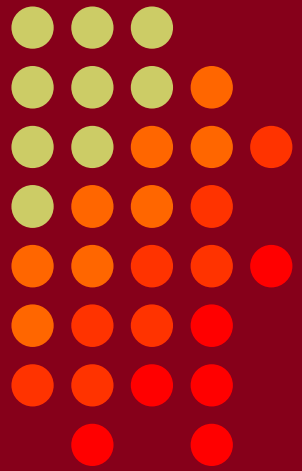
CTU 2020 Presents

Digital Contesting Hints & Kinks

Ed Muns, W0YK



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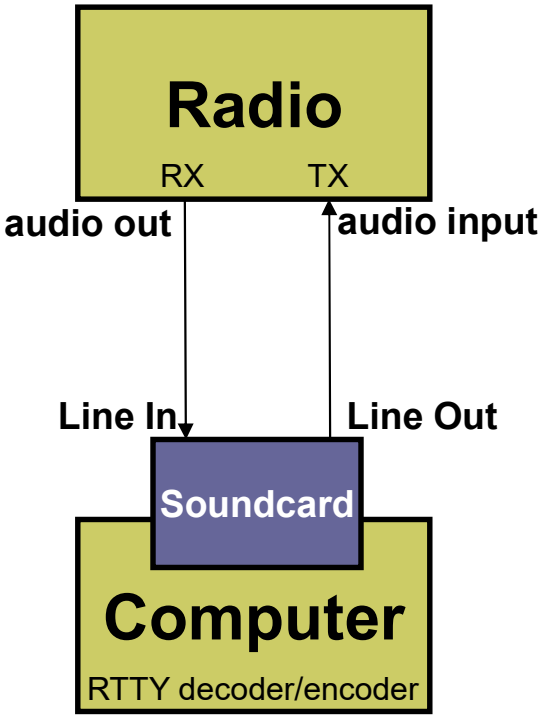
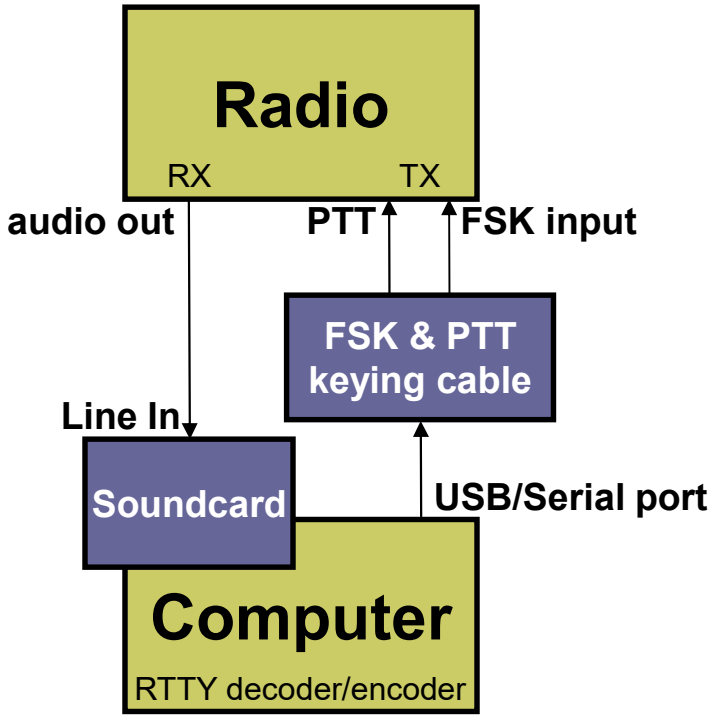
AFSK or FSK?

Personal preference

AFSK



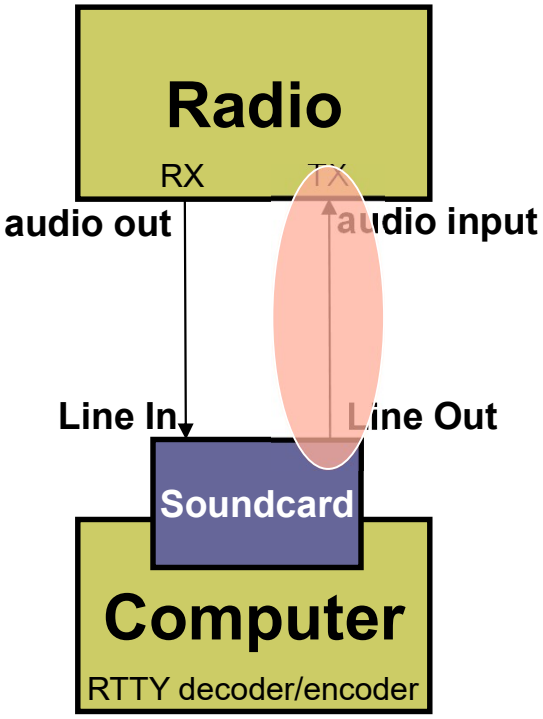
FSK



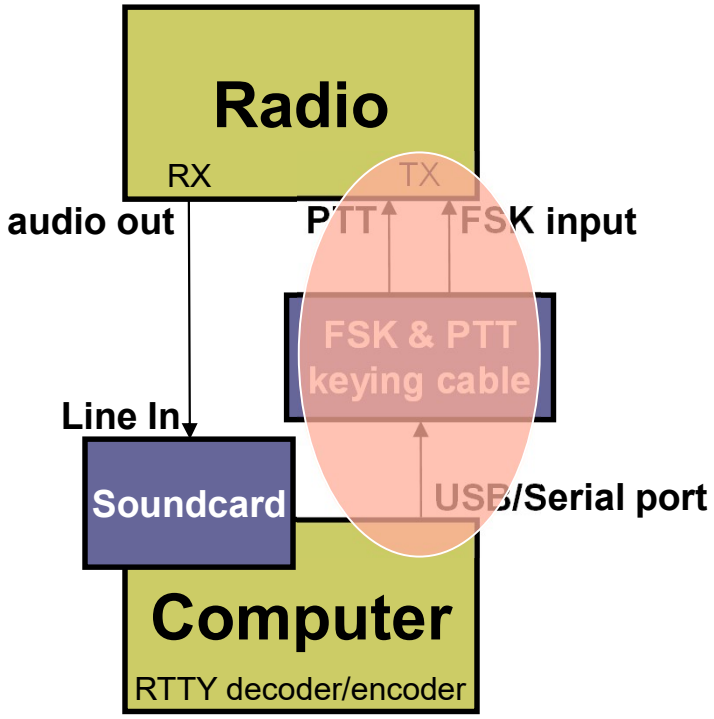
AFSK or FSK?

Method to drive transmitter

AFSK



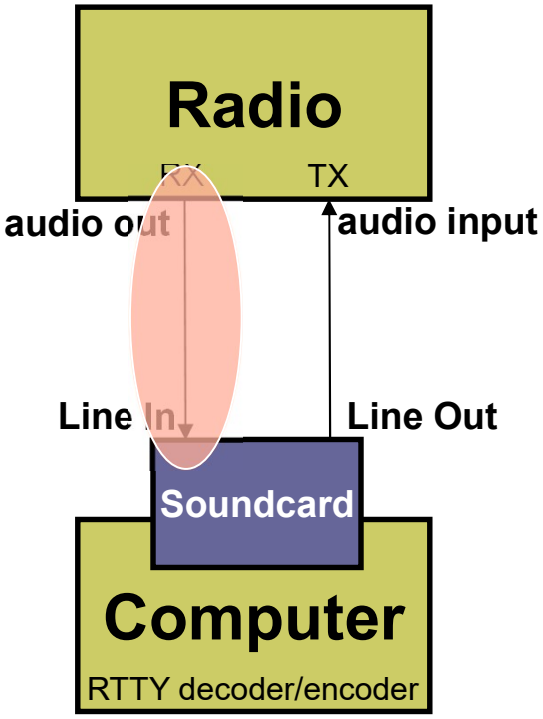
FSK



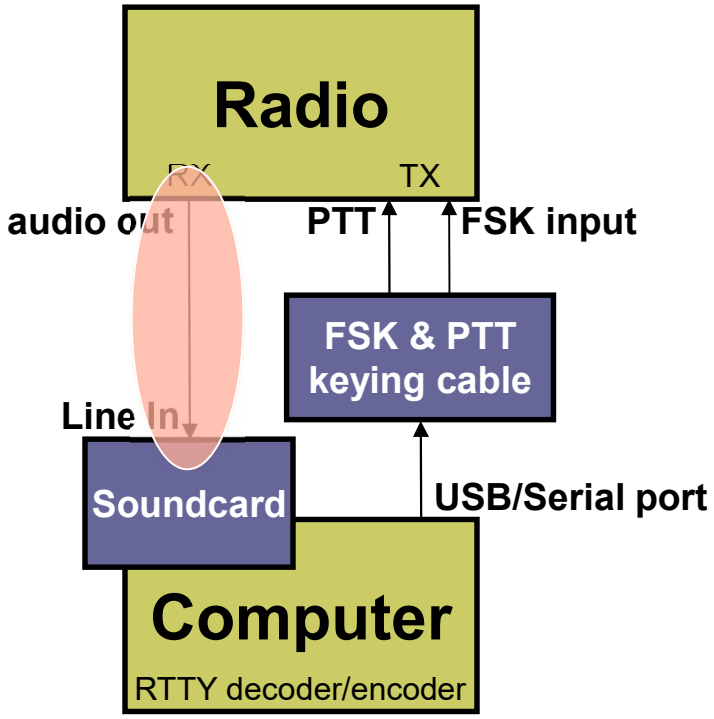
AFSK or FSK?

