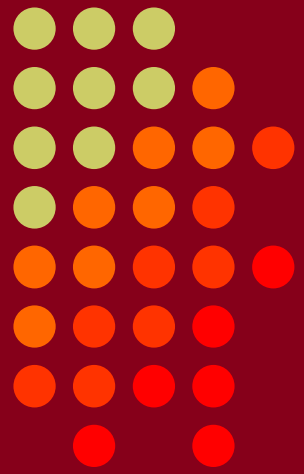
CTU 2023 Presents

RTTY – FT4/8 Digital Contesting

Ed Muns, W0YK & P49X



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Digital Contesting is Fun!

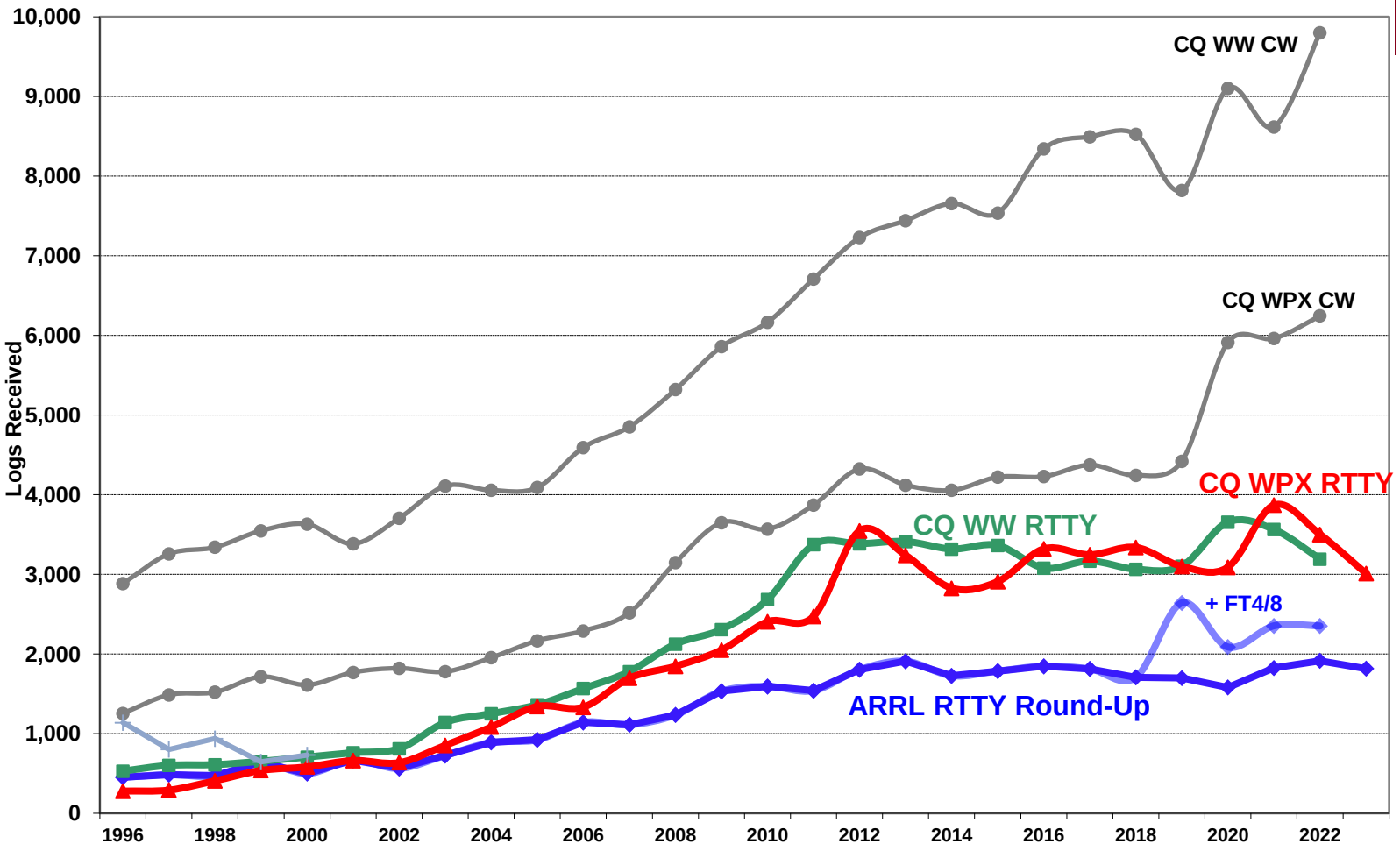
- RTTY Contesting → Digital Contesting
- RTTY
  - Operating
  - Setting Up
- FT4/8
  - Operating
  - Setting Up
- 2nd session: "*How to Maximize Your Digital Contest Station and Operation*"

Lots of RTTY Contests

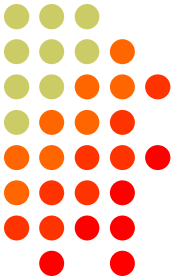
~ *two/month*

- **Biggies (3) (3 - FT4/8)**
  - ARRL RTTY Roundup (1st weekend in Jan)
  - CQ WPX RTTY (2nd weekend in Feb)
  - ARRL Int'l Digital (1st weekend in Jun)
  - WW Digi (last weekend in Aug)
  - CQ WW RTTY (last weekend in Sep)
  - FT Roundup(1st Sat in Dec)
- **NCJ contests (4)**
  - NAQP RTTY (3rd Sat in Feb, 2nd Sat in Jul)
  - Sprint RTTY (2nd Sat in Mar & Oct)
- **Other popular RTTY contests (7)**
  - BARTG:
    - Sprint (3rd weekend Jan)
    - HF RTTY (3rd weekend Mar)
    - 75 Baud (3rd weekend Apr)
  - WAE RTTY (2nd weekend in Nov)
  - JARTS, Makrothen, SARTG (2)
- **NCCC Sprint (52 - every Thursday evening)**

Three Largest RTTY Contests



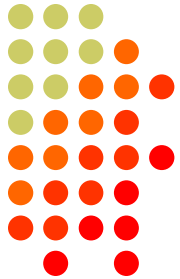
What Makes a Great RTTY Contester?



1) Contester who happily logs casual callers
2) Uses CW & SSB techniques where useful
3) Strives to exploit RTTY uniqueness
   - Auto-decode frees operator time … use it to do things difficult with CW & SSB, e.g., SO3R!
   - Speed is ~2x CW
4) Applies learning back to CW & SSB

What is RTTY?

compared to CW



CW

1) ***One*** RF carrier

2) Local audio ***pitch***

3) On ***or*** off
   - key up is data 0
   - key down is data 1

4) ***Morse*** code
   - typically 25-40 wpm

RTTY

1) ***Two*** RF carriers 170 Hz apart *(Space & Mark; Shift)*

2) Local audio ***tones***

3) One on ***and*** other off
   - Space is data 0
   - Mark is data 1

4) ***Baudot*** code
   - constant 60 wpm *(or 45.45 Baud)*

What is RTTY?

- 5-bit code→32 chars.
- 2 sets:
  - Letters set & Figures set
  - 6 common control chars.
    - LTRS (unshifted)
    - FIGS (shifted)
    - Null, Space, LF, CR
- LTRS or FIGS toggle set

Figures Shift

Code	Control Characters		
11111	LTRS		
11011	FIGS		
00000	Null		
00100	Space		
01000	LF		
00010	CR		
	Letters	Figures	
		ITA2	USTTY
00011	A	-	
11001	B	?	
01110	C	:	
01001	D	ENQ	$
00001	E	3	
01101	F		!
11010	G		&
10100	H		#
00110	I	8	
01011	J	BELL	'
01111	K	(	
10010	L	)	
11100	M	.	
01100	N	,	
11000	O	9	
10110	P	0	
10111	Q	1	
01010	R	4	
00101	S	'	BELL
10000	T	5	
00111	U	7	
11110	V	;	
10011	W	2	
11101	X	/	
10101	Y	6	
10001	Z	"	

What is RTTY?

code history

- Bacon's cipher (1605)
- Gauss & Weber (1833)
- Baudot code (1870)
  - Manual bit entry
  - 5-bit ITA1 code
  - Two 32-bit character sets
    - letters
    - figures
- Murray code (1901)
  - Teletype character entry
  - Western Union variation
- **5-bit ITA2 code (1930)**
  - **USTTY variation**
- ASCII (1963)
  - 7-bit ITA5 code

Code	Control Characters		
11111	LTRS		
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01110	C	:	
01001	D	ENQ	$
00001	E	3	
01101	F		!
11010	G		&
10100	H		#
00110	I	8	
01011	J	BELL	'
01111	K	(	
10010	L	)	
11100	M	.	
01100	N	,	
11000	O	9	
10110	P	0	
10111	Q	1	
01010	R	4	
00101	S	'	BELL
10000	T	5	
00111	U	7	
11110	V	;	
10011	W	2	
11101	X	/	
10101	Y	6	
10001	Z	"	

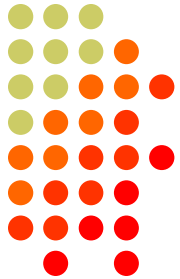
What is RTTY?

Figures Shift

- The *LTRS* and *FIGS* characters do not print
  - The code for the characters “Q” and “1” is the same; which one prints depends on if you are in Letters or Figures set
  - Note that the *LTRS*, *FIGS* and *Space* characters appear in both sets
- Example: “***KI7GUO DE K4GMH***” gets sent as:
  - *LTRS* ***K I*** *FIGS* ***7*** *LTRS* ***G U O*** *Space* ***D E*** *Space* ***K*** *FIGS* ***4*** *LTRS* ***G M H***
- Why do we care to understand this?
  - If a burst of static garbles the *LTRS* or *FIGS* character, then what prints after that is from the wrong set until the next *LTRS* or *FIGS* character appears

What is RTTY?

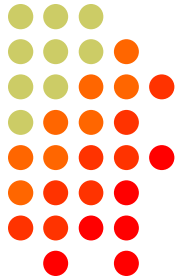
UnShift on Space



- UnShift On Space (USOS or UOS)
  - Increases noise immunity for alpha text
  - Space character forces a shift to the Letters set
- Contest exchanges are alpha and numeric
  - Should UOS be on ~~or off~~?
  - Should Space ~~or Hyphen~~ delimit exchange elements?
    - 599 1079 1079 or 599-1079-1079
- *Recommendation:*
  - *Turn on both RX & TX UOS and use Space delimiters*

What is RTTY?

audio tones



- Space and Mark audio tones
  - Default: 2295 and 2125 Hz (“high tones”)
  - Less fatiguing: 1085 and 915 Hz (“low tones”)
- Analogous to CW pitch
  - Operator choice
  - Each operator can use different tone pairs
  - Transmission is two RF carriers 170Hz apart
- Must be same in radio and decoder/encoder

What is RTTY?

AFSK vs. FSK

Two methods of transmission:

- AFSK (Audio Frequency Shift Keying)
  - keyed audio tones into SSB transmitter via:
    - Mic input, or
    - Auxiliary audio input. e.g., Line In
- FSK (Frequency Shift Keying)
  - on/off keys the transmitter just like CW

Note: Receiving is the same in either case.

What is RTTY?

dial frequency

spots are often wrong

- RTTY RF is independent of local audio tones and whether LSB or USB is used:
  - The higher RF frequency is the Mark *(14090.000 kHz)*
  - The lower RF frequency is the Space *(14089.830 kHz)*
  - The difference between the two is the shift *(170 Hz)*
- FSK displays Mark *(14090.000 kHz)*
- AFSK displays suppressed carrier which varies with local audio tones and sideband used!
  - For Mark tone of 2125 Hz (Space tone of 2295 Hz):
    - LSB *(14092.125 kHz)*
    - USB – Mark & Space tones reversed *(14087.005 kHz)*

What is RTTY?

AFSK vs. FSK

AFSK

- Indirect *(tones → Mic input)*
- Any SSB radio *(esp. legacy)*
- SSB (wide) filtering
- Dial = sup. car. frequency
- VOX
- Audio cable *(a'la FT8, JT65/9, PSK31)*
- Must use high tones

NET (automatic TX tone control)

Less bandwidth (depends on radio)

Easier hook-up; NET

FSK

- Direct *(like CW keying)*
- "Modern" radios
- RTTY (narrow) filtering
- Dial = Mark frequency
- PTT
- COM FSK keying cable
- Can use low tones

No audio level adjust

No disabling speech proc.

No erroneous sound keying

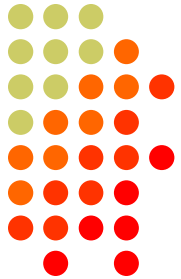
Less pitfalls

What is RTTY?

summary

- Uses 5-bit Baudot (actually, USTTY) code with two sets of 32 characters: Letters and Figures
- Space & Mark frequencies separated by 170 Hz “Shift”
- Local Space & Mark tones analogous to pitch in CW
- Constant 45.45 Baud (60 wpm) asynchronous character stream with 5 data bits and 2-3 sync bits
- Figures Shift & Letters UnShift
  - Use optional UnShift-On-Space (UOS), plus space delimiter
- AFSK vs. FSK transmission (receiving is the same)
  - Radio dial frequency differences
  - 100% duty cycle!

The Cynics Say …



- "The RTTY decoder/encoder does everything."

  however, this attribute …

  - frees the operator to improve other skills
  - enables more contest participants
  - provides mode diversity for contest junkies

- "RTTY is a pain to set up and get working."

  … stay tuned, it's really not that difficult!

RTTY Considerations

Much like CW and SSB, except:

- Non-human decoding implications
  - *serial number repeat, universal “fist” or “voice”*
- Distractions are tempting
  - *watch TV, do email, read, etc.*
- RTTY established practice
  - *‘CQ’ at end of CQ message*
- Whisper-level headphone volume; low tones
  - *just to detect presence & timing*
- Key-down transmission … 100% duty cycle

RTTY Sub-Bands

- 10 meters: 28080-28100, during contests 28080-28200
  - JA: 21070-21150
- 15 meters: 21080-21100, during contests 21080-21150
  - JA: 21070-21150
- 20 meters: 14080-14100, during contests 14080-14150
  - JA: 14070-14150
- 40 meters: 7025-7050 & 7080-7100, during contests 7025-7100
  - JA: 7030-7100
- 80 meters: 3580-3600, during contests 3560-3600
  - JA: 3520-3575 and 3599-3612
- 160 meters: 1800-2000
  - No RTTY contesting

RTTY Messages

CQ WPX RTTY Contest

- Short, as with CW/SSB
- No extraneous info
- 599 (not 5NN) once
- Serial number twice
- Space (not hyphen)
- Omit ‘DE’
- RTTY chars
  - %R (CR, LF)
  - %E (drop PTT)
- End with Space

www.rttycontesting.com/tutorials/messages

F02:	%RWPX P49X P49X CQ %O%E
F03:	%R P49X %E
F04:	P49X %E
F05:	%R%C 599 %N2 %N2 %E
F06:	%RTU P49X CQ %O%E
F07:	%RQRV %ZR.1 %E
F08:	%R %C TU .. NOW%L%E
F09:	%RAGN %E
F10:	%RNR? %E
F11:	%R%N3 %E

F02:	%RWPX P49X P49X P49X CQ %O%E
F03:	%RQSL LOTW OR W0YK %E
F04:	%R%C %E
F05:	%RTU 599 %N2 %N2 %L%E
F06:	%RKB %H P49X CQ %L%O%E
F07:	%RQRV %ZS.1 %E
F08:	%R%H %C KB .. NOW%L
F09:	%RQRZ %E
F10:	%RCALL? %E
F11:	? %E

