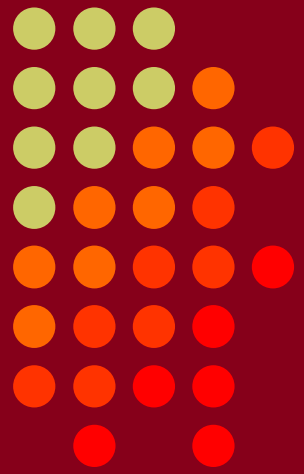
CTU Presents

Contesting Fun on That *Other* Mode (RTTY)

Ed Muns, W0YK / P49X



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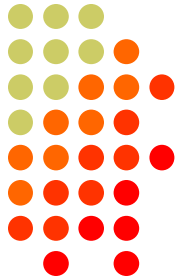
UNIVERSITY

ICOM

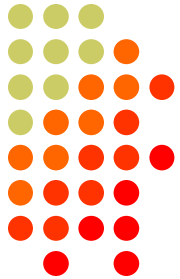
Digital Contesting Is Fun!



- Operating RTTY
  - RTTY contesting (4)
  - What is RTTY? (9)
  - Basics (10)
  - RX & TX bandwidth (7)
  - UOS and hyphen (2)
  - Multiple decoders (9)
  - Call sign stacking (6)
  - SO2V & SO2R (6)
- Setting Up RTTY (40)
- 2nd session: "*Contesting Fun on That Really Other Mode (FT8)*"

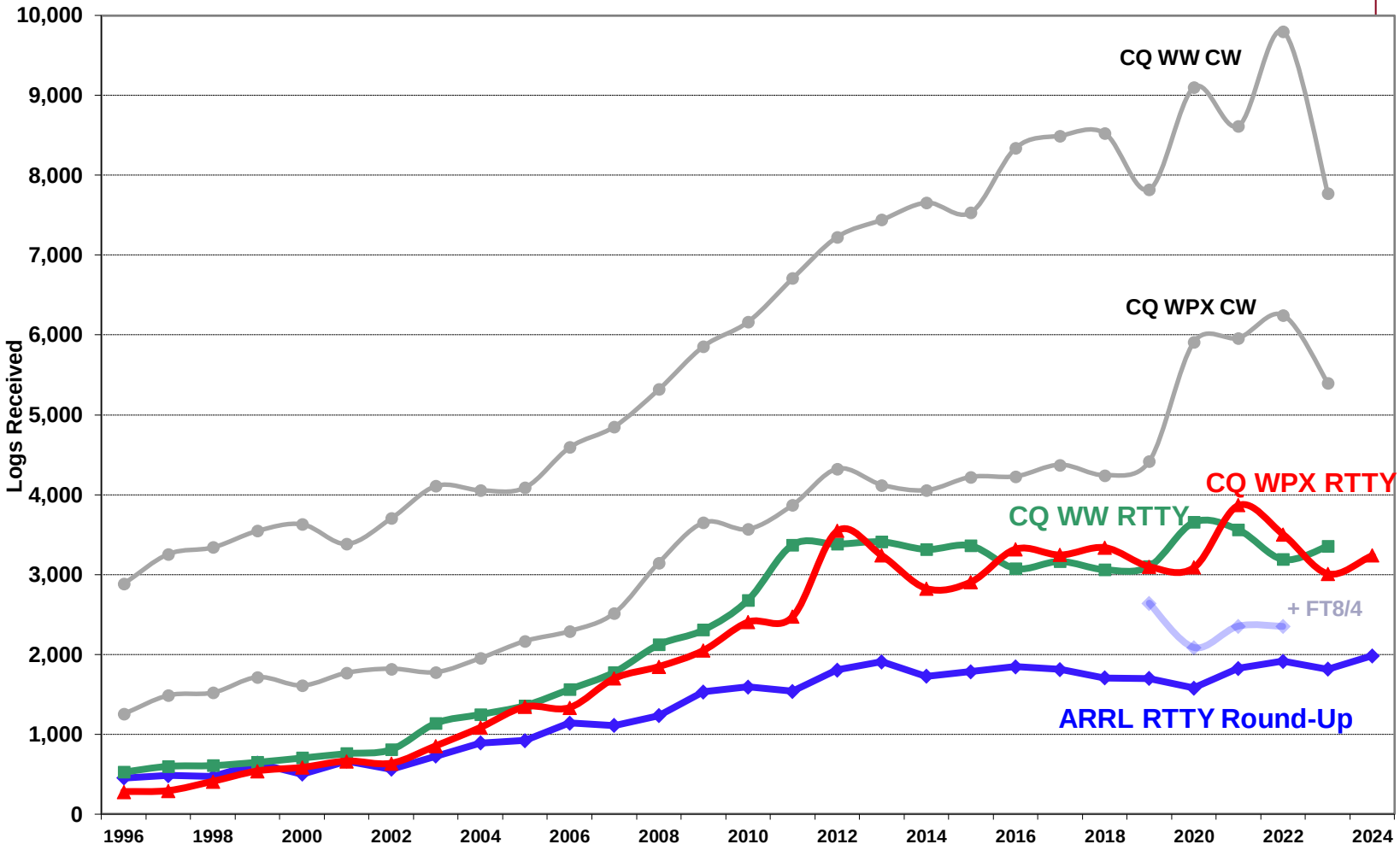
Lots of RTTY Contests

~ 2/mo.

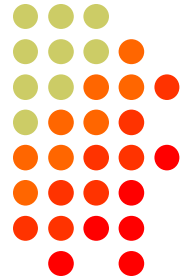


- **Biggies (3)**
  - ARRL RTTY Roundup (1st weekend in Jan)
  - CQ WPX RTTY (2nd weekend in Feb)
  - CQ WW RTTY (last weekend in Sep)
- **NCJ contests (4)**
  - NAQP RTTY (3rd Sat in Feb, 2nd Sat in Jul)
  - Sprint RTTY (2nd Sat in Mar & Oct)
- **Other popular RTTY contests (8)**
  - BARTG:
    - Sprint (3rd weekend Jan)
    - HF RTTY (3rd weekend Mar)
    - 75 Baud (3rd weekend Apr)
  - WAE RTTY (2nd weekend in Nov)
  - JARTS, Makrothen, SARTG (3)
- **WRT (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
   a. Auto-decode frees operator time … use it to do things difficult with CW & SSB, e.g., SO3R!
   b. 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) ***Baudet*** code
   - constant 60 wpm *(or 45.45 Baud)*

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

- 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		
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	"	

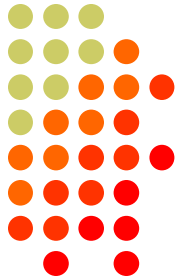
What is RTTY?

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?

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 *(legacy)*
- 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."

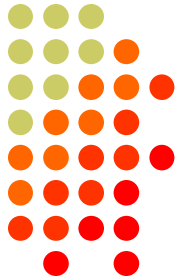
  however, this attribute …

  - 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

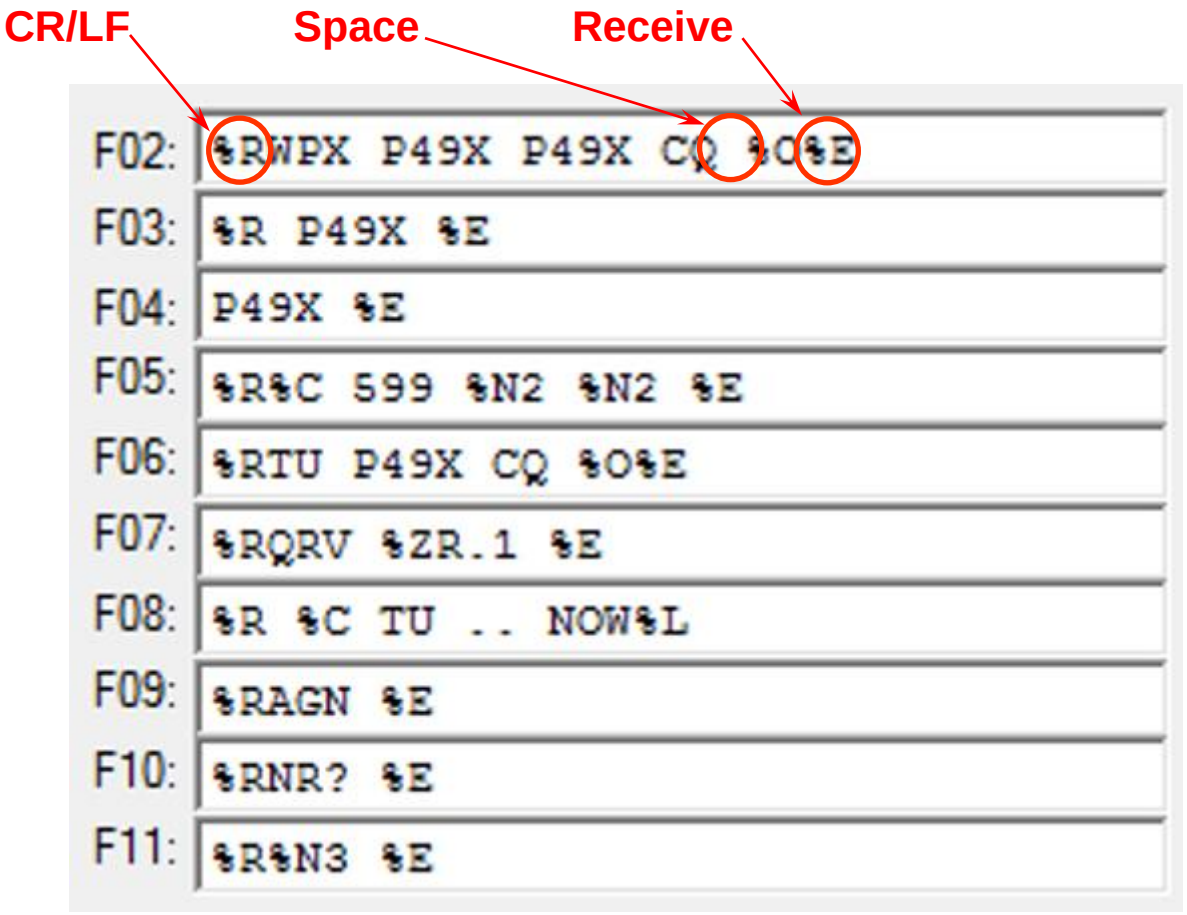
www.rttycontesting.com/tutorials/messages

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

RTTY Messages

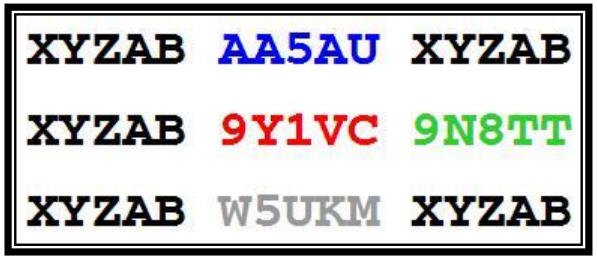
formatting



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



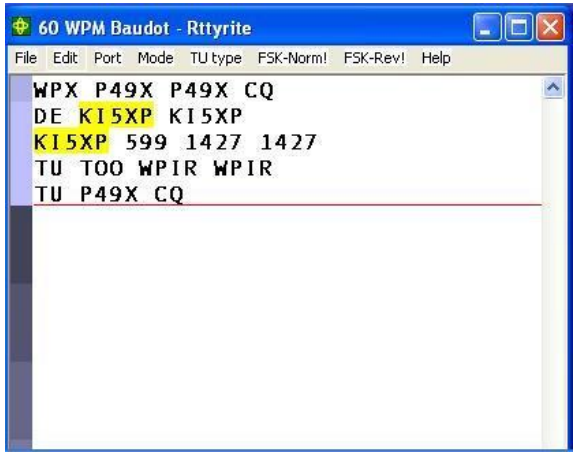
N1MM Logger

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

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)
  - WRT Thursday night practices (weekly)
- Multi-Ops

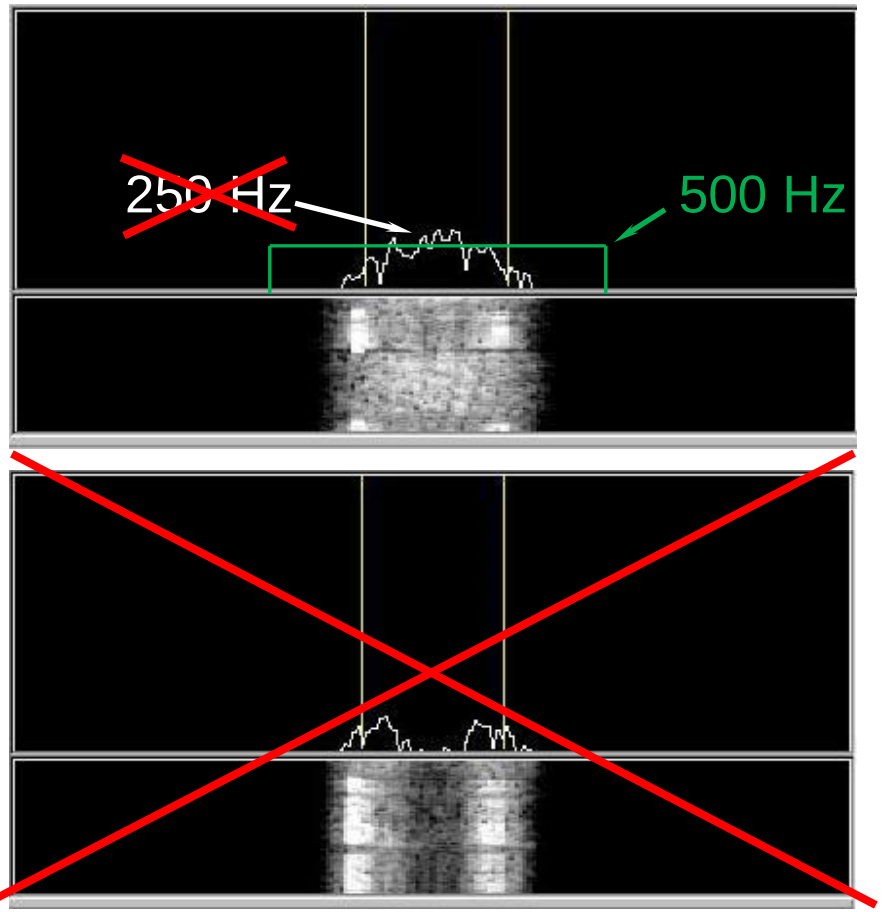
RTTY Operating Basics

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

RTTY Receive Bandwidth

radio IF filtering



Narrow IF filters

- 500 Hz - normal
- 250 Hz - extreme QRM
- Tone filters – don't use!
  - Icom Twin Peak Filter
  - K3 Dual-Tone Filter