Receive method identical

AFSK



FSK



Dial Frequency

spots are often wrong

- RTTY frequency = Mark frequency
- RTTY radio frequency definition:
  - 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)*

Dial Frequency

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- FSK displays Mark *(dial = 14090.000 kHz)*

Dial Frequency

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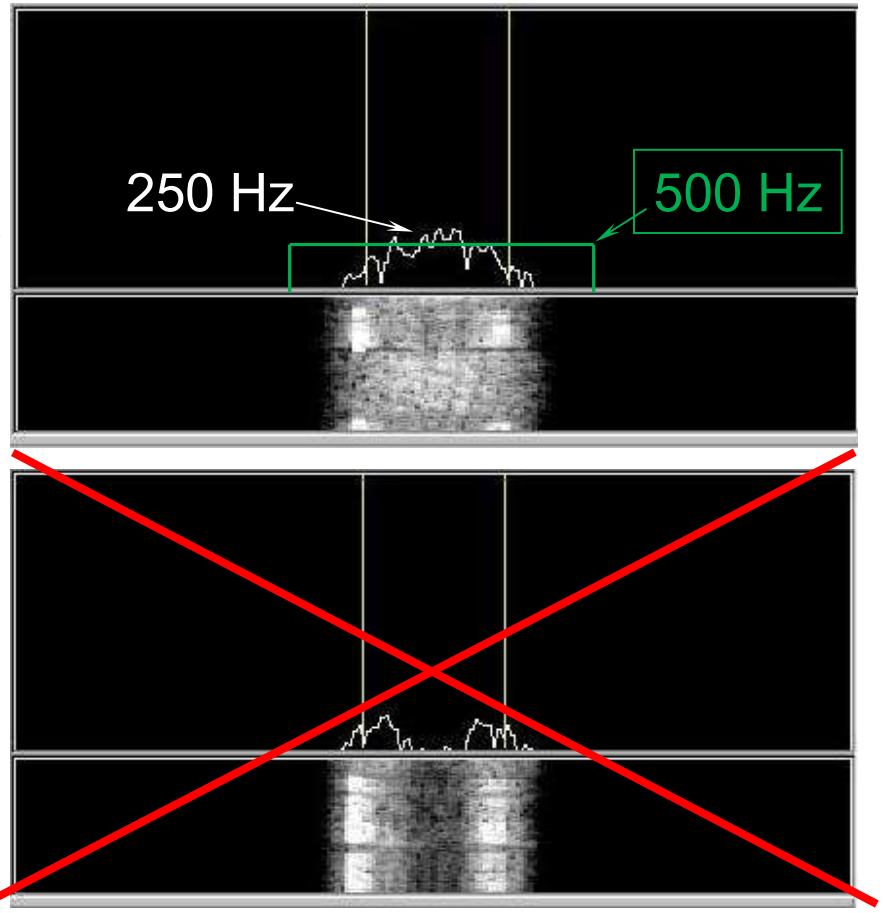
- RTTY frequency = Mark frequency
- RTTY radio frequency definition:
  - The higher RF frequency is the Mark *(14090.000 kHz)*
  - The lower RF frequency is the Space *(14089.830 kHz)*
  - The difference between the two is the shift *(170 Hz)*
- FSK displays Mark *(dial = 14090.000 kHz)*
- AFSK displays suppressed carrier (NOT the Mark) which varies with local audio tones and sideband used!
  - For tones of 2125 Hz and 2295 Hz:
    - LSB: Mark = 2125, Space = 2295 *(dial = 14092.125 kHz)*
    - USB: Mark = 2295, Space = 2125 *(dial = 14087.005 kHz)*

Receiving

radio IF filtering

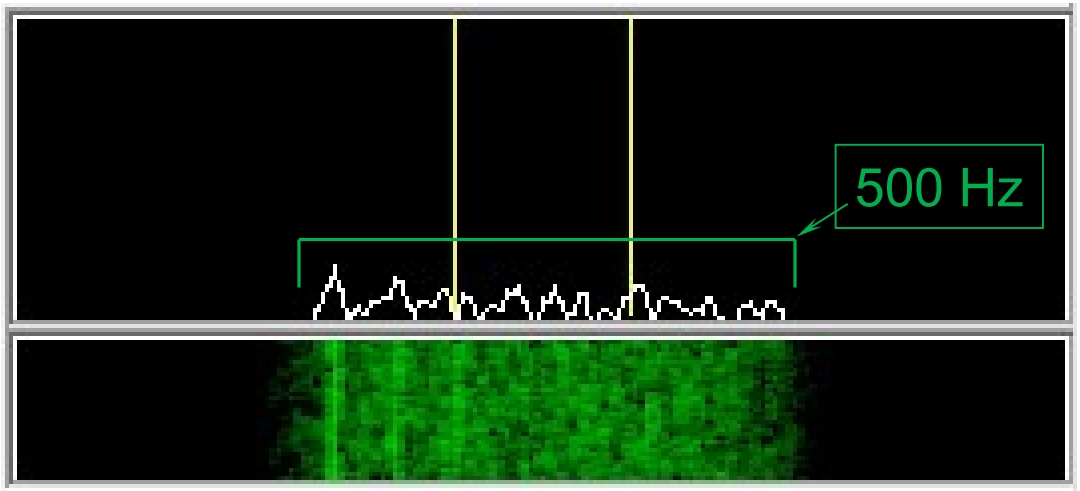


Narrow IF filters

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

Receiving

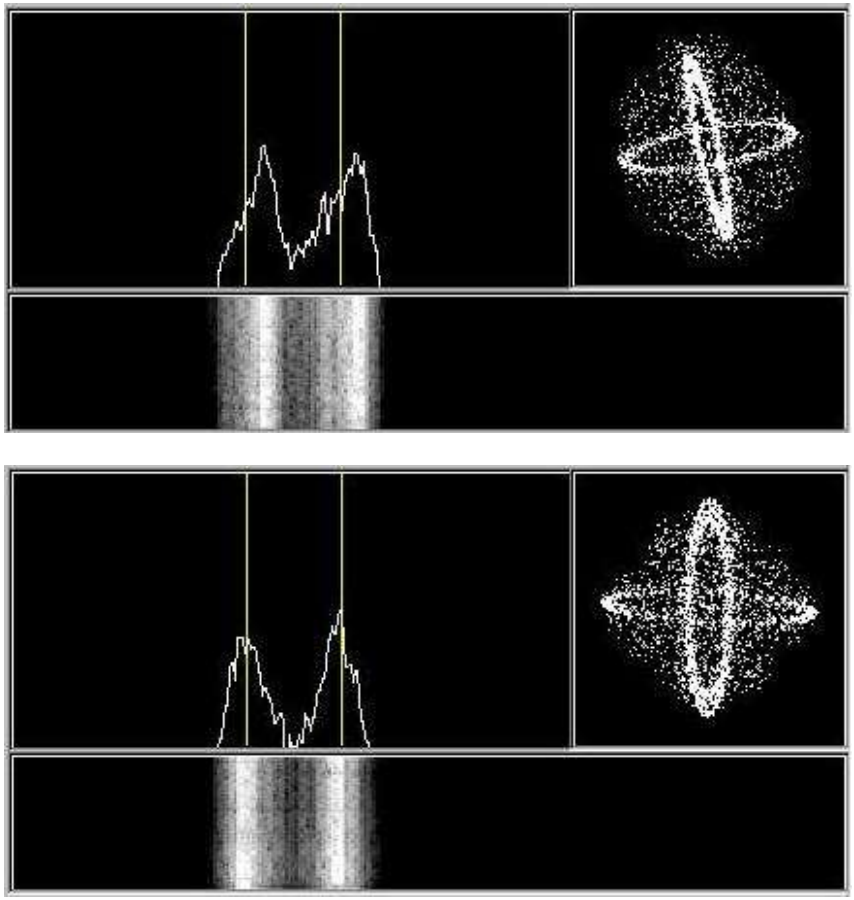
audio level



- Set RX audio level with no-signal at 5% of full-scale
  - Receiver audio out level control, and/or
  - *Windows* Recording Volume Control applet

Receiving

tuning a RTTY signal



Learn to tune by ear

- practice with eyes closed
- get within 10-20 Hz

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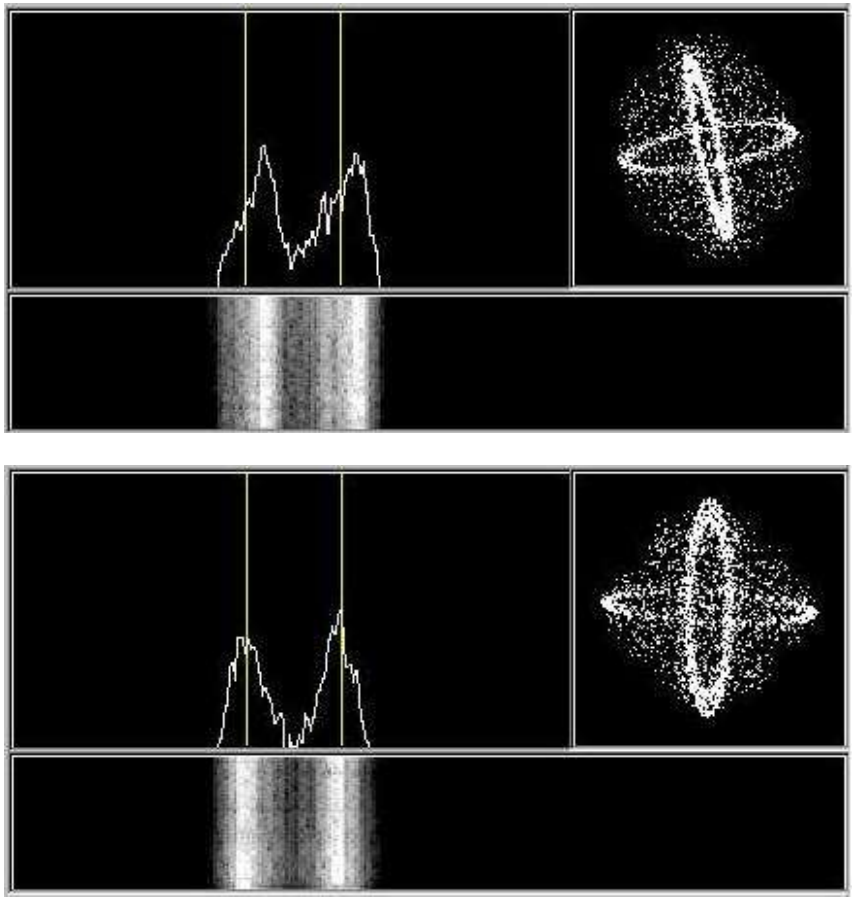
Receiving

AFC



If AFC On:

- Run: NET Off
  - Locks TX freq.
- S&P: NET On
  - Moves TX freq. = RX freq.

Transmitting

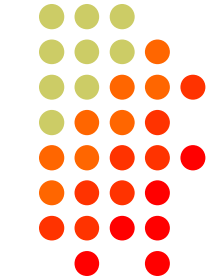
AFSK adjustment

Insure SSB processor (compression) is Off.