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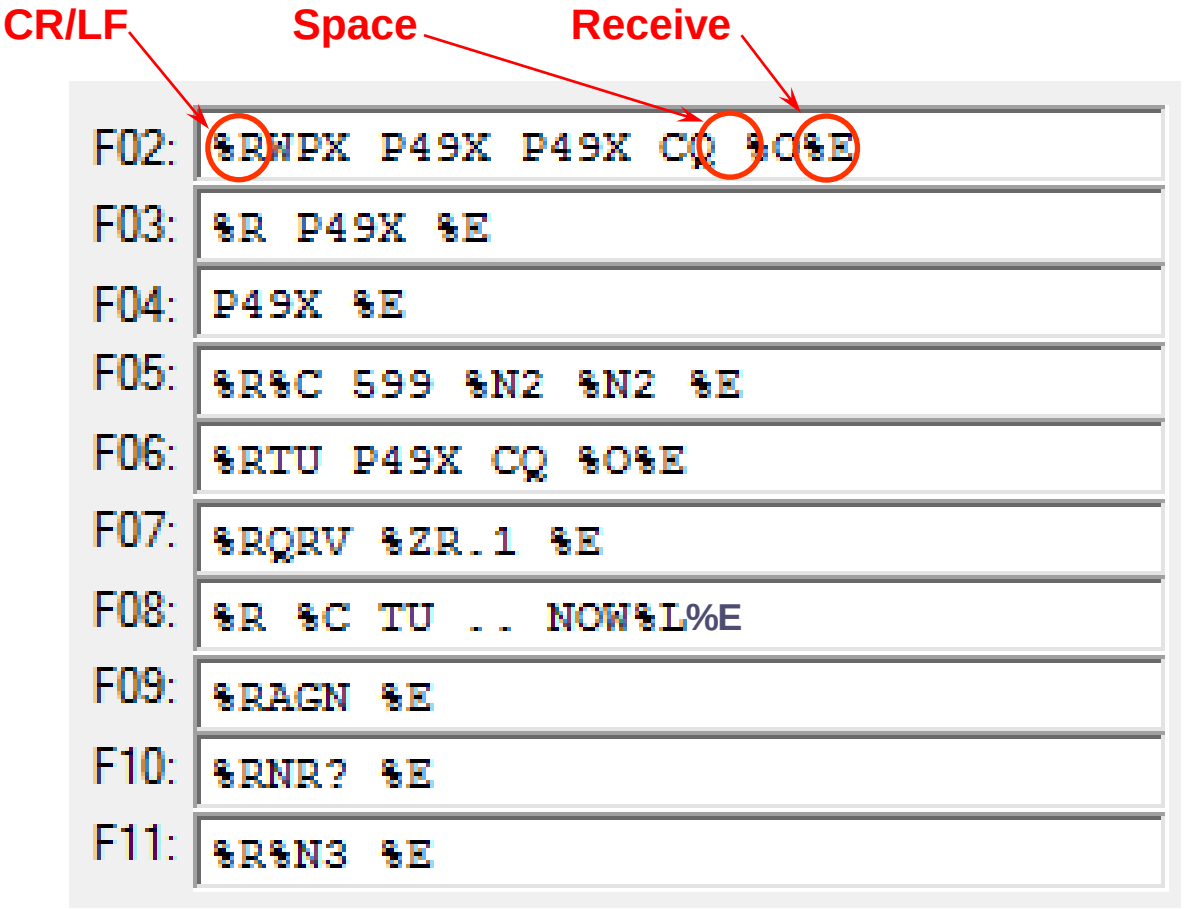
RTTY Messages

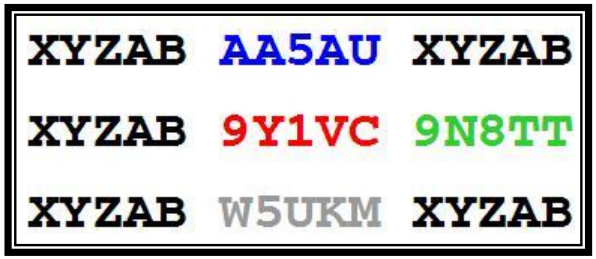
formatting



Super Check Partial

call sign selection

- SCP (Super Check Partial) enables computer to select call signs in receive window
  - Unworked calls (no mult)
  - New mults and double mults
  - Dupes

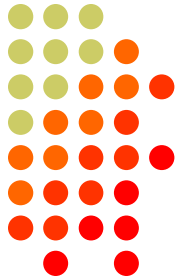


N1MM Logger

- Use main SCP from CW/SSB/RTTY contests
  - RTTY SCP is a subset, so use full file

Super Check Partial

logger differences



XYZAB	AA5AU	XYZAB
XYZAB	9Y1VC	9N8TT
XYZAB	W5UKM	XYZAB

- *Custom colors*
- *Highlight option*

N1MM Logger

XYZAB	AA5AU	XYZAB
XYZAB	9Y1VC	9N8TT
XYZAB	W5UKM	XYZAB

WriteLog

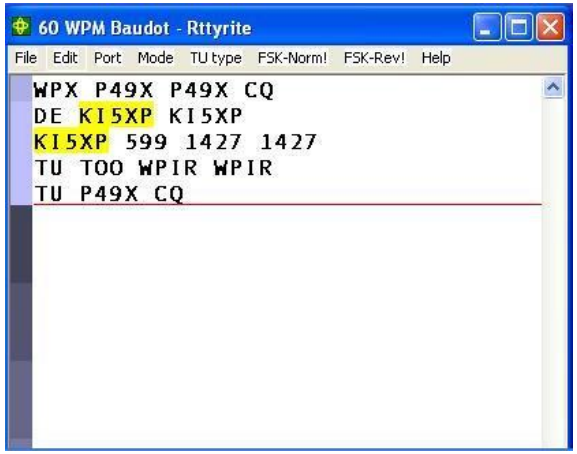
XYZAB	AA5AU	XYZAB
XYZAB	9Y1VC	9N8TT
XYZAB	W5UKM	XYZAB

Win-Test

Tips

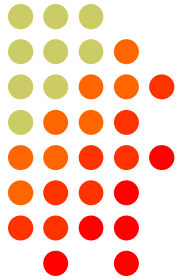
"All I receive is gibberish!"

- "Upside-down"
  - Reverse Mark & Space
  - LSB vs. USB
- Figures vs. letters
  - TOO=599, WPIR=2084
  - UOS should be on
  - Shift-click to convert, or look at top two rows
- Audio-In level, tones, flutter
- (Other station's signal)



Tips

"They never answer me!"



- "Upside-down"
  - FSK: polarity switch in radio
  - AFSK: LSB vs. USB; polarity select in software
- Off frequency
  - AFC on with NET (AFSK only) off [recommend RIT instead]
  - AFC & NET on by default in MMTTY
    - changes not sticky; change defaults in USERPARA.INI
- AFSK: Mic & SC levels; speech processor on
- Radio mode, tones, FSK interface

More Tips

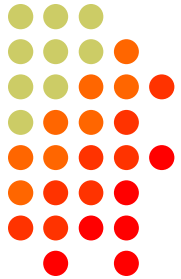
- 100% duty cycle … *caution!*
- Practice
  - During RTTY contests (~ two per month)
  - NCCC Thursday night practices (weekly)
- Multi-Ops

RTTY Operating

summary

- Many casual RTTY contest participants
- RTTY sub-bands; 10-80 only; avoid audio-digital & beacons
- 500 Hz receive filtering; USOS on
- Messages (“macros”)
  - Short, ~~5NN~~, unique exchange twice, Space delimiter
- Common problems
  - “Upside-down” (reversed Space/Mark or LSB vs. USB)
  - Figures vs. Letters
  - Audio:
    - RX audio output level and TX (AFSK only) audio input level
    - Unmuted soundcard inputs and outputs
    - Space and Mark tone consistency between decoder and radio
  - Off-frequency tuning (AFC & NET); band conditions

The Cynics Say …



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- "RTTY is a pain to set up and get working."

  … stay tuned, it's really not that difficult!

How Do I Set it Up?

overview

- ***Acquire*** and set up hardware and/or software to convert between the RTTY audio tones and text:
  - RTTY ***receive*** decoder
  - RTTY ***transmit*** encoder
  - PC-radio interface
- ***Configure*** decoder/encoder
- ***Integrate*** decoder/encoder with logger

The rest of the station setup is the same as for CW and SSB

How Do I Set it Up?

RTTY decoder/encoder

- RTTY ***receive*** decoder converts the two RTTY tones to printed characters.
  - CW decoders seldom used
  - Ears/brain/hands for CW/SSB
- RTTY ***transmit*** encoder converts typed characters (or messages) into the two tones (AFSK) or on/off keying (FSK).
  - logger *CW keyers and SSB DVKs are also used, similar to RTTY encoders*
  - Otherwise, brain/hands/mouth for CW/SSB

How Do I Set it Up?

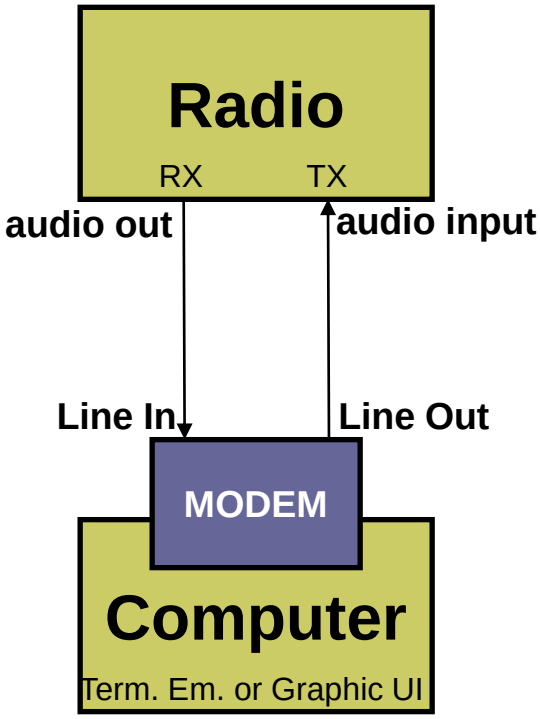
decoder/encoder terminology

- The RTTY ***transmit encoder*** and ***receive decoder*** is sometimes referred to as a MODEM or a TNC:
  - MODEM = MOdulator DEModulator
  - TNC = Terminal Node Controller
- MODEMs can be:
  - a hardware box, or
  - a software application driving a PC soundcard

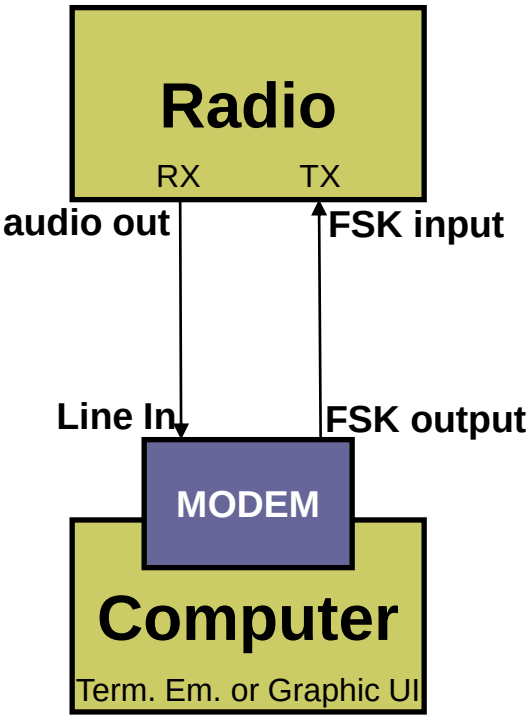
How Do I Set It Up?

hardware MODEM

AFSK



FSK



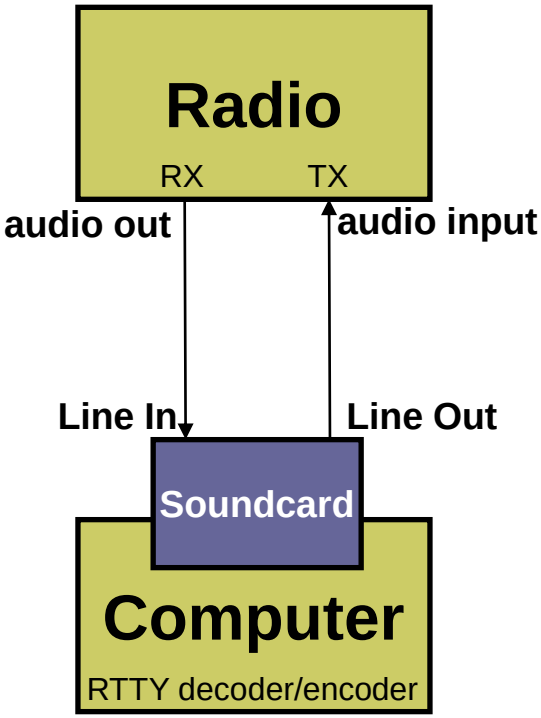
How Do I Set It Up?

hardware MODEM

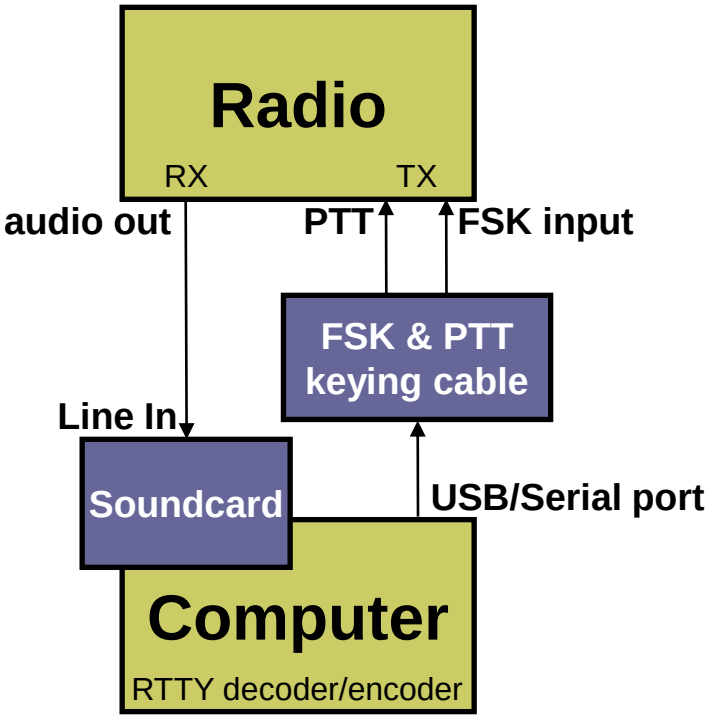
How Do I Set It Up?

software application & soundcard

AFSK



FSK



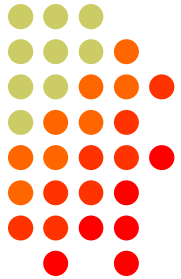
How Do I Set it UP?

cables

- Receive:
  - RX audio out to soundcard
  - ***Optional DSP filter***
  - 1:1 isolation transformer
  - ***JPS NIR-12, or …***
- Transmit:
  - AFSK: TX audio in from soundcard, ***or***
  - FSK: FSK/PTT keying
  - 1:1 isolation transformer, ***or***
  - Keying interface

How Do I Set It Up?

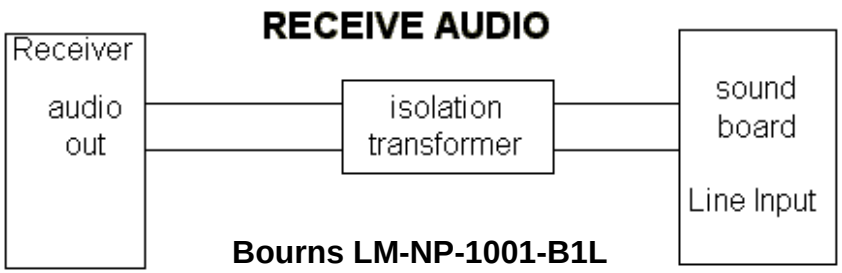
ground loops



- Eliminate ground loops between radio and PC
- Otherwise insert 1:1 audio isolation transformer on:
  - RX output
  - TX Mic input *(AFSK only)*
- Alternatives:
  - Bourns LM-NP-1001-B1L transformer → homebrew cable
  - Ground loop isolators
  - W2IHY iBox
  - Commercial RTTY interfaces
  - K3 (uses Bourns LM-NP-1001-B1L on LINE IN & OUT)

How Do I Set It Up?

homebrew audio isolation



Bourns LM-NP-1001-B1L

-90 dBc 3rd order IMD

How Do I Set It Up?

ground loop isolators

Radio Shack $19.49 or eBay $6.99

-64 dBc 3rd order IMD

eBay $3.35

eBay $5.50

eBay $7.45

How Do I Set It Up?

W2IHY iBox audio isolation

How Do I Set It Up?

commercial interface audio isolation

Rascal

How Do I Set It Up?

radio audio isolation

How Do I Set It Up?