RTTY Transmit Bandwidth

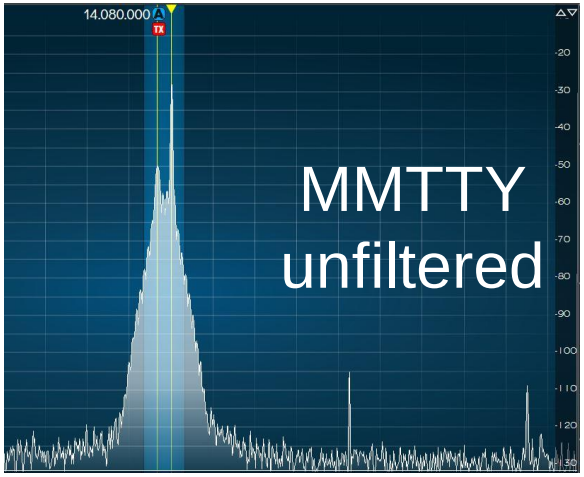
unnecessary QRM

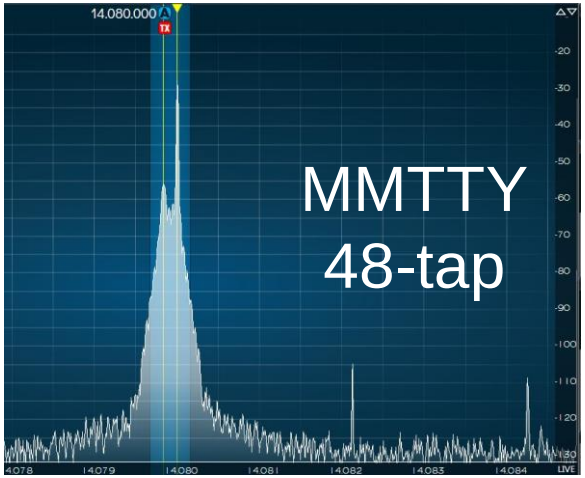
- Wasted power outside receiving decoder BW
  - Suitably narrow TX BW effectively amplifies signal
- Unnecessary QRM
  - Wide 1.5 KW RTTY can QRM 5-10 channels
  - Similar to CW key click problem of the past

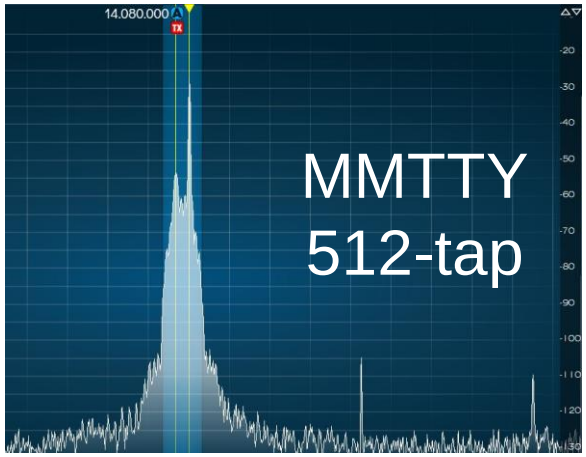
Why hurt yourself AND QRM close-by stations?

