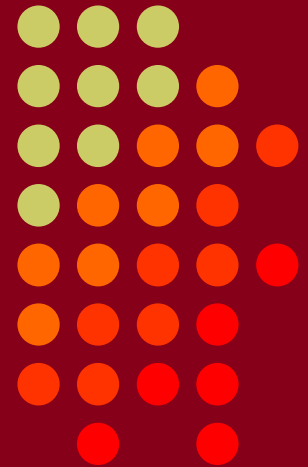


CTU 2022 Presents

Digital Contesting – RTTY and FT8/4

Ed Muns, W0YK



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Digital Contesting is Fun!



- RTTY Contesting → Digital Contesting
- RTTY
 - Operating
 - Setting Up
- FT8/4
 - Operating
 - Setting Up
- 2nd session: “*Taking Digital Contesting to the Limit*”

Lots of RTTY Contests

> two/month



- **Bigies (7)**

- CQ WW RTTY (last weekend in Sep)
- CQ WPX RTTY (2nd weekend in Feb)
- ARRL RTTY Roundup (1st weekend in Jan)
- BARTG:
 - Sprint (3rd weekend Jan)
 - HF RTTY (3rd weekend Mar)
 - 75 Baud (3rd weekend Apr)
- WAE RTTY (2nd weekend in Nov)

- **NCJ contests (4)**

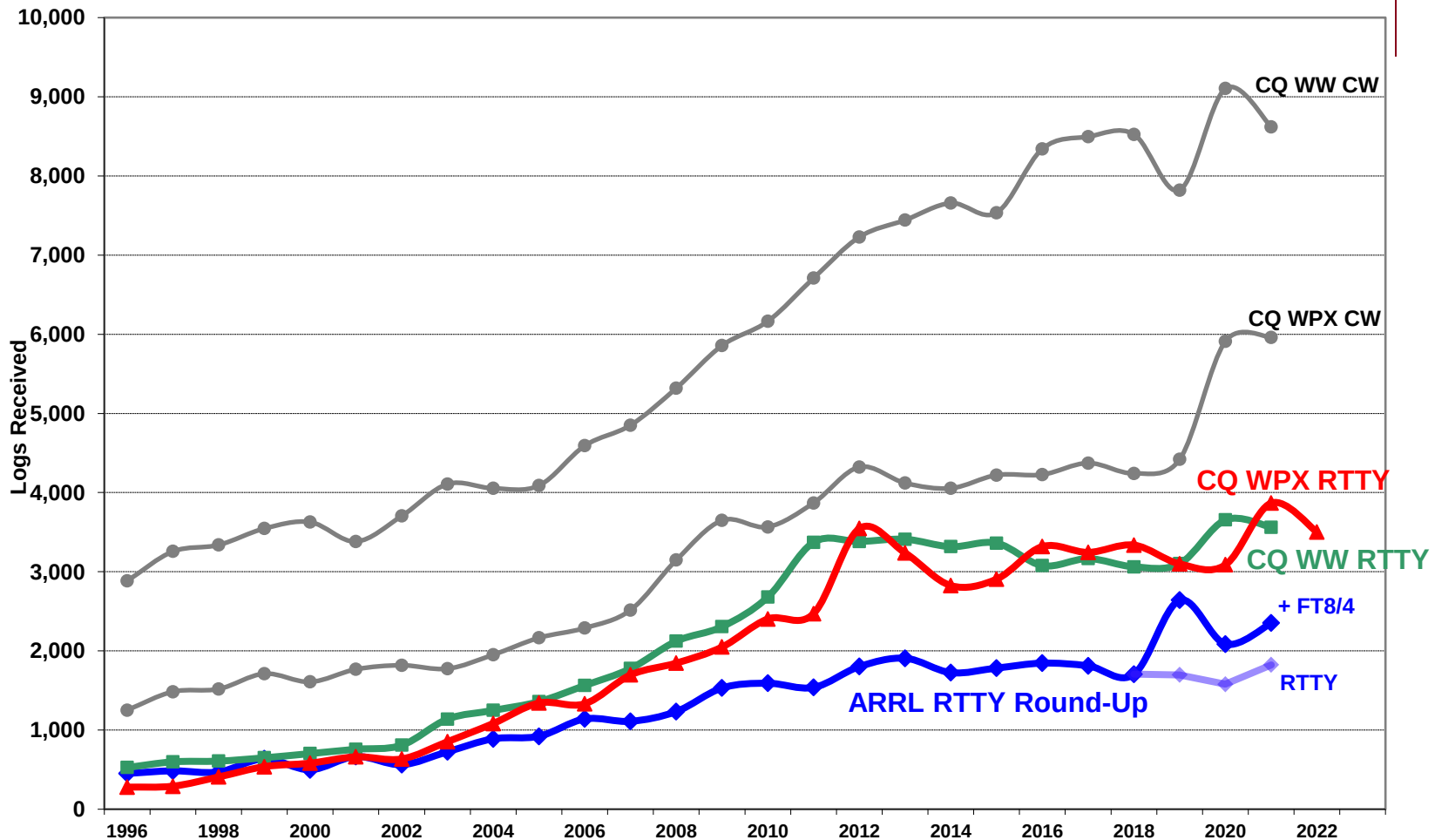
- NAQP RTTY (3rd Sat. in Feb, 2nd Sat. in Jul)
- Sprint RTTY (2nd Sat. in Mar & Oct)

- **Other popular RTTY contests (20)**

- JARTS, Makrothen, SARTG (2)
- ~~SCC RTTY Championship~~ WW Digi
- ~~Ten-Meter RTTY~~ (1st Sat. in Dec) FT Roundup

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Three Largest RTTY Contests



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19 May 2022

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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?

Figures Shift



- 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

Code	Control Characters	Figures	
		ITA2	USTTY
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		
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?

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



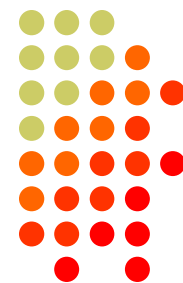
- Uses 5-bit Baudot (actually, USTTY) code with two sets of 32 characters: Letters and Figures
- Space & Mark frequencies separated by 170 Hz “Shift”
- Local Space & Mark tones analogous to pitch in CW
- Constant 45.45 Baud (60 wpm) asynchronous character stream with 5 data bits and 2-3 sync bits
- Figures 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

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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

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RTTY Sub-Bands

don't QRM!



- Avoid audio-digital operations:
 - e.g., 14070-14080
 - (14080-14083 FT4)
- Avoid the NCDXF beacons:
 - e.g., 21150 and 14100
- More details:

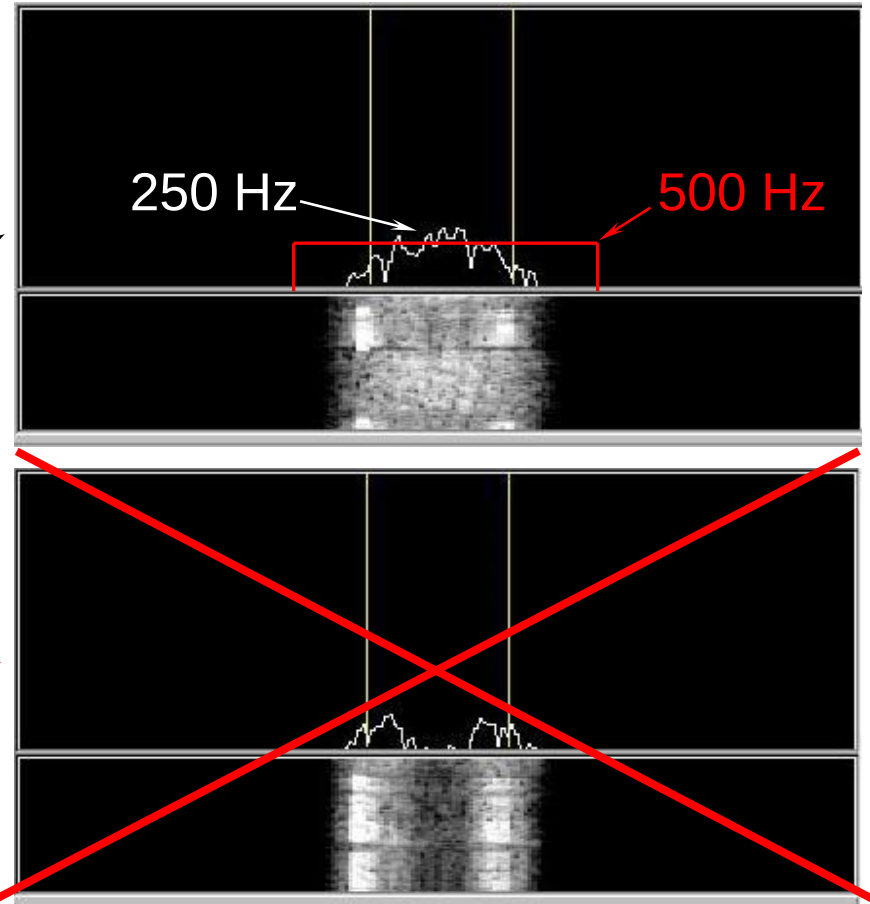
www.aa5au.com/rtty/rtty-sub-bands

Receiving

radio IF filtering

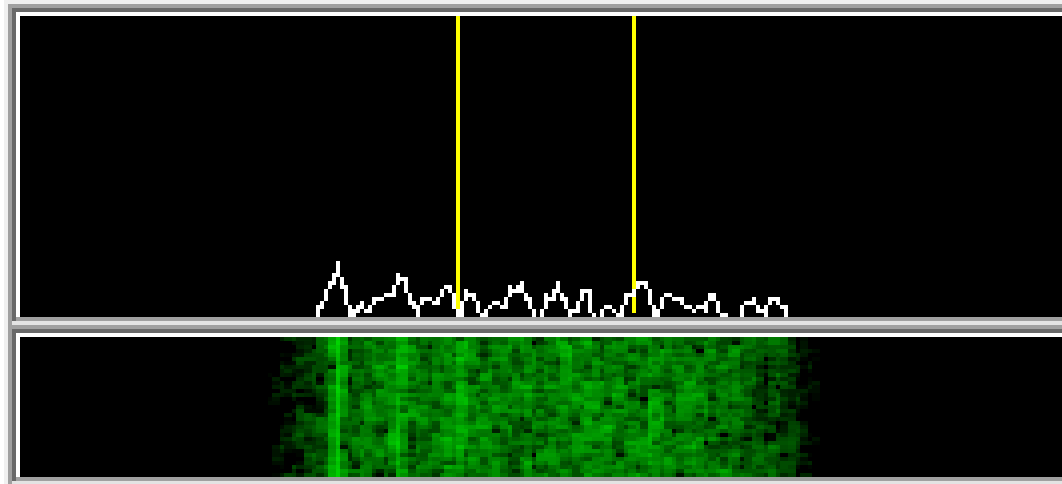


- Narrow IF filters (Roofing & DSP)
 - 500 Hz - normal
 - 250 Hz - extreme QRM only
 - Tone filters – **don't use!**
 - Icom Twin Peak Filter
 - K3 Dual-Tone Filter