SDR digital audio isolation

K3S { digital: CODEC (**soundcard**)
analog: **IN – LINE – OUT**

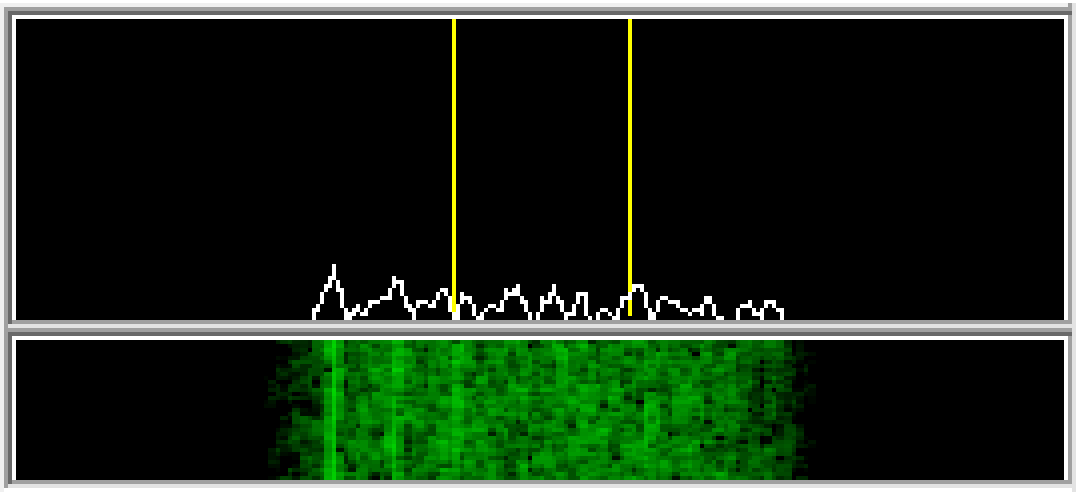
How Do I Set It Up

optional radio AF filtering

- PC Audio isolation
  - Transformer
  - Commercial interface
  - Some radios (K3, Flex)
- Narrow IF filters (Roofing & DSP)
  - 500 Hz - normal
  - 250 Hz – extreme QRM only
  - Tone filters – don't use
    - Icom Twin Peak Filter
    - K3 Dual-Tone Filter
- Audio filtering
  - JPS NIR-10/12
  - Timewave DSP-599zx
  - Modern DSP rigs

How Do I Set It Up?

adjust RX audio



- Set RX audio level for noise 5% of full-scale
  - Receiver audio out level control, and/or
  - *Windows* Recording Volume Control applet

How Do I Set It Up?

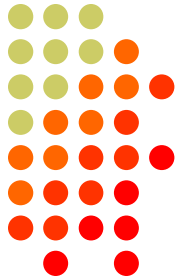
adjust AFSK audio

Insure SSB processor (compression) is Off.

- Adjust:
  - the *Windows* Playback Volume control, and
  - the transmitter Mic (or auxiliary audio input)
- Such that:
  - ALC is just backed off to moderate, and
  - full power output is attained.

How Do I Set It Up?

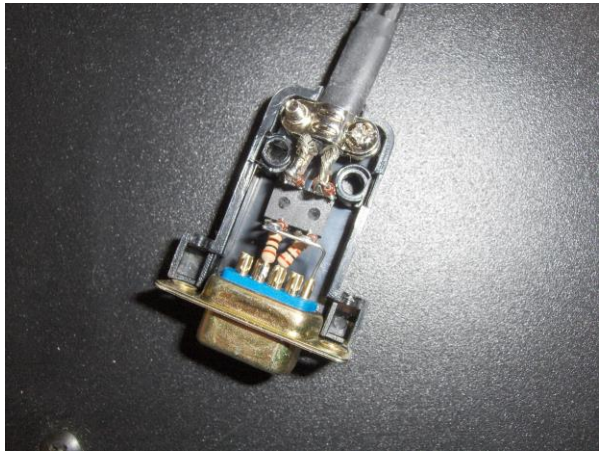
PTT vs. VOX

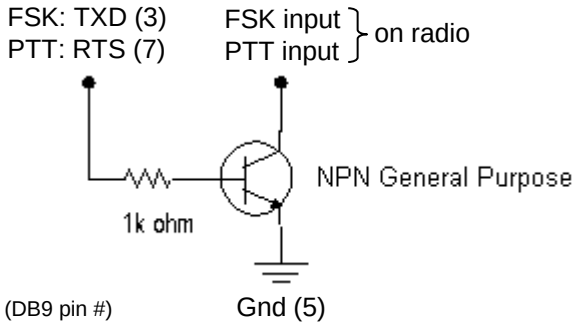


- AFSK uses VOX or PTT
  - radio Mic input will allow VOX
  - rear panel auxiliary audio input may not; then PTT
  - PTT can usually be keyed via the radio CAT cable
- FSK uses PTT
  - Serial port controls FSK and PTT signals

How Do I Set It Up?

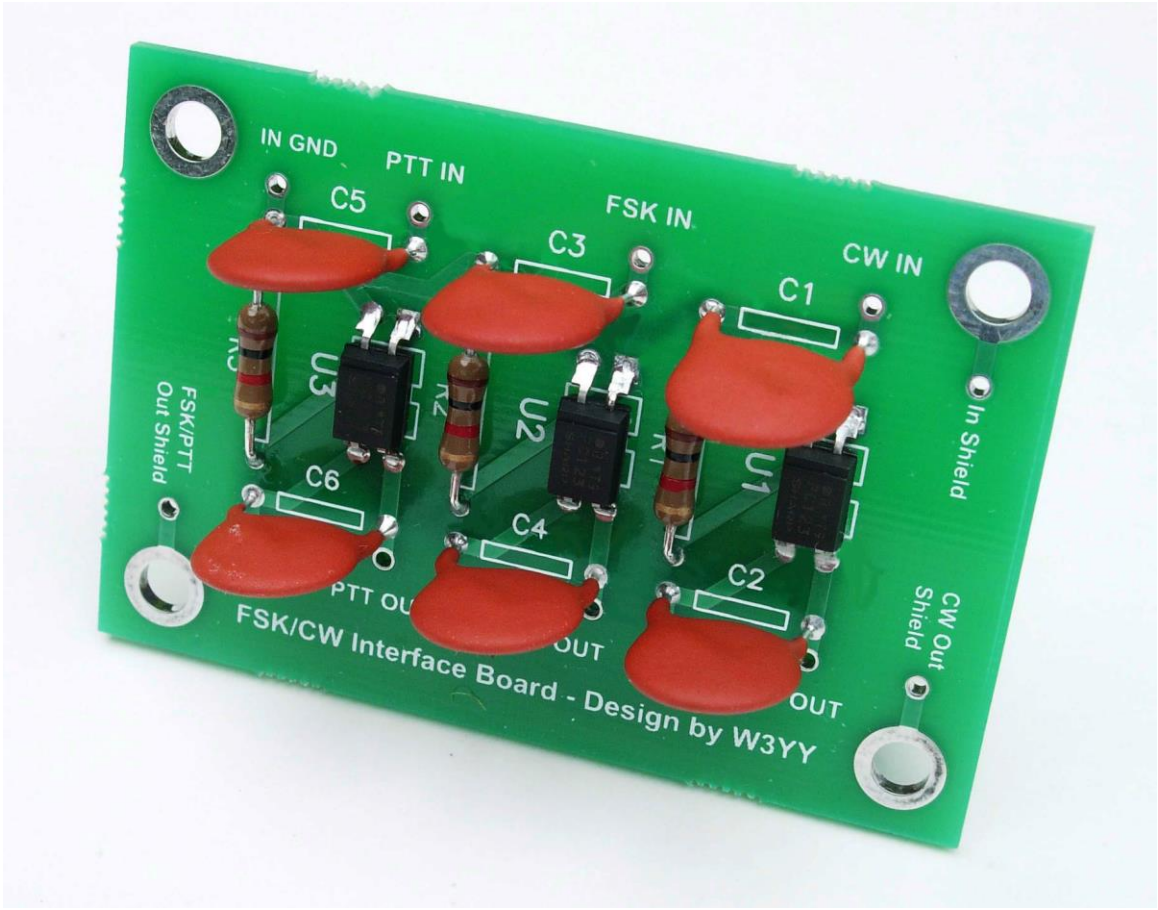
homebrew FSK & PTT keying cable





How Do I Set It Up?

W3YY *FSK & PTT keying cable*



How Do I Set It Up?

Morrty

How Do I Set It Up?

commercial interfaces

RASCAL

RIGblasters

How Do I Set It Up?

RigExpert Interfaces

How Do I Set It Up?

commercial interfaces

Vendor	Model	Price	PC In'fc	PTT	Soundcard	Level ctrl	FSK	CW	WinKey	Voice	Radio in'fc
generic (with K3)	(2) 3.5mm M-M audio cables	$ 10	-			√					
Buxcomm	Rascal-IIB or -IIIA	$ 69	-								
Buxcomm	Rascal GLX	$ 79	Serial	√							
Tigertronics	SL-1+	$ 80	-	auto							
Tigertronics	USB	$ 110	USB	auto	√	√					
MFJ	1273B	$ 60	Serial	√							
MFJ	1275	$ 110	Serial	√							
MFJ	1279	$ 140	Serial	√	√						
Mountain Radio	RIGblaster Nomic	$ 60	Serial/USB	√							
Mountain Radio	RIGblaster Plug & Play	$ 120	USB	√				√			some
Mountain Radio	RIGblaster Plus II	$ 160	USB	√			√ or CW	√ or FSK			some
Mountain Radio	RIGblaster Advantage	$ 200	USB	√	√	√	√ or CW	√ or FSK			√
Mountain Radio	RIGblaster Pro	$ 300	Serial/USB	√			√	√			√
Navigator	Navigator	$ 417	USB	√	√	√	√	√	√		√

See May-June 2012 NCJ, "RTTY Contesting" column

How Do I Set It Up?

microHAM interfaces

One Radio

SO2R

How Do I Set It Up?

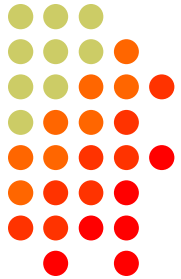
RigExpert & microHAM interfaces

Vendor	Model	Price	PC In'fc	PTT	Soundcard	Level ctrl	FSK	CW	WinKey	Voice	Radio in'fc	SO2R
RigExpert	Tiny	$ 120	USB	√	√			√		√	√	
RigExpert	Standard	$ 265	USB	√	√	√	√	√	√	√	√	
RigExpert	TI-5	$ 365	USB	√	√	√	√	√	√	√	√	
microHAM	USB Interface II	$ 179	USB	√				√			√	
microHAM	USB Interface III	$ 225	USB	√	√	√		√			√	
microHAM	Digi KEYER II	$ 369	USB	√	√	√	√	√	√		√	
microHAM	microKEYER II	$ 479	USB	√	√	√	√	√	√	√	√	
microHAM	micro2R	$ 369	USB	√		√	√	√	√	√	√	√
microHAM	MK2R	$ 899	USB	√		√	√	√	√	√	√	√
microHAM	MK2R+	$ 999	USB	√	√	√	√	√	√	√	√	√

See May-June 2012 NCJ, "RTTY Contesting" column

How Do I Set It Up?

summary - receive



1. Connect receiver audio output, via isolation, to …
   - MODEM Audio In,
     or
   - MMTTY via Soundcard Line In (or Mic In with pad):
     - Enable/adjust soundcard Line In (or Mic) input, disable/mute other inputs
2. Optional receive audio filtering

How Do I Set It Up?

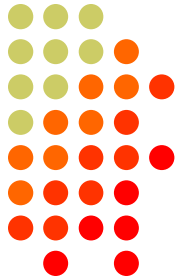
summary - AFSK

1. Connect radio's Line In (or, Mic In with pad), via isolation, from:
   - MODEM Audio Out

     or …
   - Soundcard Line Out
2. Speech processor off
3. Enable/adjust SC audio level
   - Disable or mute all other SC outputs

How Do I Set It Up?

summary - FSK

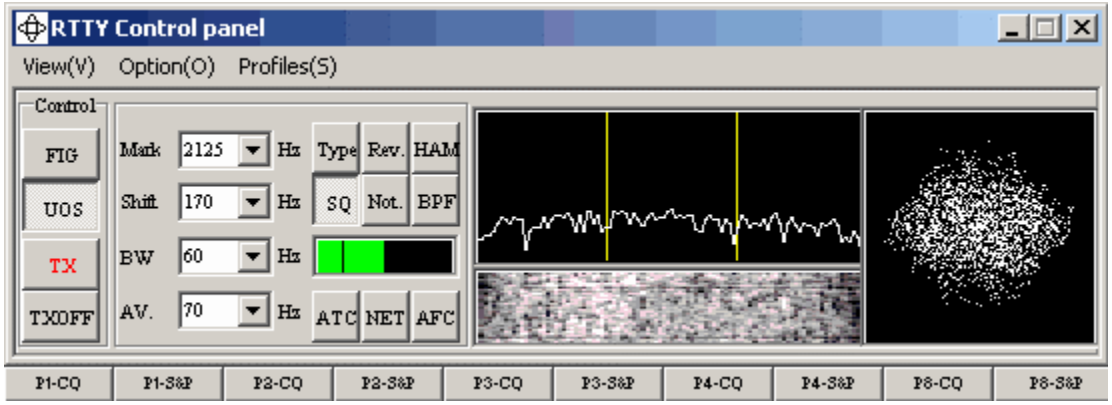


1. Connect the radio FSK and PTT inputs to:
   - the MODEM FSK and PTT outputs and connect the MODEM Serial port to the PC (USB adapter)

     or, if MMTTY …
   - the RTTY interface FSK and PTT outputs and connect the interface Serial port to PC (USB adapter)
2. If no PC Serial port, then use a USB-Serial adapter.
   - Beware that some won't key FSK properly. Edgeport USB-Serial adapters are known good.

Decoders

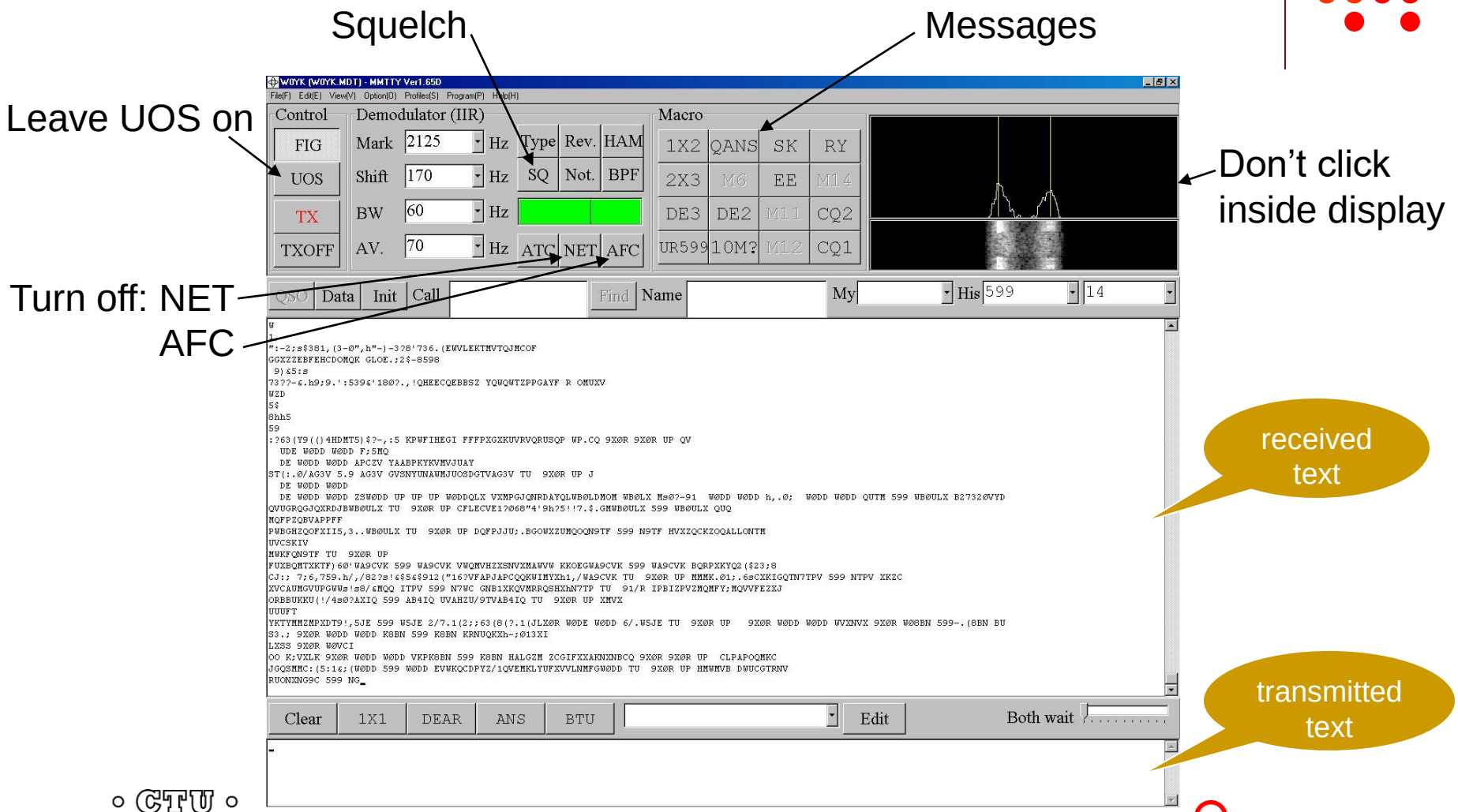
MMTTY



- Dominant soundcard MODEM in use today
- Exceeds performance of most other MODEMs
- Freeware since introduction in 2000
- Written by Mako, JE3HHT