- Adjust:
  - the *Windows* Playback Volume control, and/or
  - the transmitter Mic (or auxiliary audio input)
- Such that:
  - ALC is barely above zero, and
  - full power output is still attained.
    - Level too low < full power output
    - Level too high (ALC) = distortion

RTTY Transmit Bandwidth

unnecessary QRM

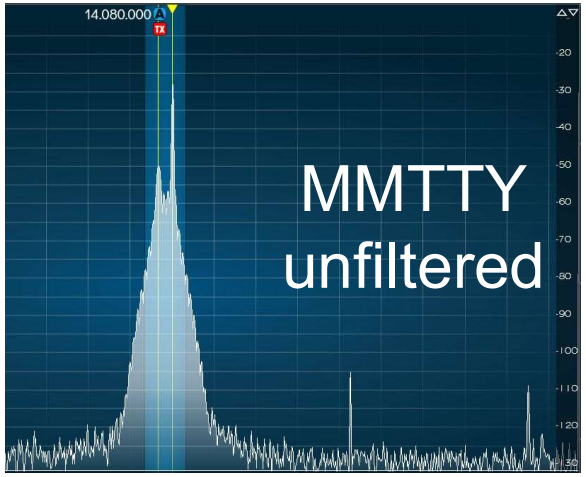


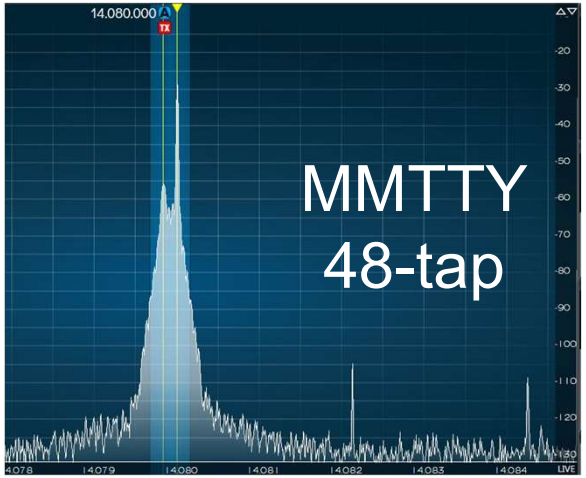
- Wasted power outside receiving decoder BW
  - Suitably narrow TX BW effectively amplifies signal
- Unnecessary QRM
  - Wide 1.5 KW RTTY can QRM 5-10 channels
  - Similar to CW key click problem of the past

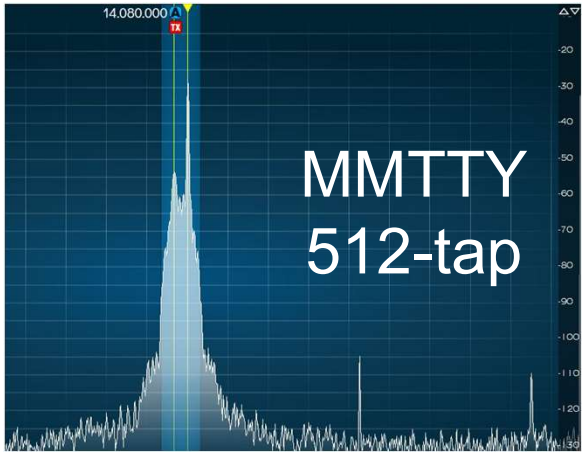
Why hurt yourself AND QRM close-by stations?

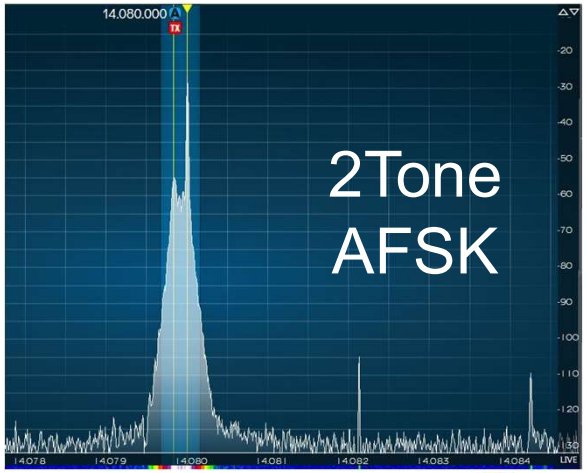
RTTY Transmit Bandwidth

AFSK



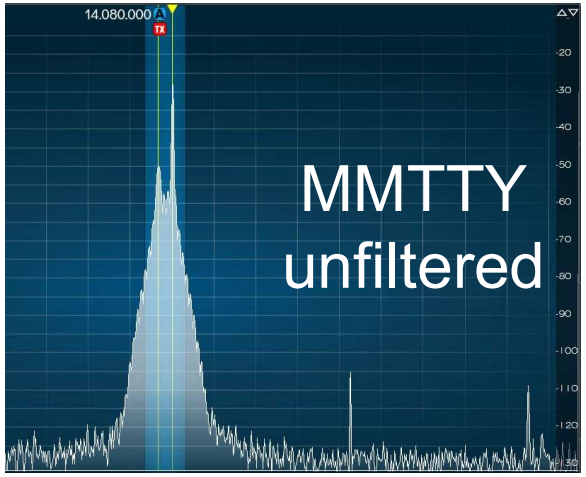


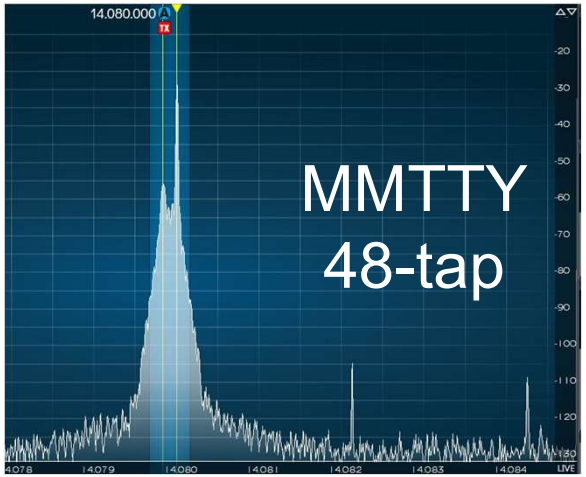


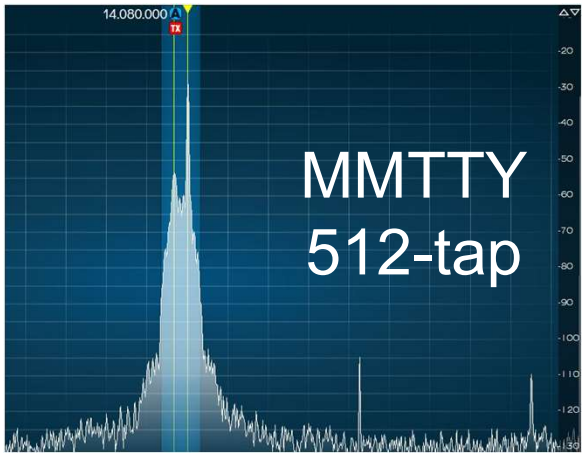


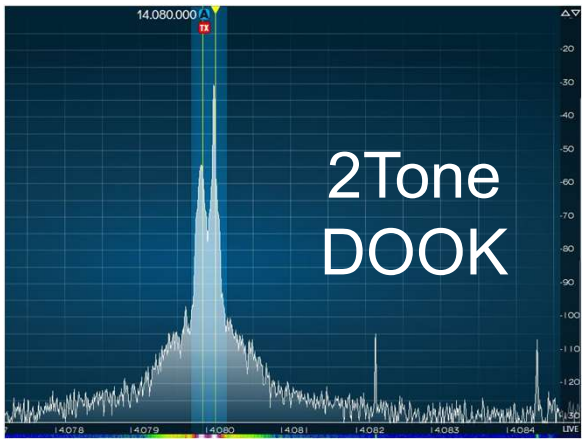
RTTY Transmit Bandwidth

AFSK - DOOK









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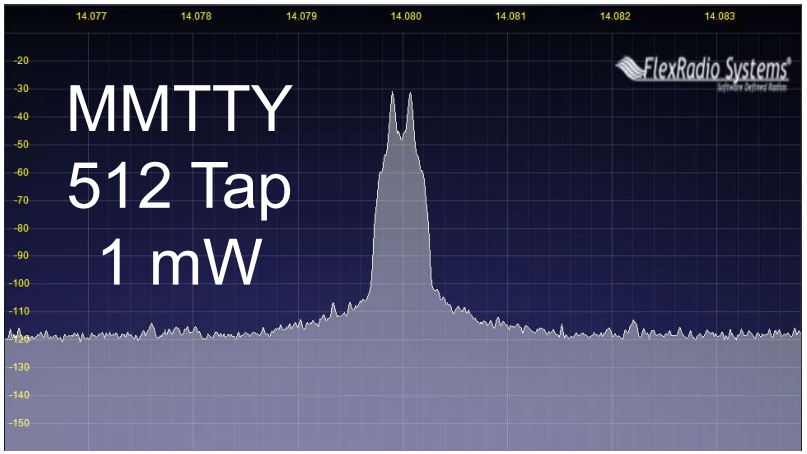
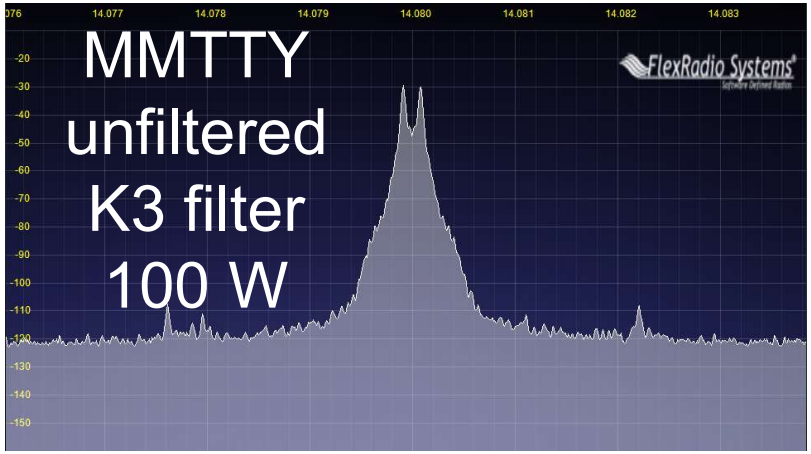
RTTY Transmit Bandwidth

