# HF Digital Keyboard Modes

by

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# What is it?

- Utilizes DSP Technology
- Uses High Speed PC's or DSP Chips
- Implemented in S/W
  - Reduces Cost
  - Easy to Update
  - Most S/W is FreeWare (unlike other modes)
- Simple Inexpensive Interface (no TNC needed)
- Performance Similar to CW, but Easier

# Summary

- Theory
- Modes
- Equipment
- Software
- Operating
- References
- Conclusions

# Theory

- Digitize Audio
- Use Digital Filters to Encode/Decode
- Use Efficient Coding Schemes
- PSK/FSK are Fade Tolerant
- Soft Keying for Narrow Bandwidth

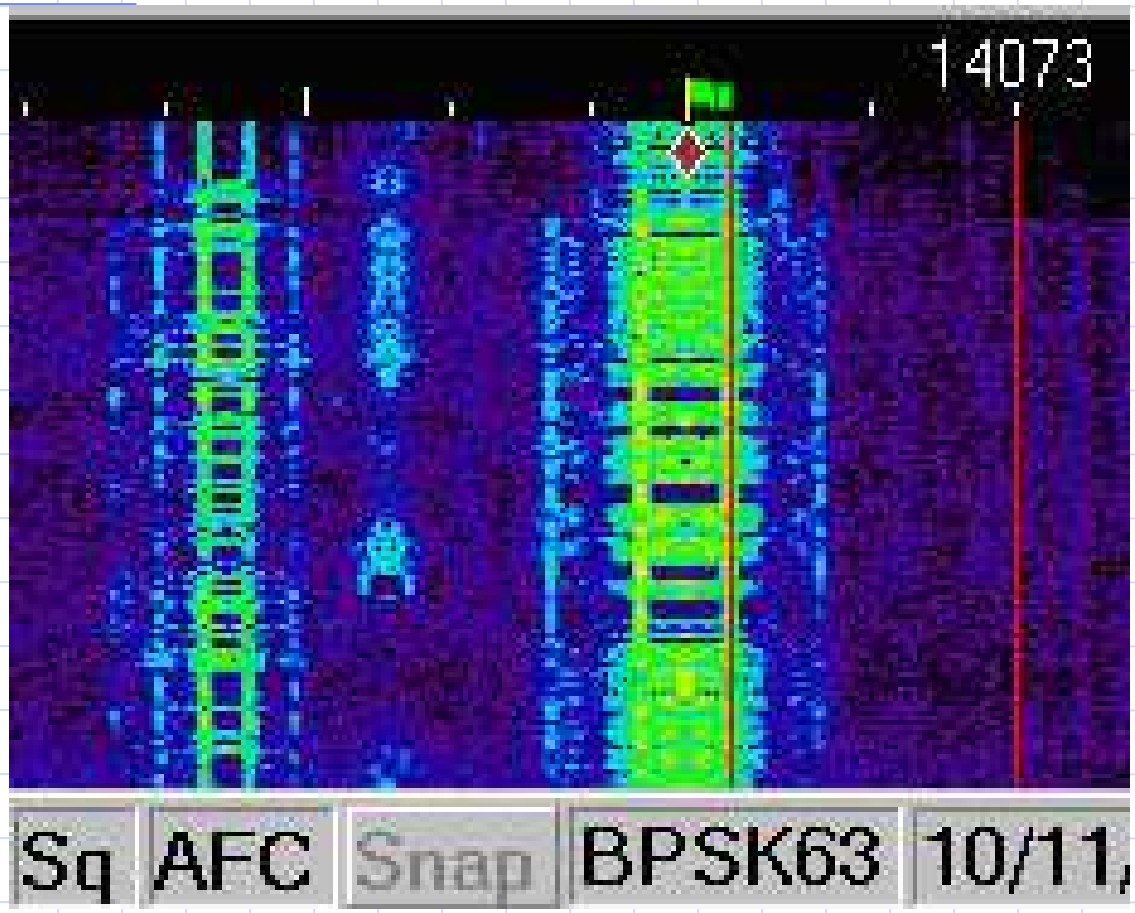
# Modes

- PSK 31 – Two Phases,  31Hz
- QPSK 31 – Four Phases, 31Hz
- MFSK 16 – Sixteen FSK Channels
- Variations:
  - PSK 63, PSK 125
  - MFSK 8, MFSK 16

# (B)PSK 31

- (Bi) Phase Shift Keyed (BPSK)
- Two Phases (180° apart)
- Transmits at 31.25 Baud (Symbols/Second)
- Fundamental Data Rate is 31.25 b/s
- Text is Encoded in Varicode for Speed
- Narrow Bandwidth (31.25 Hz)
- First used in 1998 ?

