RTTY Receiving

Optimized RTTY Decoding to Improve your Contesting

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Technology vs. Brain

- CW (and phone) “decoded” by our brain
- RTTY decoded by software/hardware
  - Very difficult by brain!

Therefore, the receiving and decoding technology is critical for reliable RTTY reception.

This may be the most important system component for the RTTY contester to optimize.

The System

- Antenna
- Receiver
- Modem (decoder)
- PC
- Soundcard
- Inter-connect

The system components interact and each must be considered in the context of the others.

Topics

- Receiver
- Decoder
- Multiple Decoders
- Second Receiver
- Audio Levels

Receiver

- IF Bandwidth
- AGC settings
- Sensitivity and other receiver characteristics

Receiver IF Bandwidth

- ITU recommendation[1]
  - 45.$\overline{45}$ baud + (1.2 x 170 Hz) = 249.$\overline{45}$ Hz
  - How many signals can fit in a given band width?
  - Ideal conditions: no QRM, QSB, flutter, multi-path, …
- BUT … Most decoders work best with a WIDE bandwidth (500 Hz or more)
- BUT … QRM may dictate a trade-off downward (as low as 200 Hz)

[1] ITU-R SM.1138.2 (10/2008)

Special RTTY Filters

- Icom Twin Peak Filter
- Elecraft Dual Tone Filter
- These special filters treat Mark and Space individually
- ***Do not use these filters!***
  - Narrow filtering degrades the decoder performance

AGC

- ***Slow AGC*** setting so decoder selective fade algorithms will work effectively

Decoders

- The receive half of a MODEM
- Software MODEMs:
  - RITTY (DOS-based)
  - MMTTY
  - 2Tone
  - MixW (bundled with logging function)
  - WinRtty (native WriteLog RTTY MODEM)
  - CocoaMODEM (Mac-based)
- Hardware MODEMs:
  - PK232
  - Kam
  - Hal DXP38 & P38, 8000 series

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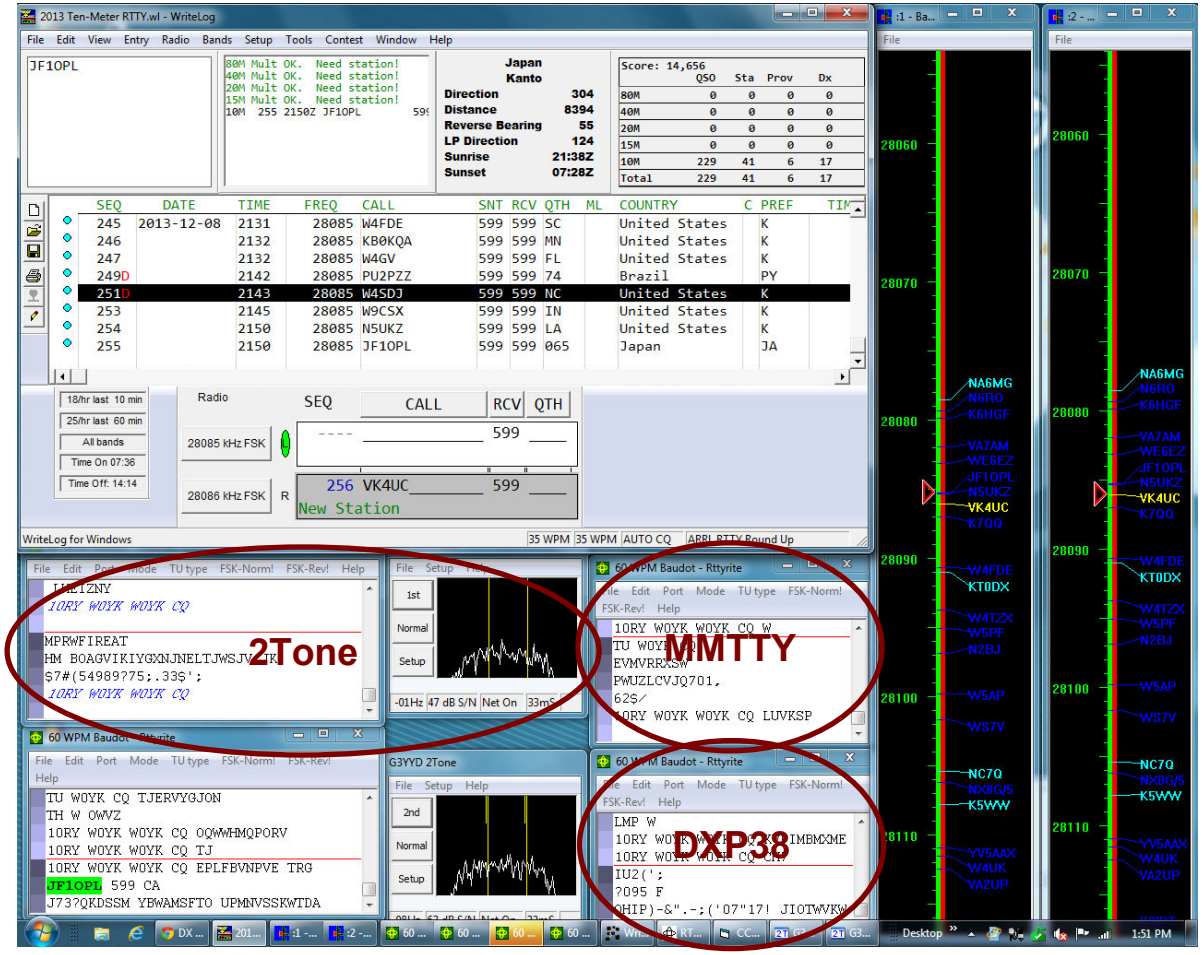
Decoder Design