Receiving

adjust audio



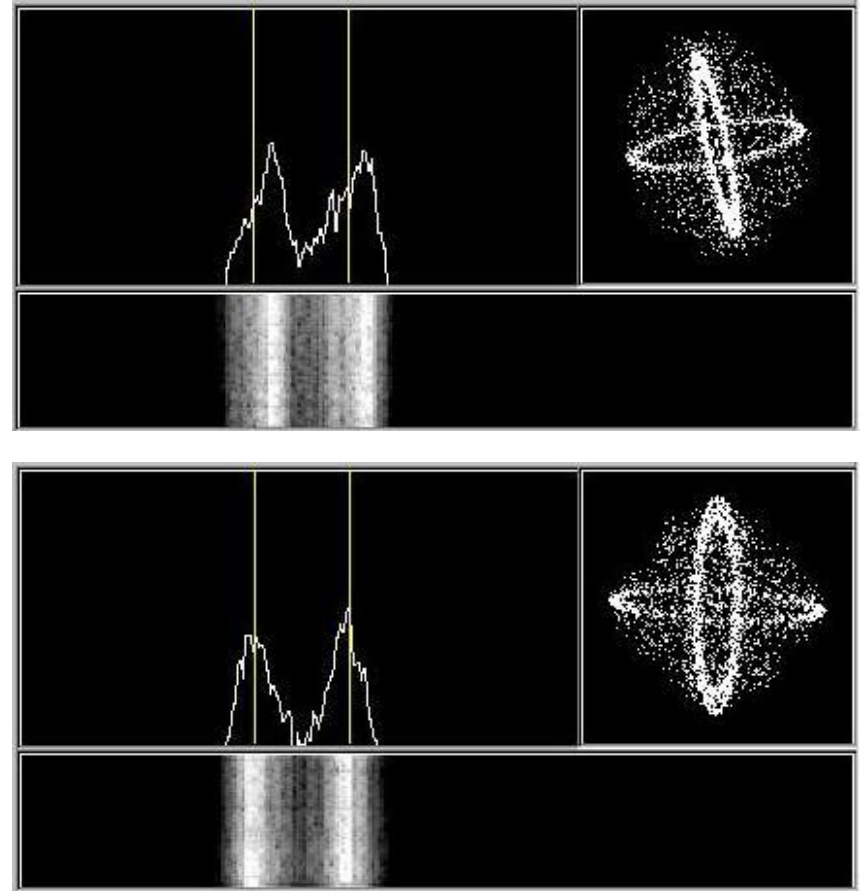
- Set RX audio level for noise 5% of full-scale
 - Receiver audio out level control, and/or
 - *Windows* Recording Volume Control applet

Receiving

tuning a RTTY signal



- Use narrow filtering
 - CW filters ~ 500 Hz
- Set RX audio level
 - noise 5% of full-scale
- Learn to tune by ear
 - practice with eyes closed
 - get within 10-20 Hz



Receiving

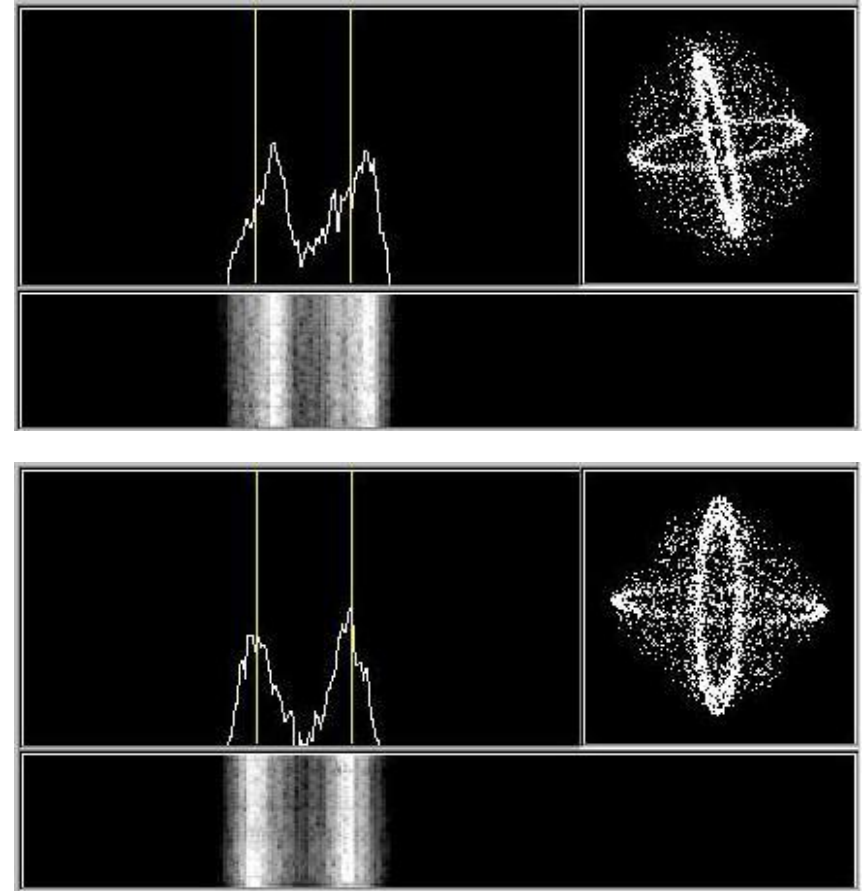
MMTTY AFC



- Use narrow filtering
 - CW filters ~ 500 Hz
- Set RX audio level
 - noise 5% of full-scale
- Learn to tune by ear
 - practice with eyes closed
 - get within 10-20 Hz
- AFC On or Off
 - 'On' may cause TX frequency to be off

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Transmitting

AFSK adjustment



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.

Transmitting

FSK adjustment



- None!

(That's the whole point of FSK.)

Basic RTTY Contest QSO

CQ WPX RTTY Contest



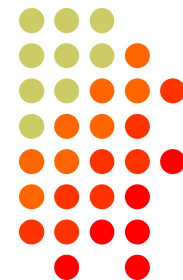
- 1. WPX K5AM K5AM CQ
- 2. ZC4LI ZC4LI
- 3. ZC4LI 599 1349 1349
- 4. [K5AM] TU 599 985 985
- ← 1. [ZC4LI] TU K5AM CQ

K5AM: running station

ZC4LI: S&P station

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

RTTY Messages

formatting



CR/LF

Space

Receive

F02:	%RWPX P49X P49X CQ %C%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

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

XYZAB	AA5AU	XYZAB
XYZAB	9Y1VC	9N8TT
XYZAB	W5UKM	XYZAB

N1MM Logger

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

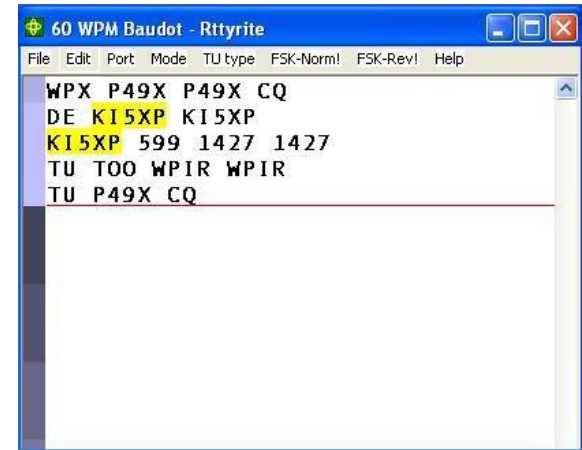
Win-Test

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)



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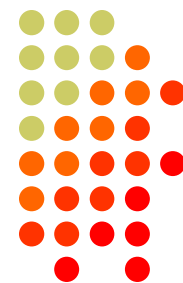
Tips

“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

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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!

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



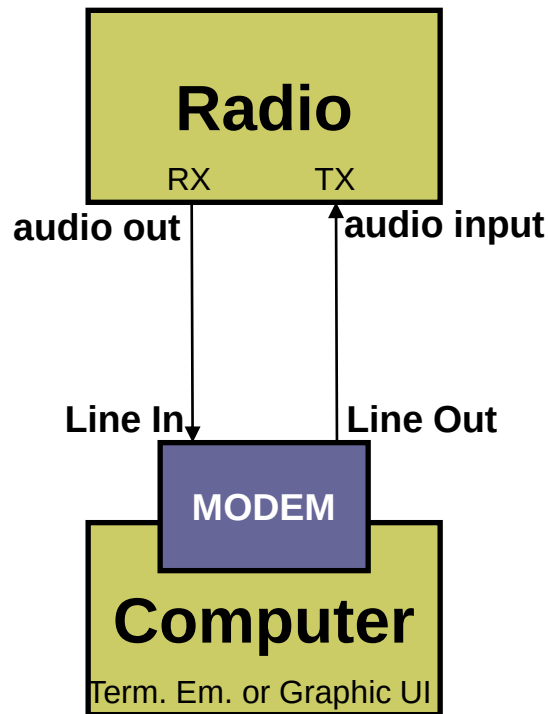
- The RTTY *transmit encoder* and *receive decoder* is sometimes referred to as a MODEM or a TNC:
 - MODEM = MOdulator DEModulator
 - TNC = Terminal Node Controller
- MODEMs can be:
 - a hardware box, or
 - a software application driving a PC soundcard

How Do I Set It Up?

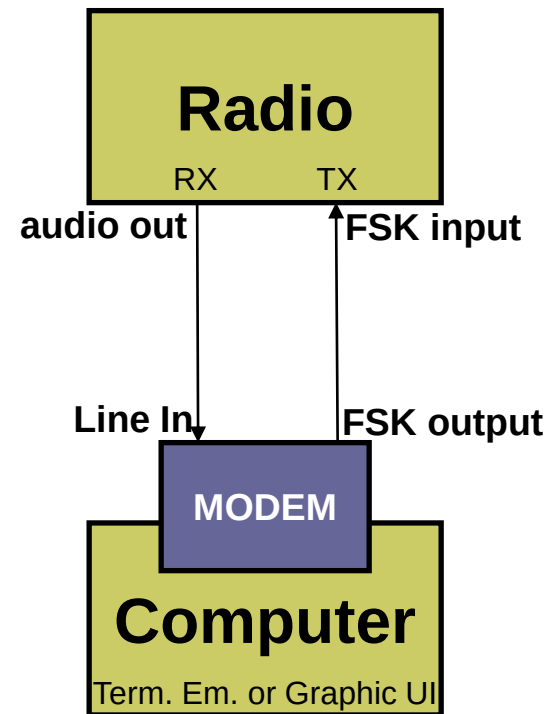
hardware MODEM



AFSK



FSK



How Do I Set It Up?

hardware MODEM

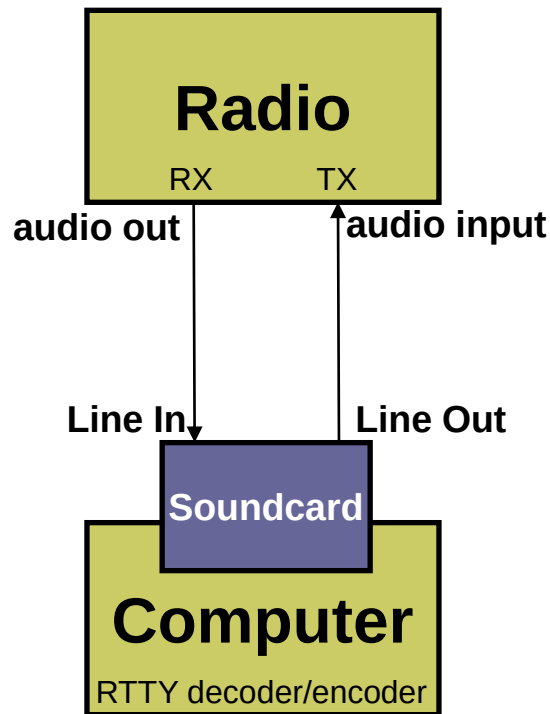


How Do I Set It Up?