# BPSK16 and BPSK63




www.mymorninglight.org/ham/psk.htm

# Varicode Examples

- All characters start and end with "1"

| Symbol | Ascii | Varicode | CW |
|---|---|---|---|
| " " | 0100000 | 1 | |
| a | 0111101 | 1011 | • – |
| b | 0111110 | 1011111 | – • • • |
| c | 0111111 | 101111 | – • – • |
| d | 1000000 | 101101 | – • • |
| e | 1000001 | 11 | • |
| t | 1010000 | 101 | – |

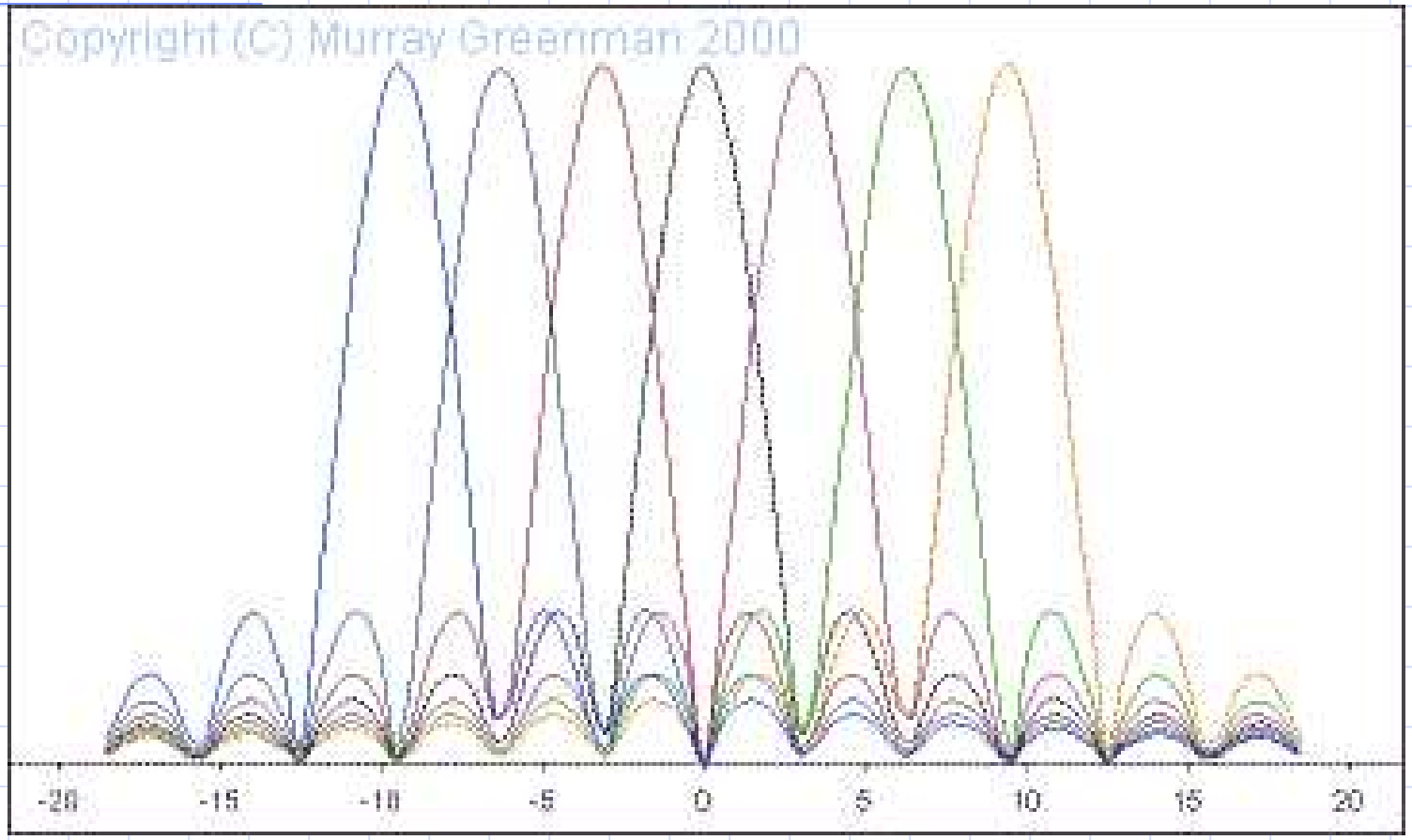
# QPSK 31

- Quadrature Phase Shift Keyed
- Four phases (90º apart)
- Transmits at 31.25 Baud (Symbols/Second)
- Fundamental Data Rate is 62.5 b/s (2 bits/symbol)
- Convolution Encoding for Error Correction
- Reduced Noise Immunity vs. BPSK31
- 3dB Weaker than PSK31

# MFSK 16

- Sixteen (16) Carrier Tones @ 15.625 Hz Spacing
- Compare w/ RTTY (Two Tones (Mark/Space))
- Data Rate per Channel is 15.625 b/s
- Total Date Rate is: Cr x log2(Cn) x Fr = 31.25 b/s
  - 15.625 x log2(16) x 1/2 => 16.25 b/s
- Convolution Coded FEC w/ Bit Interleaving
- Wider Bandwidth vs. PSK31: Cn x Cs = 250 Hz
- Tuning is Critical (5 Hz)
- First used in 2000