- "Raised Cosine" filters: RITTY, 2Tone, CocoaMODEM
  - Optimized for 500+ Hz bandwidth
- MMTTY tolerates narrower BW, but starts out with a higher inherent error rate
- Empirically, 500+ Hz bandwidth copies better in all decoders
  - Very weak signals are decoded
  - Flutter, multipath, QSB, QRN, QRM errors are minimized
  - ***UNLESS QRM degrades the receiver***

Multiple Decoders



Multiple Decoders

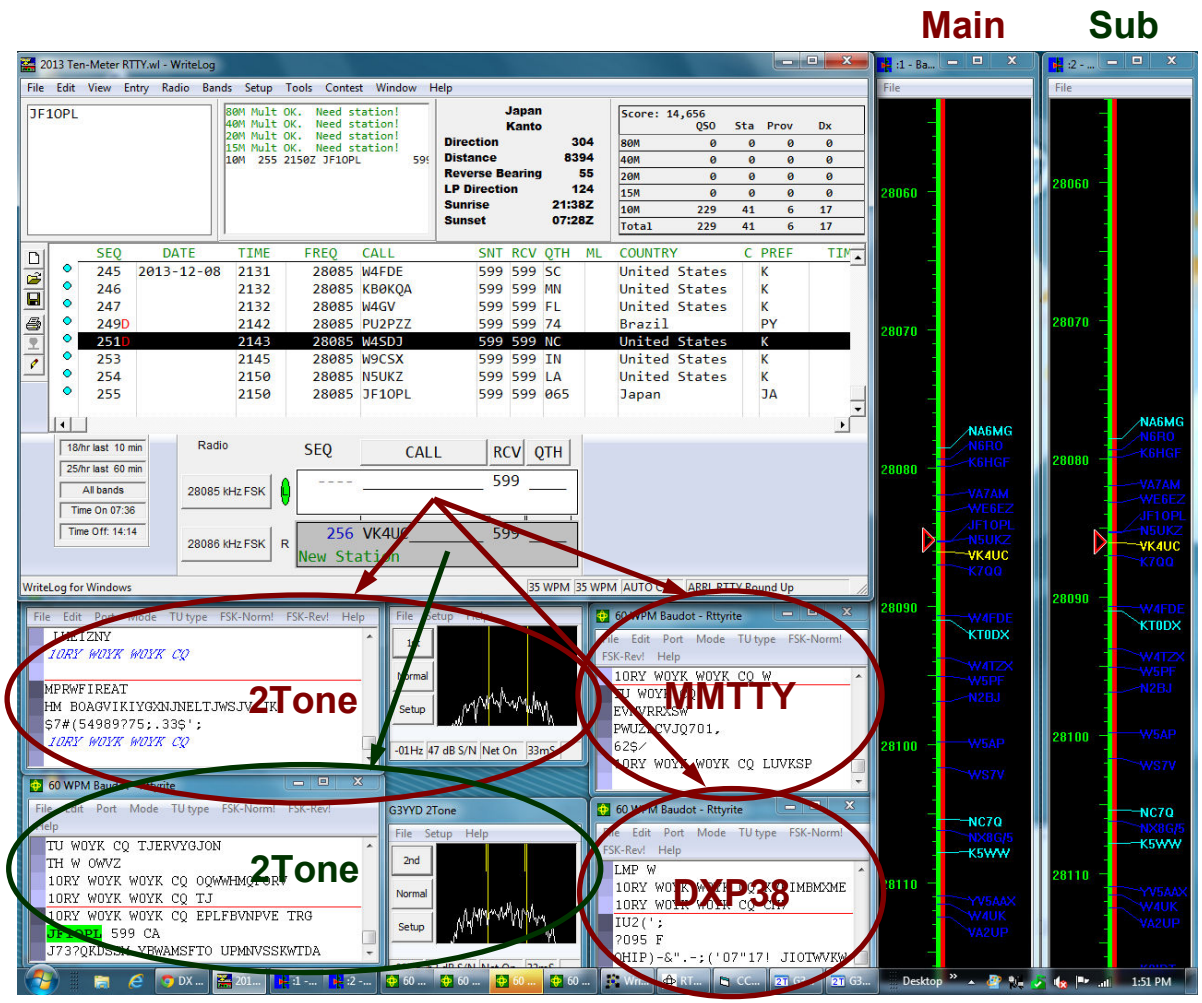
- Supported by both N1MM Logger & WriteLog
- 5% of the time only one will decode properly
  - MMTTY, 2Tone or DXP38 prevails about equally
- One may be superior in a given situation
  - Early 2Tone versions superior in most W0YK contesting
  - Later 2Tone versions not so much
  - MMTTY often superior in P49X contesting
  - DXP38 decodes further off-frequency (advantage)
  - 2Tone delays the first few characters (disadvantage)