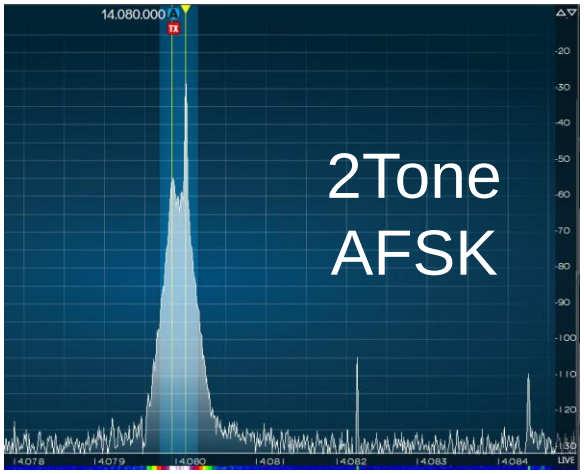
RTTY Transmit Bandwidth

AFSK



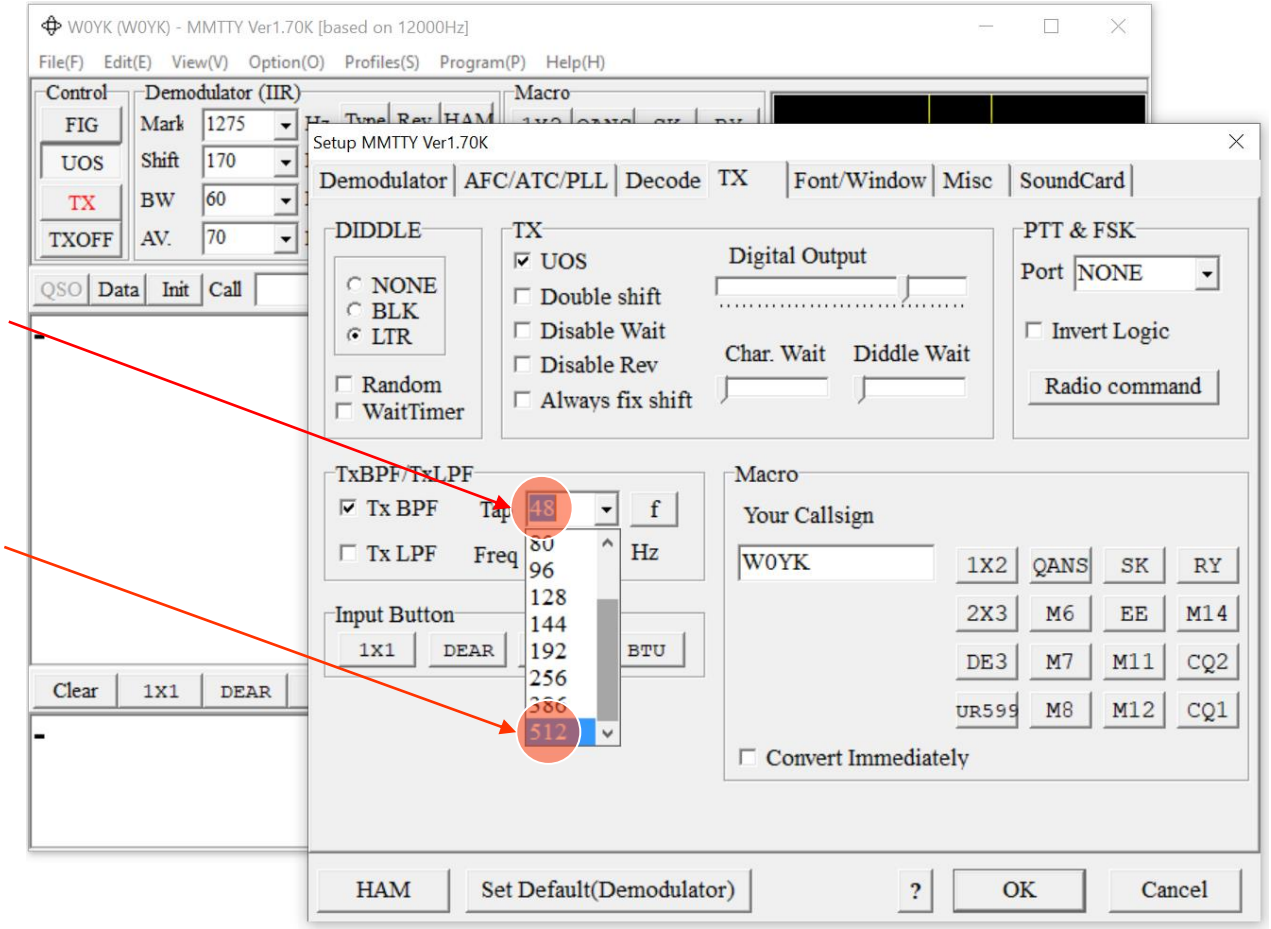






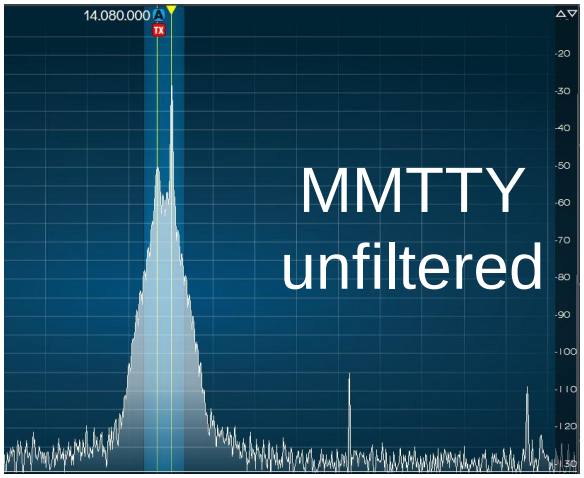
Tx BPF Setting

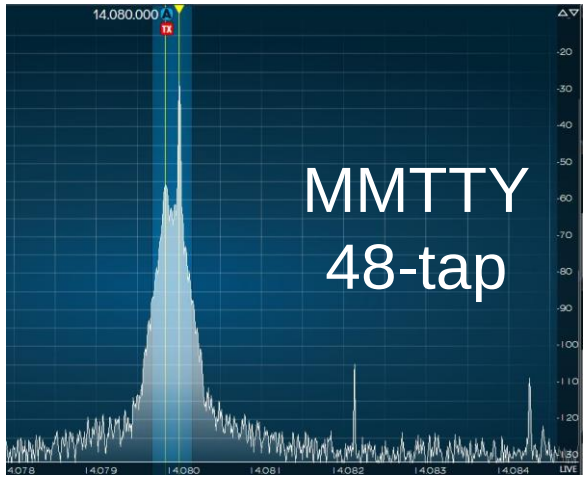
MMTTY

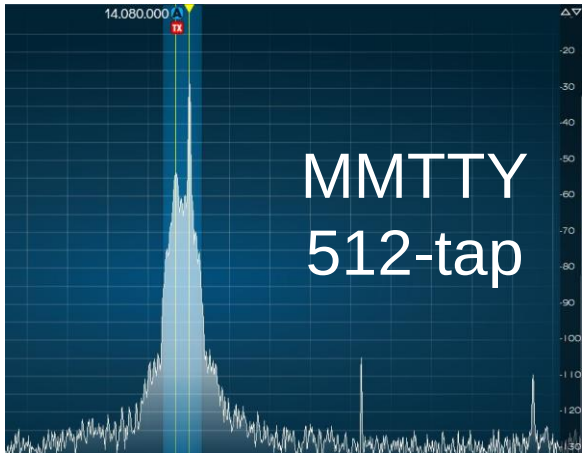


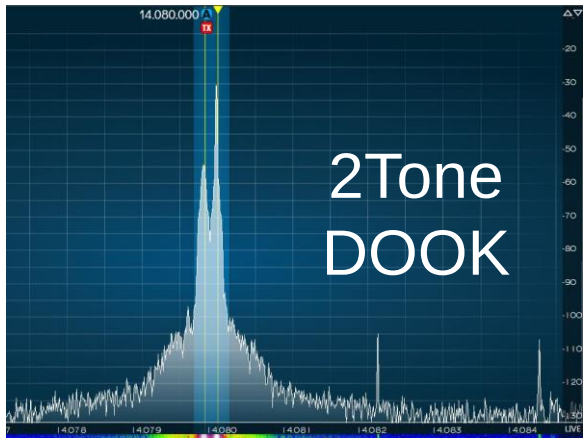
RTTY Transmit Bandwidth

AFSK – 2Tone DOOK



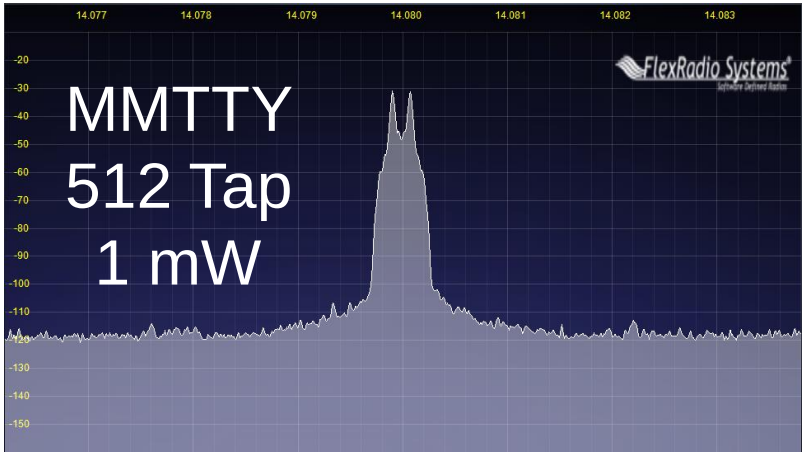


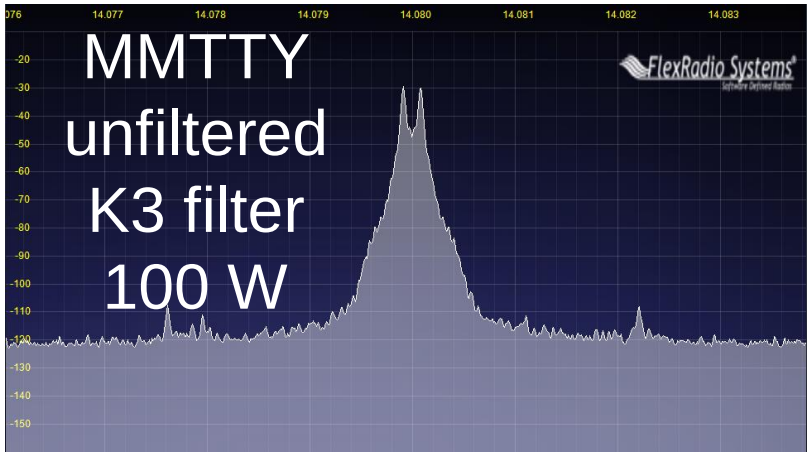




RTTY Transmit Bandwidth

AFSK - *PA IMD effect*

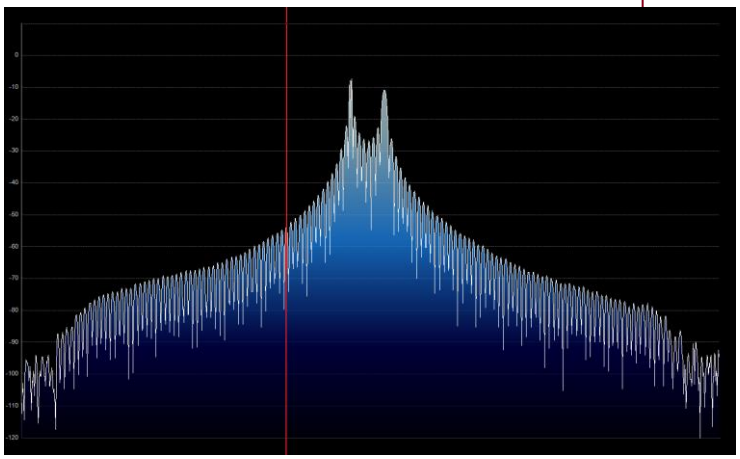




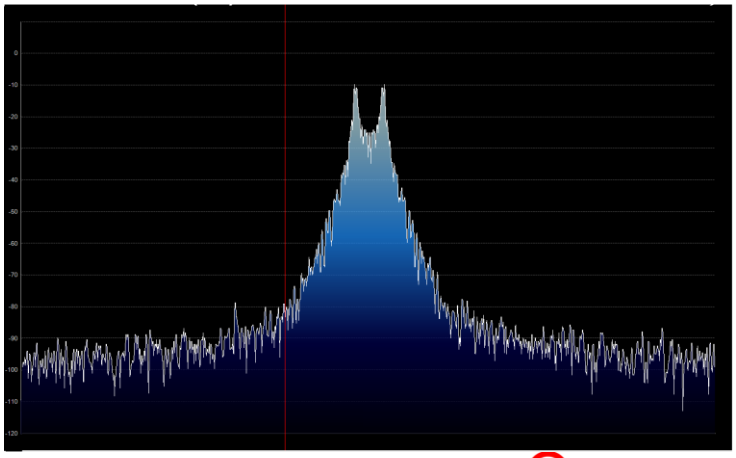
RTTY Transmit Bandwidth

FSK

- Old K3 FSK bandwidth
  - No waveshaping
  - < DSP281 firmware
  - Typical of all radios
  - 50 watts



- New K3 FSK bandwidth
  - Optimal DSP filter
  - DSP281 firmware, March 2013



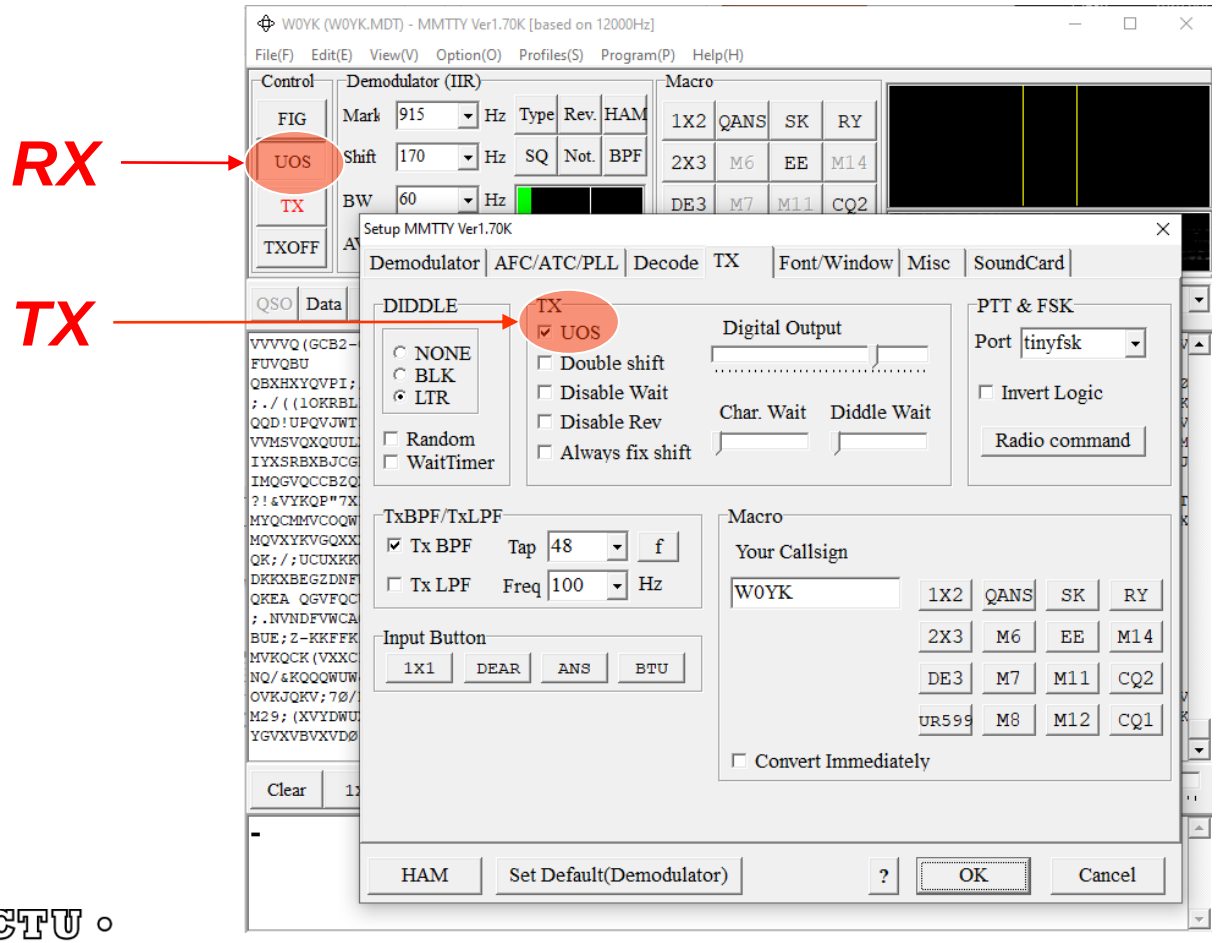
UOS

(Unshift-On-Space)

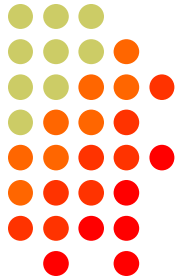
- Receive UOS:
  - Space character forces a shift to the Letters set
  - Increases noise immunity for alpha text
- Transmit UOS:
  - Sends FIGS character after Space, before numeric “word”
- Contest exchanges are alpha and numeric
  - Should UOS be on ~~or off~~?
  - Should Space ~~or Hyphen~~ delimit exchange elements?
    - 599 1234 1234 or 599-1234-1234
- *Recommendation:*
  - *Turn on both RX & TX UOS and use Space delimiters*

UOS

MMTTY


RX
TX
W0YK (W0YK.MDT) - MMTTY Ver1.70K [based on 12000Hz]
File(F) Edit(E) View(V) Option(O) Profiles(S) Program(P) Help(H)
Control
FIG
UOS
TX
TXOFF
Demodulator (IIR)
Mark 915 Hz
Shift 170 Hz
BW 60 Hz
Type Rev. HAM
SQ Not. BPF
Macro
1X2 QANS SK RY
2X3 M6 EE M14
DE3 M7 M11 CQ2
QSO Data
Setup MMTTY Ver1.70K
Demodulator AFC/ATC/PLL Decode TX Font/Window Misc SoundCard
DIDDLE
NONE
BLK
LTR
Random
WaitTimer
TX
UOS
Double shift
Disable Wait
Disable Rev
Always fix shift
Digital Output
Char. Wait
Diddle Wait
PTT & FSK
Port tinyfsk
Invert Logic
Radio command
TxBPF/TxLPF
Tx BPF
Tap 48
f
Tx LPF
Freq 100 Hz
Input Button
1X1 DEAR ANS BTU
Macro
Your Callsign
W0YK
1X2 QANS SK RY
2X3 M6 EE M14
DE3 M7 M11 CQ2
UR599 M8 M12 CQ1
Convert Immediately
Clear
HAM
Set Default(Demodulator)
?
OK
Cancel

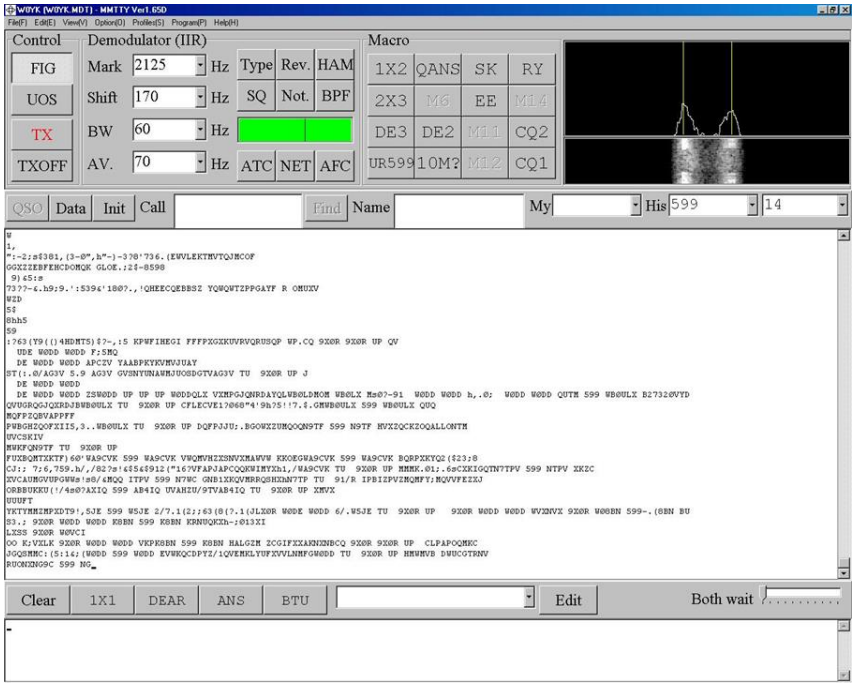
Multiple Decoders



- Parallel decoding with
  - Different decoders
  - Different decoder “profiles”
  - Different RX IF bandwidths (dual receivers)
- Reduces repeats
- Almost “free”
  - Screen space for multiple decoder windows
    - Can be relatively small
  - CPU performance

Multiple Decoders

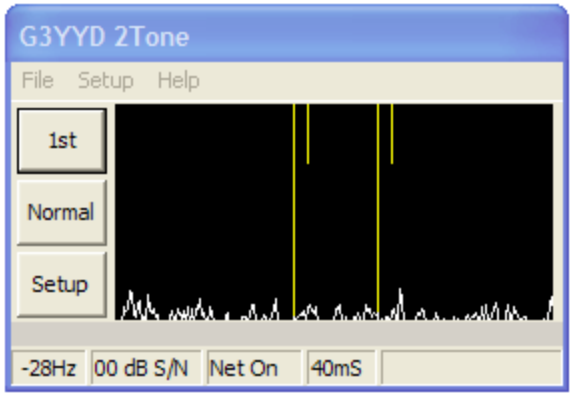
MMTTY

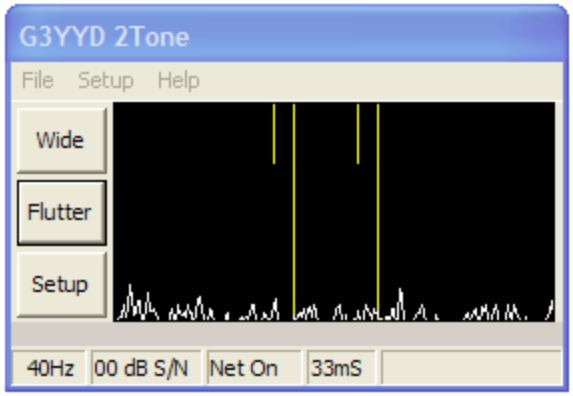


- Dominant SC MODEM
- Standalone, or …
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced June 2000
- Mako Mori, JE3HHT