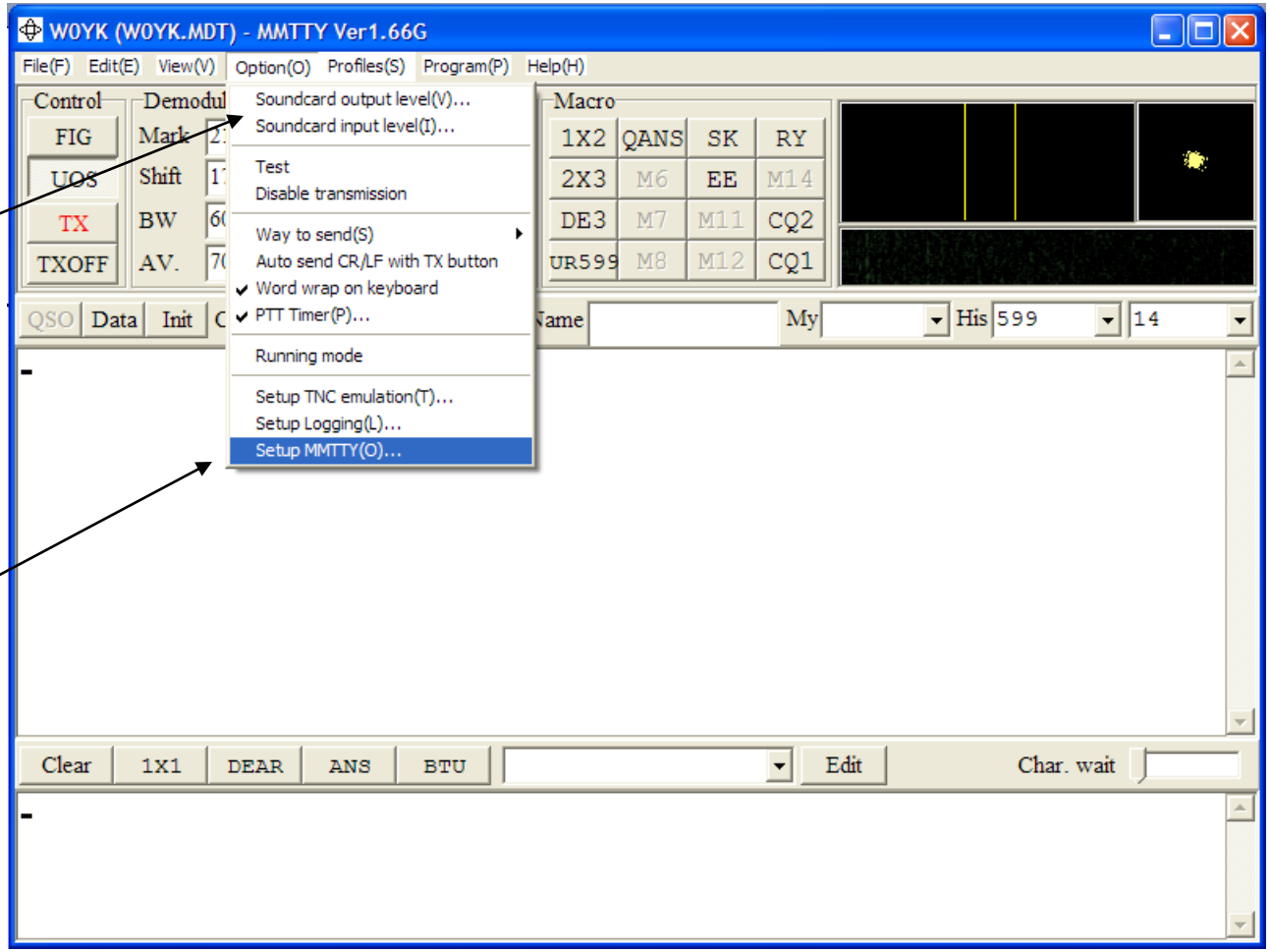
How Do I Set It Up?

MMTTY standalone



How Do I Set It Up?

MMTTY Option menu

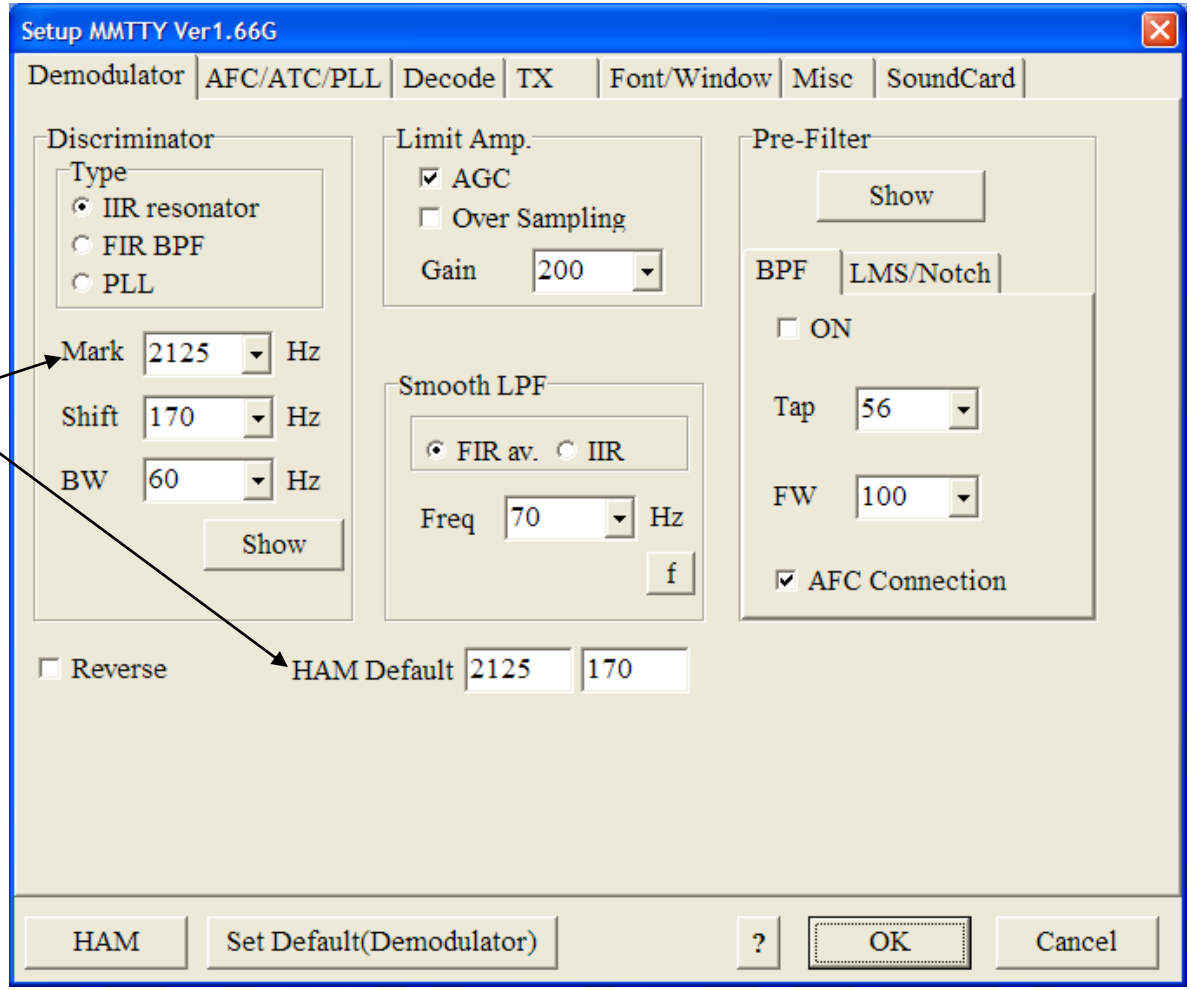


Soundcard levels

MMTTY setup

How Do I Set It Up?

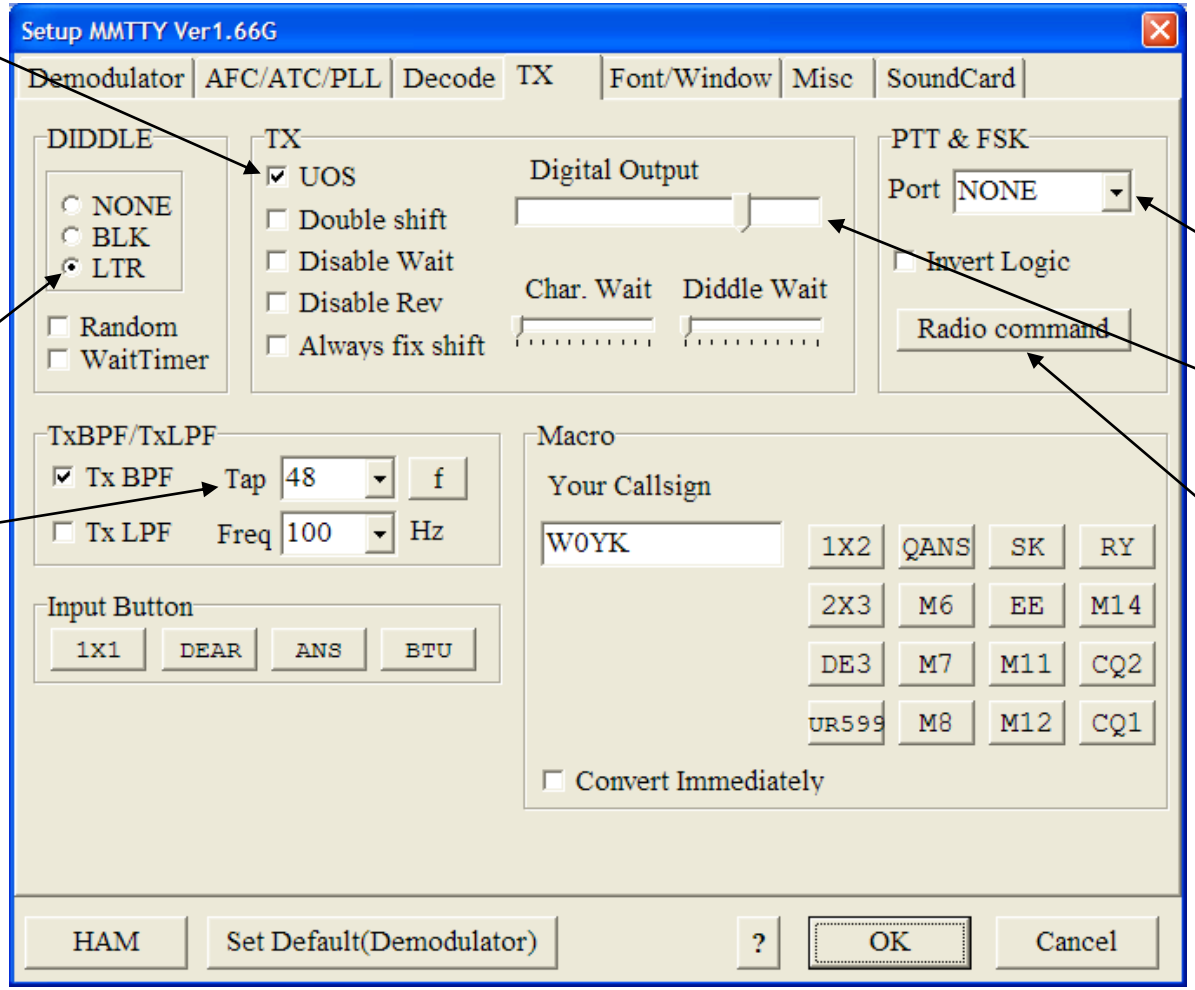
MMTTY Option/Setup/Demodulator



Set tones
(radio same)

How Do I Set It Up?

MMTTY Option/Setup/TX



TX UOS on

Select LTR

512 Tap,
if PC has perf.

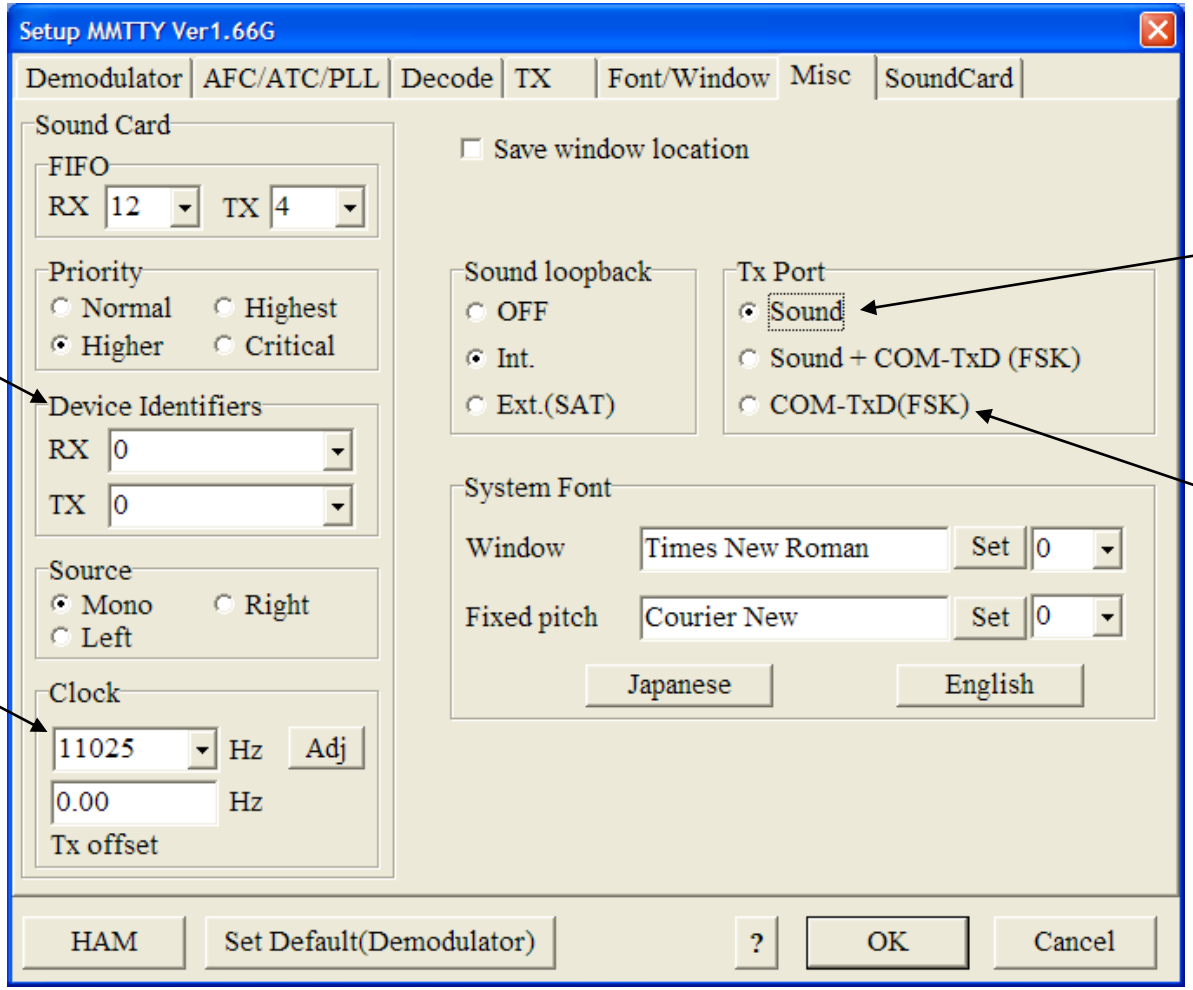
FSK/PTT port

Soundcard
Line Out level

AFSK PTT

How Do I Set It Up?