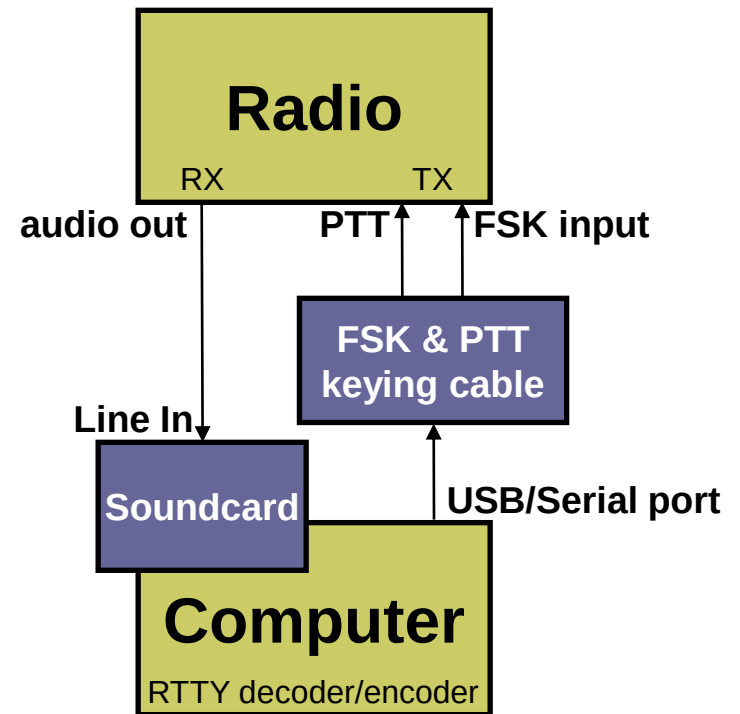
software application & soundcard



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

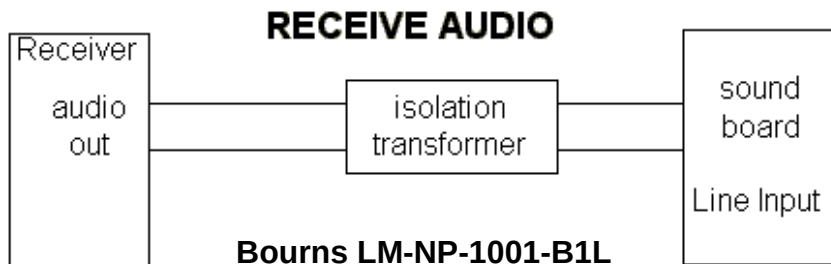


- Eliminate ground loops between radio and PC
- Otherwise insert 1:1 audio isolation transformer on:
 - RX output
 - TX Mic input (*AFSK only*)
- Alternatives:
 - Bourns LM-NP-1001-B1L transformer → homebrew cable
 - Ground loop isolators
 - W2IHY iBox
 - Commercial RTTY interfaces
 - K3 (uses Bourns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

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How Do I Set It Up?

homebrew audio isolation



\$1.78

-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



\$60

How Do I Set It Up?

commercial interface audio isolation



Rascal



RIGblasters



How Do I Set It Up?

radio audio isolation



K3 audio isolation IN - LINE - OUT



How Do I Set It Up?

SDR digital audio isolation



digital: soundcard
analog: IN - LINE - OUT



How Do I Set It Up

optional radio AF filtering

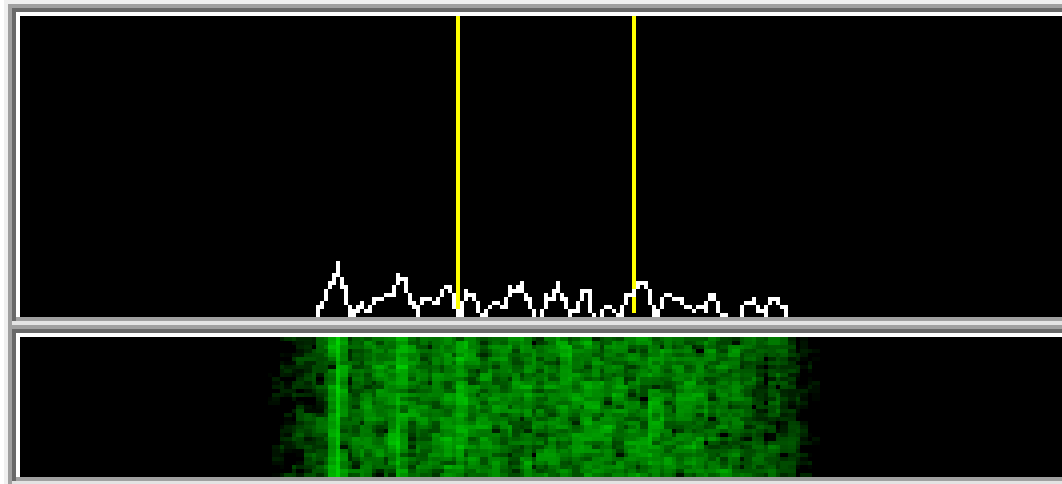


- PC Audio isolation
 - Transformer
 - Commercial interface
 - Some radios (K3, Flex)
- Narrow IF filters (Roofing & DSP)
 - 500 Hz - normal
 - 250 Hz – extreme QRM only
 - Tone filters – don't use
 - Icom Twin Peak Filter
 - K3 Dual-Tone Filter
- Audio filtering
 - JPS NIR-10/12
 - Timewave DSP-599zx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

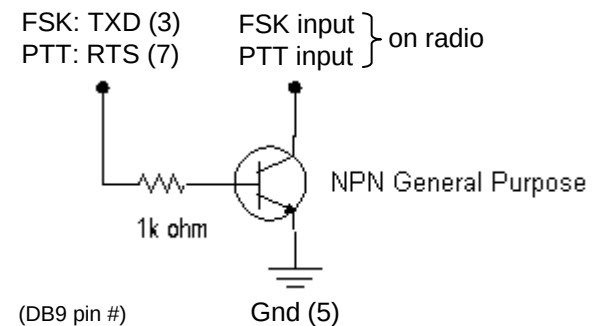
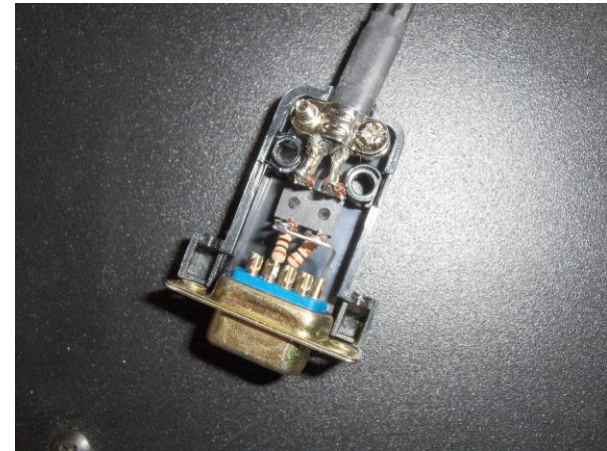
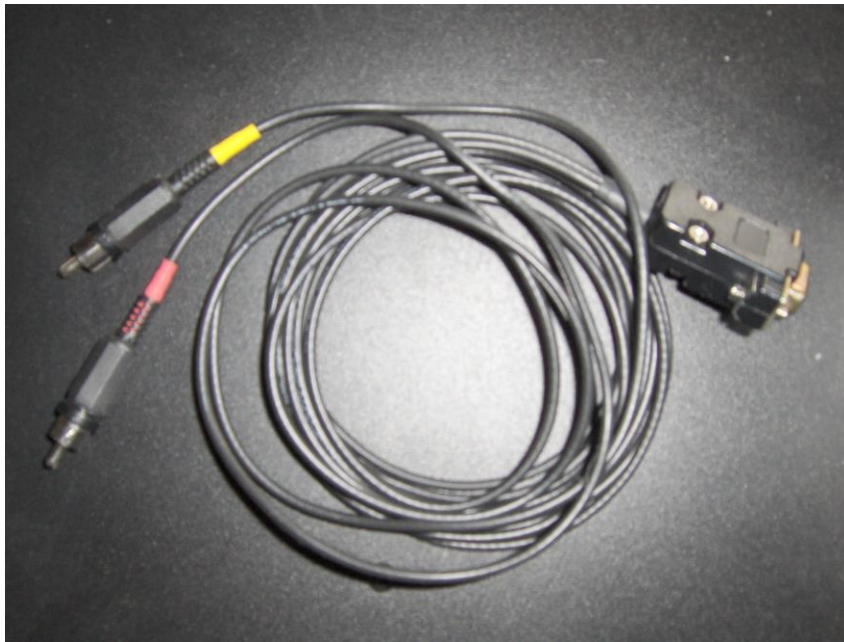
PTT vs. VOX



- 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

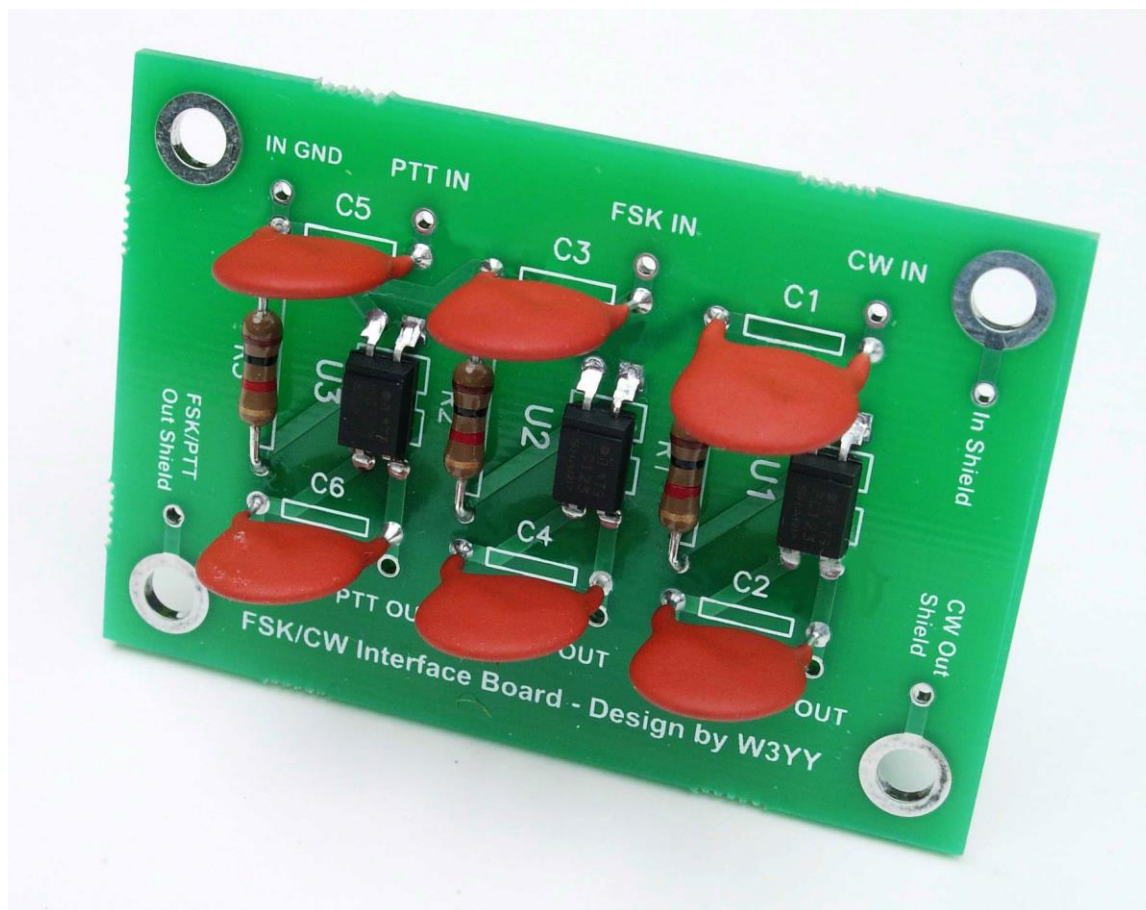
How Do I Set It Up?