Multiple decoders give clear copy more of the time.

Second Receiver

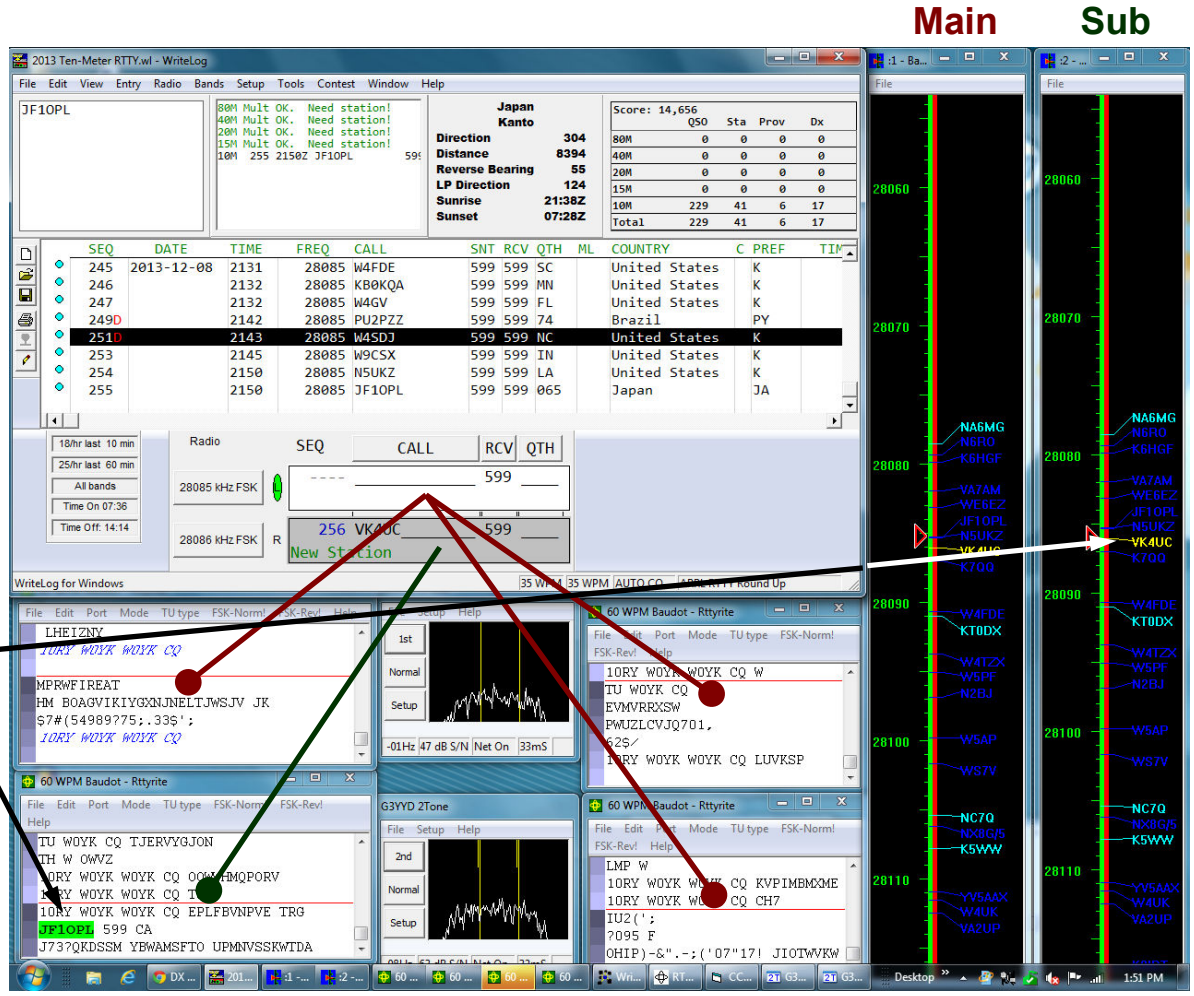
- More useful for RTTY due to decoder technology (vs. brain!)
- A “real” second receiver, not a second VFO
- Applications:
  - S&P on same band while running
  - Efficient “leapfrog” S&P
  - Split operation
  - Alternate CQing, high and low in the band