PA IMD effect





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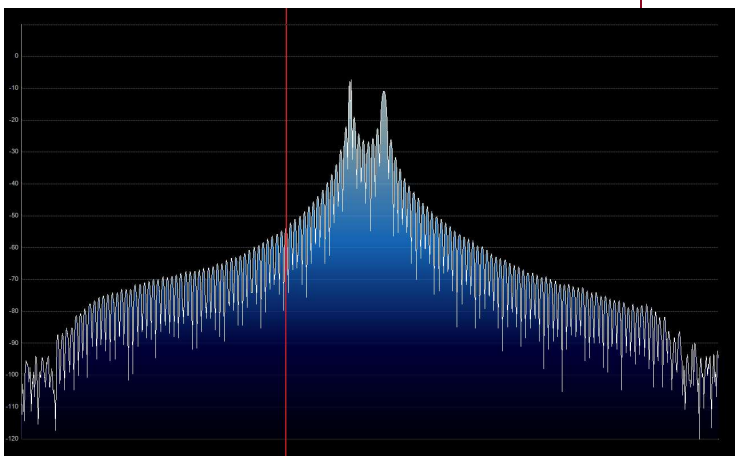
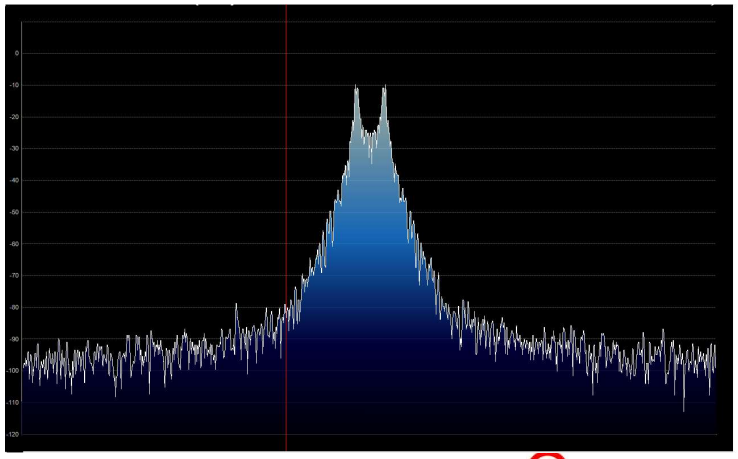
RTTY Transmit Bandwidth

FSK

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

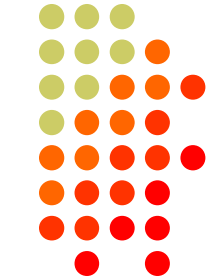


- New K3 FSK bandwidth
  - Optimal DSP filter
  - DSP281 firmware, March 2013



UOS

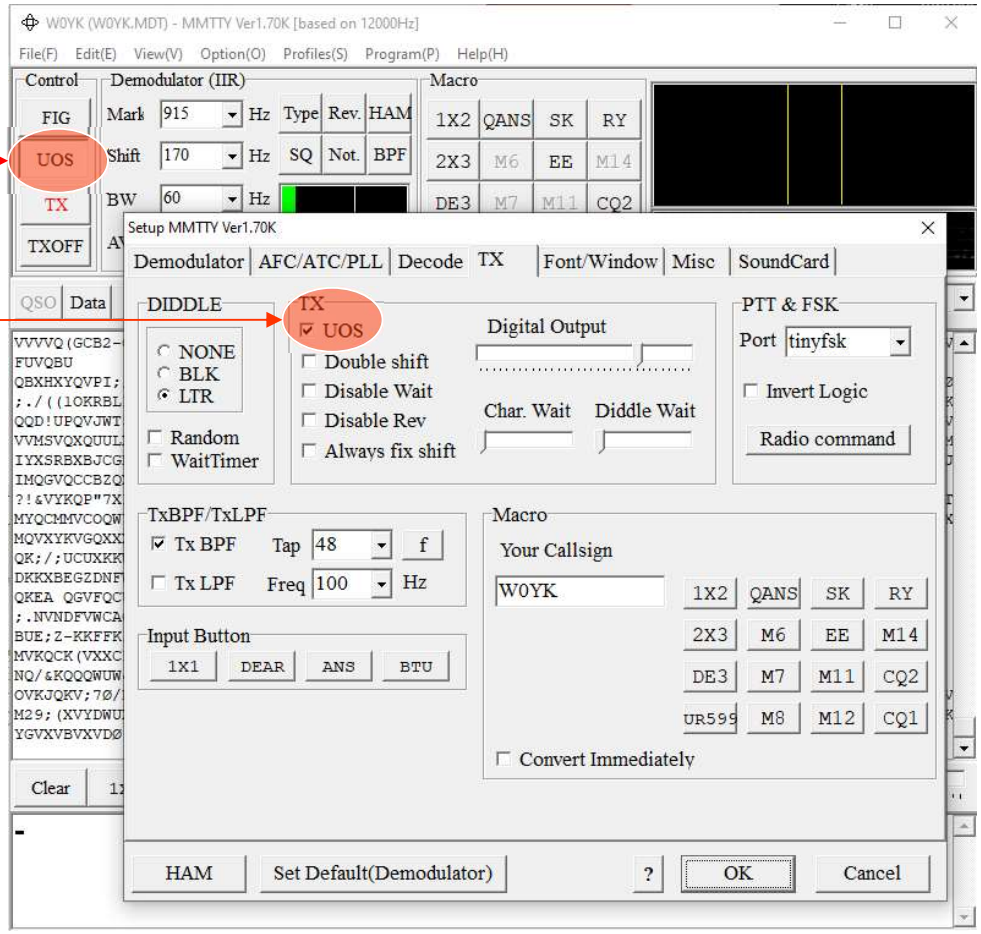
(Unshift-On-Space)



- Receive UOS:
  - Increases noise immunity for alpha text
  - Space character forces a shift to the Letters set
- Transmit UOS:
  - Sends Figures 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
Clear
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
HAM
Set Default(Demodulator)
?
OK
Cancel

Basic RTTY Contest QSO

CQ WPX RTTY Contest

- ***WPX K5AM K5AM CQ***
- ***ZC4LI ZC4LI***
- ***ZC4LI 599 1349 1349***
- ***[K5AM] TU 599 985 985***
- ***[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, %E)

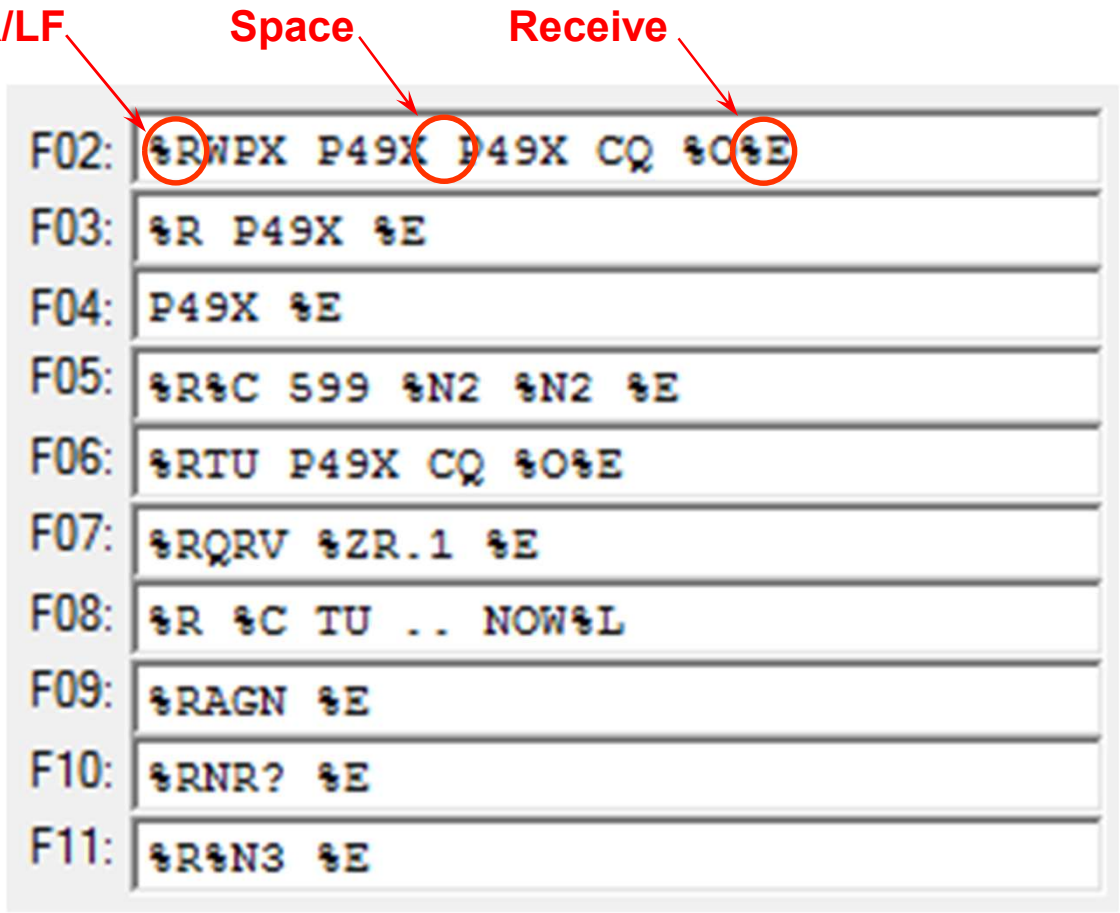
F02:	%RWPX P49X P49X CQ %O%E
F03:	%R P49X %E
F04:	P49X %E
F05:	%R%C 599 %N2 %N2 %E
F06:	%RTU P49X CQ %O%E
F07:	%RQRV %ZR.1 %E
F08:	%R %C TU .. NOW%L
F09:	%RAGN %E
F10:	%RNR? %E
F11:	%R%N3 %E

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

www.rttycontesting.com/tutorials/messages

RTTY Messages

formatting



RTTY Sub-Bands

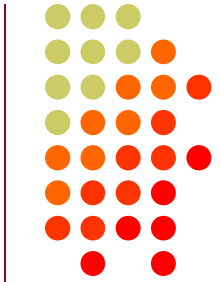
don't QRM!