Multiple Decoders

2Tone

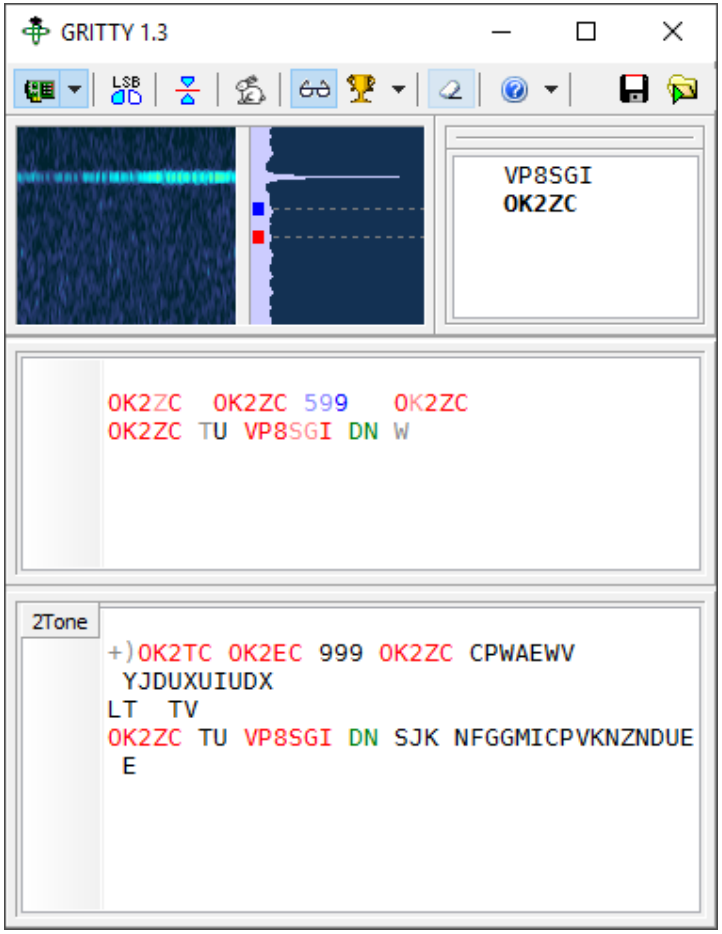




- Outperforms MMTTY ?
- Uses less CPU cycles
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced late 2012
- David Wicks, G3YYD

Multiple Decoders

GRITTY

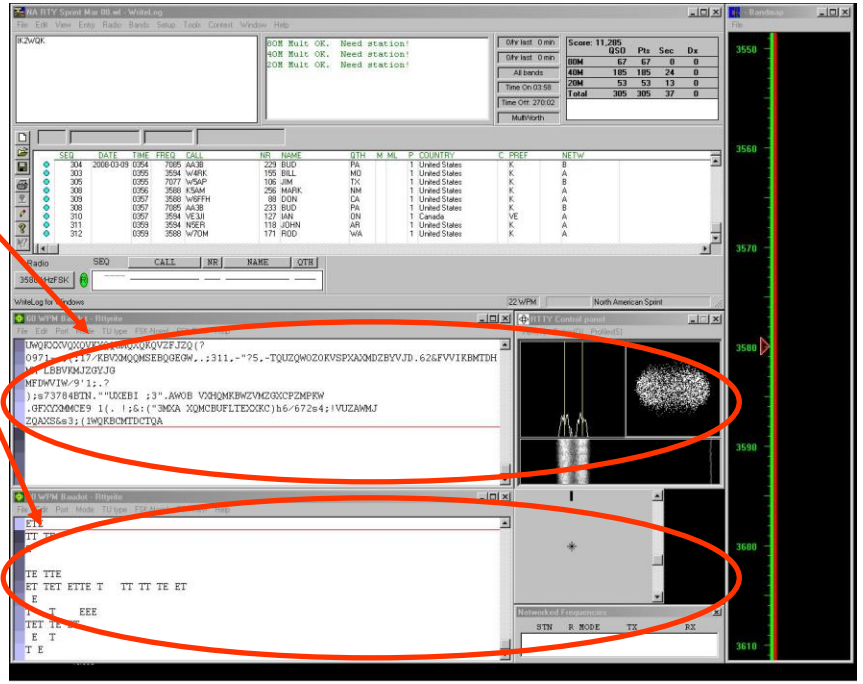


- Best accuracy ?
- Bayesian statistics
- Standalone, or …
- Contest loggers:
  - N1MM Logger+ only
- Introduced late 2015
- Alex Shovkoplyas, VE3NEA

Multiple Decoders

MMTTY & DXP38

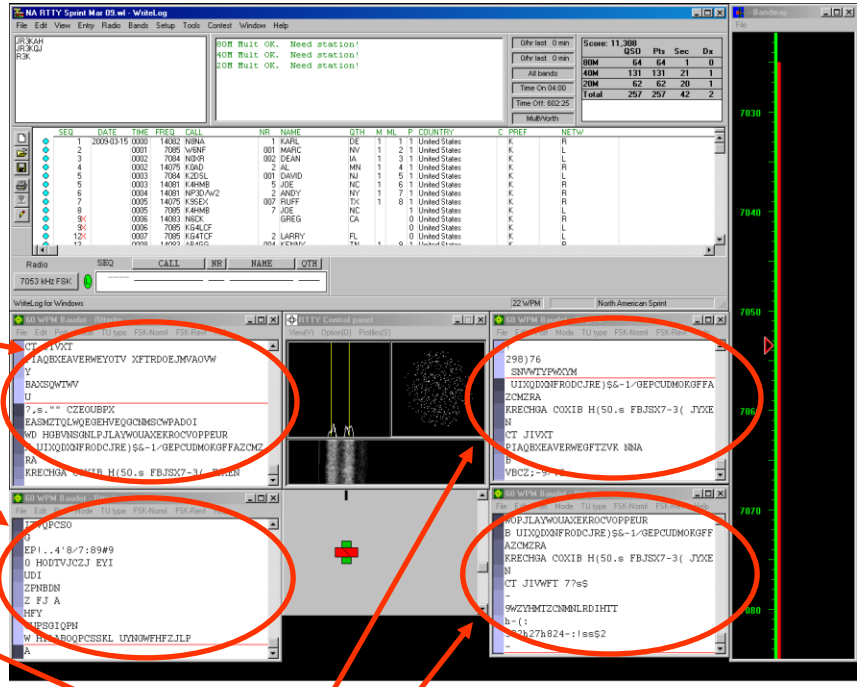
- Parallel decoding
  - Software, e.g., MMTTY
  - Hardware, e.g., DXP38
- Diverse conditions
  - Flutter
  - Multi-path
  - QRM, QRN
  - Weak signals
  - Off-frequency stations



Multiple Decoders

multiple MMTTY profiles

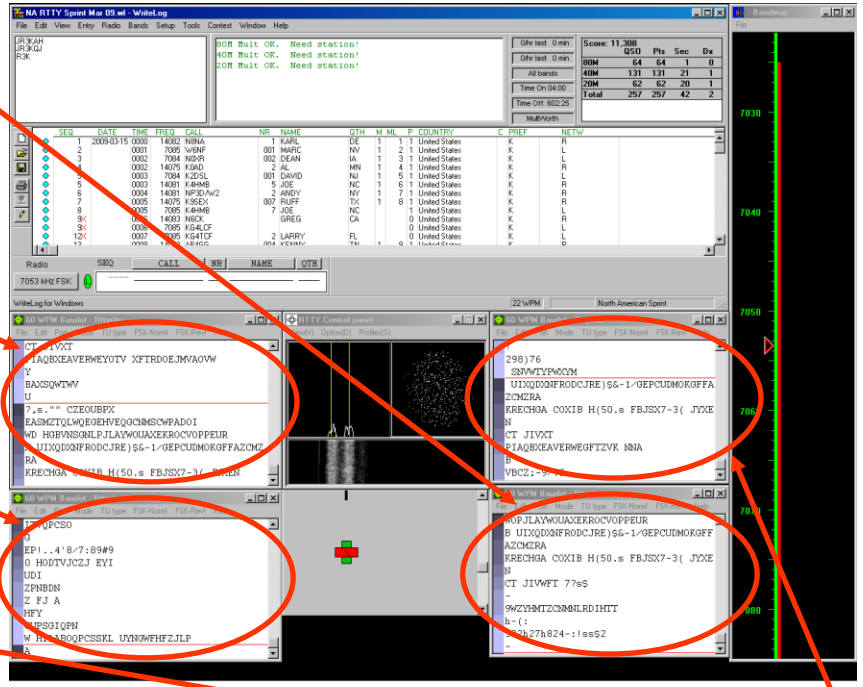
- Parallel decoding
  - same audio stream
  - switching takes too long
- Multiple profile windows
  - Standard
  - Fluttered signals
  - Fluttered signals (FIR)
  - Multi-path
  - hyper sensitive
  - EU1SA
  - AA6YQ-FIR-512
    - weak signals in QRN



Multiple Decoders

two IF bandwidths

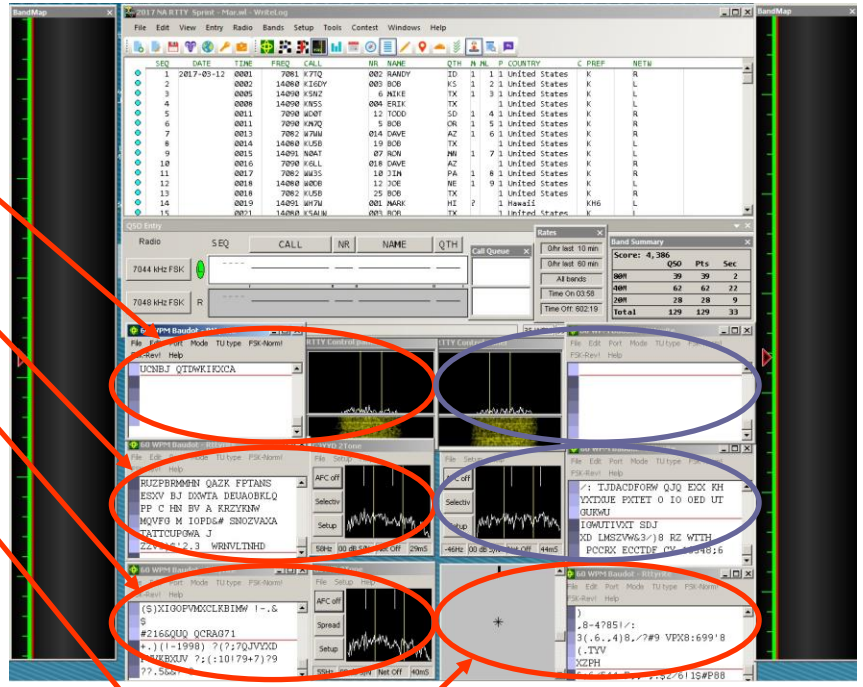
- Narrow IF filtering (main RX)
  - Hardware modem, i.e. DXP38
  - MMTTY profiles:
    - Standard
    - Fluttered signals
    - Fluttered signals (FIR)
    - Multi-path
    - hyper sensitive
    - EU1SA
- Wide IF filtering (sub RX)
  - MMTTY profile:
    - AA6YQ-FIR-512
      - Dual Peak Filter
      - “Matched filter”



Multiple Decoders

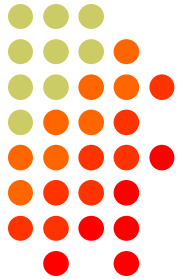
SO2V

- VFO-A (main RX)
  - MMTTY Standard profile
  - 2Tone Flutter profile
  - 2Tone Selective profile
  - DXP38
- VFO-B (sub RX)
  - MMTTY Standard profile
  - 2Tone Flutter profile
- 6 decoders
  - A→B



Multiple Decoders

Tone choices for monitoring

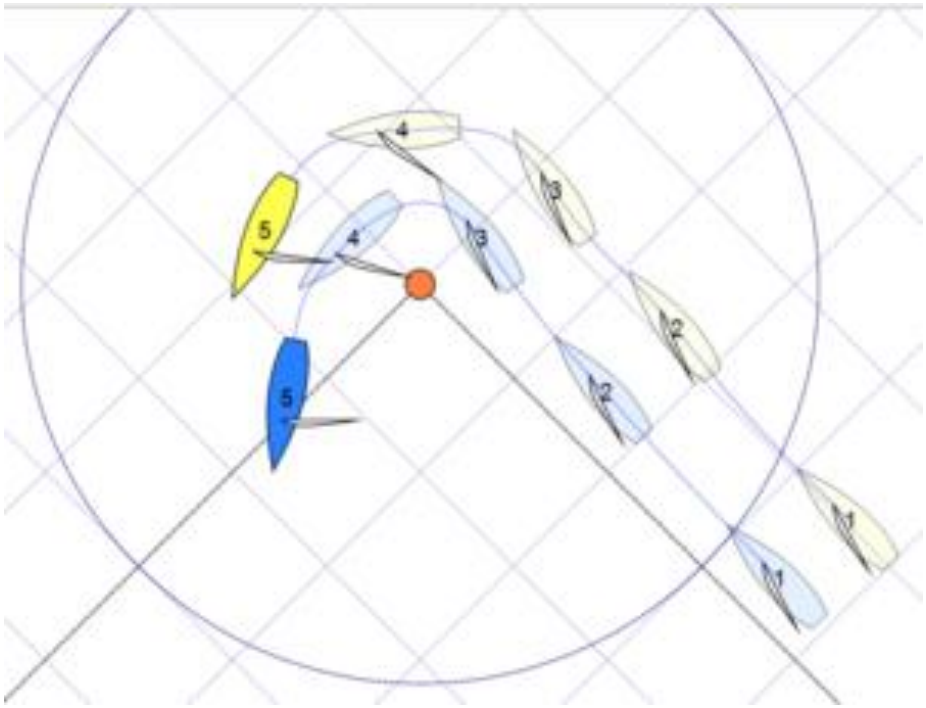


- Low tones are less fatiguing
  - Use high tones for secondary audio stream(s)
- Low/High tones can be mixed to put two audio streams in one ear:
  - SO2R plus SO2V per radio (4 streams)
  - SOnR (3+ streams)

Sailboat Buoy Racing

mark rounding

Yellow falls behind by keeping up with Blue



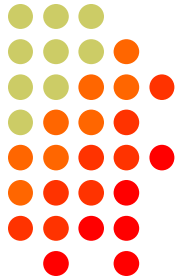
Call Sign Stacking

"Slow Down to Win"

- Sailboat racing analogy:
  - Pinwheel effect at mark-rounding→slow down
- Let pile-up continue a "beat" after getting the first call sign
  - Increase chance for another call sign or two
  - Increase chance for QSO-phase-skip
- Apply same tactic for tail-enders … pause ½-second before sending TU/CQ message

Call Sign Stacking

The 4 Phases of a QSO



Normal Run mode flow:

1. CQ msg
   - repeat
   - AGN?
2. pile-up
3. Exchange msg
   - Send fill(s)
4. receive his Exchange
   - AGN? or NR? or QTH? or NAME?

