° 37½' East

Locator RF80HL

260m ASL

IOTA OC-036

CQ zone 32

A1 Ops
ARRL
CDXC
FOC
G0FBB
G-QRP-C
M6T
NZART
Voodudes
ZL6QH
ZM4T

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Get on the Air with HF Digital 2nd Edition

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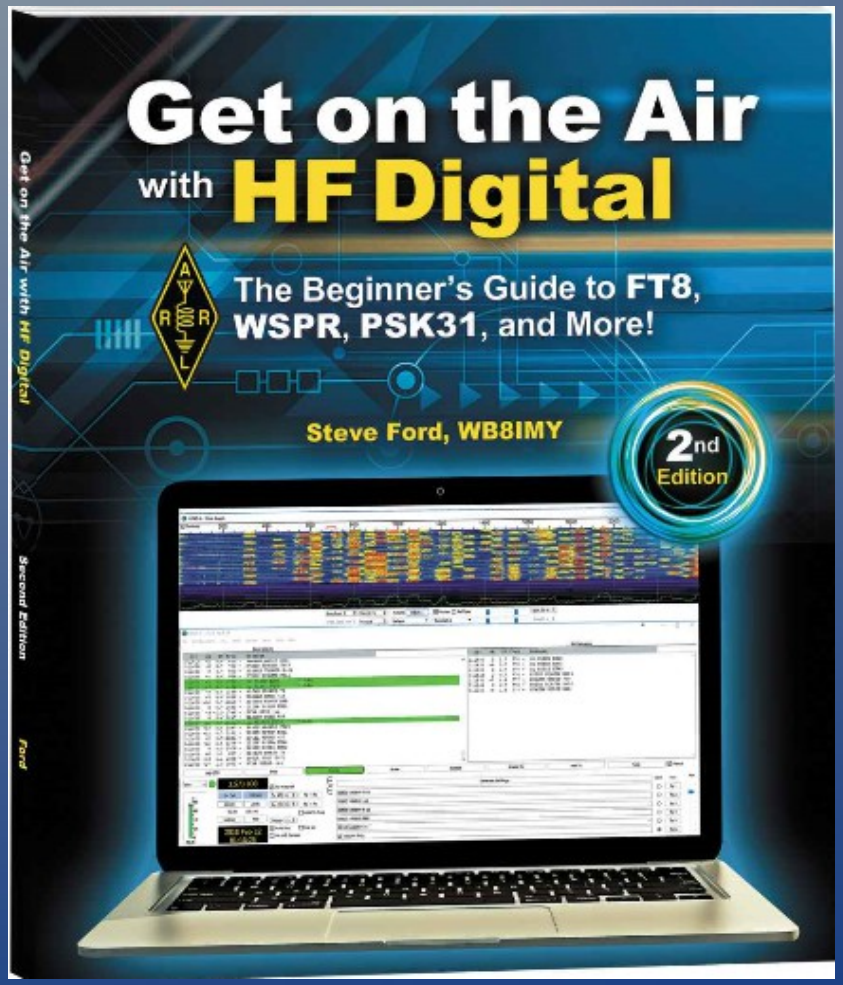
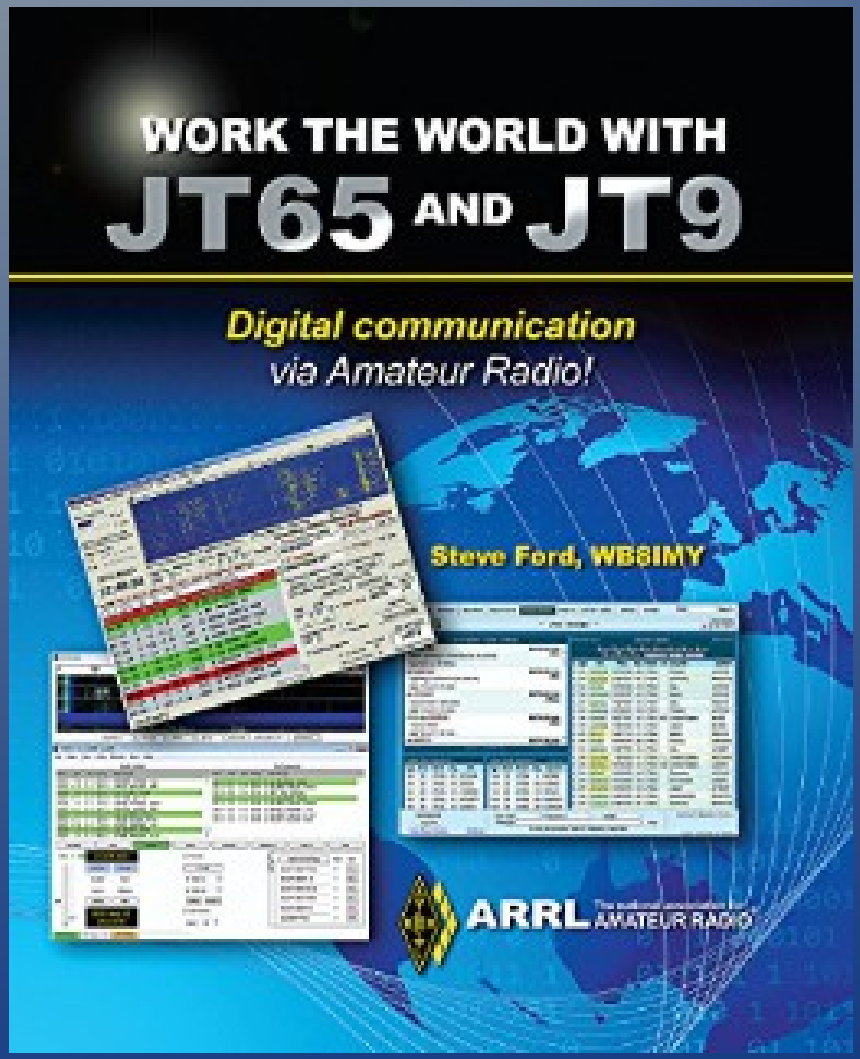


- FT8 chapter
- WSRP chapter
- Good if you are just starting out on HF digital

Work the World with JT65 and JT9

https://www.amazon.com/Work-World-JT65-ARRL-Inc-ebook/dp/B01CGU79EQ/ref=pd_sbs_351_6?_encoding=UTF8&psc=1&refRID=FT20GCQEQREXBGQ87CYD



- FT8 is based on JT65 & JT9
- Book goes in detail on WSJT-X before FT8 was added to the software.

FT8 Start Simple

WSJT-X

rsNTP

Have Fun Adding Accessories

WSJT-X

rsNTP

JTAlertX

QRZ Info & Image

Amateur Contact Log

eQSL

LoTW

Club Log

ADIF File

QRZ Log

PSK Reporter

IrfanView

73

WA9ONY

Presentation link is at www.qrz.com/db/WA9ONY

www.stargazing.net/david