- Avoid audio-digital operations near:
  - e.g., 14070-14083
- Avoid the NCDXF beacons:
  - e.g., 21150 and 14100

- More details:

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

RTTY Considerations



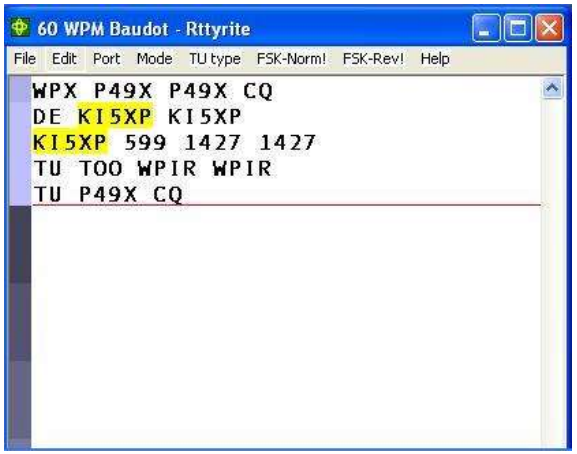
Much like CW and SSB, except:

- Non-human decoding implications
  - *serial number repeat*
- 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
- Distractions are tempting
  - *watch TV, do email, read, etc.*

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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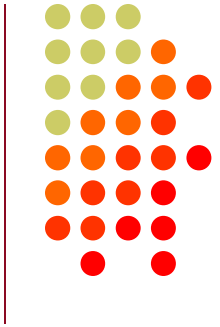
Tips

"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 are on by default; changes non-sticky
    - Change defaults in MMTTY userpara.ini file
- AFSK: Mic & SC levels; speech processor on
- Radio mode, tones, FSK interface

More Tips

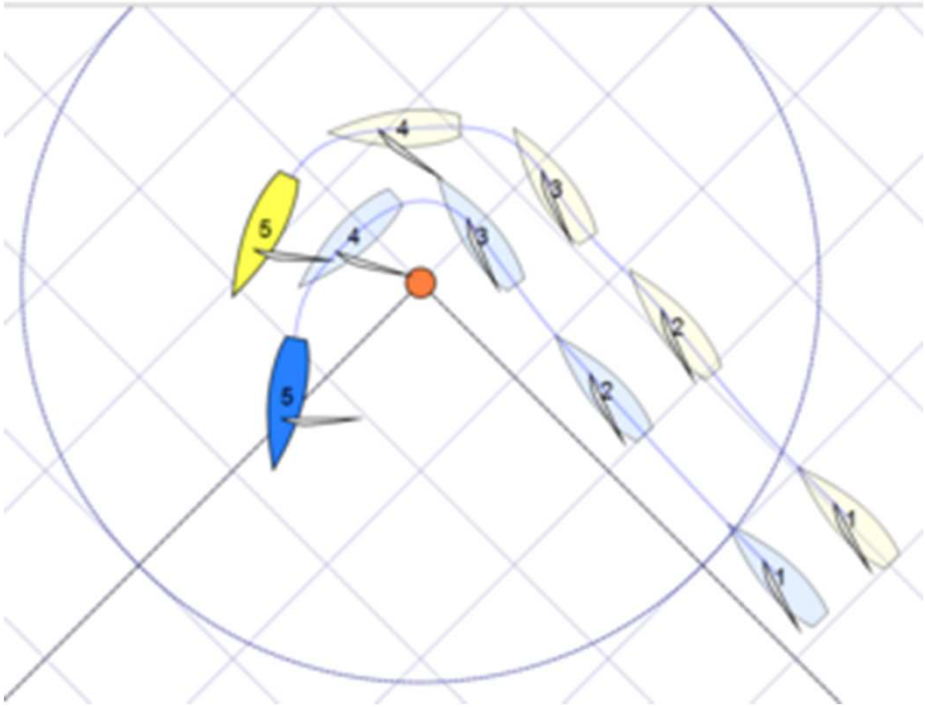


- Practice
  - During RTTY contests (~ two per month)
  - NCCC Sprint each Thursday night (30 min.)
- Multi-Ops

Sailboat 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
- 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)

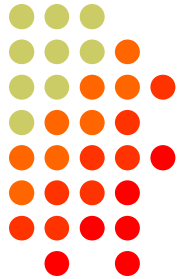
1. find next CQ

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

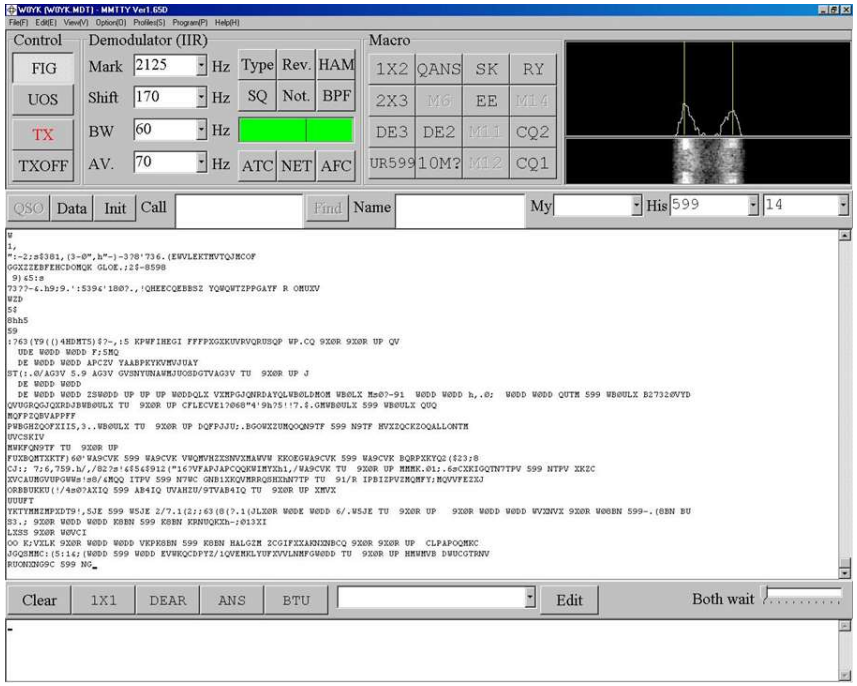
Call Sign Stacking

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

Multiple Decoders

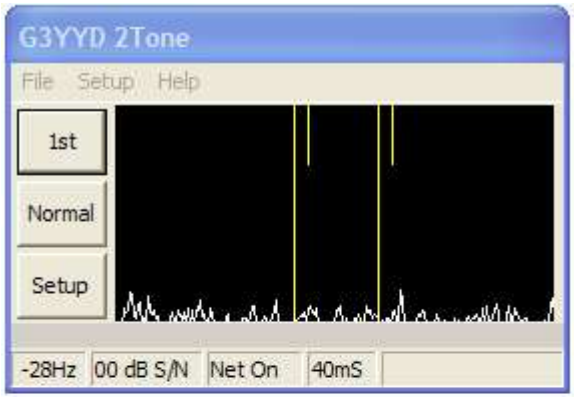
MMTTY

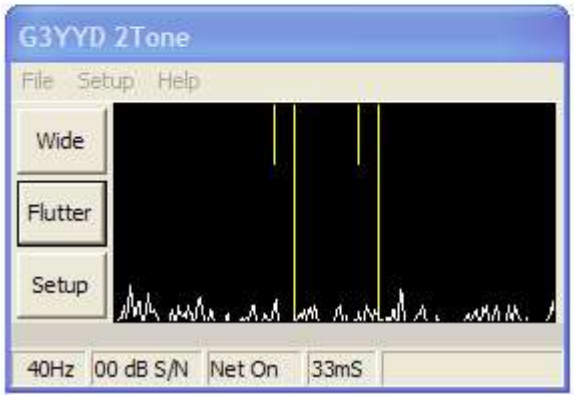


- Dominant SC MODEM
- Standalone, or …
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced June 2000
- Mako Mori, JE3HHT

Multiple Decoders

2Tone

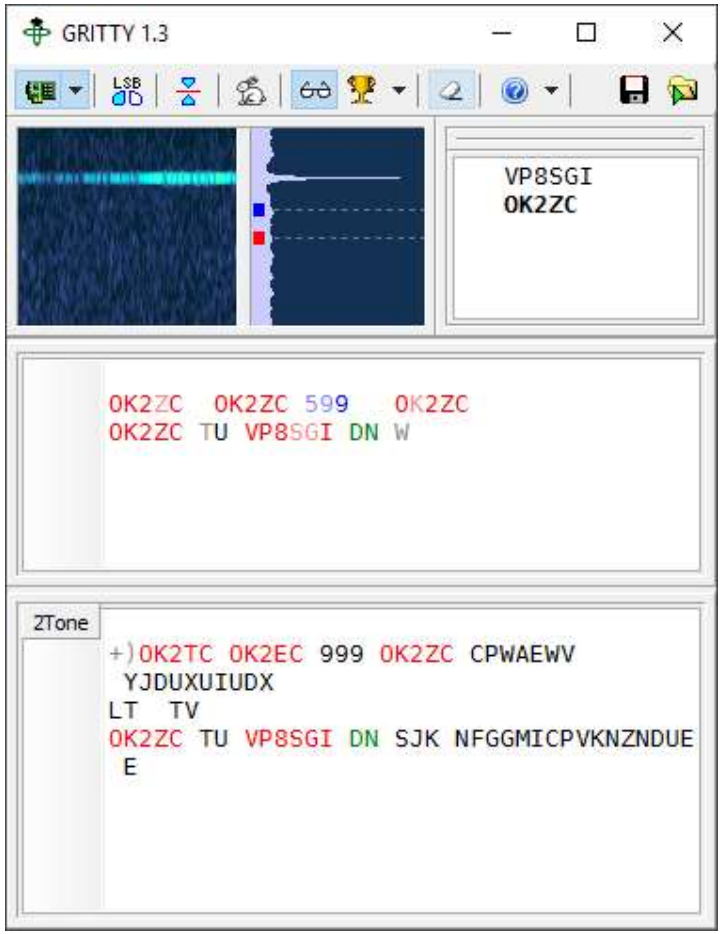




- Outperforms MMTTY ?
- Uses less CPU cycles
- Contest loggers:
  - N1MM Logger+
  - WriteLog
  - Win-Test
- Introduced late 2012
- David Wicks, G3YYD

Multiple Decoders

GRITTY

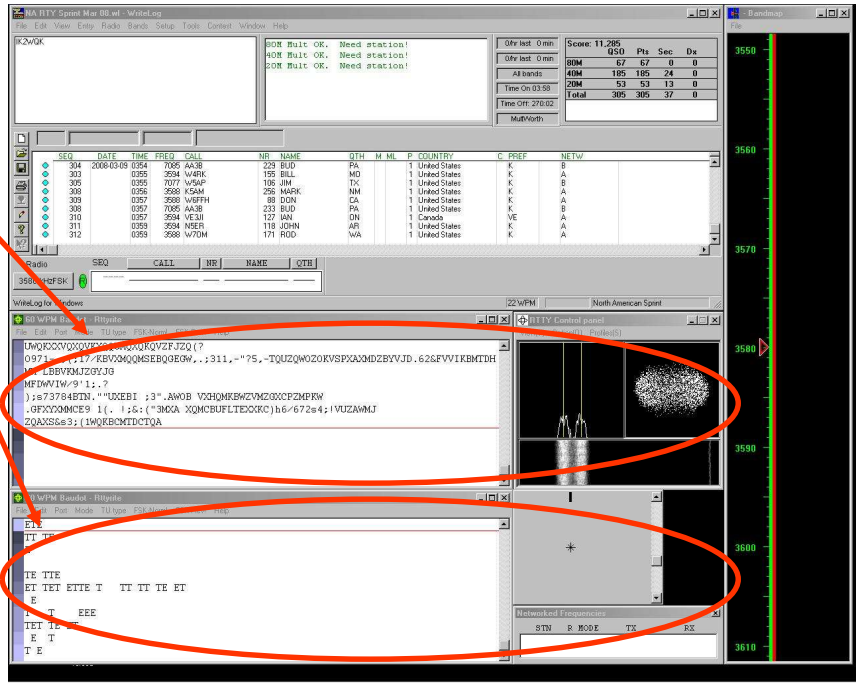


- Best accuracy ?
- Bayesian statistics
- Standalone, or …
- Contest loggers:
  - N1MM Logger+ only
- Introduced late 2015
- Alex Shovkoplyas, VE3NEA