1. TU/CQ msg (logs QSO)

Normal S&P mode flow:

1. CQ
2. <mycall> msg
   - repeat
3. receive his Exchange
   - AGN? or NR? or QTH? or NAME?
4. Exchange msg
   - send fill(s)

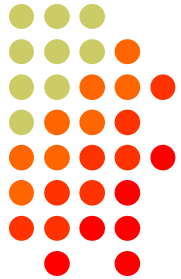
1. find next CQ

transmit

receive

Call Sign Stacking

Pileup



Normal	***Shortened***
1. *WPX P49X P49X CQ, or TU P49X CQ*	1. (skip CQ)
2. *K3LR K3LR K5ZD K5ZD*	2. (skip pileup)
3. *K3LR 599 2419 2419*	3. *K3LR TU NW K5ZD 599 2420 2420*
4. *TU 599 842 842*	4. *TU 599 1134 1134*

transmit

receive

Call Sign Stacking

Tail-end

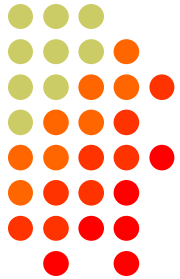
Normal	***Shortened***
1. *WPX P49X P49X CQ, or TU P49X CQ*	1. (skip CQ)
2. *K3LR K3LR*	2. (skip pileup)
3. *K3LR 599 2419 2419 K5ZD (tail-end)*	3. *K3LR TU NW K5ZD 599 2420 2420*
4. *TU 599 842 842*	4. *TU 599 1134 1134*

transmit

receive

Call Sign Stacking

summary



- Efficiently work:
  - multiple callers in a pile-up, and
  - tail-enders to a completing QSO
- Calls pushed onto the stack as they arrive
- Message parameter pops call off of the stack into the Entry window
- Eliminates 2 of 4 QSO phases, which doubles short-term rate

SO2V

2 VFOs

1. [single rcvr] If Assisted and running on VFO-A, then
   - A<>B, click spot, tune, ID station, work station
   - A<>B, resume running

   } Toggle as needed
2. [dual rcvr] Set up decoder windows on VFO-A and VFO-B
   - Radio must have two true receivers
   - Monitor both frequencies simultaneously with right/left channels of sound card and separate RTTY windows
     - Left-click call from 2nd RTTY window into VFO-B Entry Window
   - Two ways to transmit on VFO-B:
     1. A<>B, work the mult, A<>B *(but, mixes print from two frequencies)*
     2. SPLIT, work the mult, un-SPLIT, resume running
        - Requires “wire-OR’d” FSK or AFSK and two transmit RTTY windows
          - WriteLog Shared Com Port obviates the wire-OR
        - K3/WriteLog invokes SPLIT when VFO-B call is clicked

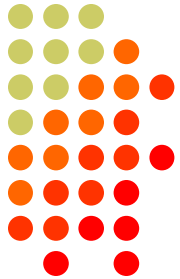
1BSIQ

interleaved QSO phases

- Receive on one VFO, while transmitting on the other.
- VFOs must be interlocked to guarantee only one signal at a time.
- 1BSIQ=One Band Synchronized Interleaved QSOs

SO2R

optionally 2BSIQ



- Eliminates SO1R RTTY “boredom”
- Think beyond run and S&P:
  - Dueling CQs; run on two bands simultaneously ***(2BSIQ)***
  - S&P on two bands simultaneously, esp. w/Packet
  - SO2V on one or both radios (SO4V!)
- [optional] Two networked computers:
  - Eliminates swapping radio-focus
  - Display room for more decoder windows per radio
  - RTTY doesn’t require much typing; mini-keyboards
  - 2 x SO2V=SO4V for picking up mults on both run bands
  - Easily extendible to SOnR

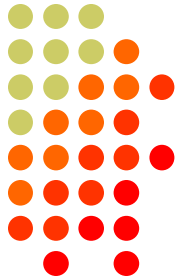
No time to watch TV or read spy novels!

SO2R

Multi-2 configuration

SO2R in the NA Sprint

maximize TX duty cycle



- Set VFOs at least 10 kHz apart on both radios
- Find a clear spot on one radio and CQ while you tune the other radio for a station to work
- If you don’t find a station to work before the CQ finishes, find a clear frequency and duel CQ
- After a QSO, swap VFOs on that radio, search during other transmission, then resume dueling CQ
- Don’t waste time trying to work the “couplet” … CQing is OK in Sprint!

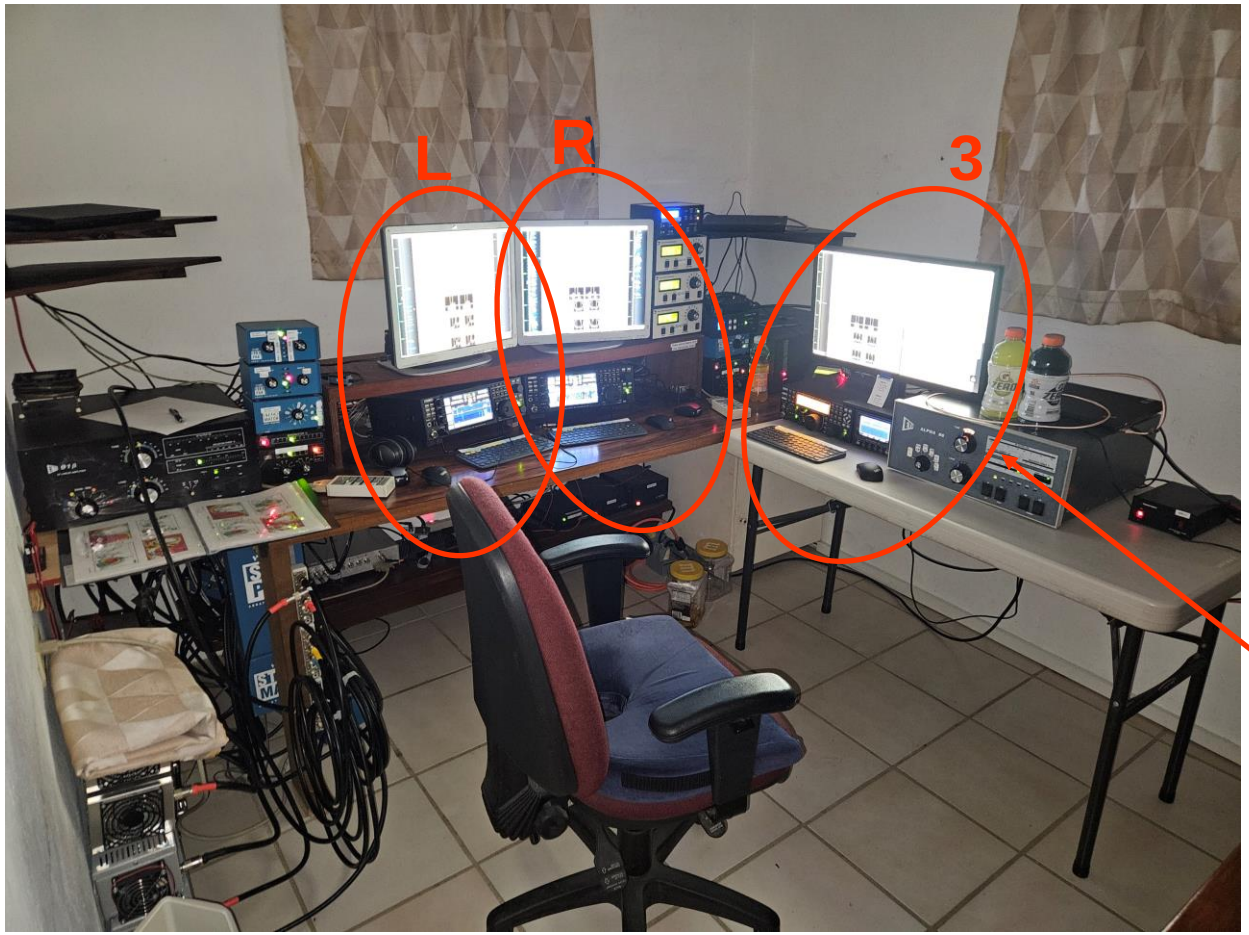
SOnR

> 2 radios

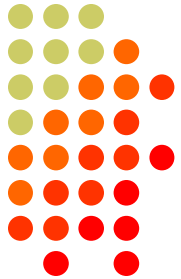
- Simplify antenna/filter band-decoding:
  - Dedicate a band/antenna to the 3rd (and 4th) radio
- Networked PC/radio simplifies configuration
- RTTY (vs. CW or SSB) easier to operate
  - PC decodes for operator
  - Low tones & high tones allows two radios per ear
    - Classic audio headphone mixer (per ear) provides radio A, radio B or both
  - RigSelect to instantly select 2 of 4 radios for main SO2R operation

SO3R

Multi-Multi configuration



The Cynics Say …



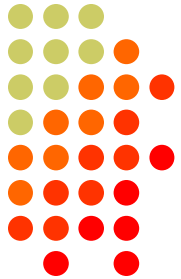
- "The RTTY decoder/encoder does everything."
  however, this attribute …
  - frees the operator to improve other skills
  - enables more contest participants
  - provides mode diversity for contest junkies

- "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



1. ***Acquire*** and set up hardware and/or software to convert between the RTTY audio tones and text:
   a. RTTY ***receive*** decoder
   b. RTTY ***transmit*** encoder
   c. PC-radio interface
2. ***Configure*** decoder/encoder
3. ***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?

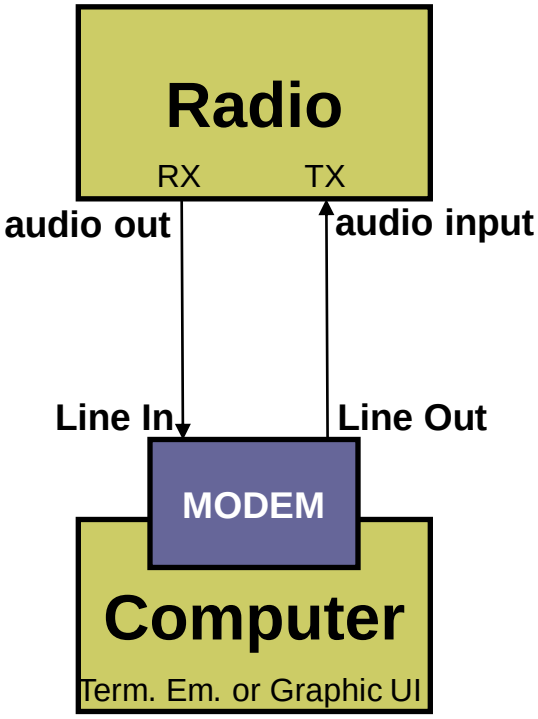
decoder/encoder terminology

- 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

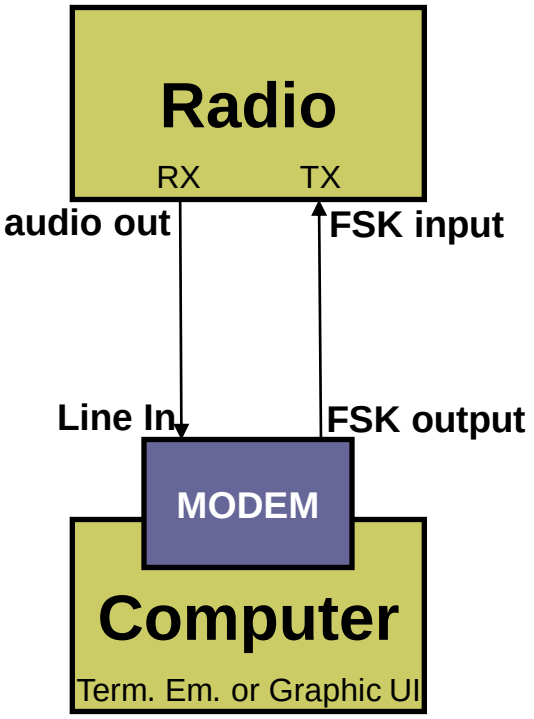
How Do I Set It Up?