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



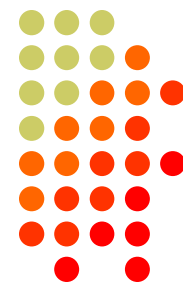
How Do I Set It Up?

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?

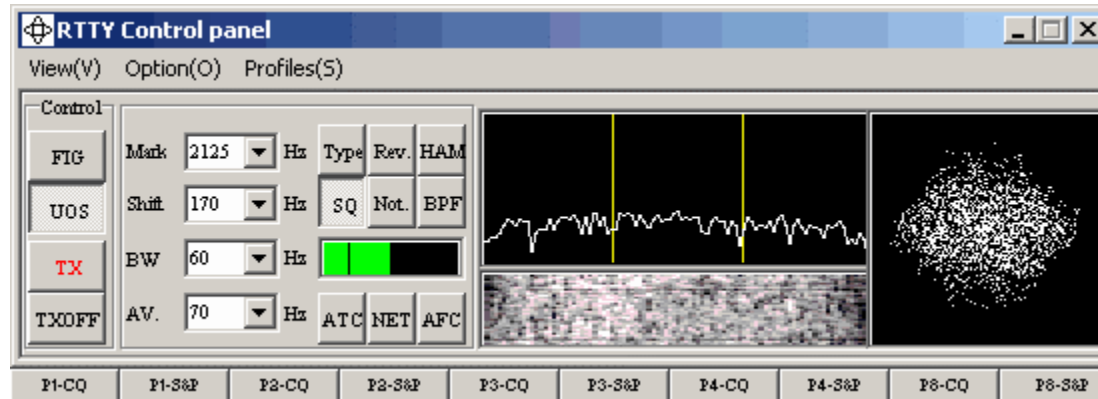
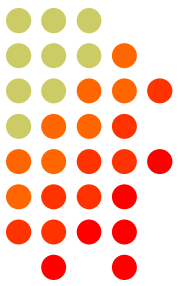
summary - FSK



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



Leave UOS on

Squelch

Messages

Don't click inside display

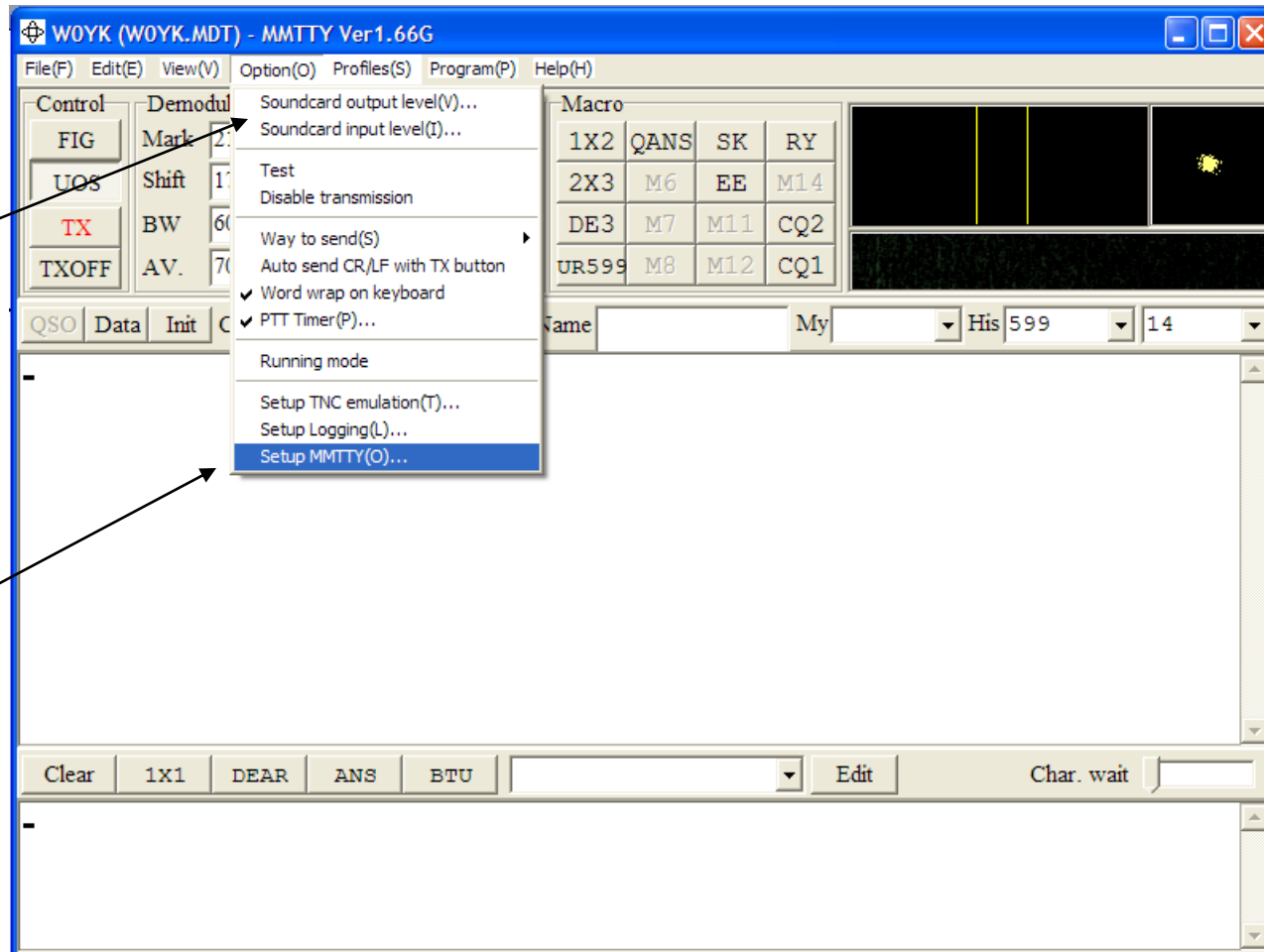
Turn off: NET
AFC

received text

transmitted text

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)

Setup MMTTY Ver1.66G

Demodulator | AFC/ATC/PLL | Decode | TX | Font/Window | Misc | SoundCard

Discriminator

Type

- ☒ IIR resonator
- ☐ FIR BPF
- ☐ PLL

Mark: 2125 Hz

Shift: 170 Hz

BW: 60 Hz

Show

Limit Amp.

☒ AGC

☐ Over Sampling

Gain: 200

Pre-Filter

Show

BPF: LMS/Notch

☐ ON

Tap: 56

FW: 100

☒ AFC Connection

Smooth LPF

☒ FIR av. ☐ IIR

Freq: 70 Hz

f

☐ Reverse

HAM Default: 2125 170

HAM Set Default(Demodulator) ? OK Cancel

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



Setup MMTTY Ver1.66G

Demodulator | AFC/ATC/PLL | Decode | TX | Font/Window | Misc | SoundCard

Sound Card

FIFO
RX 12 TX 4

Priority
☐ Normal ☐ Highest
☒ Higher ☐ Critical

Device Identifiers
RX 0 TX 0

Source
☒ Mono ☐ Right
☐ Left

Clock
11025 Hz Adj
0.00 Hz
Tx offset

☐ Save window location

Sound loopback
☐ OFF
☒ Int.
☐ Ext.(SAT)

Tx Port
☒ Sound
☐ Sound + COM-TxD (FSK)
☐ COM-TxD(FSK)

System Font
Window Times New Roman Set 0
Fixed pitch Courier New Set 0
Japanese English

HAM Set Default(Demodulator) ? OK Cancel

Soundcard

Soundcard Format, 4x

AFSK

FSK

How Do I Set It Up?

MMTTY Option/Setup/SoundCard



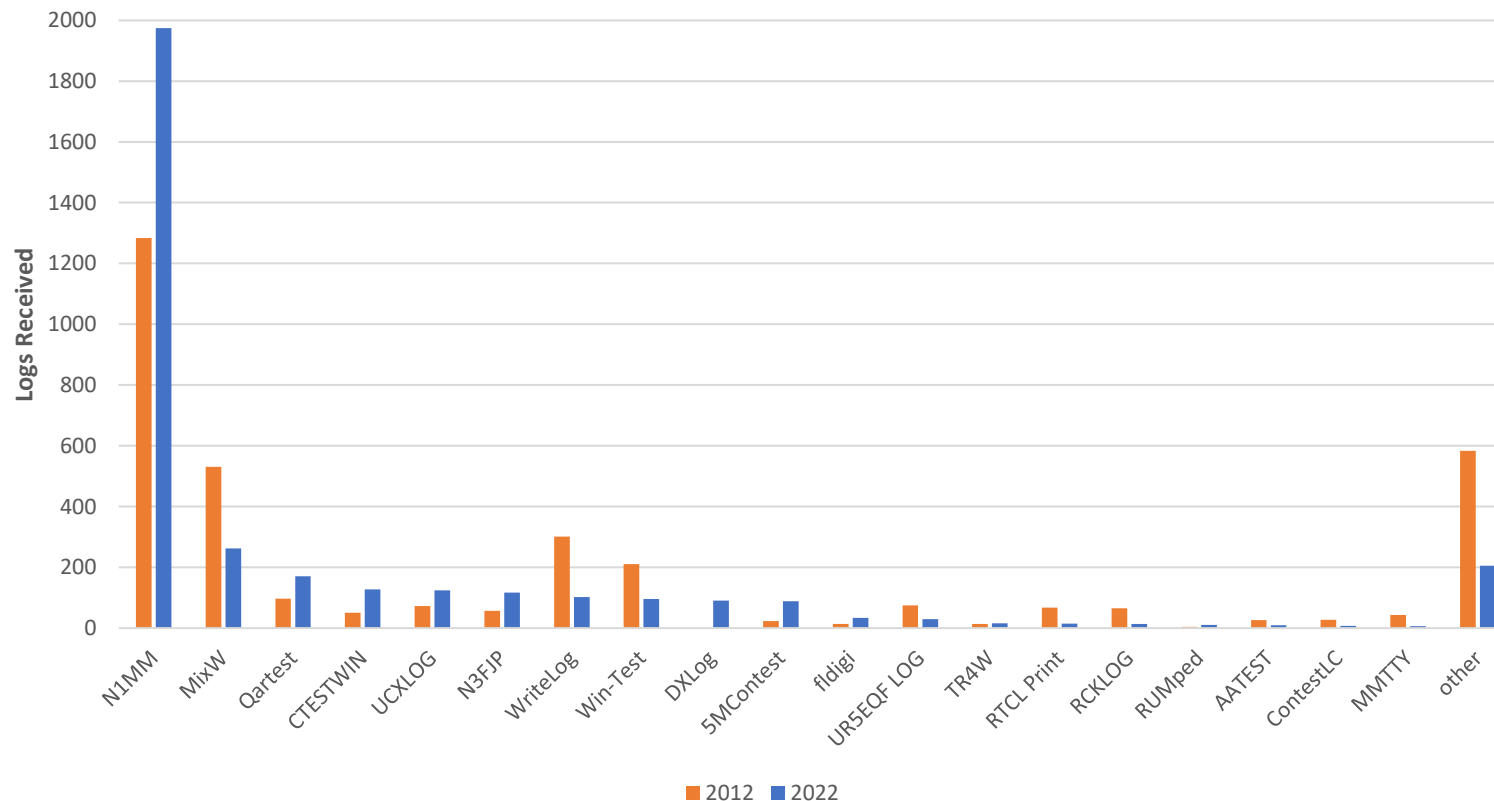
Select receive
Soundcard

The screenshot shows the 'Setup MMTTY Ver1.66G' window with the 'SoundCard' tab selected. The window has a blue title bar and a tabbed interface with tabs for Demodulator, AFC/ATC/PLL, Decode, TX, Font/Window, Misc, and SoundCard. The 'SoundCard' tab is active, showing two columns: 'Reception' and 'Transmission'. In the 'Reception' column, the 'Line in/Mic in' option is selected with a radio button. In the 'Transmission' column, the 'Realtek HD Audio rear output' option is selected with a radio button. Below the options are buttons for 'HAM', 'Set Default(Demodulator)', '?', 'OK', and 'Cancel'.