# MFSK Modulation

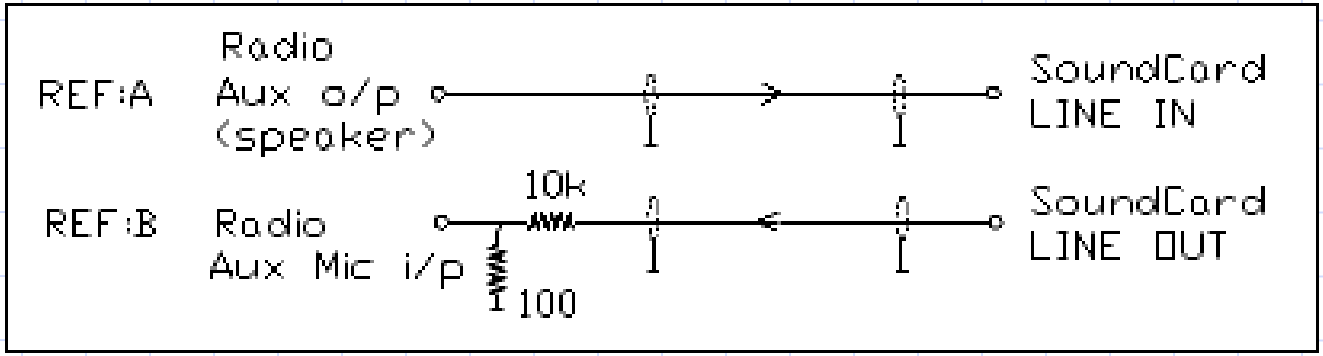


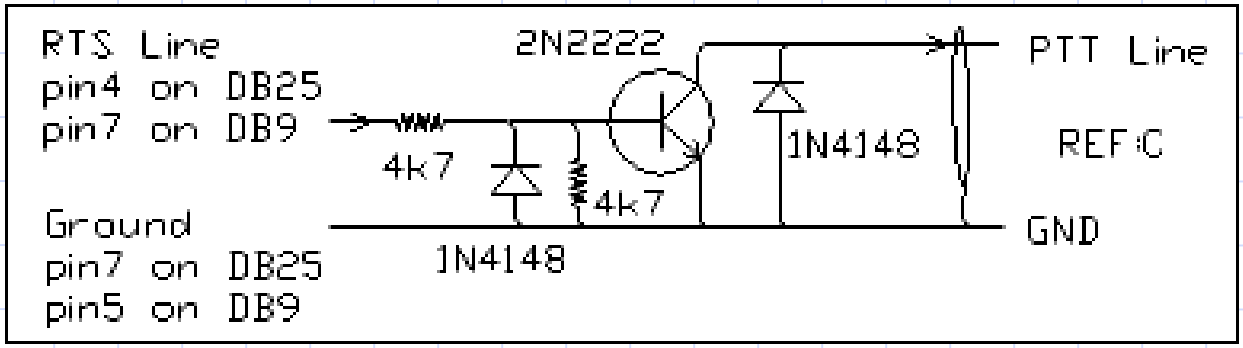

http://www.qsl.net/zl1bpu/MFSK

# Equipment

- SSB Capable HF Transceiver
- 100MHz Pentium Computer
- Interface Cable (make or buy)
- 16-bit Sound Card
- 16-bit SVGA

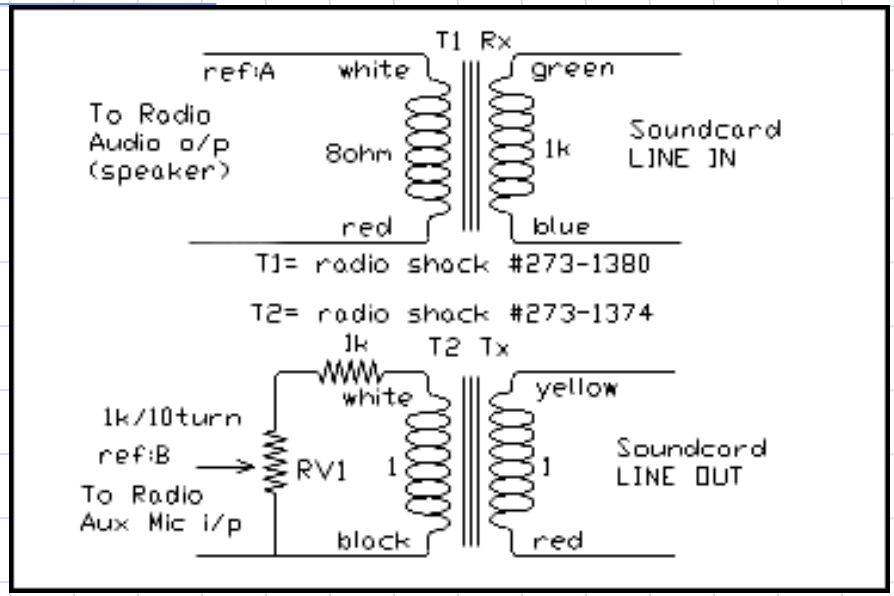