hardware MODEM

AFSK



FSK



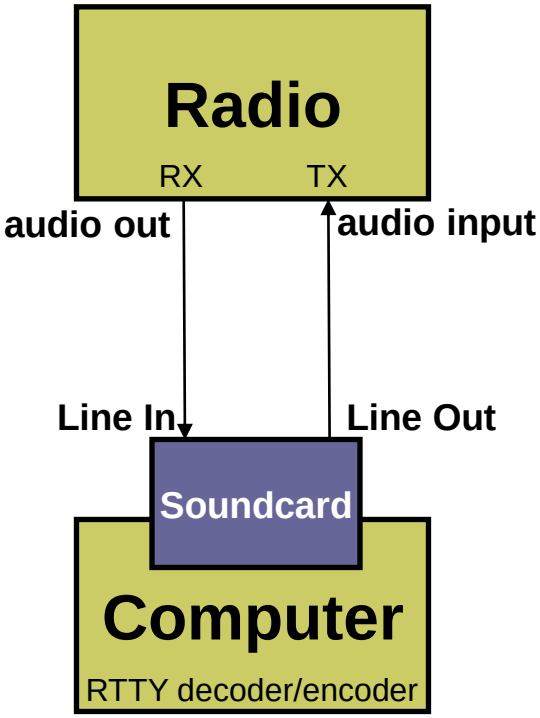
How Do I Set It Up?

hardware MODEM

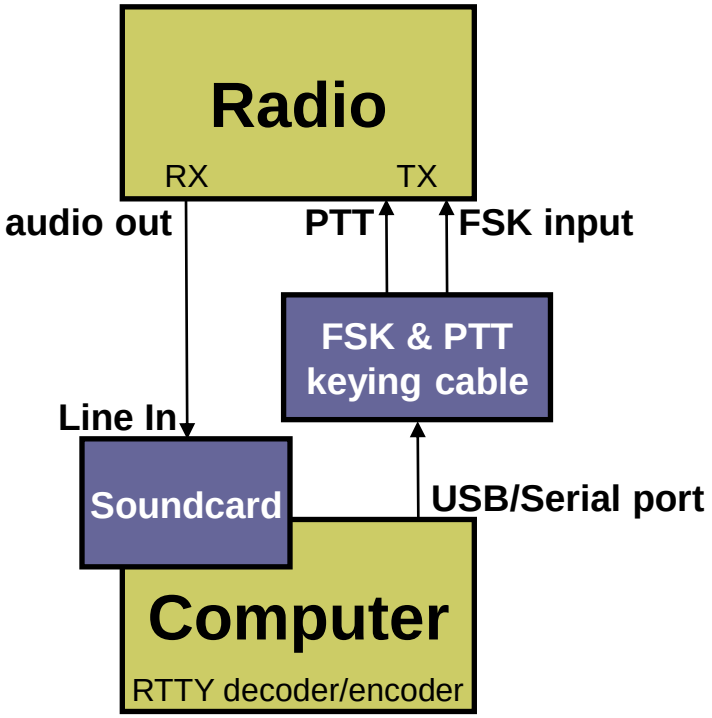
How Do I Set It Up?

software application & soundcard

AFSK

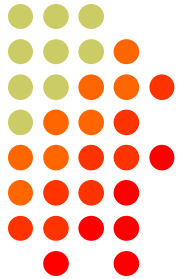


FSK



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

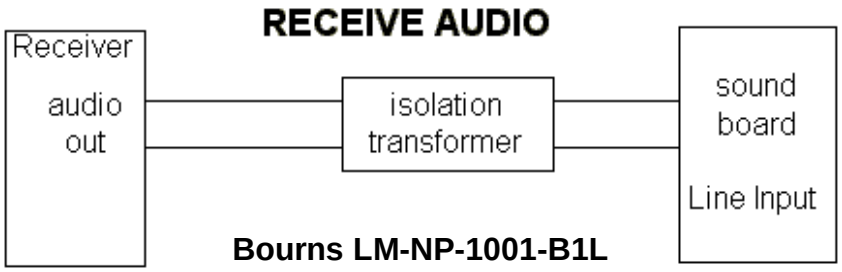
How Do I Set It Up?

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

Amazon $7.99

Radio Shack $19.49 or eBay $6.99

-64 dBc 3rd order IMD

eBay $5.50

eBay $7.45

How Do I Set It Up?

SDR digital audio isolation

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

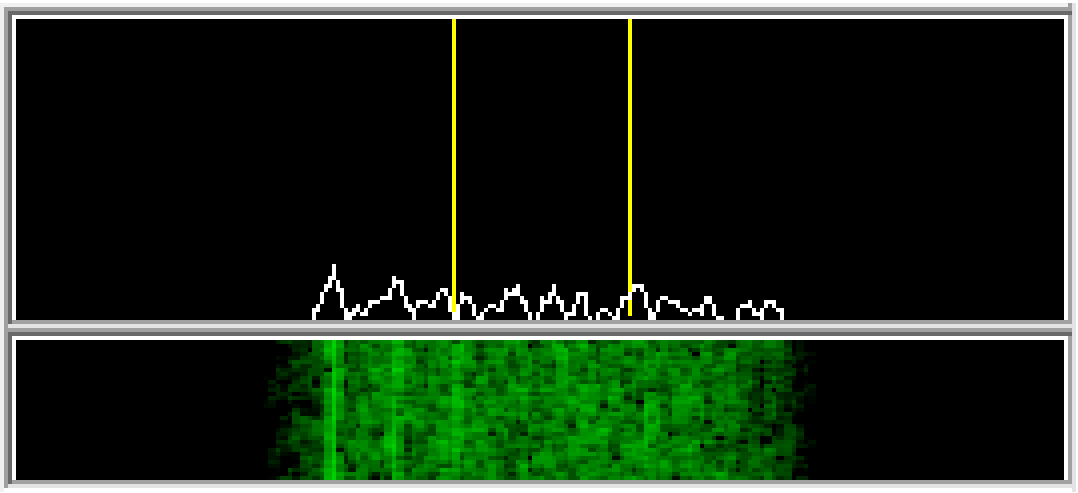
How Do I Set It Up?

legacy 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?

maximize RX dynamic range



- 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/or
  - the Mic level (or auxiliary audio input)
- such that:
  - full power output is attained, but no more.
- Back off a bit to avoid overdrive.

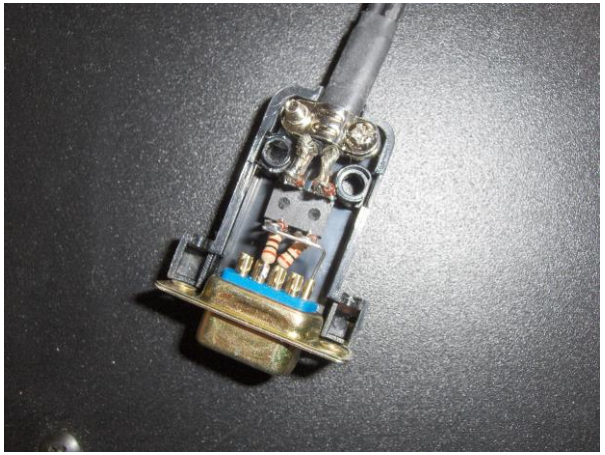
How Do I Set It Up?

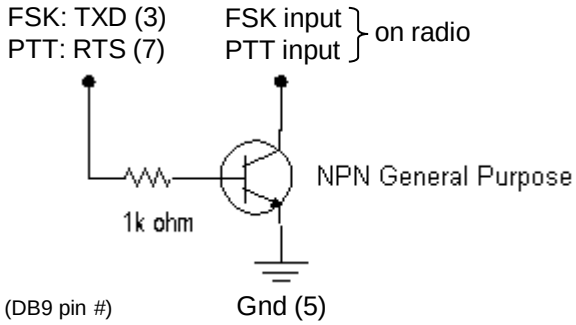
PTT vs. VOX

- AFSK uses VOX (rarely 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?

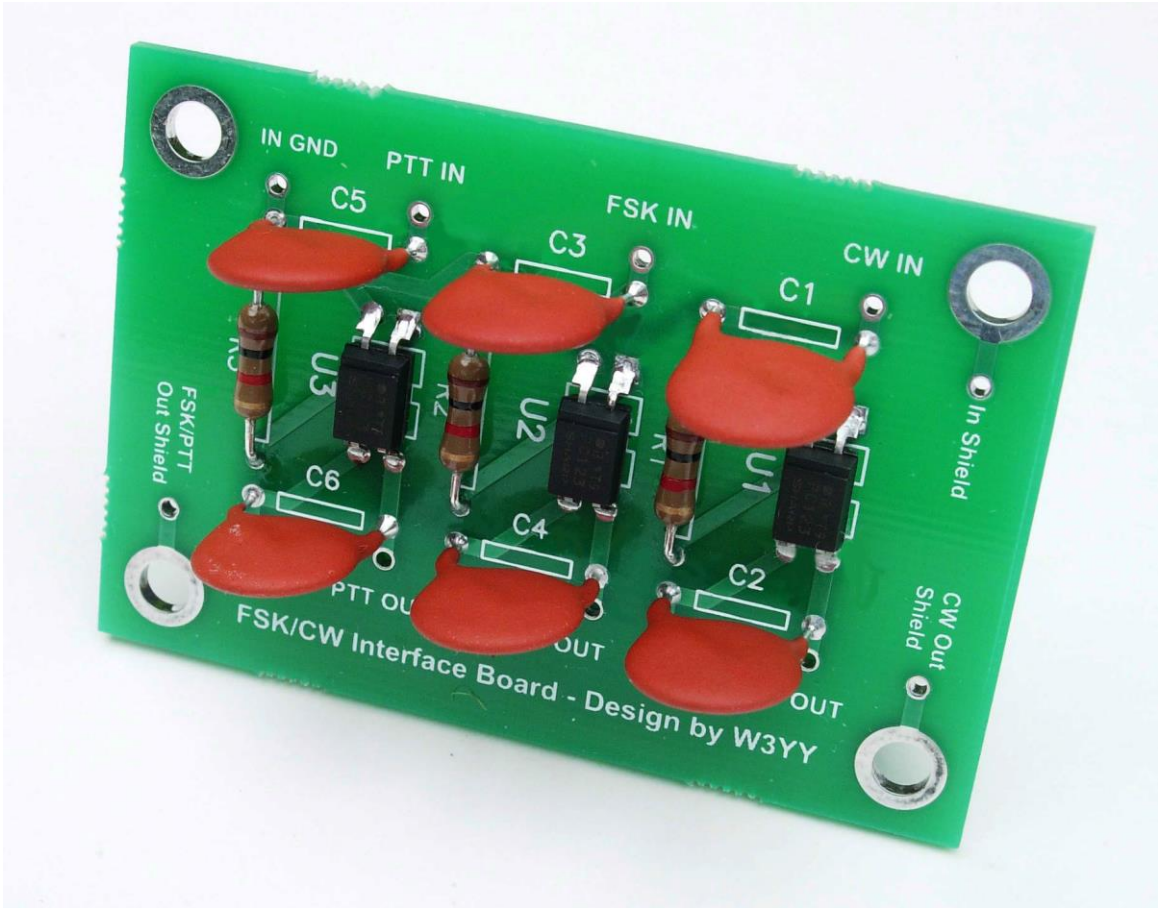
homebrew FSK & PTT keying cable





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?

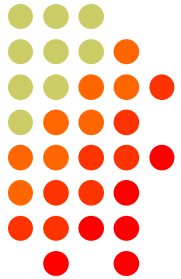
RigExpert & microHAM interfaces

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?