MMTTY Option/Setup/Misc



Soundcard

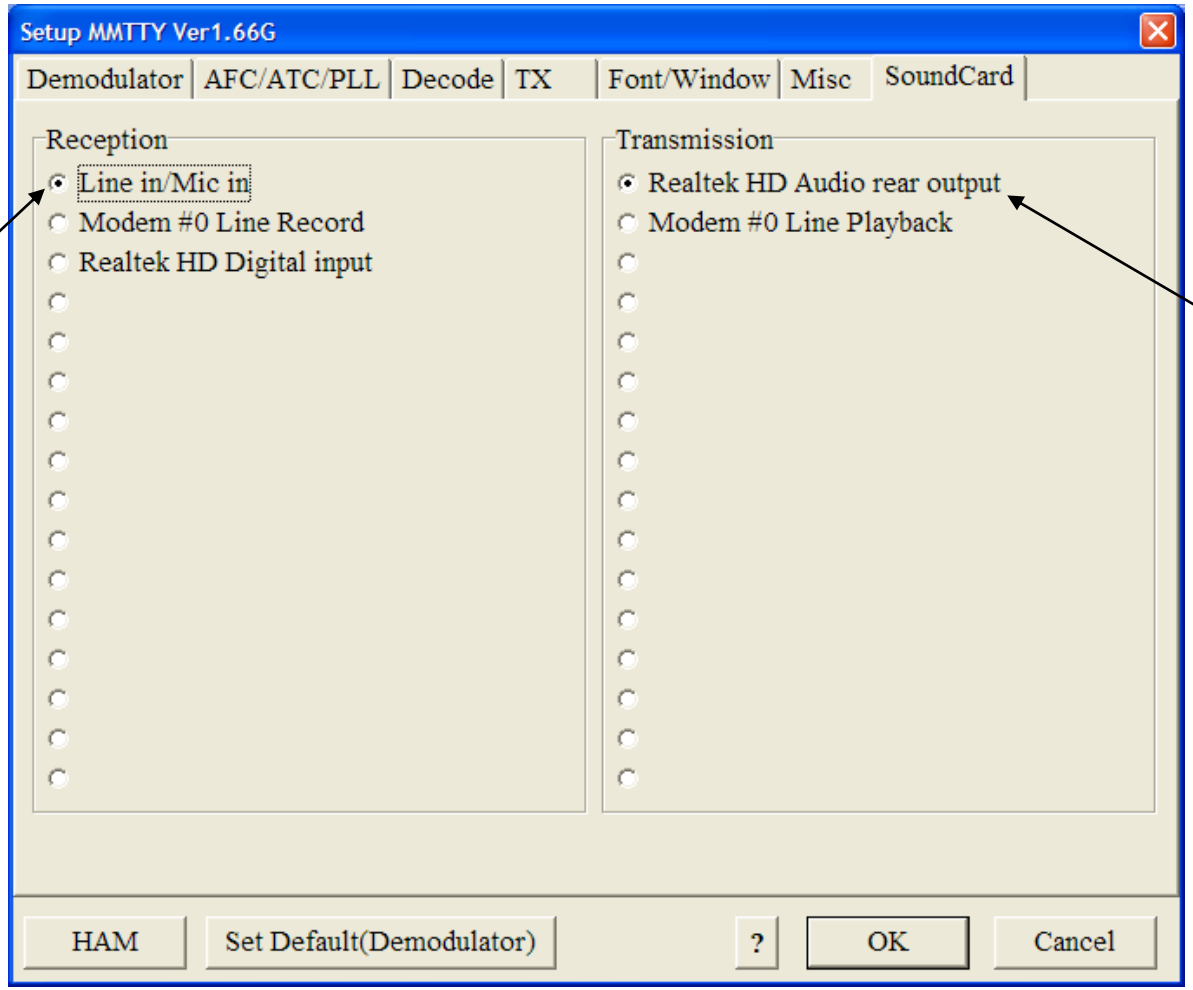
Soundcard Format, 4x

AFSK

FSK

How Do I Set It Up?

MMTTY Option/Setup/SoundCard

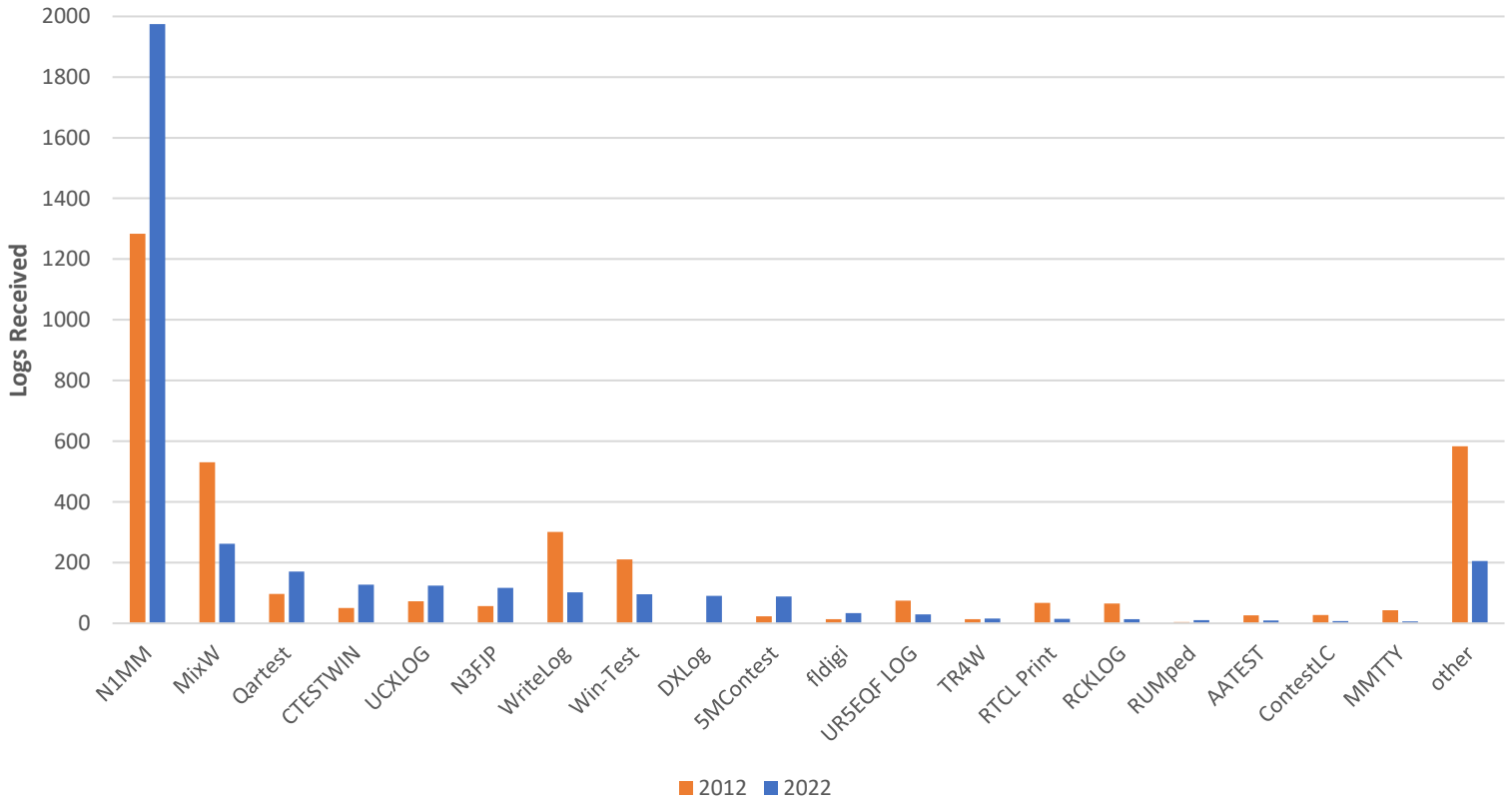


Select receive Soundcard

Select transmit Soundcard (AFSK only)

CQ WPX RTTY

logs received: 2022 vs. 2012



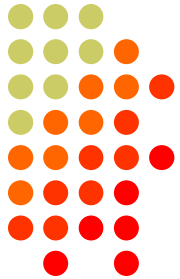
RTTY Contest Loggers

- WriteLog *(1994; created for RTTY)*
  - CW & RTTY came later
  - *www.rttycontesting.com/tutorials*
- N1MM Logger+ *(2000; dedicated RTTY software designer)*
  - Free
  - *www.rttycontesting.com/tutorials*
- Win-Test *(2003; RTTY is low priority)*

All three integrate MMTTY & 2Tone and have similar functionality for basic RTTY contesting.

A Blizzard of Details!

this is fun??



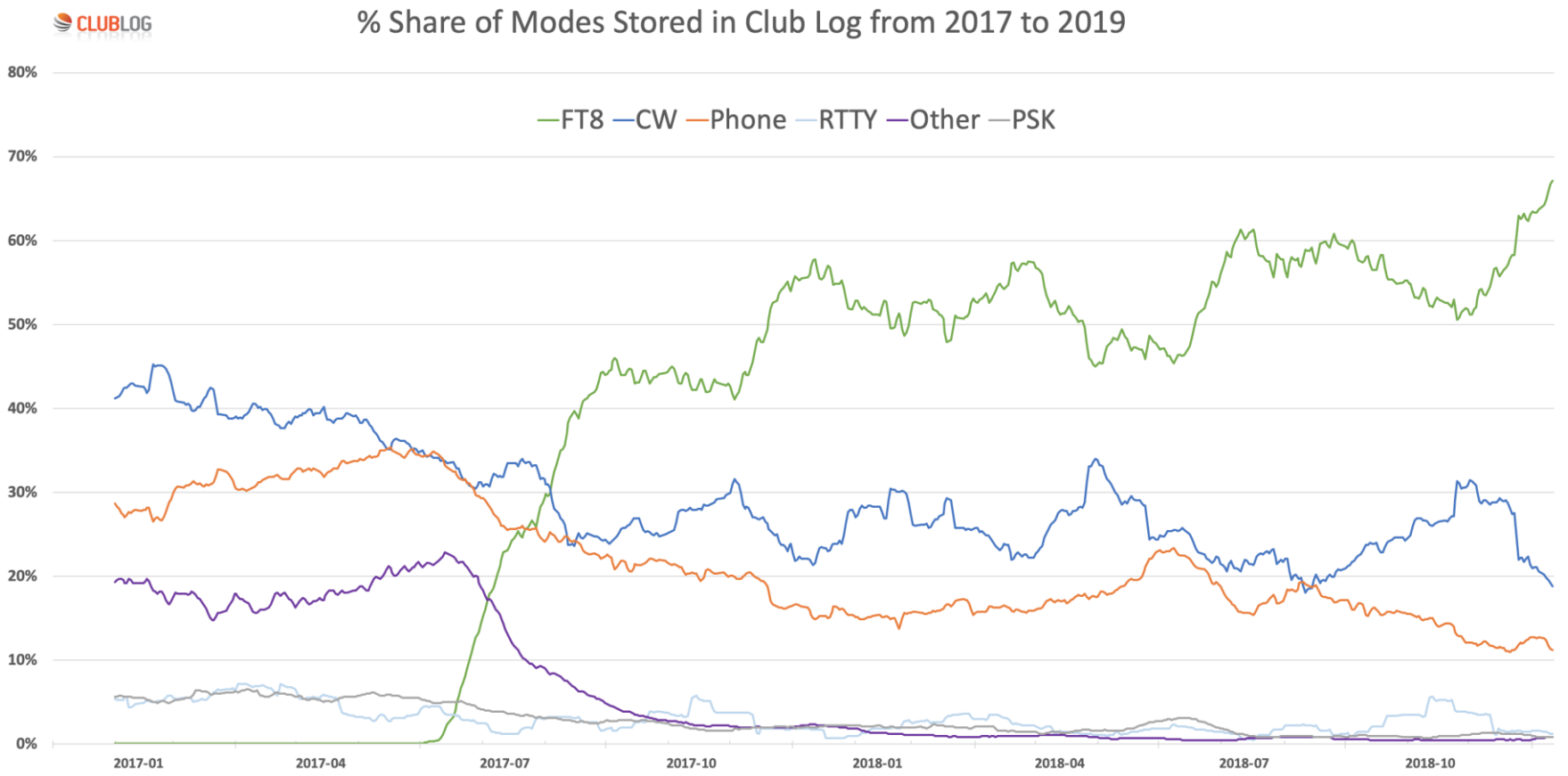
Start Simple, then Enhance

- MMTTY *(free)*
  - get RX working *(std audio cable from radio to PC)*
  - get TX working using either:
    - AFSK *(2nd std audio cable from radio to PC)*
    - FSK *(keying cable or commercial interface)*
- Integrate MMTTY with logging software
- Enhance later
  - Audio isolation *(highly recommended)*
  - 2Tone
  - Higher capability interface *(DIY or commercial)*
  - Advanced setup: SO2V, SO2R, multiple decoders, ...

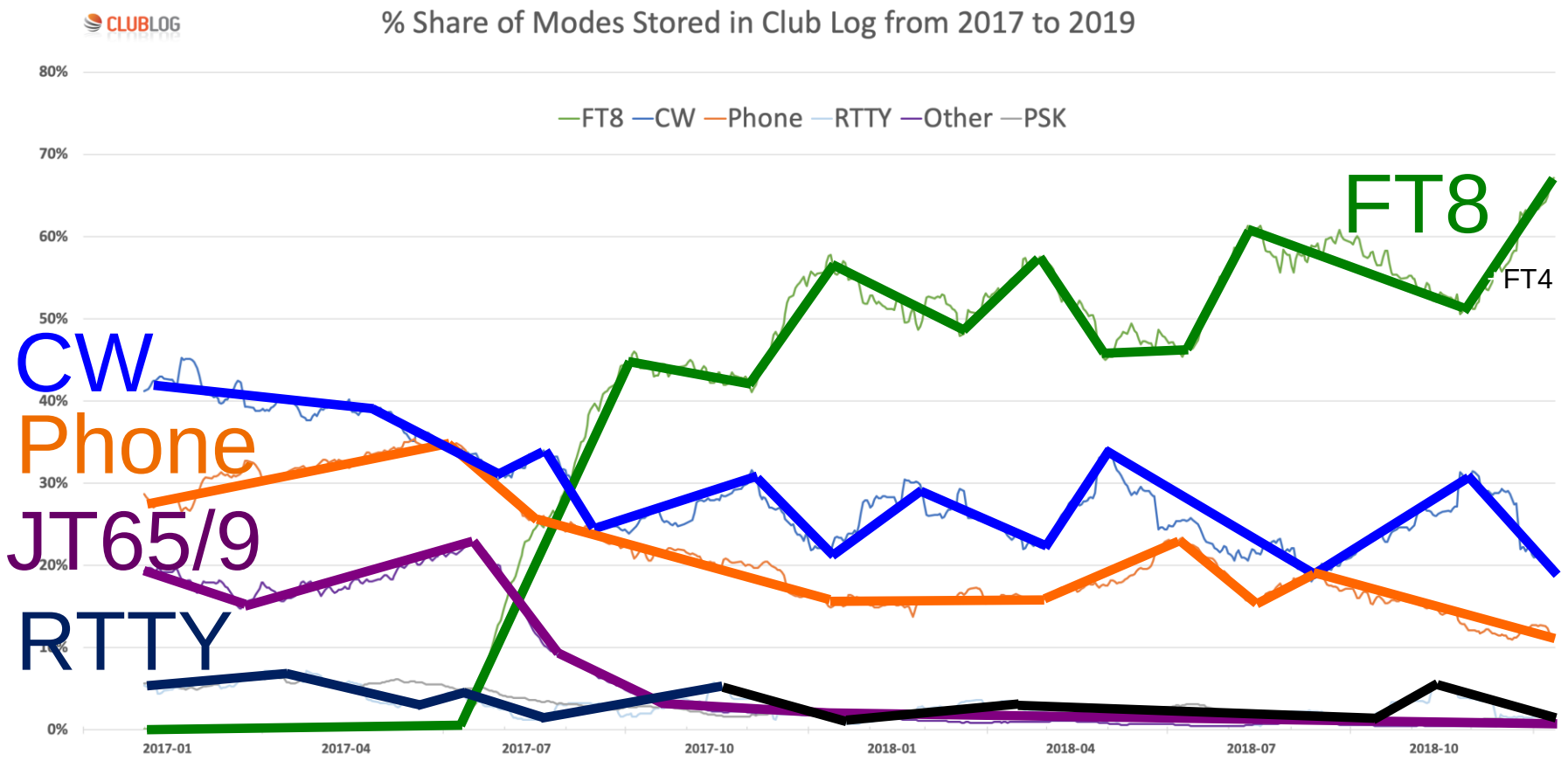
Resources

- www.rttycontesting.com premier website
  - Tutorials and resources (beginner to expert)
  - WriteLog, N1MM Logger+ and MMTTY
- rtty@groups.io Email reflector
  - RTTY contester networking
  - Q&A
- Software web sites
  - hamsoft.ca/ (MMTTY)
  - n1mm.hamdocs.com/tiki-index.php (N1MM Logger+)
  - www.writelog.com (WriteLog)
  - www.win-test.com (Win-Test)
- Software Email reflectors
  - mmtty@yahoogroups.com (MMTTY)
  - N1MMLoggerplus@groups.io (N1MM Logger+)
  - Writelog@contesting.com (WriteLog)
  - support@win-test.com (Win-Test)