# Simple PSK 31 Interface



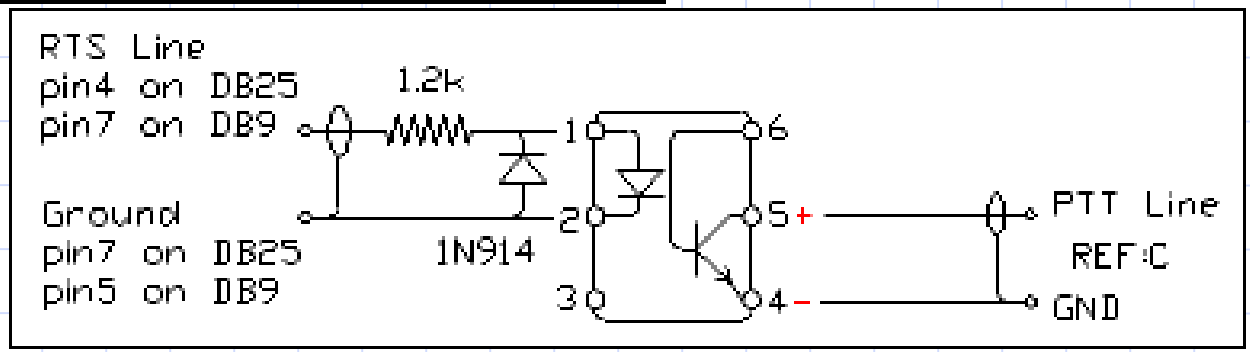




www.w5bbr.com/soundbd.html

# Better PSK 31 Interface




www.w5bbr.com/soundbd.html



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# Software

- HamScope (1.56)
- Digipan (2.0)
- Stream (1.2)
- PSK31SBW (?)
- WinPSK (2.13)
- gMFSK (for Linux, etc.)
- KPSK (Linux, etc.)
- Much more…