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 RTTY 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

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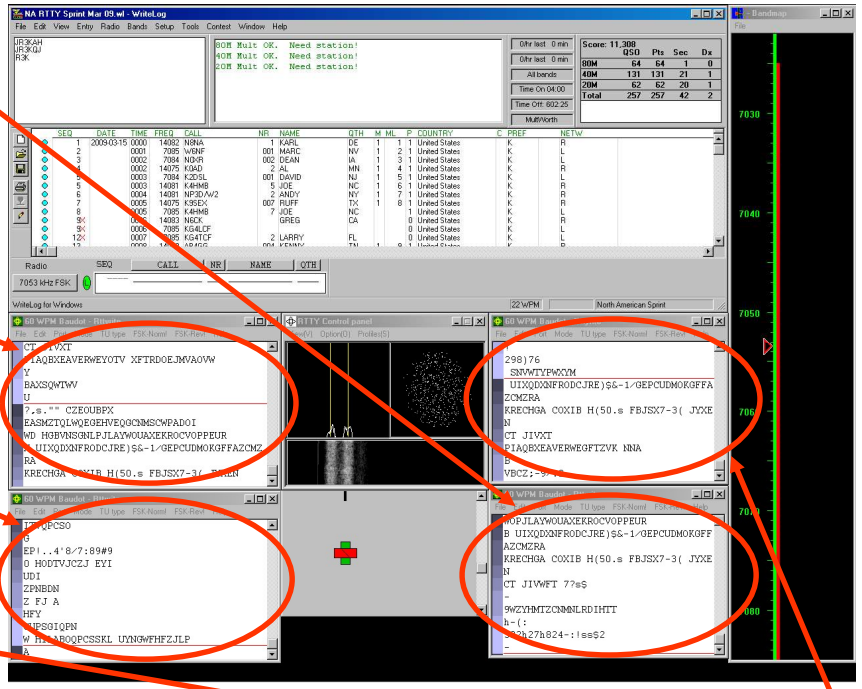
Multiple Decoders

two IF bandwidths

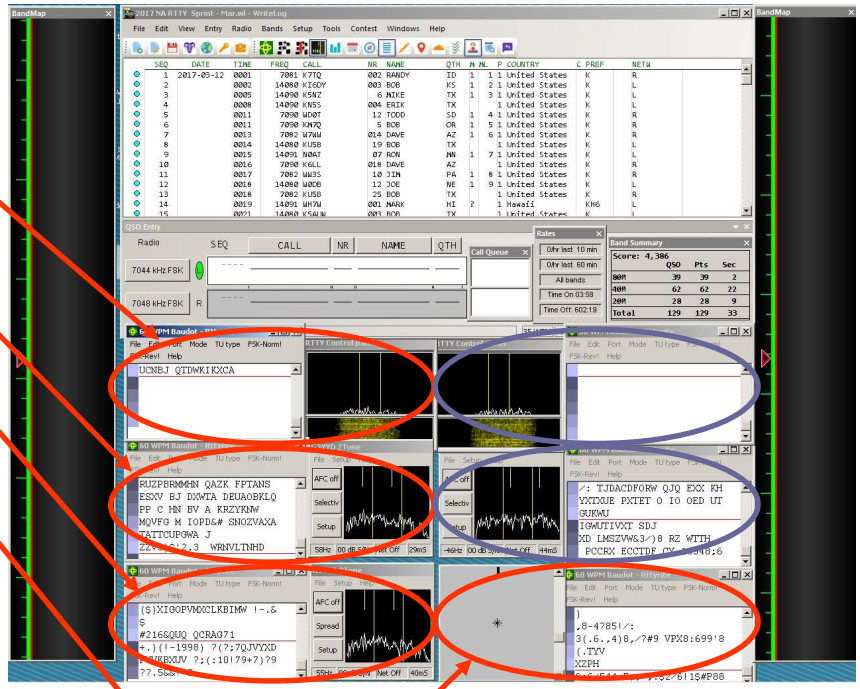
- Narrow IF filtering (main RX)
  - Hardware modem, i.e. DXP38
  - MMTTY profiles:
    - Standard
    - Fluttered signals
    - Fluttered signals (FIR)
    - Multi-path
    - hyper sensitive
    - EU1SA
- Wide IF filtering (sub RX)
  - MMTTY profile:
    - AA6YQ-FIR-512
      - Dual Peak Filter
    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



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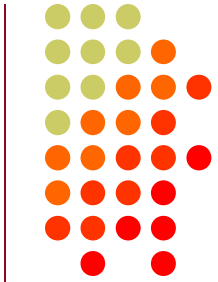
Multiple Decoders

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)

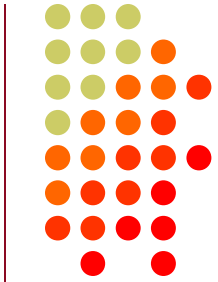
SO2V



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
     - Left-click call from 2nd RTTY window into VFO-B Entry Window
   - Two ways to transmit on VFO-B:
     I. A<>B, work the mult, A<>B
     II. 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

SO2R

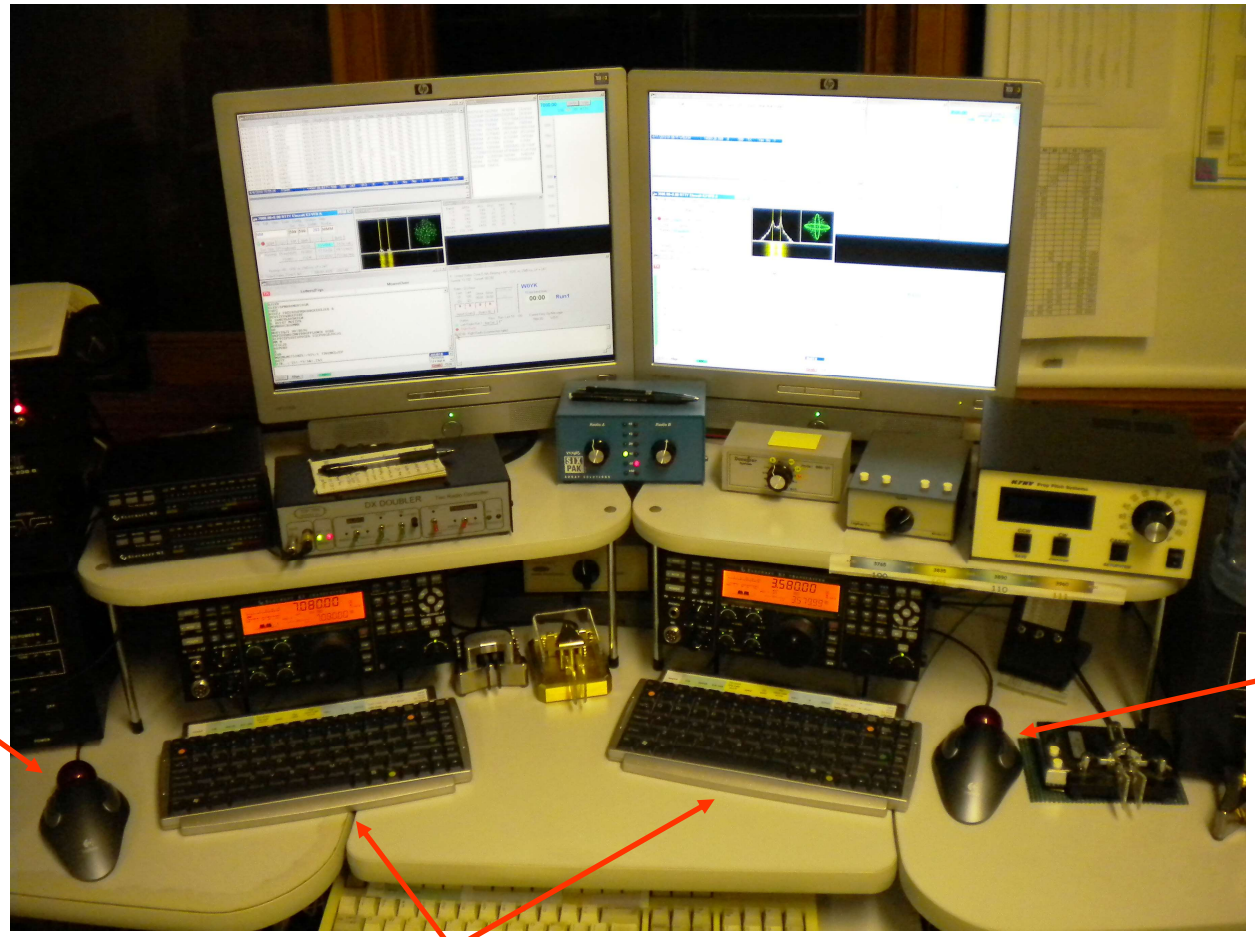


- Eliminates SO1R RTTY boredom
- Think beyond run and S&P:
  - Dueling CQs; run on two bands simultaneously
  - S&P on two bands simultaneously, esp. w/Packet
  - SO2V on one or both radios (SO4V!)
- Two networked computers:
  - Eliminates swapping radio-focus
  - Display room for more decoder windows 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!