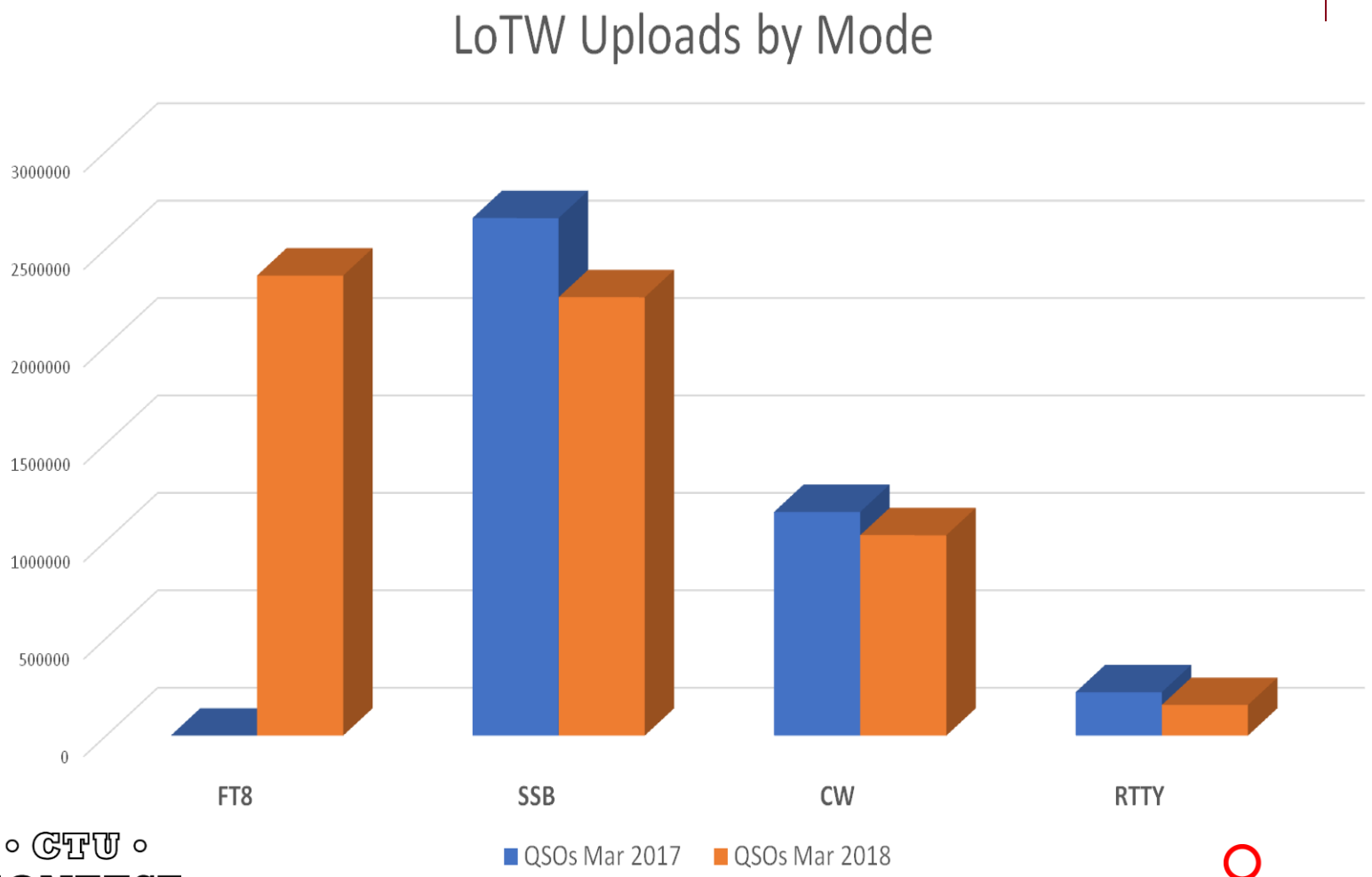
Clublog QSOs by Mode



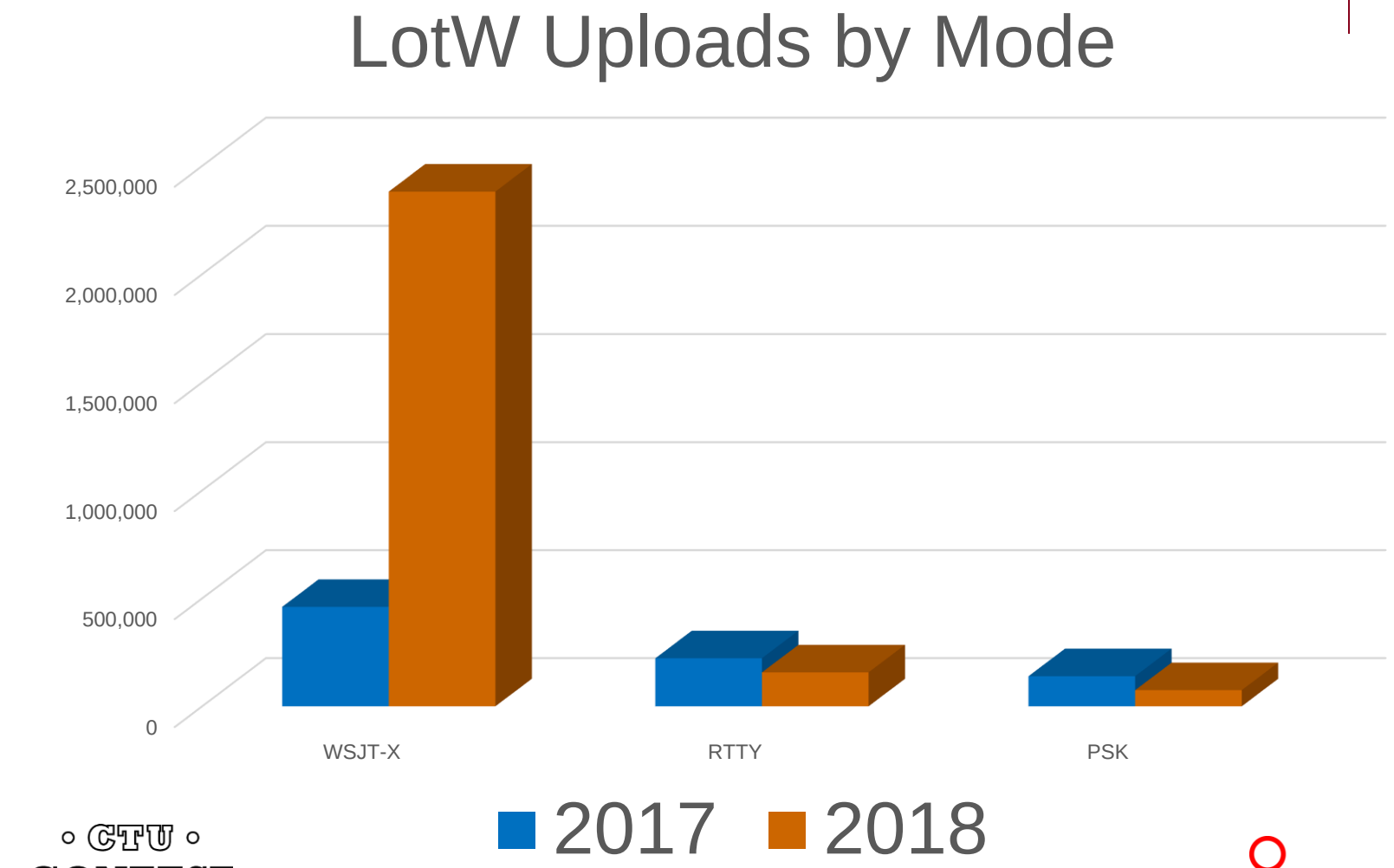
Clublog % QSOs by Mode: 2017-2018



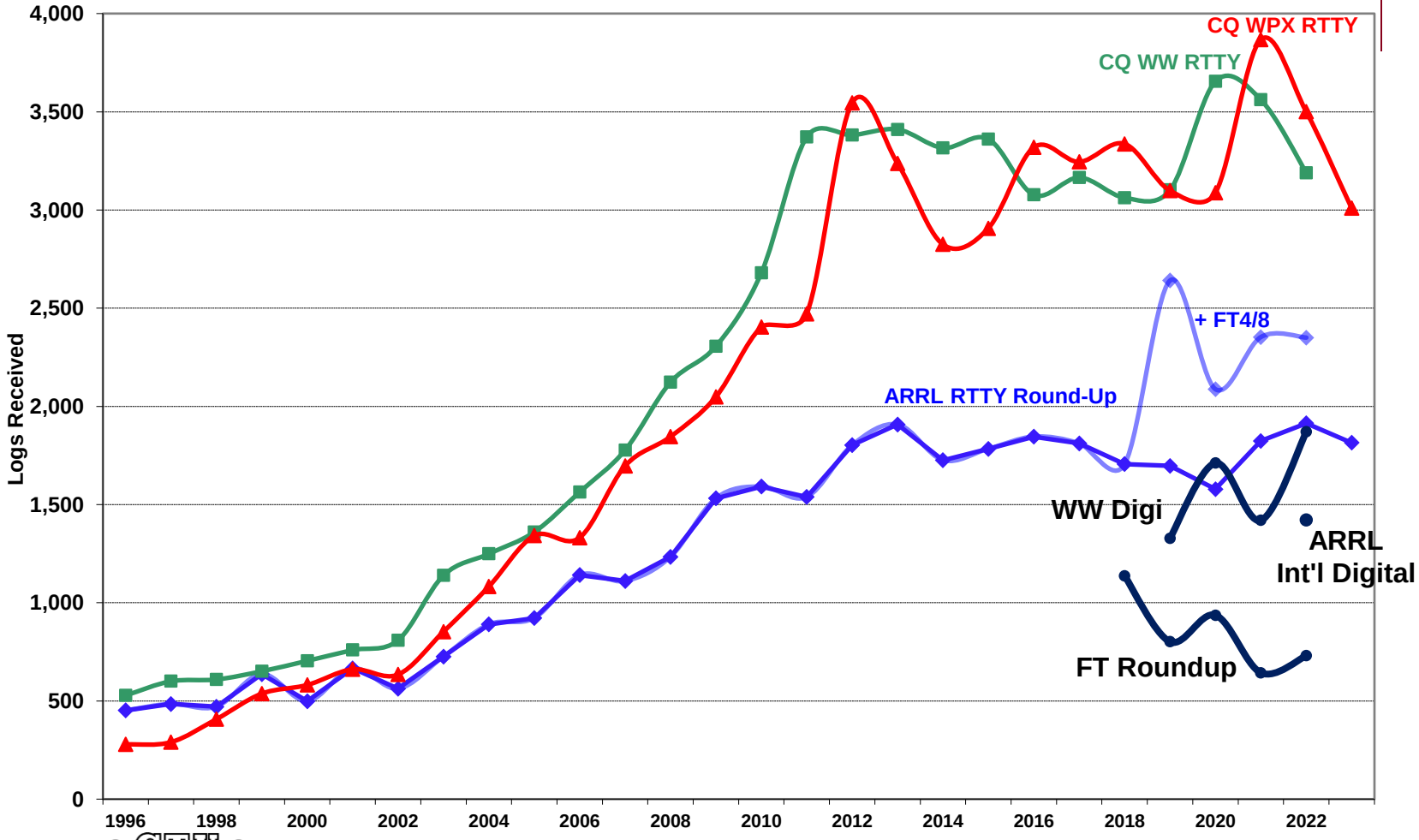
The FT8 Explosion



Digital Mode Trends



Three Largest FT4/8 Contests

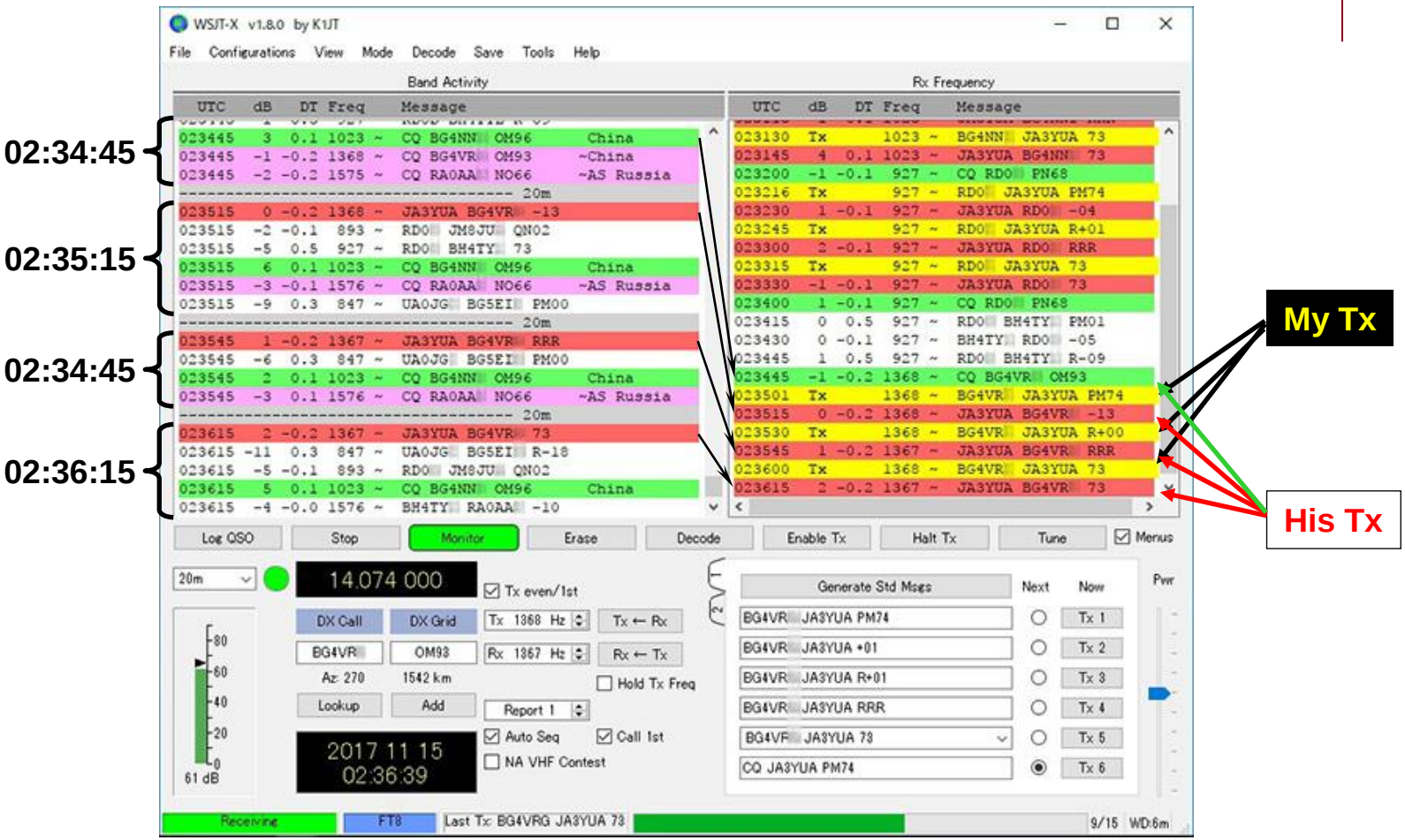


WSJT & WSJT-X Overview

- Weak Signal communication by Joe Taylor - eXperimental
- Developed for EME; adapted by HF
- Several modes (JT65, JT9, FT8, etc.)
- TX/RX cycles synchronous with time servers

+ Multi-channel (external spotting and CQ/S&P irrelevant)
+ Weak signal (inaudible)
    + Longer DX
    + Lower power
    + Compromised antennas and/or QTH
+ Narrow bandwidth (4-176 Hz)
+ "Perfect" copy (SCP irrelevant)