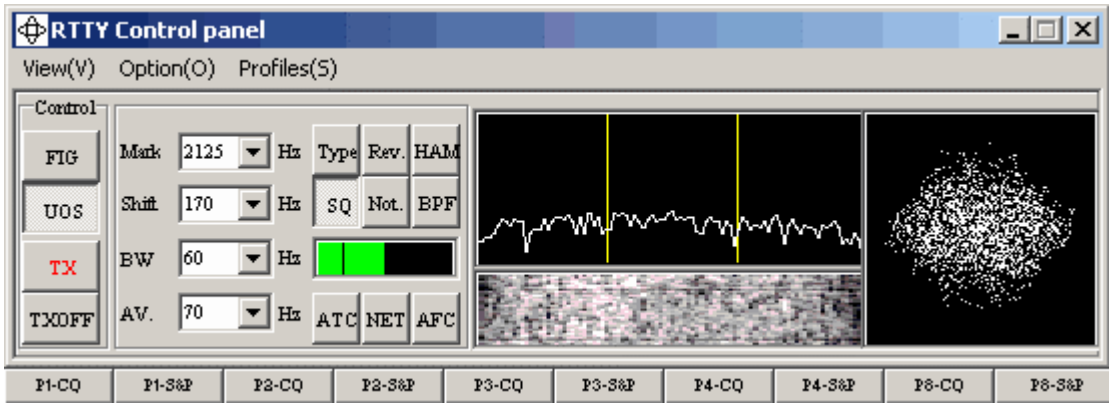
summary - FSK

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

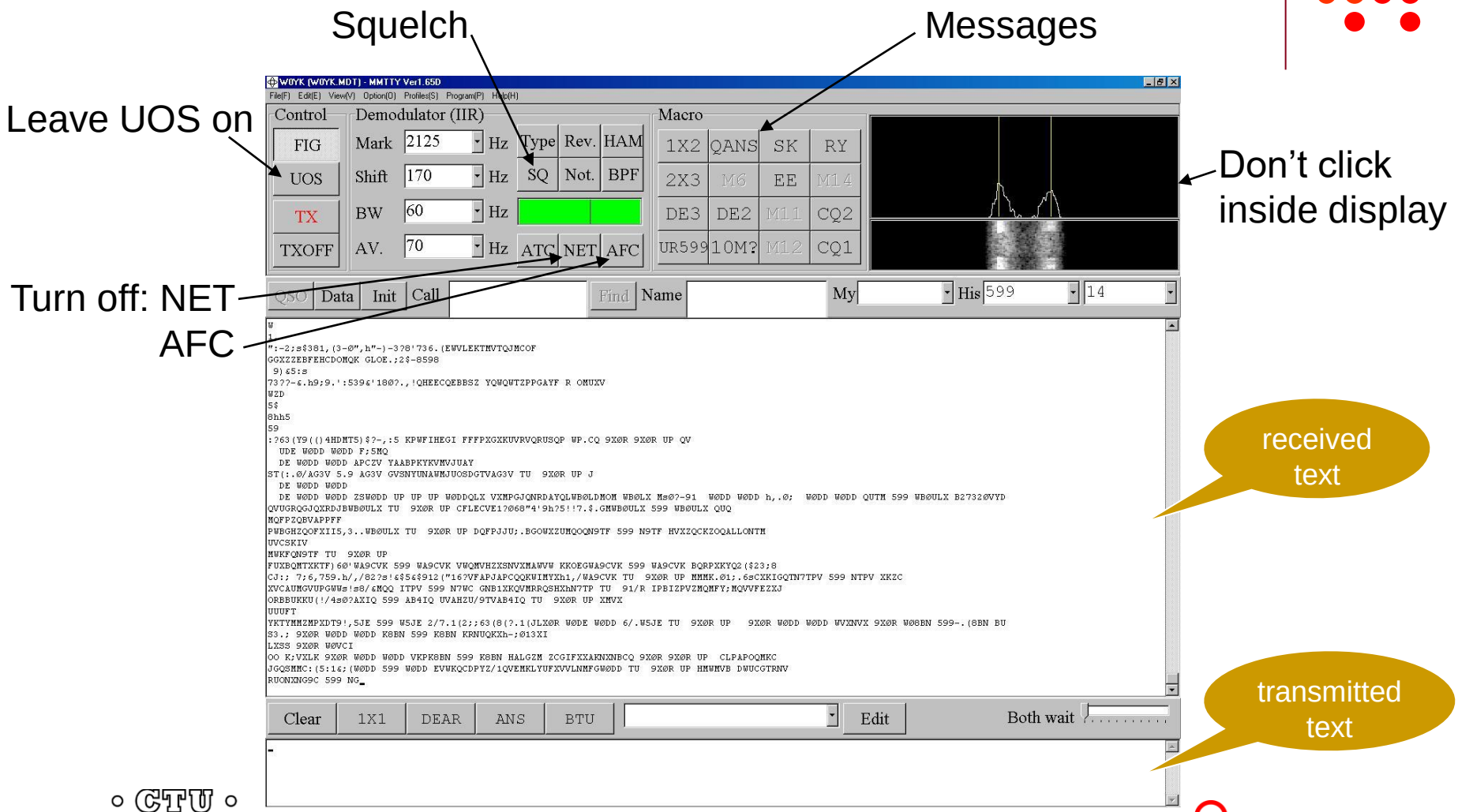
MMTTY



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

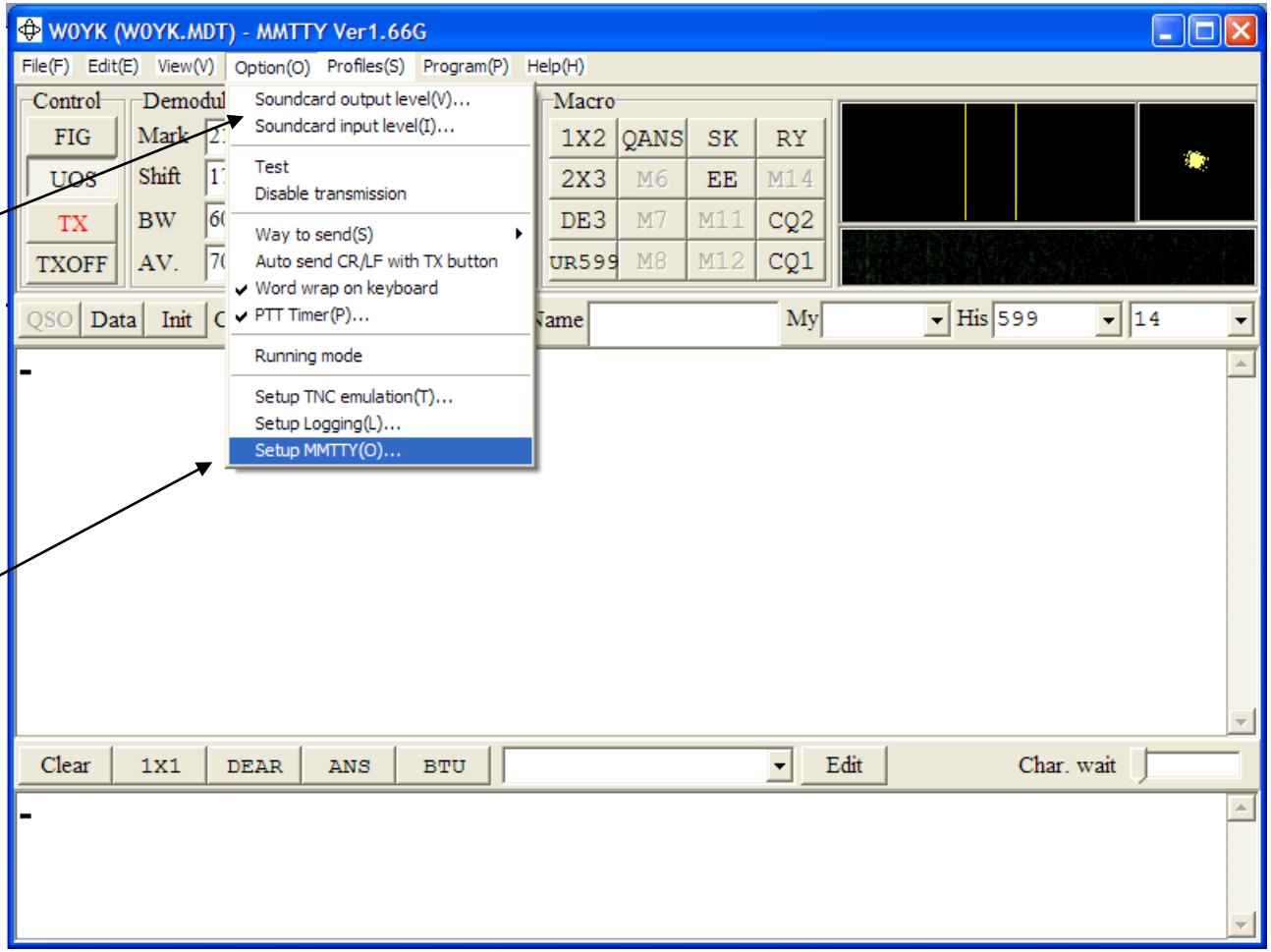
How Do I Set It Up?

MMTTY standalone



How Do I Set It Up?

MMTTY Option menu

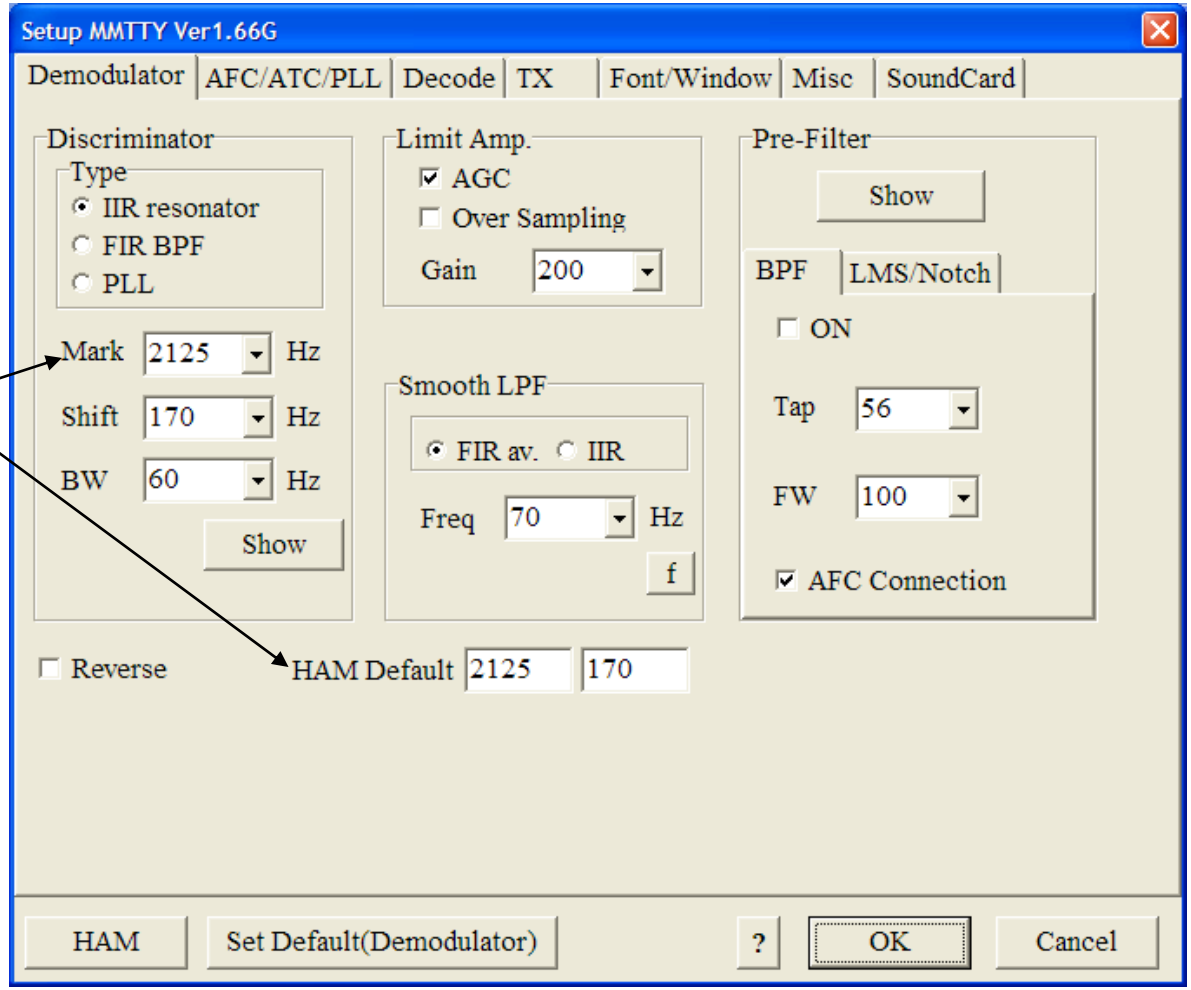


Soundcard levels

MMTTY setup

How Do I Set It Up?

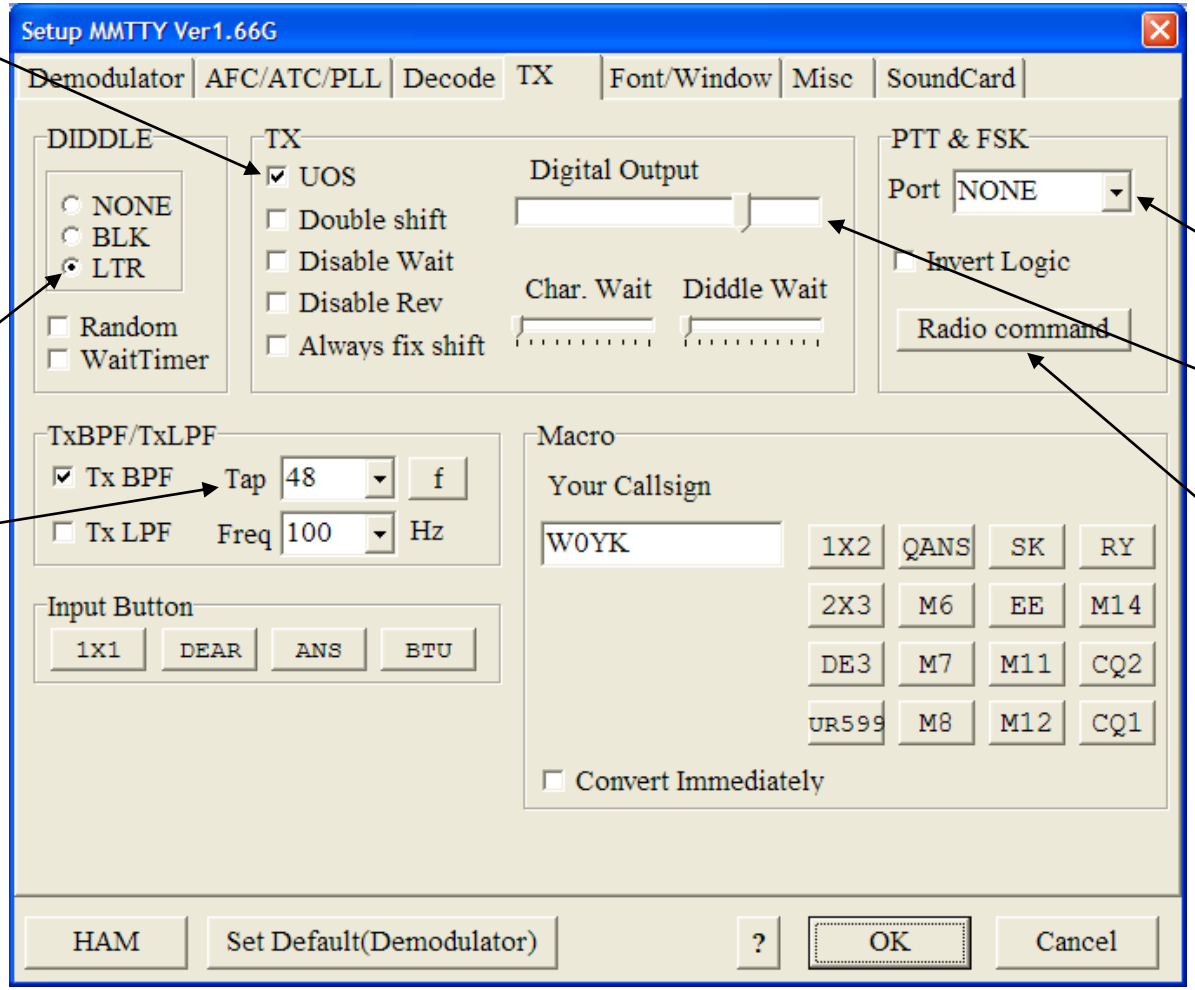
MMTTY Option/Setup/Demodulator



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.