Second Receiver



Second Receiver

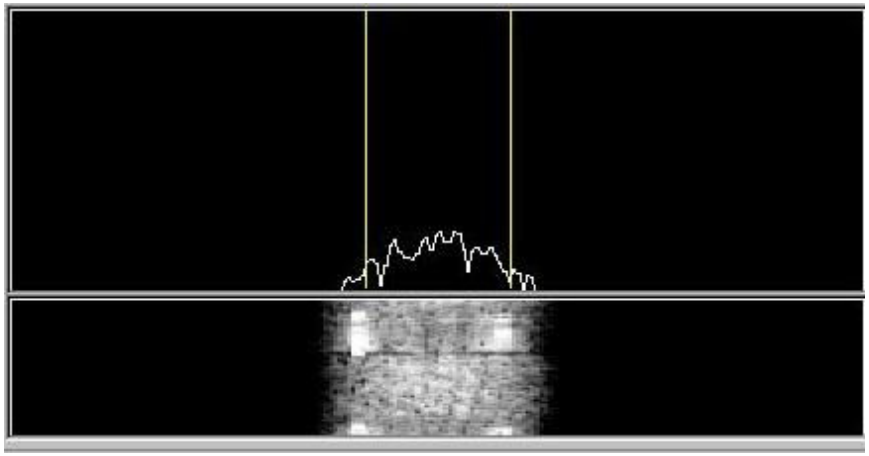
1. Click call
2. Work stn
3. Move back to main RX



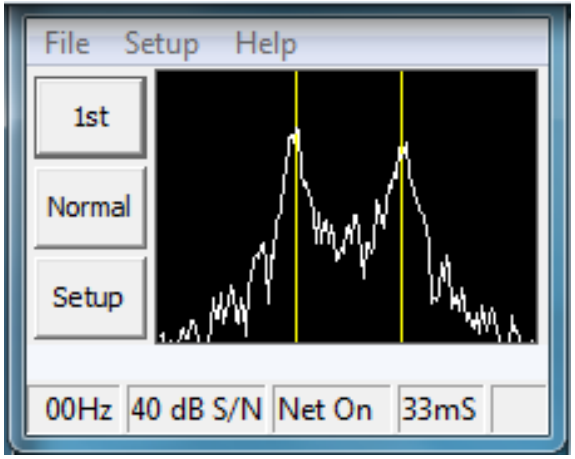
Audio Level

- Optimize the system dynamic range
  - Decode the weakest and strongest signal
    - Set the noise floor to 5-10% of full scale in MMTTY, or
    - Set the strong signal peak to 90% of full scale in 2Tone
- Don’t saturate isolation transformers
  - If used for ground loops/Pin-1 problems
    - e.g., keep K3 LINE OUT level below ’10’
  - Increase soundcard level (after the transformer) to achieve desired level in MMTTY or 2Tone

Setting the Audio Level



MMTTY



2Tone

- Adjust MMTTY noise floor to 5-10% full scale
- Adjust 2Tone strong signal to 90% full scale
  - 2Tone AGC will compensate for wide range of signal strengths

Summary

- Maintain as wide a receiver IF bandwidth as possible
  - QRM will force a narrower bandwidth
- Use slow AGC or none at all
- Do not use special RTTY filters, e.g., Twin Peak Filter
- Deploy multiple decoders for signal diversity
- Use the second receiver
- Optimize audio dynamic range
  - Noise floor at 5-10% full scale in MMTTY
  - Strong signal at 90% full scale in 2Tone
- Don’t saturate audio transformers
  - Run low levels through them