FT8 Multi-Channel Reception

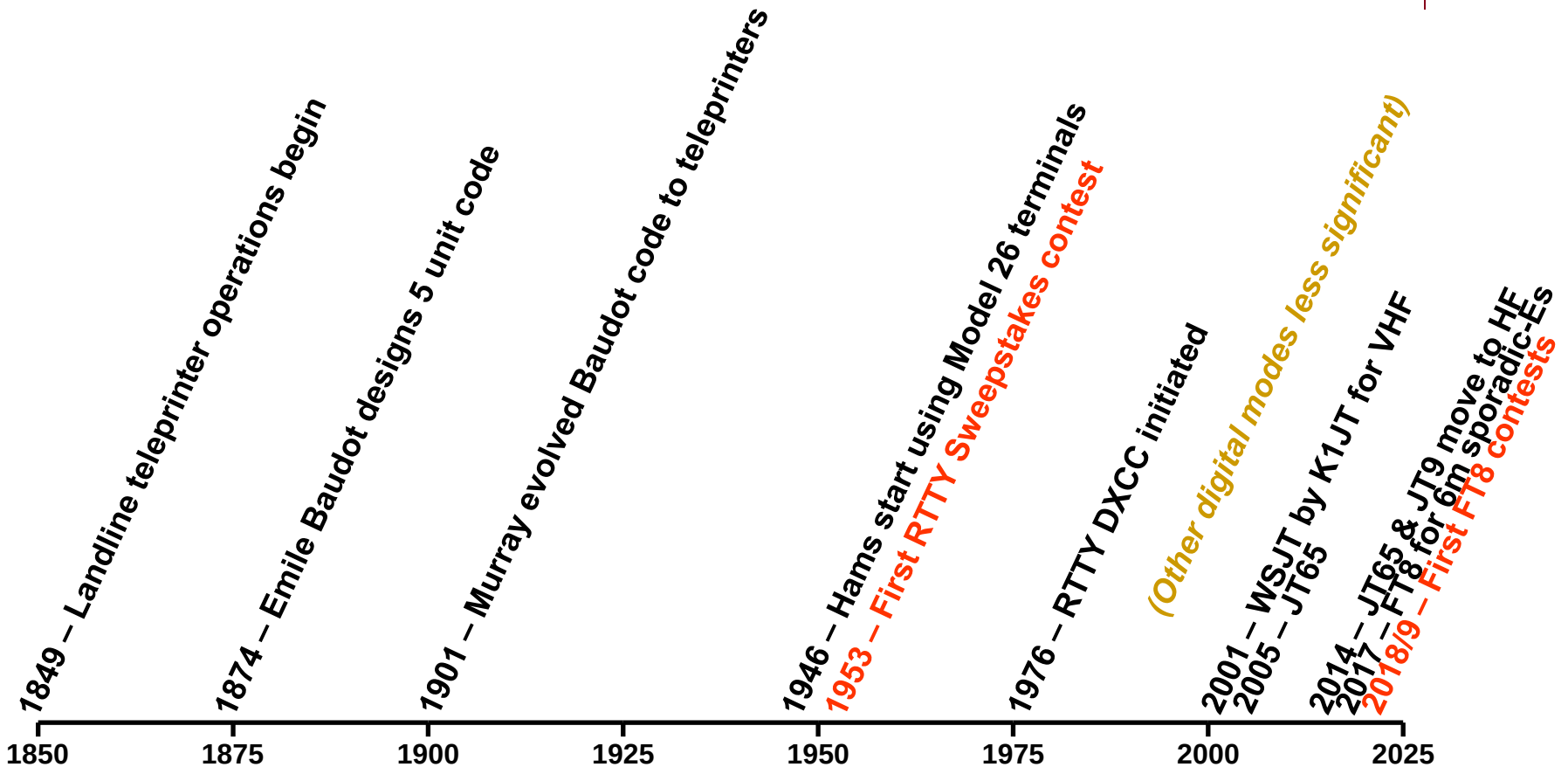


WSJT-X Overview

- Multi-channel (external spotting and CQ vs. S&P irrelevant)
- Weak signal (FT8 -13dB & FT4 -10dB compared to RTTY)
  - Longer DX
  - Lower power
  - Compromised antennas and/or QTH
- Narrow bandwidth (4-176 Hz: FT8=50 Hz; FT4=80 Hz)
- “Perfect” copy (SCP irrelevant)

- Slow 1-6 minutes/QSO → 30 seconds (FT4)
- Limited, fixed messages → fine for contesting
- Minimal reaction time → message automation

RTTY & WSJT History



WSJT & WSJT-X History

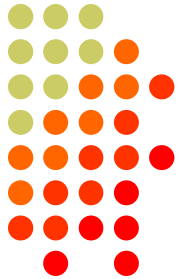
- 2001: FSK441 for meteor scatter
- 2002: JT6M for ionospheric scatter
- 2003: JT65 VHF/UHF EME
  - Adopted for QRP HF DXing; 176 Hz bandwidth; 60 sec. transmission
- 2014: JT9 for LF, MF and HF
  - 2 dB more sensitive than JT65; 16 Hz bandwidth
- Jun 2017: FT8 for 6m Es & HF
  - 50 Hz bandwidth; 15 second transmission
- May 2018: Baker Is. DXpedition > 11,000 FT8 HF QSOs
- *Dec 2018: FT8 Roundup (first WSJT-X HF contest)*
- *Jan 2019: ARRL RTTY Roundup (FT8 permitted)*
- *Apr 2019: FT8 DX Contest*
- *Sep 2019: SCC RTTY Championship → WW Digi*
- *Jun 2022: ARRL International Digital*
- *Jan 2023: ARRL RTTY Roundup becomes RTTY-only*

Major FT Contests

- ARRL RTTY Roundup [1st weekend in Jan]
  - 2019: FT8 added
  - 2020: FT4 added
  - 2022: RTTY-only or FT-only or Mixed
  - 2023: RTTY-only; no other modes
- ARRL International Digital [1st weekend in Jun]
  - Distance-based scoring
- WW Digi DX Contest [last weekend in Aug]
  - Same as ARRL Int'l Digital
    - plus Grid multipliers
    - minus 160m and 6m
- FT Roundup [1st weekend in Dec]
  - RTTY Roundup rules

FT8 Standard QSO

90 sec./QSO



- **CQ K1ABC FN42**
- **W9XYZ K1ABC -11**
- **W9XYZ K1ABC RRR**
- **K1ABC W9XYZ EN37**
- **K1ABC W9XYZ R-09**
- **K1ABC W9XYZ 73 (superfluous 2nd QSL)**

FT8 Short-Cycle QSO

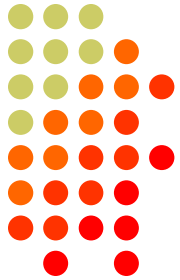
60 sec./QSO

- **CQ K1ABC FN42**
- **W9XYZ K1ABC R-11**
- **CQ K1ABC FN42**
  N5DEF K1ABC R-07
- **K1ABC W9XYZ -09** **(TX2, not TX1)**
- **K1ABC W9XYZ RR73**
  K1ABC N5DEF -01

30 sec. rolling QSOs

FT8 DXpedition QSO

75 sec./QSO
60 sec./5 QSOs



- **CQ KH1/KH7Z**
- **K1ABC KH7Z -12**
  <"CQ" for others>
- **K1ABC RR73**
  W9XYZ KH7Z -08
  W0YK KH7Z -13
  <"CQ" for others>
- **W9XYZ KH7Z RR73**
  W0YK KH7Z RR73

- **KH7Z K1ABC FN42**
- **KH7Z K1ABC R-14**
  KH7Z W9XYZ EN37
  KH7Z W0YK CM97
  etc.
- **KH7Z W9XYZ R-11**
  KH7Z W0YK R-15
  KH7Z K9YC CM87
  KH7Z W6OAT CN87
  etc.

QSO period 1
QSO period 2
QSO period 3

CTU
CONTEST UNIVERSITY

ICOM

WW Digi QSO

60-75 sec./QSO
30 sec./rolling QSO

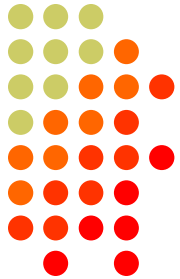
QSO period 1
QSO period 2
QSO period 3

- **CQ WW K1ABC FN42**
- **W9XYZ K1ABC R-FN42**
  (implicit "CQ" for others)
- **W0YK K1ABC R-FN42**
  (implicit "2nd QSL" for W9XYZ)
  (implicit "CQ" for others)
- **P49X K1ABC R-FN42**
  (implicit "2nd QSL" for W0YK)
- **P49X K1ABC 73**
  (superfluous 2nd QSL)

- **K1ABC W9XYZ EM05**
- **K1ABC W9XYZ RR73**
  K1ABC W0YK CM97
- **K1ABC W0YK RR73** ← **K1ABC W9XYZ RR73**
  K1ABC P49X FK52
- **K1ABC P49X RR73** ← **K1ABC W0YK RR73**

WW Digi QSO

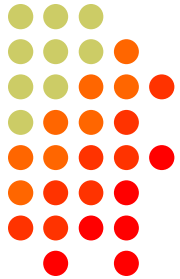
60-75 sec./QSO
30 sec./rolling QSO



QSO period 1
QSO period 2
QSO period 3

- CQ WW K1ABC FN42
- K1ABC W9XYZ EM05
- W9XYZ K1ABC R-FN42
  (implicit "CQ" for others)
- K1ABC W9XYZ RR73
  K1ABC W0YK CM97
- W0YK K1ABC R-FN42
  (implicit "2nd QSL" for W9XYZ) ← W9XYZ may want 73
  (implicit "CQ" for others)
- K1ABC W0YK RR73 ← K1ABC W9XYZ RR73
  K1ABC P49X FK52
- P49X K1ABC R-FN42
  (implicit "2nd QSL" for W0YK) ← W0YK may want 73
- K1ABC P49X RR73 ← K1ABC W0YK RR73
- P49X K1ABC 73
  (superfluous 2nd QSL)

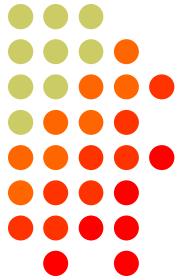
Setting Up for FT8



- **Download/install WSJT-X**
  - **Alternatively MSHV or DigiRite (WriteLog only)**
- **Hardware (radio and PC) same as AFSK**
- **Study the:**
  - **Quick Start Guide to WSJT-X 2.0, and**
  - **the WSJT-X User Guide**

Time Synchronization

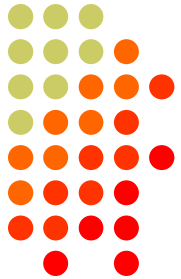
mandatory for reliable QSOs



- Windows Internet Time Sync
  - Weekly updates
  - Can be unreliable
- Alternatives
  - Meinberg NTP (recommended by K1JT)
  - NetTime (recommended by W0YK)
  - Dimension 4
  - Atomic Clock Sync

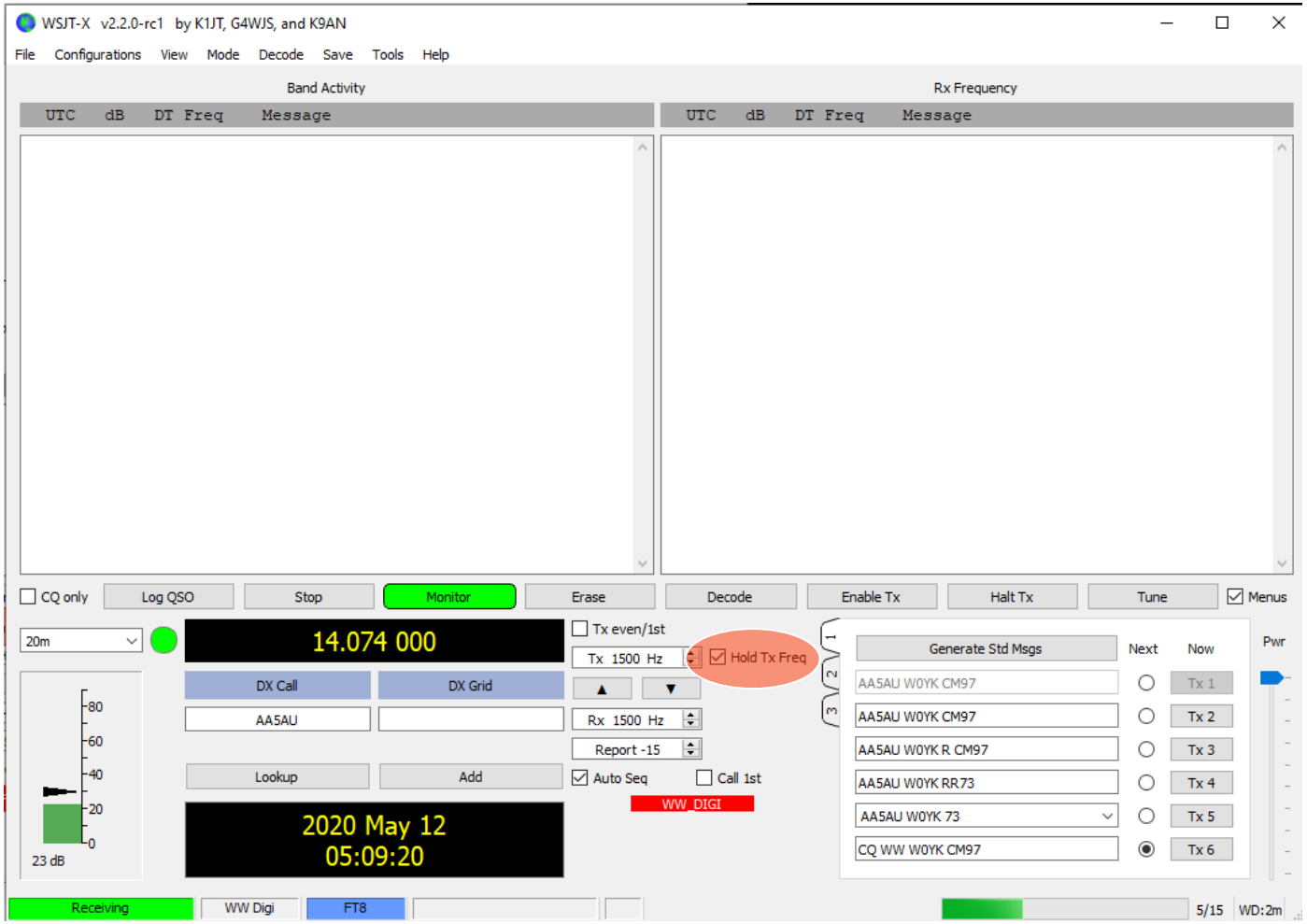
Sub-Band Choices

Int'l Digi, WW Digi, FT RU

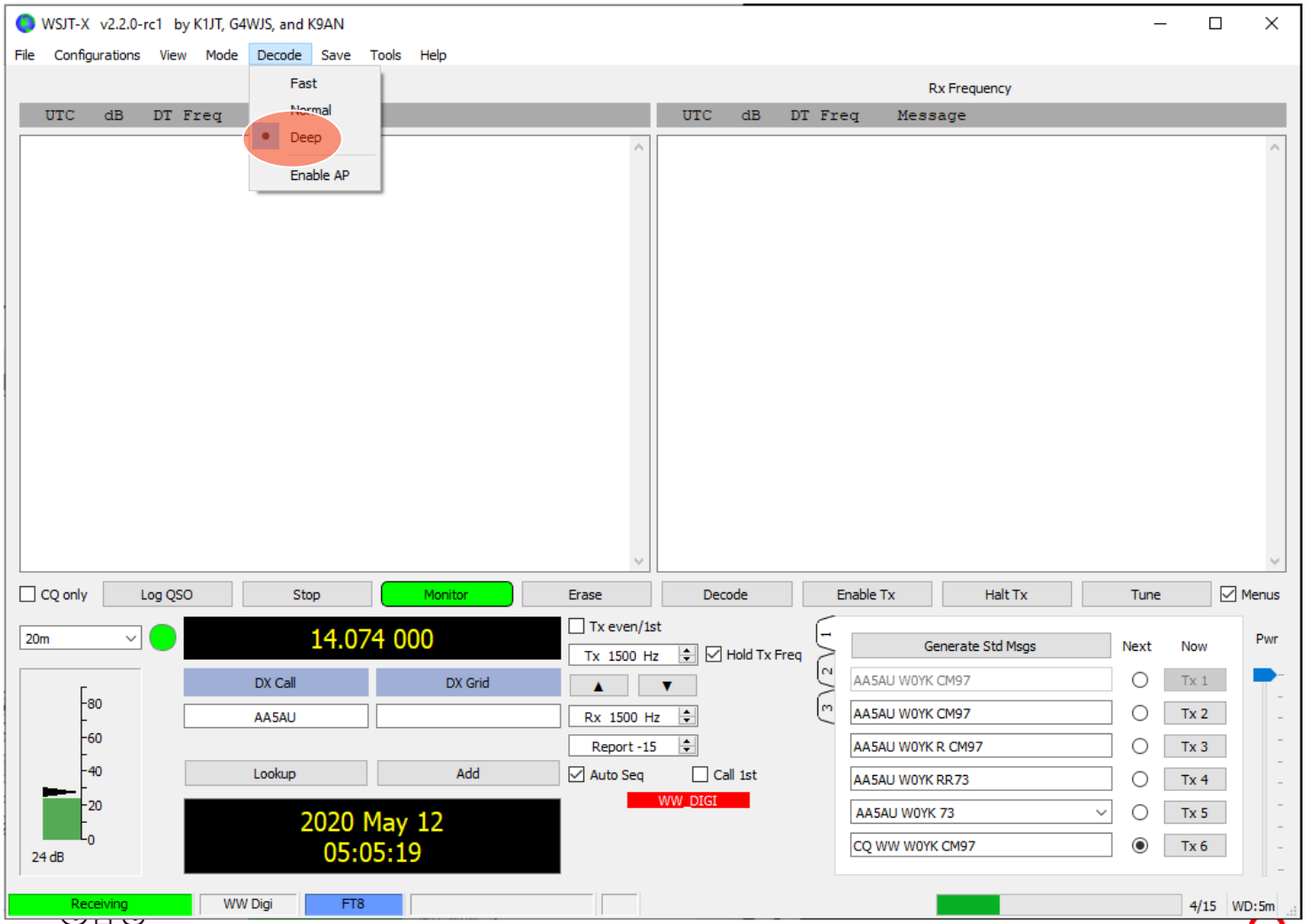


- Suppressed-Carrier dial frequency
  - FT4: 14080
  - FT8: 14090
- Use receiver's maximum BW: 2.5-4 kHz
- QSO partner > 3 kHz … call above 3 kHz
- Move dial frequency up in 3 kHz increments