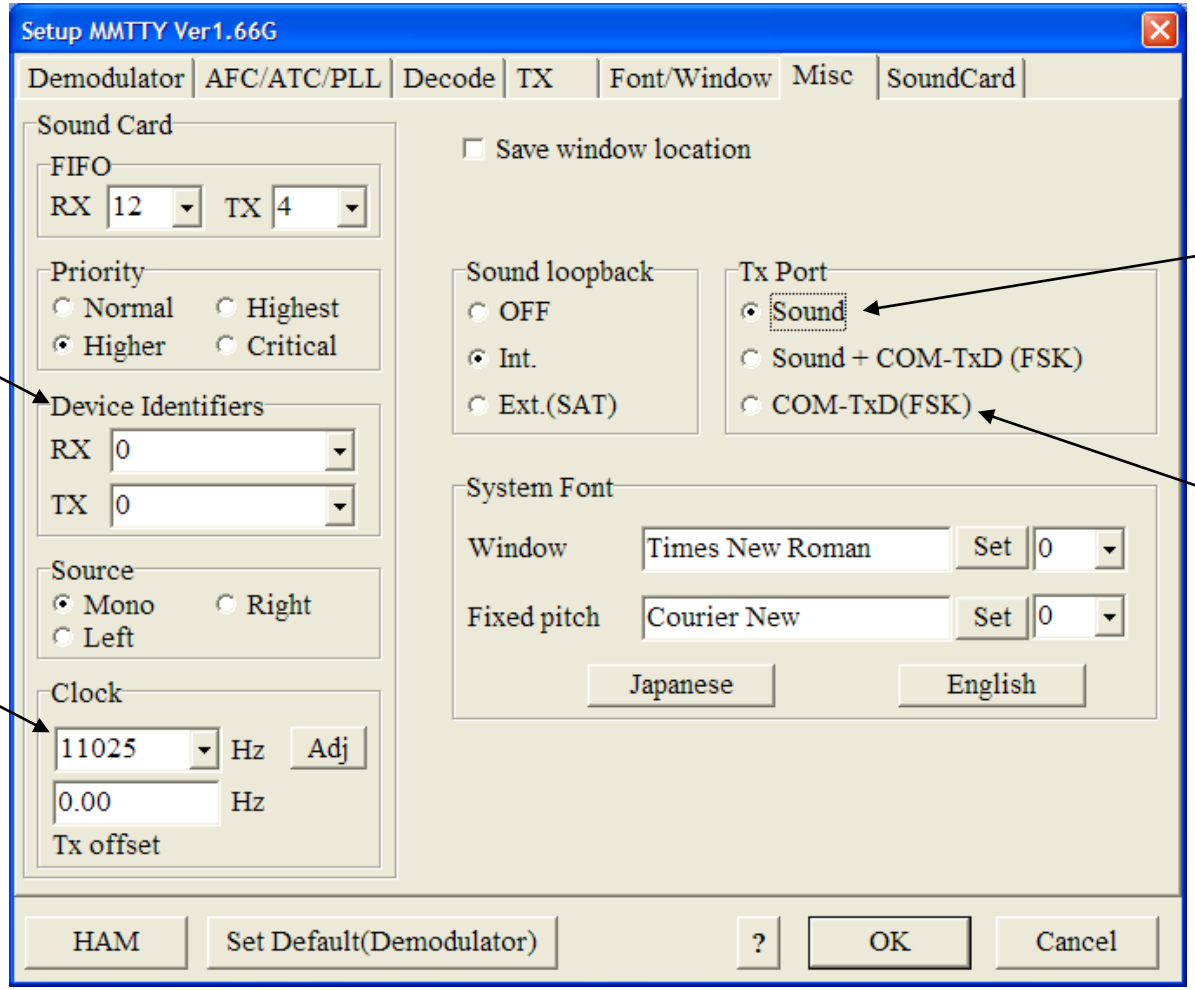
FSK/PTT port

Soundcard
Line Out level

AFSK PTT

How Do I Set It Up?

MMTTY Option/Setup/Misc



Soundcard

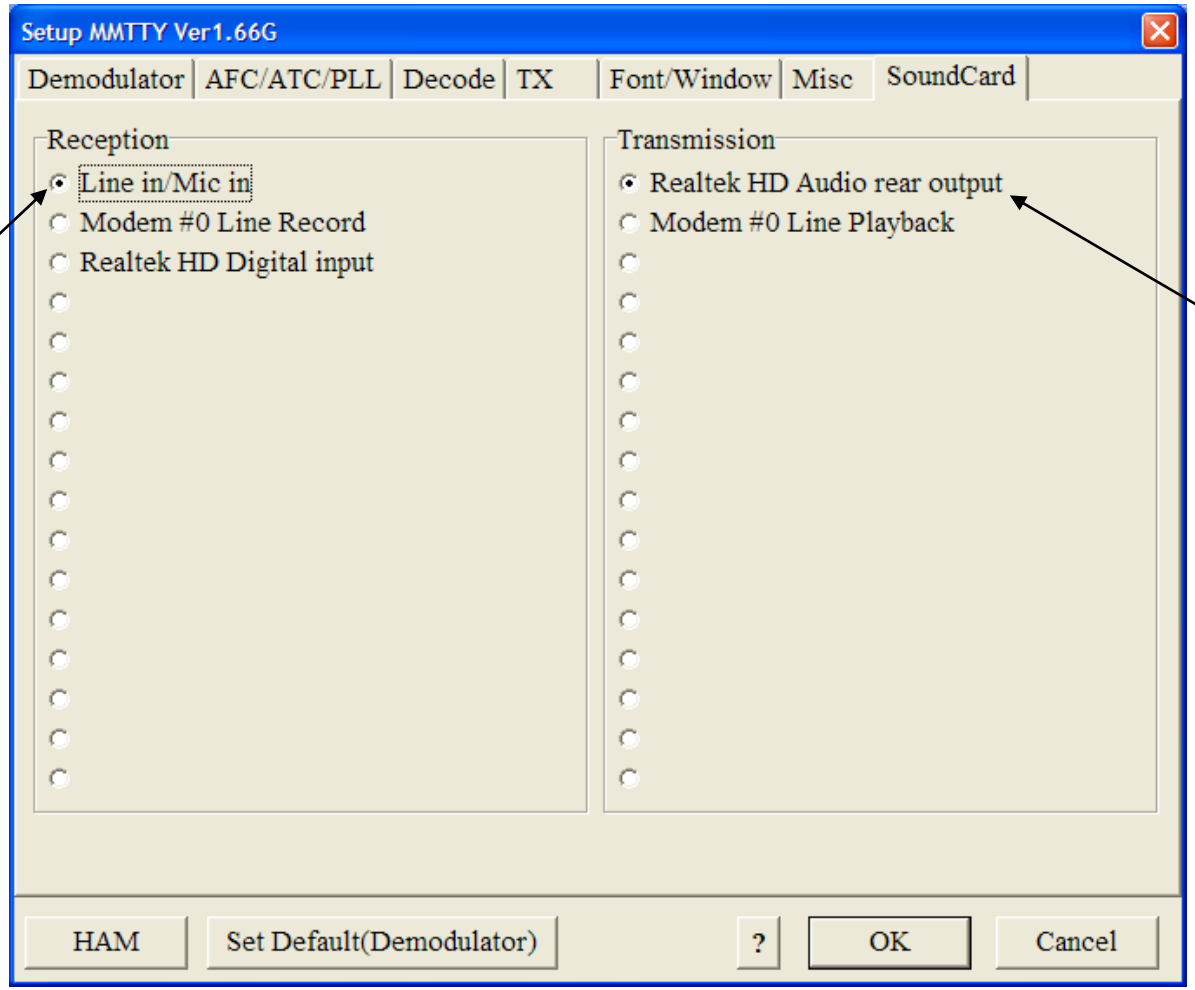
Soundcard Format, 4x

AFSK

FSK

How Do I Set It Up?

MMTTY Option/Setup/SoundCard

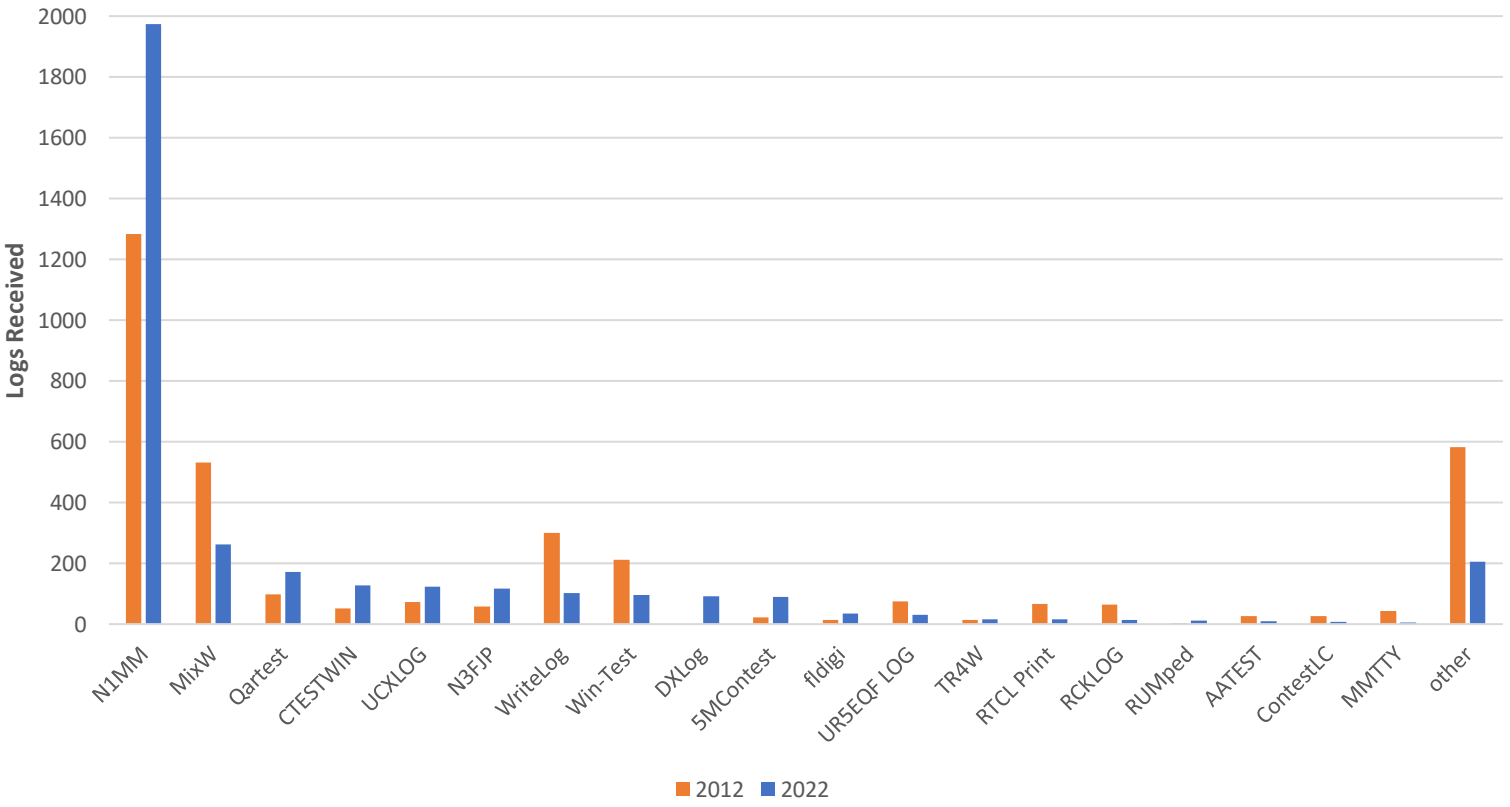


Select receive Soundcard

Select transmit Soundcard (AFSK only)

CQ WPX RTTY

logs received: 2022 vs. 2012



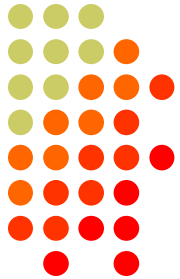
RTTY Contest Loggers

- 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

- Standalone 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 alternative decoder
  - Higher capability interface *(DIY or commercial)*
  - Advanced setup: multiple decoders, SO2V, SO2R, SO3R, ...

Resources

- www.rttycontesting.com premier website
  - Tutorials and resources (beginner to expert)
  - WriteLog, N1MM Logger+, MMTTY and 2Tone
- rtty@groups.io & rttydigital@groups.io Email reflectors
  - RTTY contester networking
  - Real-time 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)