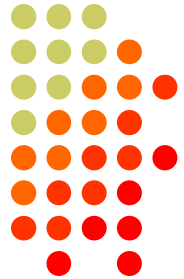
SO2R

"M2" 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

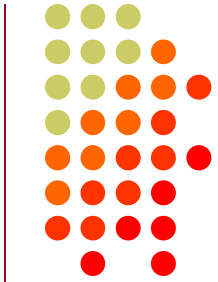
- Simplify antenna/filter band-decoding:
  - Dedicate a band/antenna to the 3rd (or 4th) radio
- Networked PC/radio simplifies configuration
- RTTY (vs. CW or SSB) easier for operator
  - PC decodes for operator
  - Low tones & high tones allows two radios per ear
    - Classic audio headphone mixer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

SOnR

Multi-Multi configuration

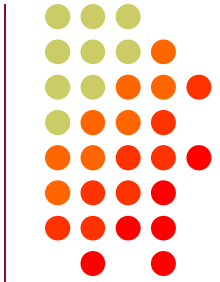
dedicated to 10 meters

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)

Major FT Contests



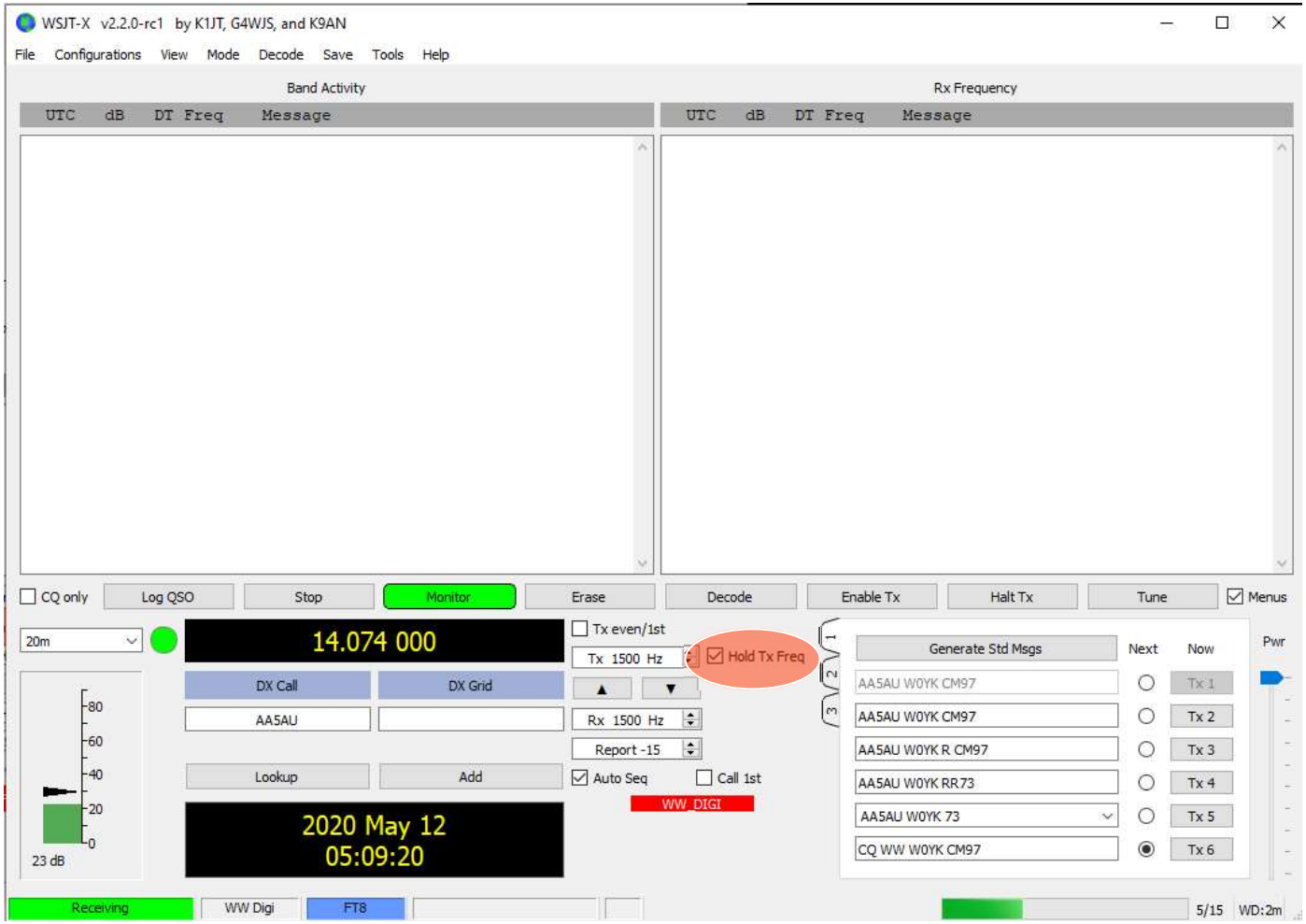
- ARRL RTTY Roundup [1st weekend in Jan]
  - RTTY-only
  - FT/other-only (once/band)
  - Mixed (once/band)
- WW Digi DX Contest [last weekend in Aug]
  - FT4 and FT8 (once/band)
- FT Roundup [1st weekend in Dec]
  - FT4 and FT8 (once/band)

Sub-Band Choices

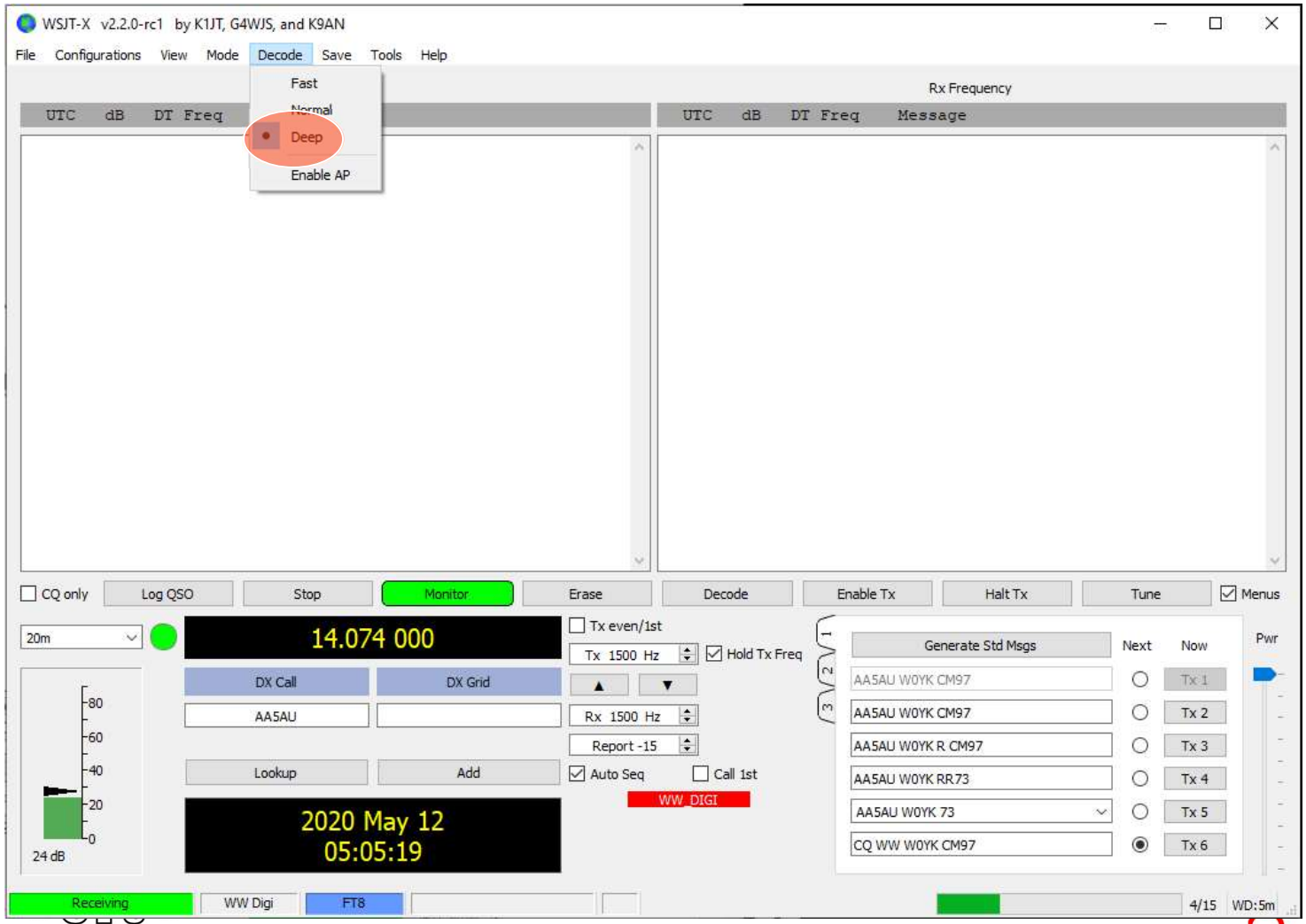
WW Digi

- Suppressed-Carrier dial frequency
  - FT4: 14080
  - FT8: 14090
- Use receiver's maximum BW: 2.5-4 kHz
- QSO partner > 2 kHz … call above 2 kHz
- Move dial frequency up in 2 kHz increments