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

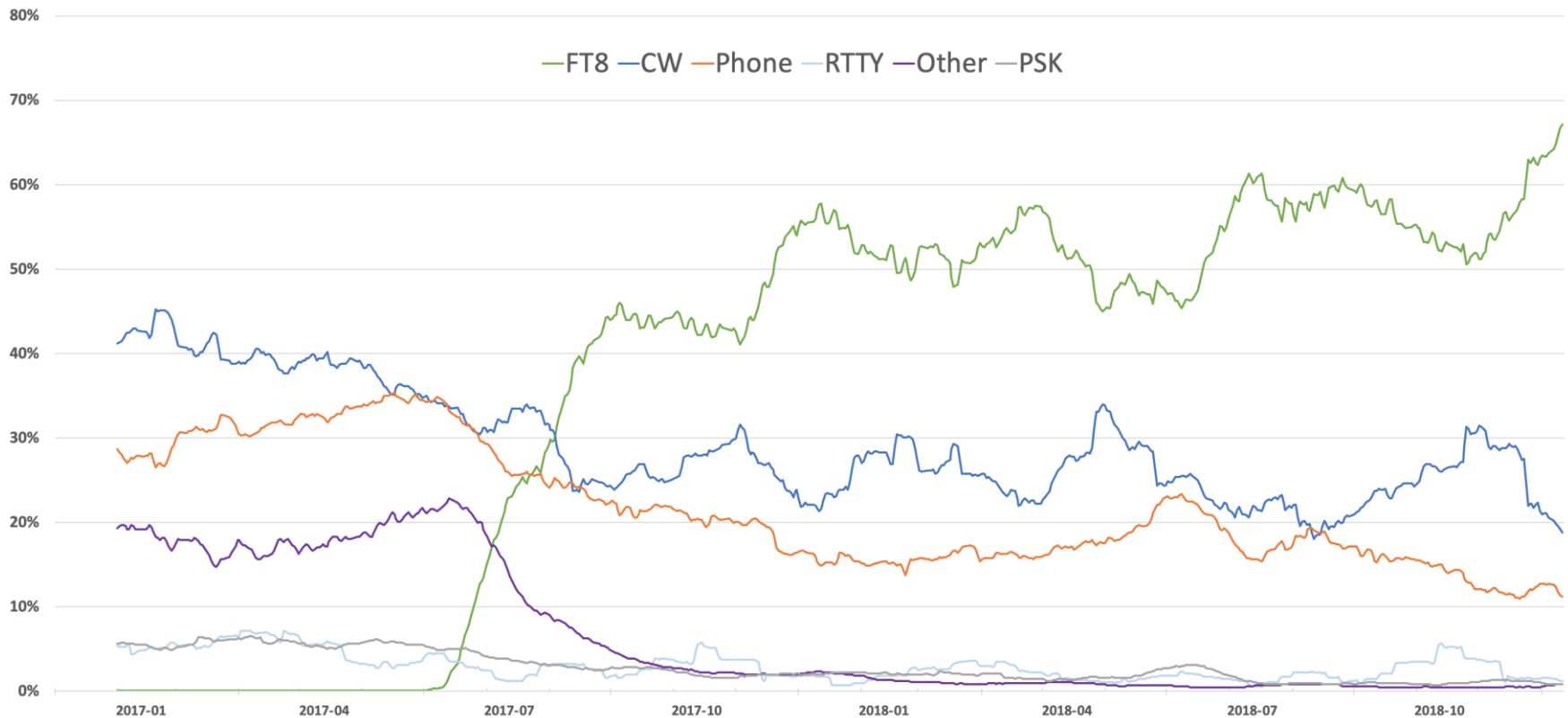


- www.rttycontesting.com premier website
 - Tutorials and resources (beginner to expert)
 - WriteLog, N1MM Logger+ and MMTTY
- rtty@groups.io Email reflector
 - RTTY contester networking
 - Q&A
- Software web sites
 - hamsoft.ca/ (MMTTY)
 - n1mm.hamdocs.com/tiki-index.php (N1MM Logger+)
 - www.writelog.com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



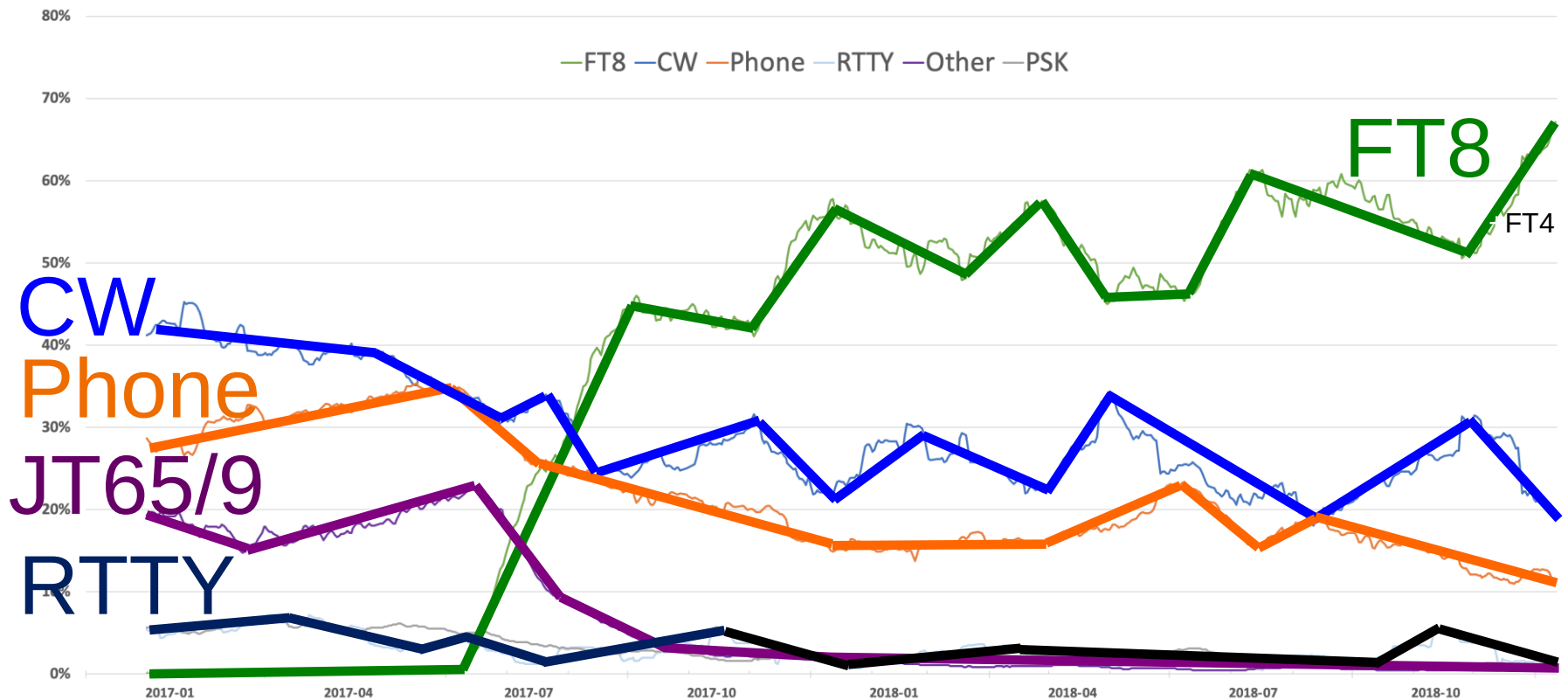
% Share of Modes Stored in Club Log from 2017 to 2019