# HamScope 1.56

- Supports BPSK, QPSK, MFSK, and RTTY
- Spectrum & Standard Waterfall Displays
- Phase Meter (for tuning & quality)
- Integrates w/ MMTTY for RTTY



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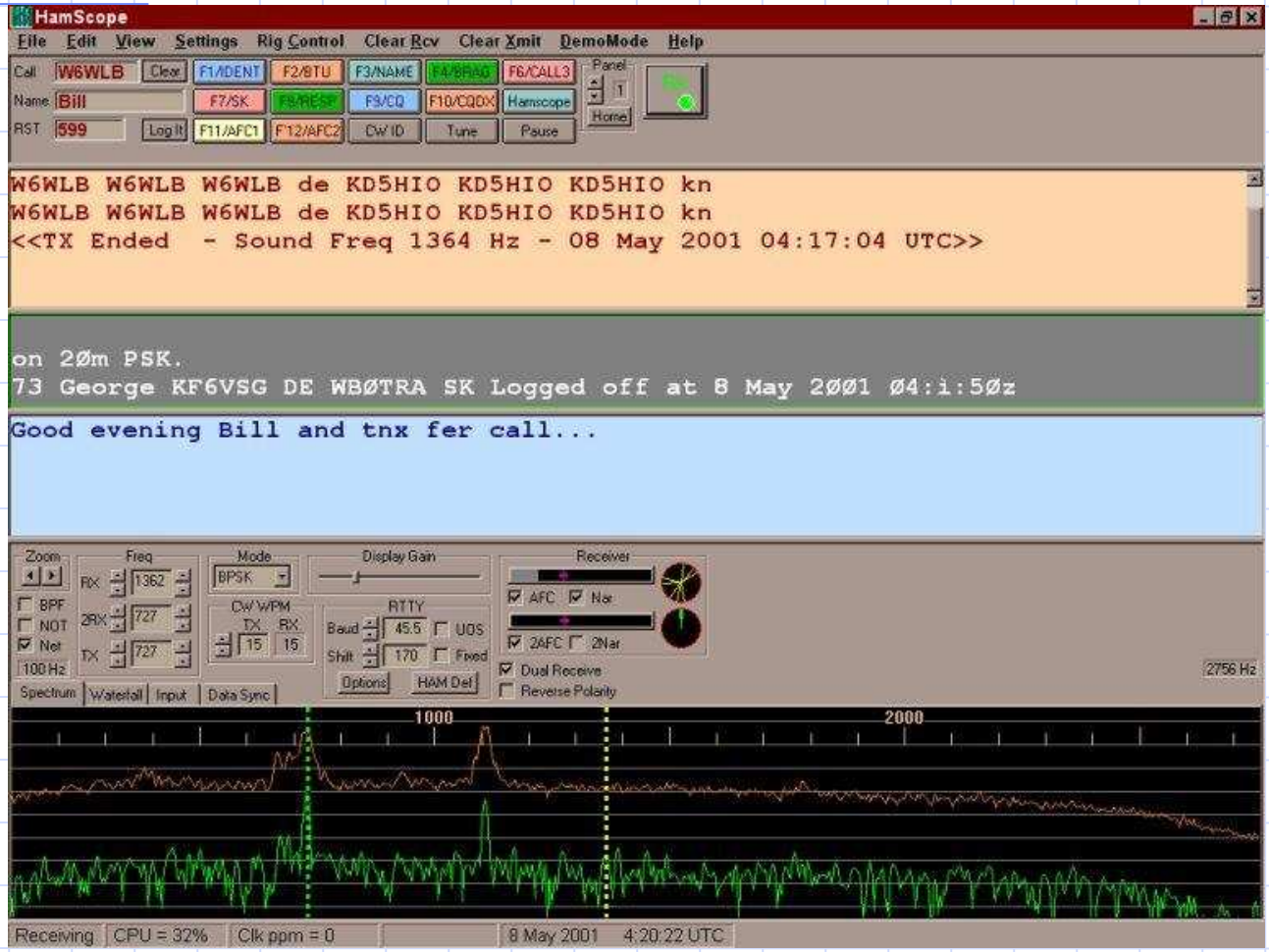
# Hamscope 1.56