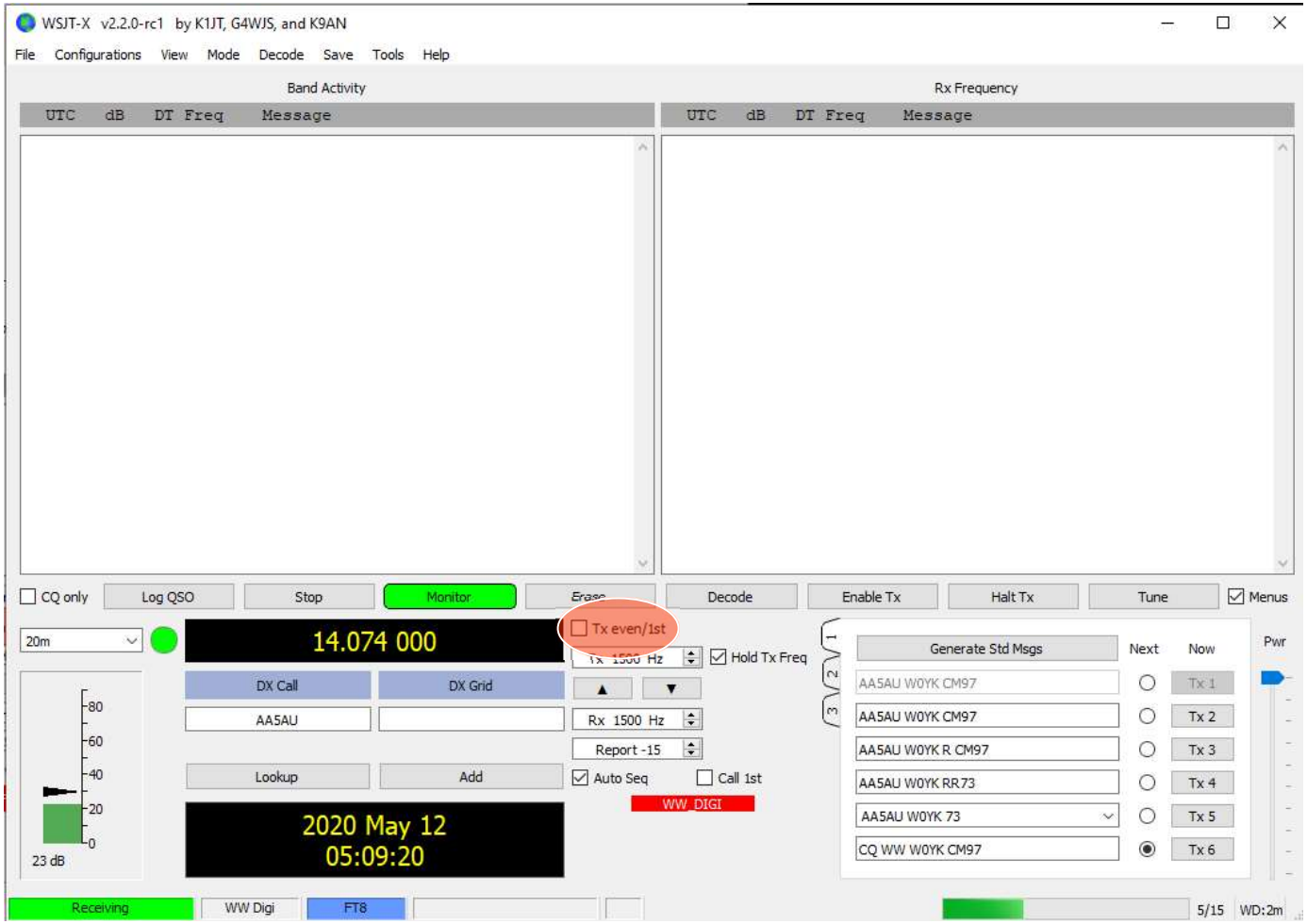
Split Transmit



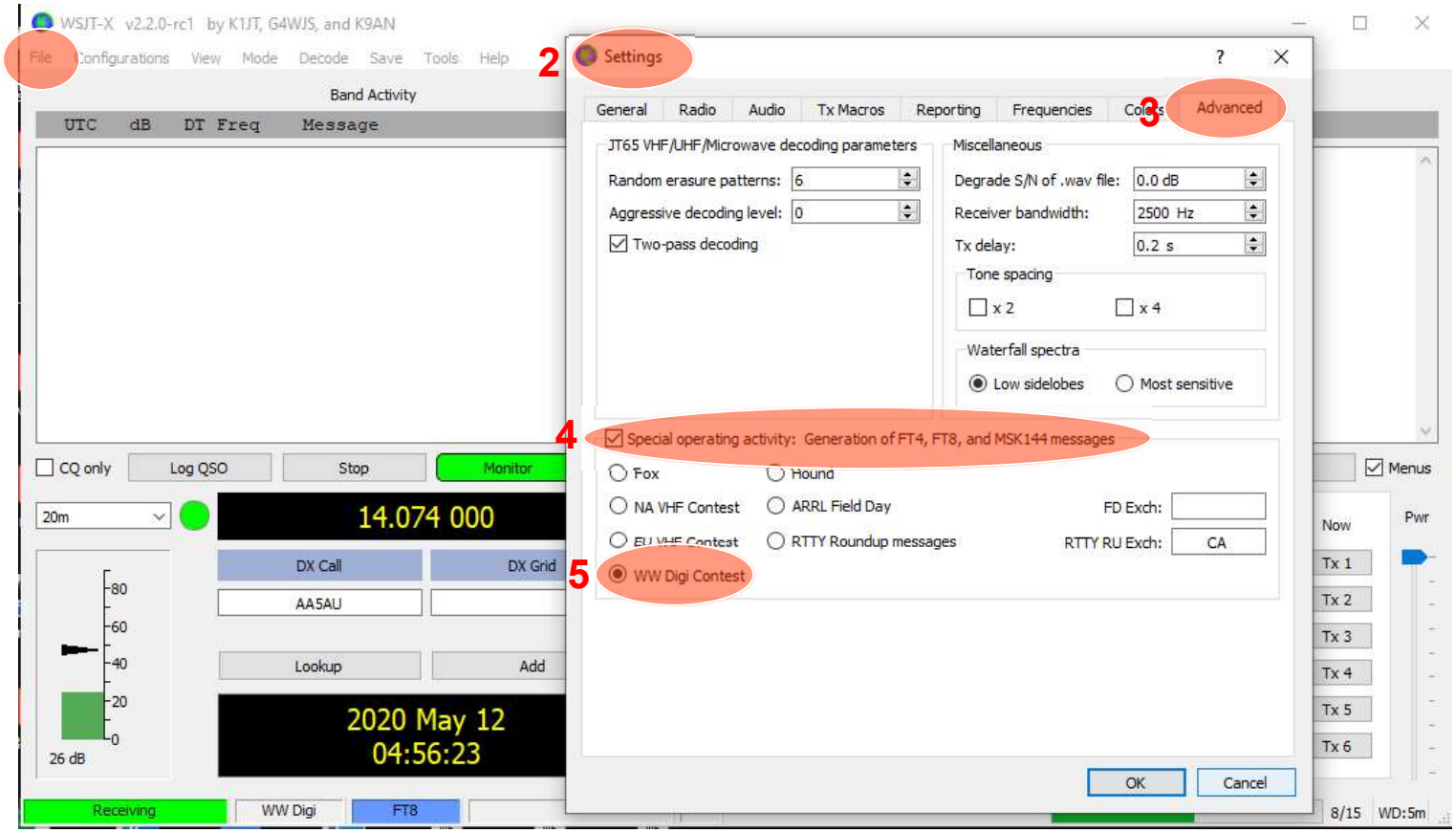
Deep Decode


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
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
Pwr
Receiving
WW Digi
FT8
4/15
WD:5m

Utilize Odd/Even Cycles



WW Digi DX Contest



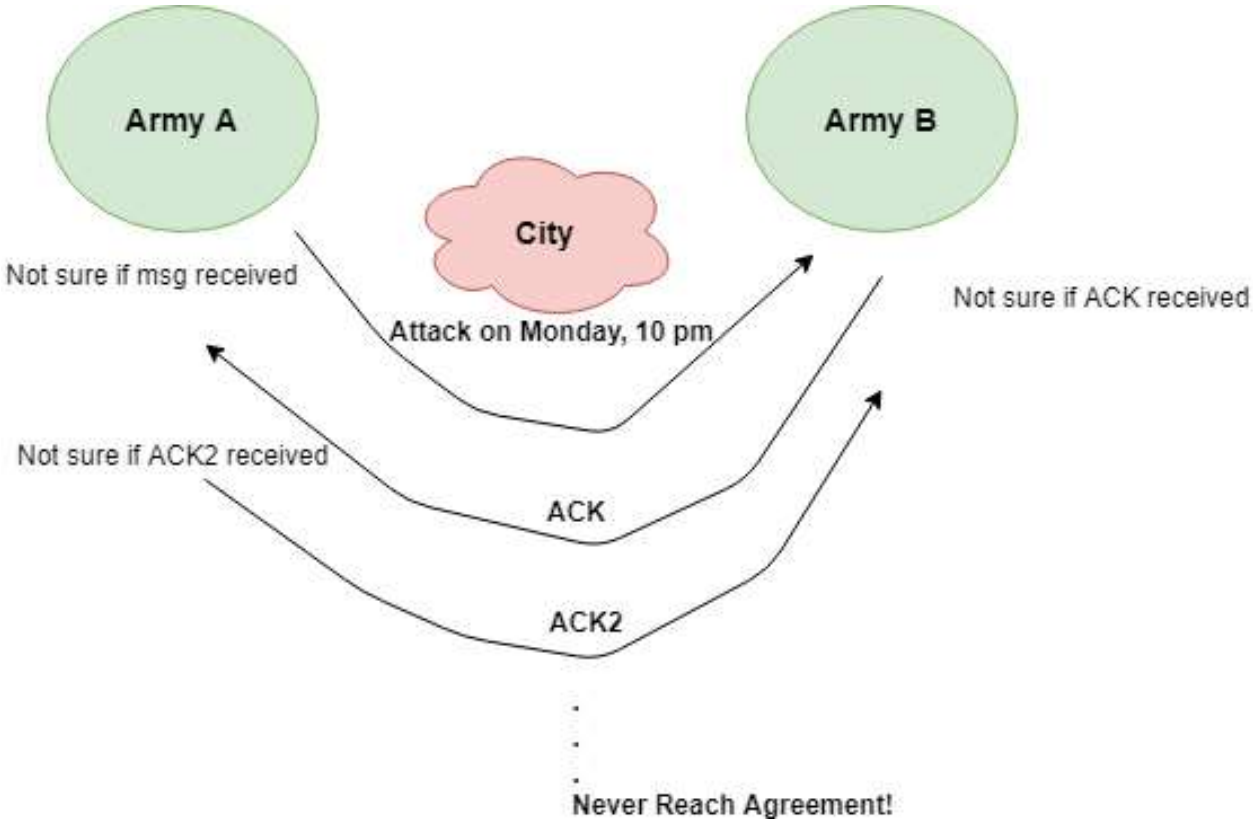
Minimizing NILs in WW Digi

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

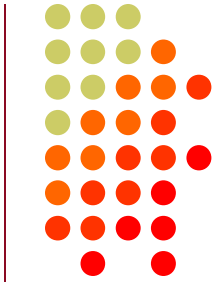
CQ W0YK CM97

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



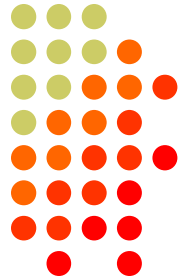
FT Repeat Protocol



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*

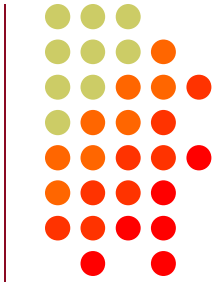
Minimizing NILs

Recommendation



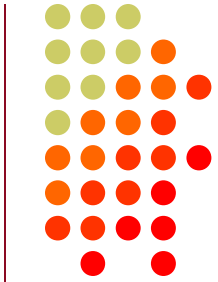
- Develop skill to dynamically change message
  - e.g., use the Alternate F1-F6 keys in WSJT-X
- Always log the QSO when receiving a RRR, RR73 or 73 message.
- Always log the QSO when sending RRR, RR73 or 73 message.
  - Look for a clue that your message was not received, e.g., your QSO partner re-sends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