Clublog % QSOs by Mode: 2017-2018



% Share of Modes Stored in Club Log from 2017 to 2019



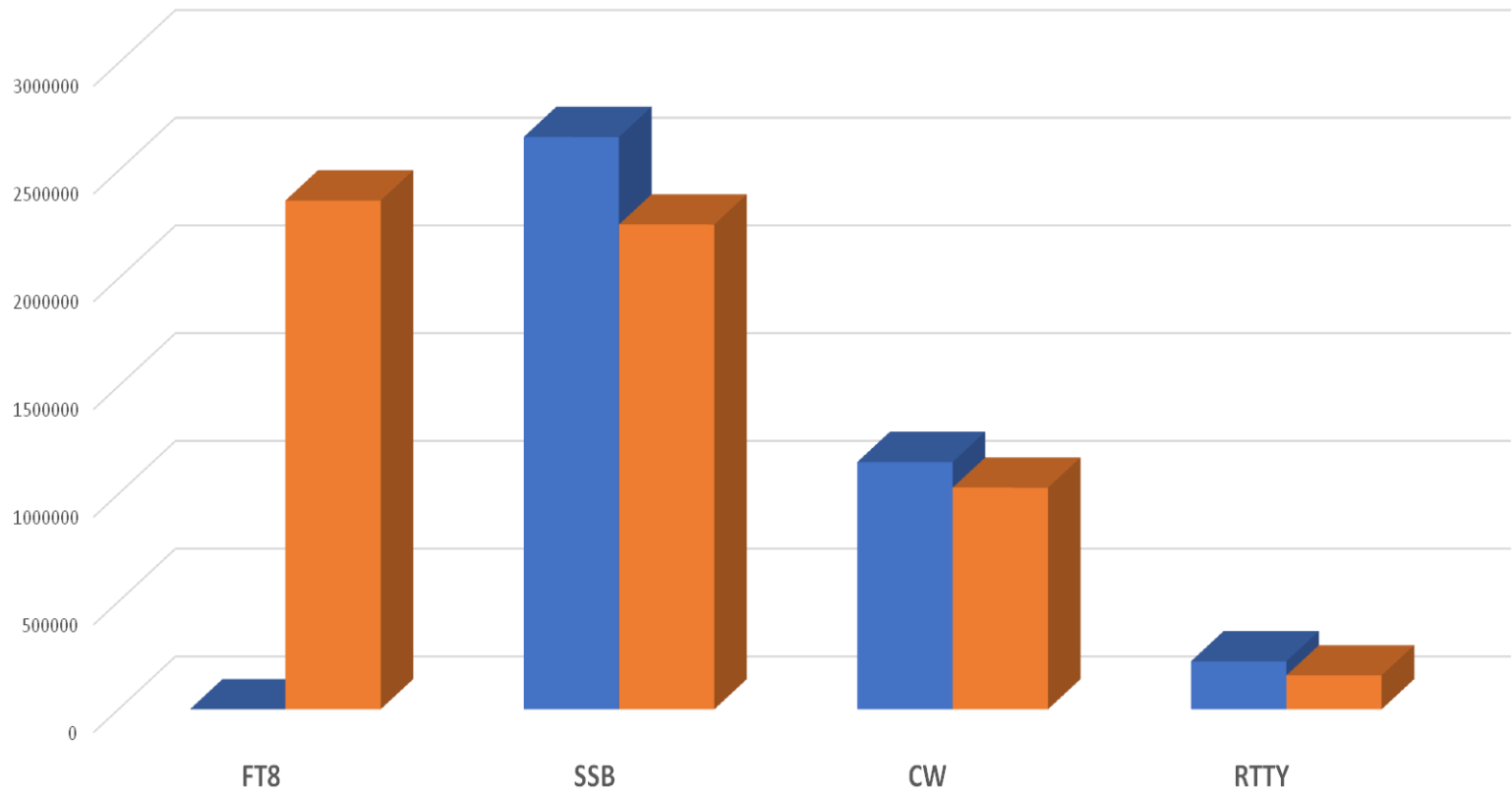
CW
Phone
JT65/9
RTTY

FT8
FT4

The FT8 Explosion



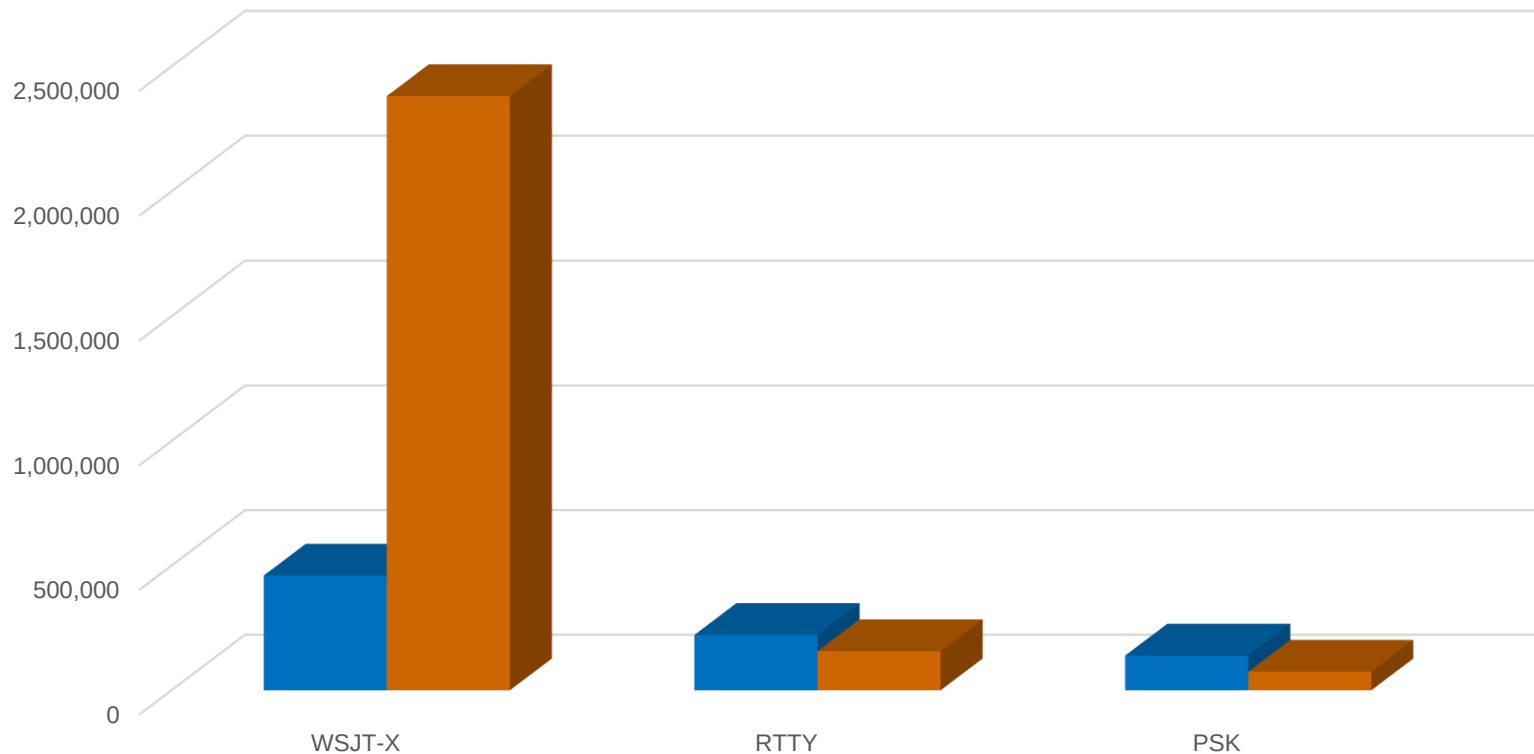
LoTW Uploads by Mode



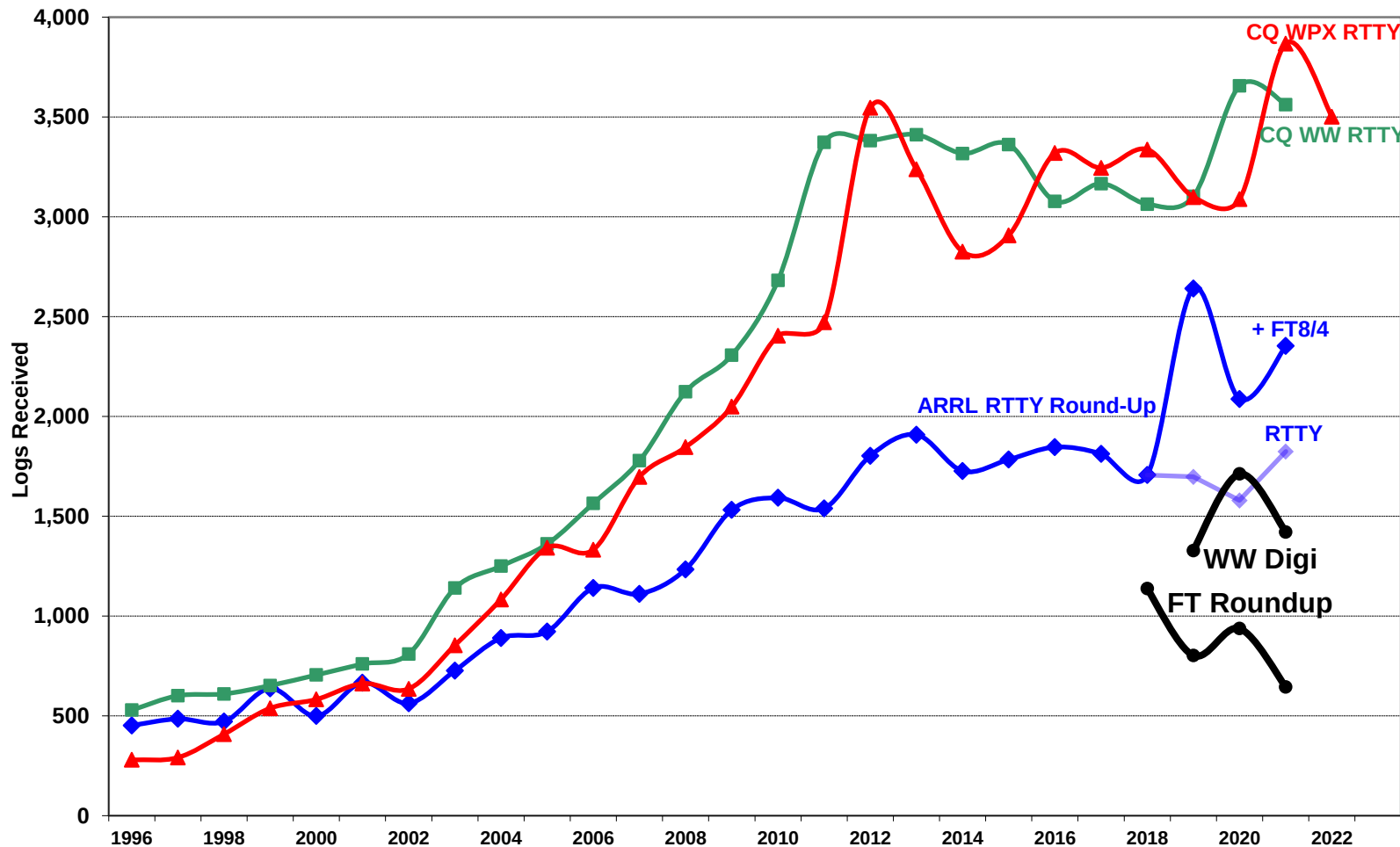
Digital Mode Trends



LotW Uploads by Mode



Two Largest FT8/4 Contests



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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 v1.8.0 by K1JT

File Configurations View Mode Decode Save Tools Help

Band Activity

UTC	dB	DT	Freq	Message
023445	3	0.1	1023	~ CQ BG4NN OM96 China
023445	-1	-0.2	1368	~ CQ BG4VR OM93 ~China
023445	-2	-0.2	1575	~ CQ RA0AA NO66 ~AS Russia
20m				
023515	0	-0.2	1368	~ JA3YUA BG4VR -13
023515	-2	-0.1	893	~ RD0 JMSJU QN02
023515	-5	0.5	927	~ RD0 BH4TY 73
023515	6	0.1	1023	~ CQ BG4NN OM96 China
023515	-3	-0.1	1576	~ CQ RA0AA NO66 ~AS Russia
023515	-9	0.3	847	~ UA0JG BG5EI FM00
20m				
023545	1	-0.2	1367	~ JA3YUA BG4VR RRR
023545	-6	0.3	847	~ UA0JG BG5EI FM00
023545	2	0.1	1023	~ CQ BG4NN OM96 China
023545	-3	0.1	1576	~ CQ RA0AA NO66 ~AS Russia
20m				
023615	2	-0.2	1367	~ JA3YUA BG4VR 73
023615	-11	0.3	847	~ UA0JG BG5EI R-18
023615	-5	-0.1	893	~ RD0 JMSJU QN02
023615	5	0.1	1023	~ CQ BG4NN OM96 China
023615	-4	-0.0	1576	~ BH4TY RA0AA -10

Rx Frequency

UTC	dB	DT	Freq	Message
023130	Tx		1023	~ BG4NN JA3YUA 73
023145	4	0.1	1023	~ JA3YUA BG4NN 73
023200	-1	-0.1	927	~ CQ RD0 PN68
023216	Tx		927	~ RD0 JA3YUA PM74
023230	1	-0.1	927	~ JA3YUA RD0 -04
023245	Tx		927	~ RD0 JA3YUA R+01
023300	2	-0.1	927	~ JA3YUA RD0 RRR
023315	Tx		927	~ RD0 JA3YUA 73
023330	-1	-0.1	927	~ JA3YUA RD0 73
023400	1	-0.1	927	~ CQ RD0 PN68
023415	0	0.5	927	~ RD0 BH4TY FM01
023430	0	-0.1	927	~ BH4TY RD0 -05
023445	1	0.5	927	~ RD0 BH4TY R-09
023445	-1	-0.2	1368	~ CQ BG4VR OM93
023501	Tx		1368	~ BG4VR JA3YUA PM74
023515	0	-0.2	1368	~ JA3YUA BG4VR -13
023530	Tx		1368	~ BG4VR JA3YUA R+00
023545	1	-0.2	1367	~ JA3YUA BG4VR RRR
023600	Tx		1368	~ BG4VR JA3YUA 73
023615	2	-0.2	1367	~ JA3YUA BG4VR 73