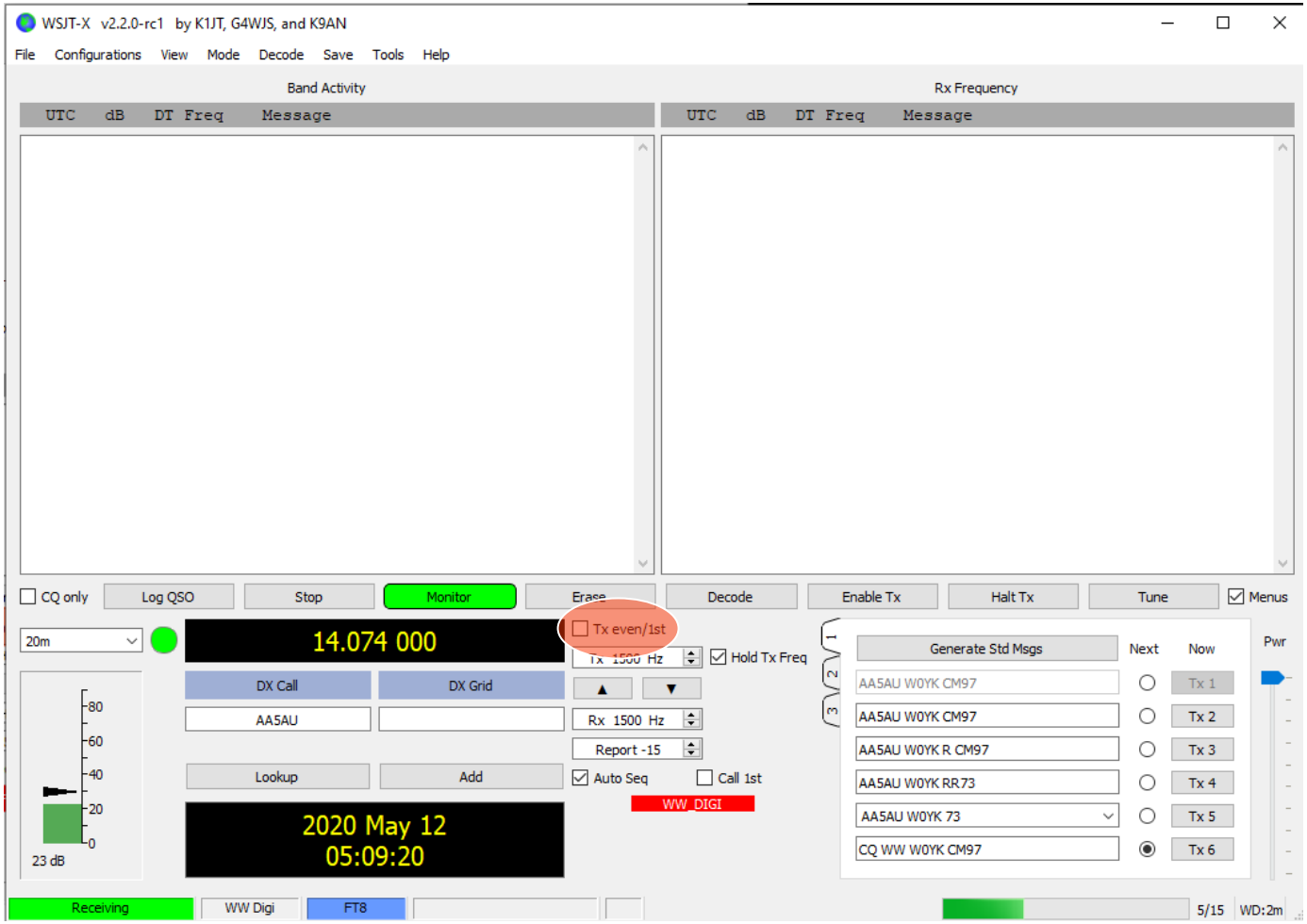
Split Transmit



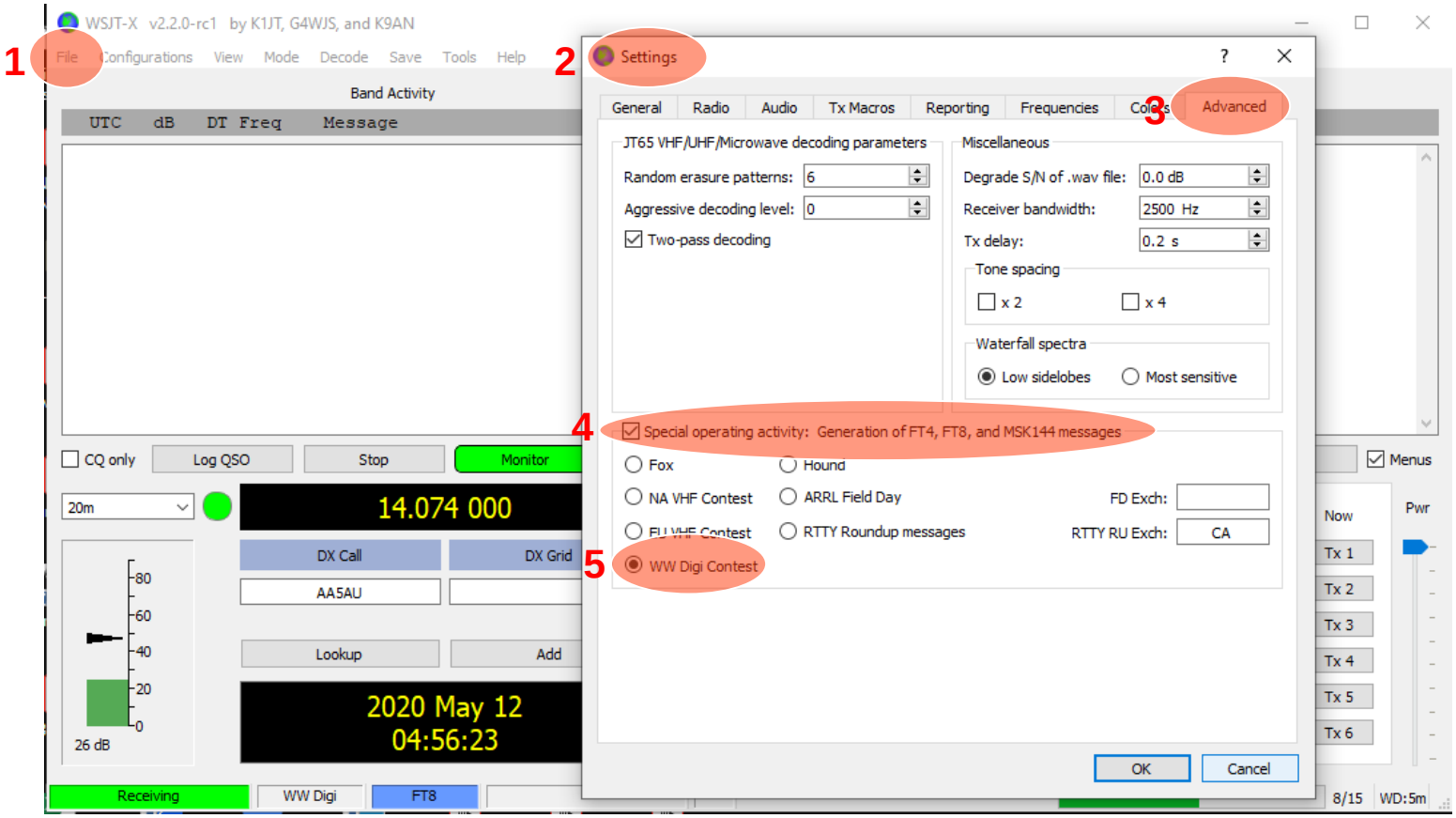
Deep Decode


WSJT-X v2.2.0-rc1 by K1JT, G4WJS, and K9AN
File Configurations View Mode Decode Save Tools Help
Fast
Normal
Deep
Enable AP
Rx Frequency
UTC dB DT Freq
UTC dB DT Freq Message
CQ only
Log QSO
Stop
Monitor
Erase
Decode
Enable Tx
Halt Tx
Tune
Menus
20m
14.074 000
Tx even/1st
Tx 1500 Hz
Hold Tx Freq
DX Call
DX Grid
AA5AU
Rx 1500 Hz
Report -15
Lookup
Add
Auto Seq
Call 1st
WW_DIGI
2020 May 12
05:05:19
24 dB
Generate Std Msgs
Next
Now
Pwr
AA5AU W0YK CM97
AA5AU W0YK CM97
AA5AU W0YK R CM97
AA5AU W0YK RR73
AA5AU W0YK 73
CQ WW W0YK CM97
Tx 1
Tx 2
Tx 3
Tx 4
Tx 5
Tx 6
Receiving
WW Digi
FT8
4/15
WD:5m

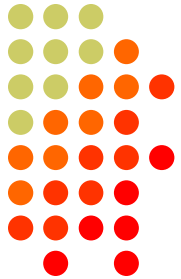
Utilize Odd/Even Cycles



WW Digi DX Contest



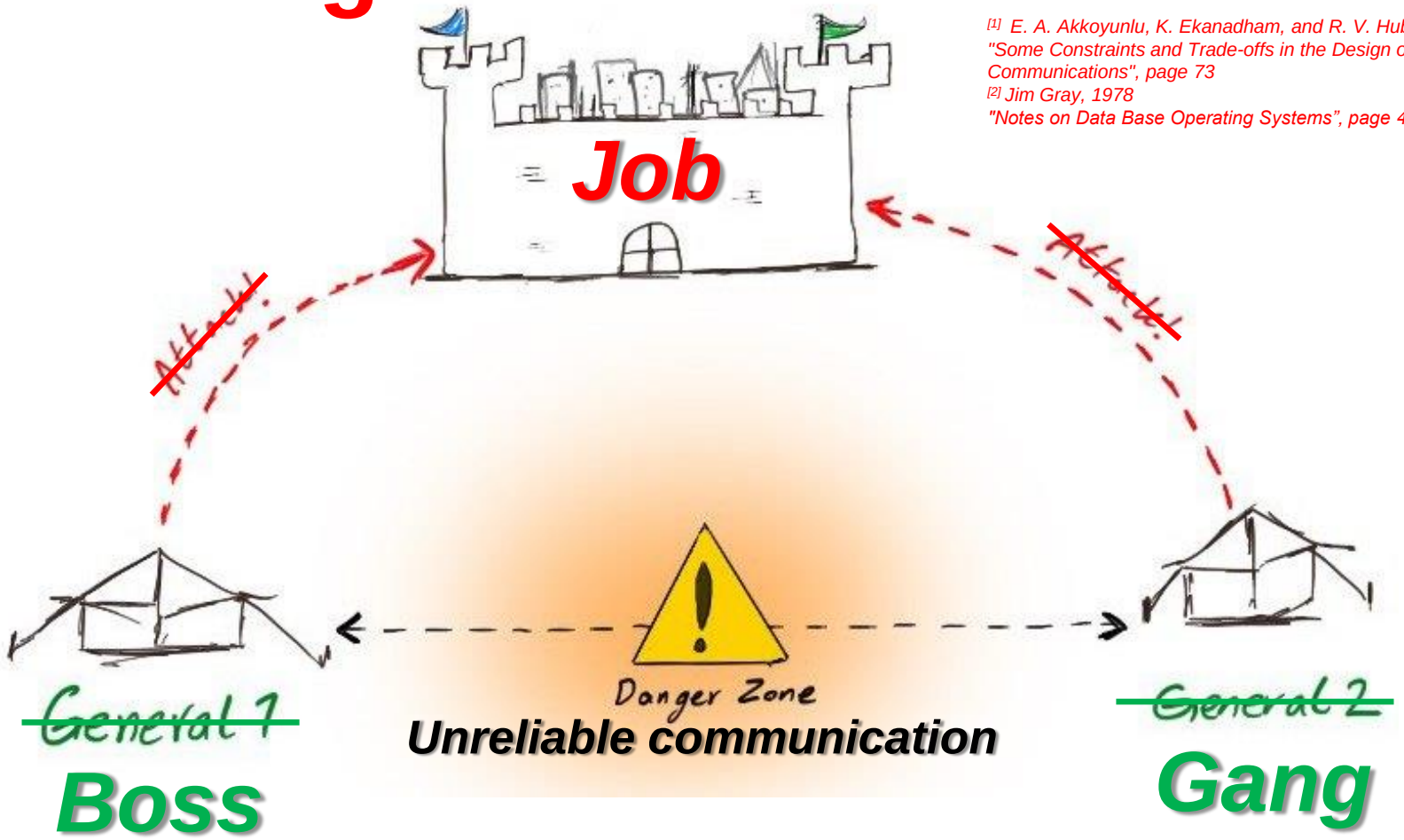
Minimizing NILs in WW Digi



- FT contest NILs are high
  - RTTY is 1-2%, FT is 5-6%
- QSO partners disagree on QSO completion
  - One doesn't log, the other logs (and, gets a NIL)

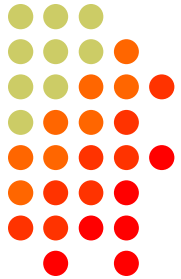
CQ W0YK CM97	
W0YK AA5AU EL92	***←AA5AU answers with exch***
AA5AU W0YK R CM97	***← W0YK QSLs with exch***
W0YK AA5AU RR73	***← AA5AU QSLs***
AA5AU W0YK 73	***← W0YK QSLs AA5AU's QSL!***
	← when does it end?

~~Two Generals~~ Paradox [1,2]
The Gangsters



[1] E. A. Akkoyunlu, K. Ekanadham, and R. V. Huber, 1975
"Some Constraints and Trade-offs in the Design of Network Communications", page 73
[2] Jim Gray, 1978
"Notes on Data Base Operating Systems", page 465

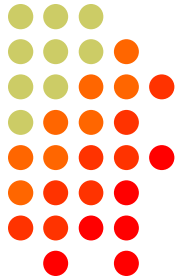
FT Repeat Protocol



CQ W0YK CM97	
W0YK AA5AU EL92	***←AA5AU calls with exch***
AA5AU W0YK R CM97	***← W0YK QSL's with exch***
W0YK AA5AU RR73	***←AA5AU QSL's***
AA5AU W0YK R CM97	***← W0YK missed QSL msg***
W0YK AA5AU RR73	***←AA5AU repeats QSL***

Minimizing NILs

Recommendation

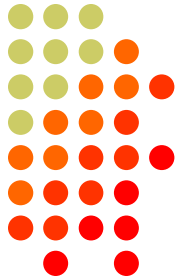


- Develop skill to dynamically change message
  - e.g., use the Alternate F1-F6 keys in WSJT-X
- Always log the QSO when receiving a RRR, RR73 or 73 message.
- Always log the QSO when sending RRR, RR73 or 73 message.
  - Look for a clue that your message was not received, e.g., your QSO partner re-sends his report.

FT8 vs. FT4 Strategy

- FT4 is faster; FT8 decodes better
  - Intrinsic vs. extrinsic speed
    - FT4 is intrinsically 2x the speed of FT8
    - FT8 is more likely to decode
    - Either might be extrinsically faster at a given time
  - Dynamically use the mode with highest QSO rate
- New stations & multipliers in each mode

Resources



- Software web sites
  - physics.princeton.edu/pulsar/K1JT/wsjtx.html (WSJT-X)
  - n1mm.hamdocs.com/tiki-index.php (N1MM Logger+)
  - https://writelog.com/digirite (DigiRite)
  - www.writelog.com (WriteLog)
- Software Email reflectors
  - wsjt-devel@lists.sourceforge.net (WSJT-X)
  - n1mmloggerplus@groups.io (N1MM Logger+)
  - digirite@groups.io (DigiRite)
  - writelog@contesting.com (WriteLog)
- Tutorials for WW Digi DX Contest
  - rttycontesting.com/tutorials/n1mm/operating-ww-digi-with-n1mm/ N1MM+/WSJT-X
  - rttycontesting.com/tutorials/writelog3/digirite/ WriteLog/DigiRite