Log QSO Stop Monitor Erase Decode Enable Tx Halt Tx Tune Morkus

20m 14.074 000 Tx even/1st

DX Call DX Grid Tx 1368 Hz Tx ← Rx

BG4VR OM93 Rx 1367 Hz Rx ← Tx

Az: 270 1542 km

Lookup Add Report 1

2017 11 15 02:36:39

Auto Seq Call 1st NA VHF Contest

Generate Std Msgs Next Now Pwr

BG4VR JA3YUA PM74 Tx 1

BG4VR JA3YUA +01 Tx 2

BG4VR JA3YUA R+01 Tx 3

BG4VR JA3YUA RRR Tx 4

BG4VR JA3YUA 73 Tx 5

CQ JA3YUA PM74 Tx 6

Receiving FT8 Last Tx: BG4VRG JA3YUA 73 9/15 WD6m

02:34:45

02:35:15

02:34:45

02:36:15

My Tx

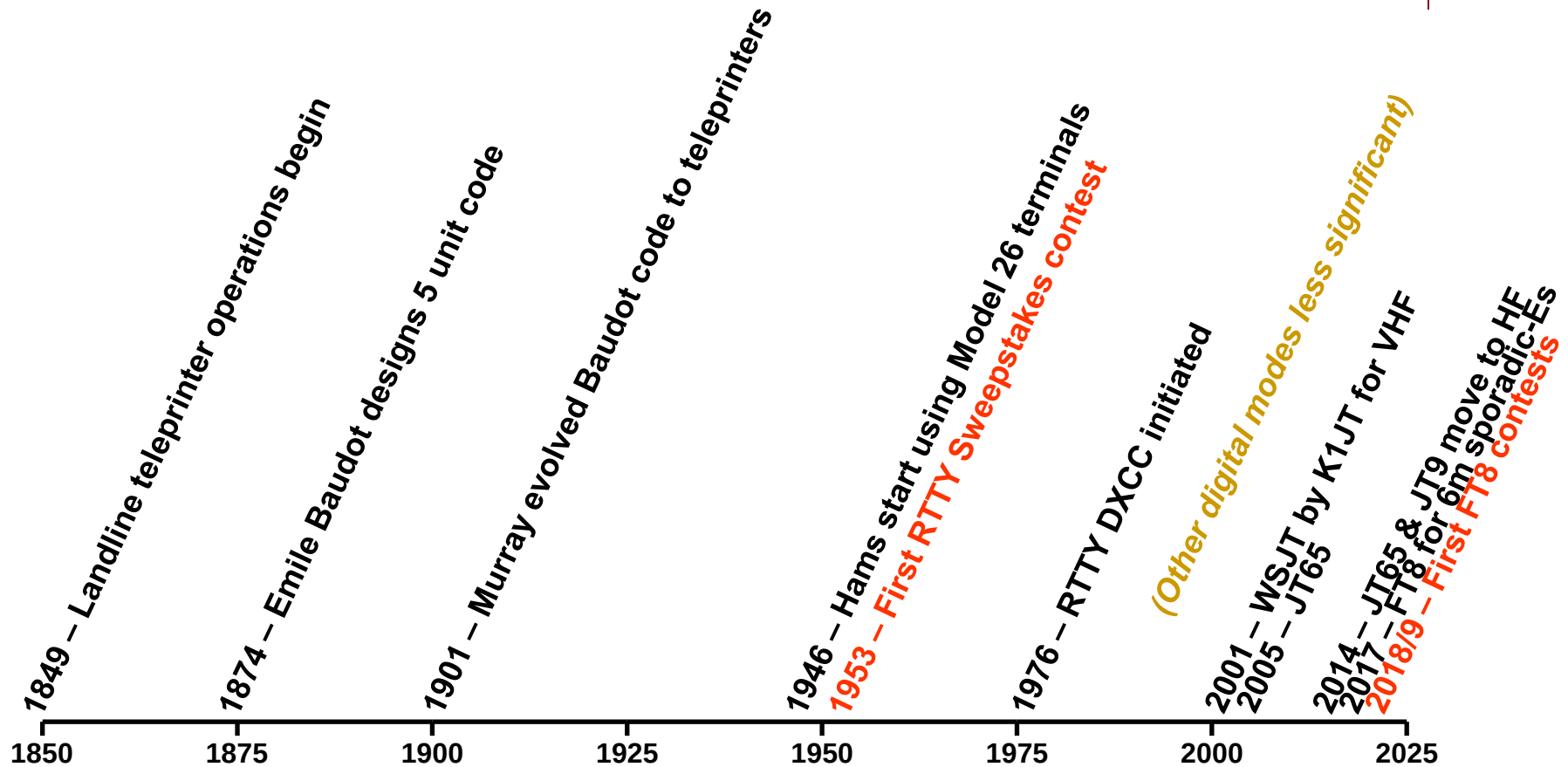
His Tx

WSJT & 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*

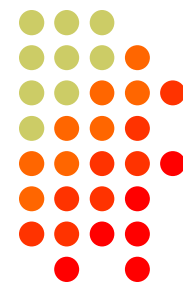
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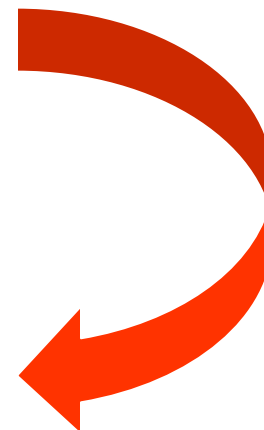
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19 May 2022

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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



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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

75 sec./QSO



- CQ K1ABC FN42
- K1ABC W9XYZ -09
- W9XYZ K1ABC R-11
- K1ABC W9XYZ RR73
- W9XYZ K1ABC 73
(superfluous 2nd QSL)
<“CQ” K1ABC>

60 sec. rolling QSOs

FT8 DXpedition QSO

75 sec./QSO
60 sec./5 QSOs



QSO period 1
QSO period 2
QSO period 3

- 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
○ CTU ○
- 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.

FT8 Contest QSO

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



QSO period 1
QSO period 2
QSO period 3

- CQ RU K1ABC FN42
- W9XYZ K1ABC R 589 MA
("CQ" for others)
- W0YK K1ABC R 569 MA
(final "QSL" for W9XYZ)
("CQ" for others)
- P49X K1ABC R 559 M
(final "QSL" for W0YK)
- P49X K1ABC 73
(superfluous 2nd QSL)
- K1ABC W9XYZ 579 WI
- K1ABC W9XYZ RR73
K1ABC W0YK 559 CA
- K1ABC W0YK RR73
K1ABC P49X 529 1743
- K1ABC P49X RR73

Setting Up for FT8



- **Download/install WSJT-X**
 - **Alternatively MSHV**
- **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

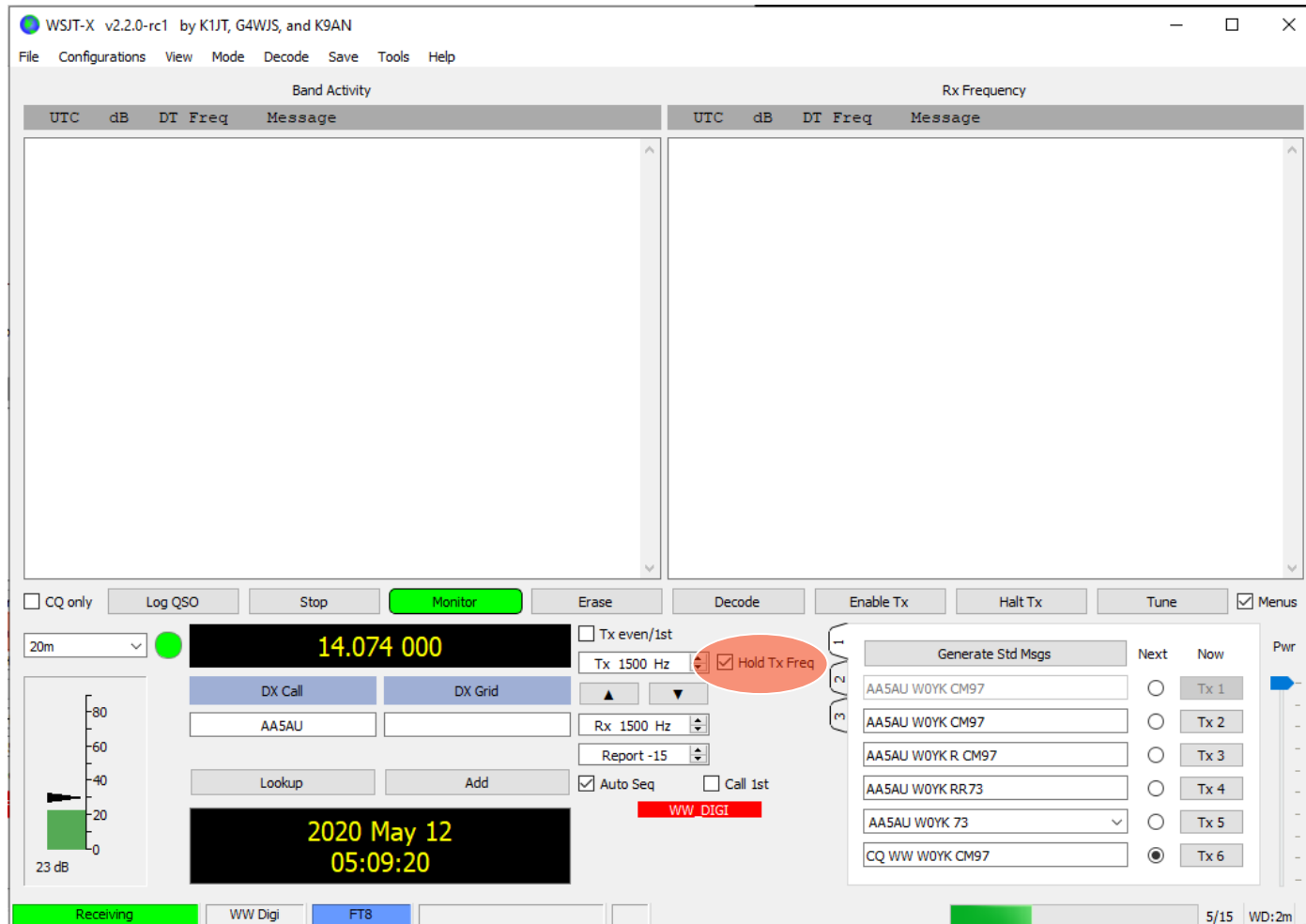
Sub-Band Choices

Int'l Digi, WW Digi, FT RU

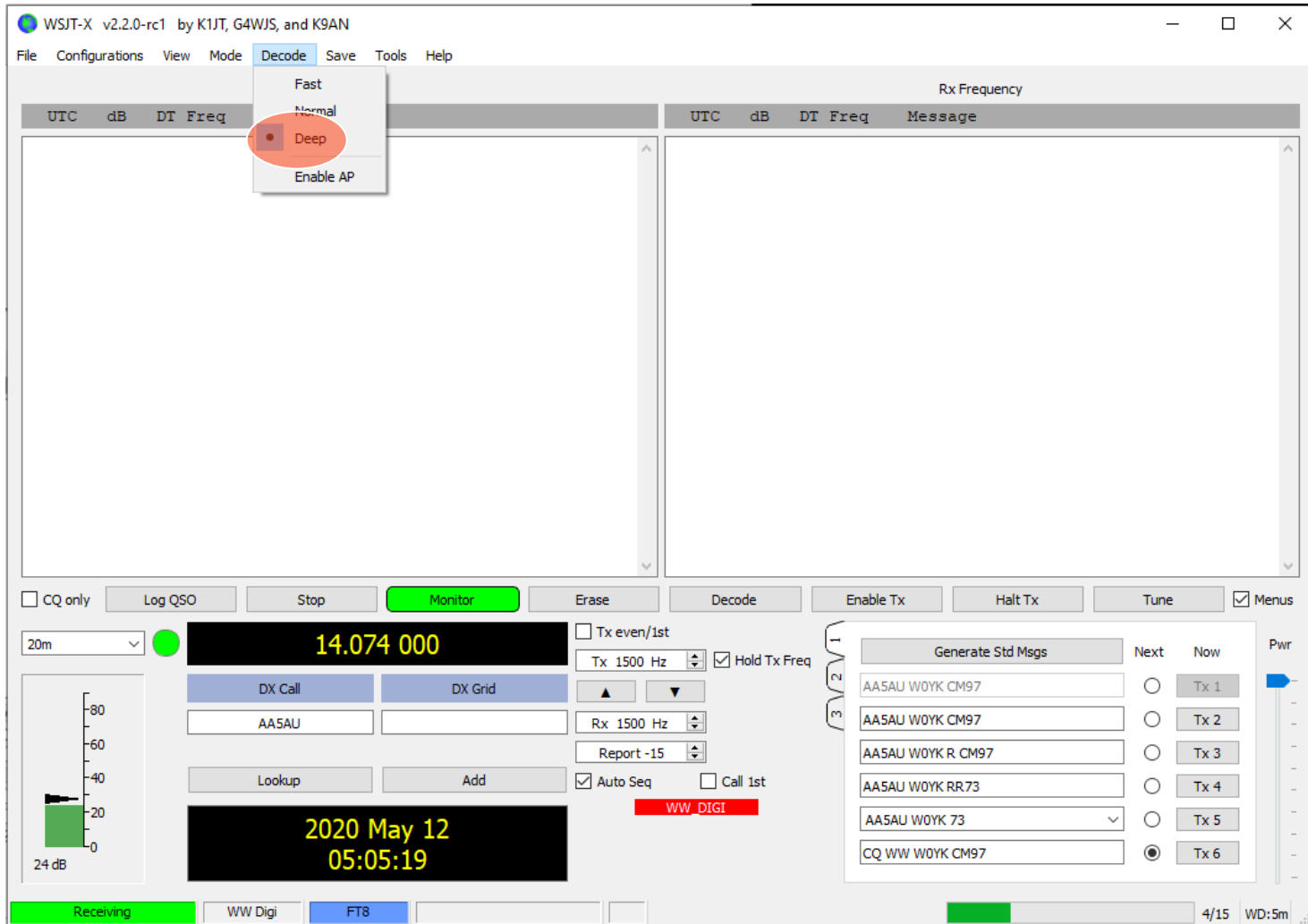


- Suppressed-Carrier dial frequency
 - FT4: 14080
 - FT8: 14090
- Use receiver's maximum BW: 2.5-4 kHz
- QSO partner > 3 kHz ... call above 3 kHz
- Move dial frequency up in 3 kHz increments

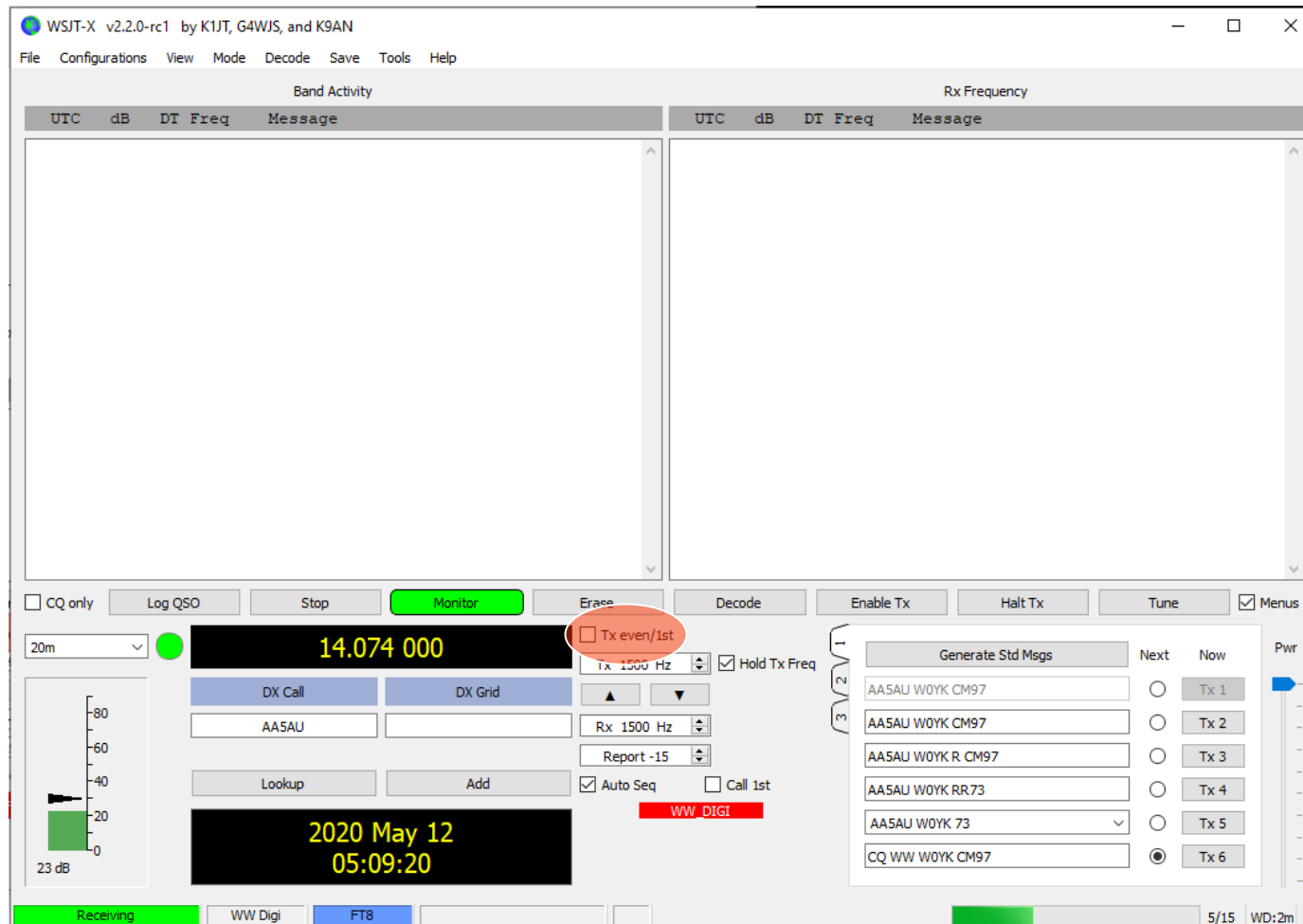
Split Transmit



Deep Decode



Utilize Odd/Even Cycles



WW Digi DX Contest



WSJT-X v2.2.0-rc1 by K1JT, G4WJS, and K9AN

1 File 2 Settings 3 Advanced

Band Activity

UTC dB DT Freq Message

4

5

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

WW Digi Contest

20m 14.074 000

DX Call AA5AU DX Grid

Lookup Add

2020 May 12 04:56:23

Receiving WW Digi FT8

8/15 WD:5m

Minimizing NILs in WW Digi



- FT contest NILs are high
 - RTTY is 1-2%, FT is 5%
- 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?

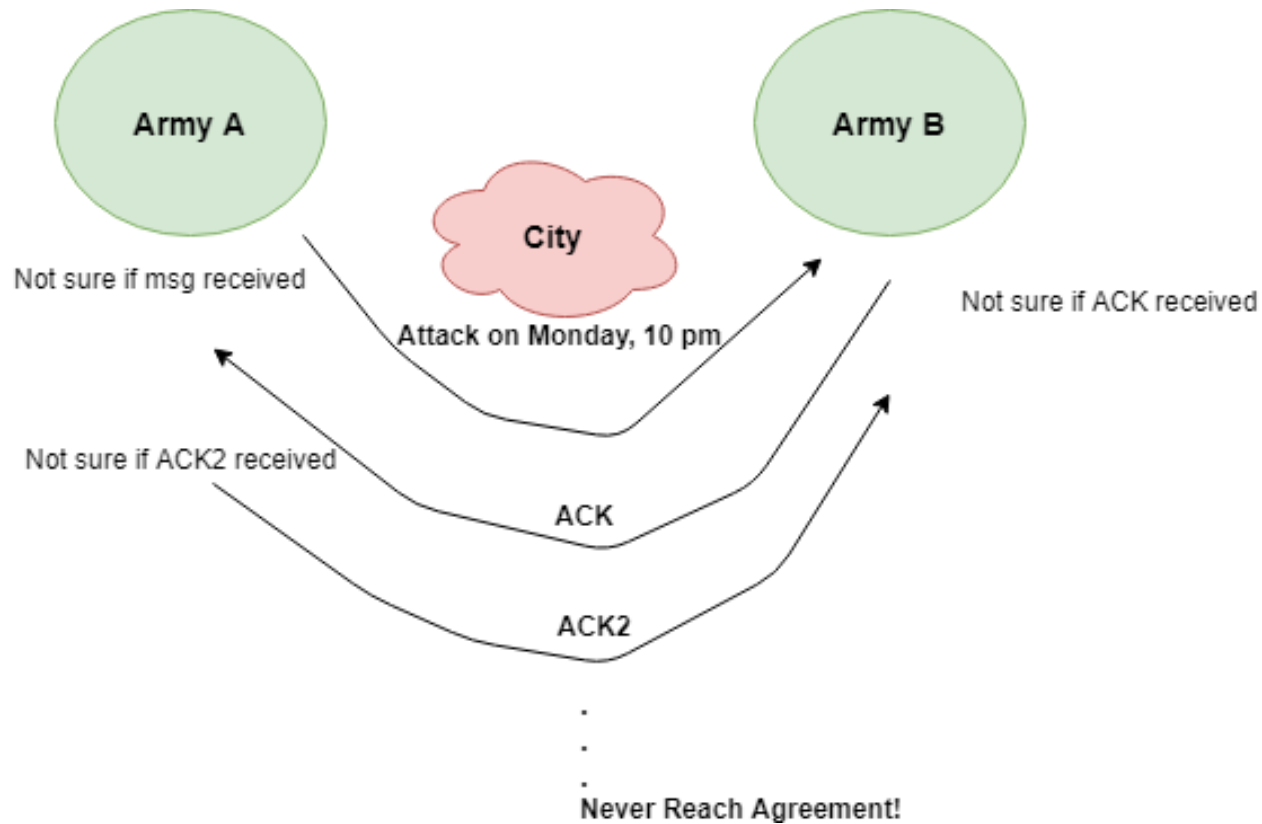
◦ CTU ◦

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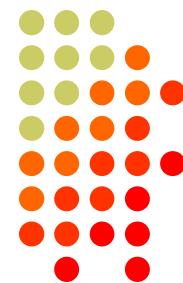
98/103
19 May 2022

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Two Generals Paradox



FT Repeat Protocol



CQ W0YK CM97

W0YK AA5AU EL92

AA5AU W0YK R CM97

W0YK AA5AU RR73

AA5AU W0YK R CM97

W0YK AA5AU RR73

←AA5AU calls with exch

← W0YK QSL's with exch

←AA5AU QSL's

← W0YK missed QSL msg

←AA5AU repeats QSL

Minimizing NILs

Recommendation



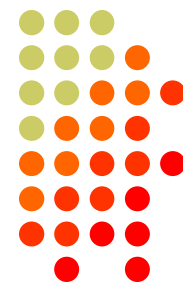
- Develop skill to dynamically change message
 - e.g., use the Alternate F1-F6 keys in WSJT-X
- Always log the QSO when receiving a RRR, RR73 or 73 message.
- Always log the QSO when sending RRR, RR73 or 73 message.
 - Look for a clue that your message was not received, e.g., your QSO partner re-sends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