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# Digipan 2.0

- Supports BPSK & QPSK
- Supports Dual Receive Channels
- Full Spectrum Display (find signals)
- Phase Meter (for tuning & quality)



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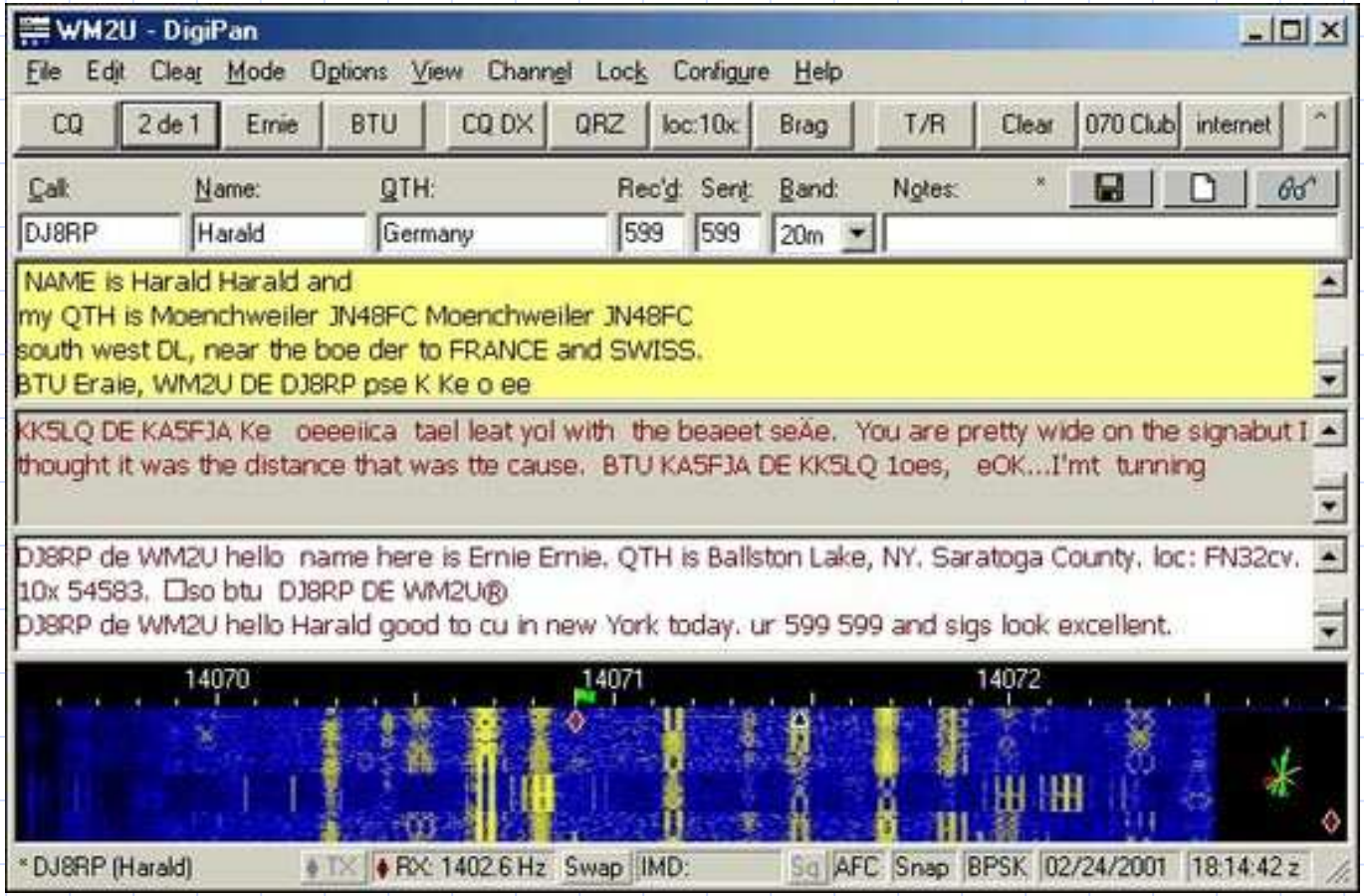
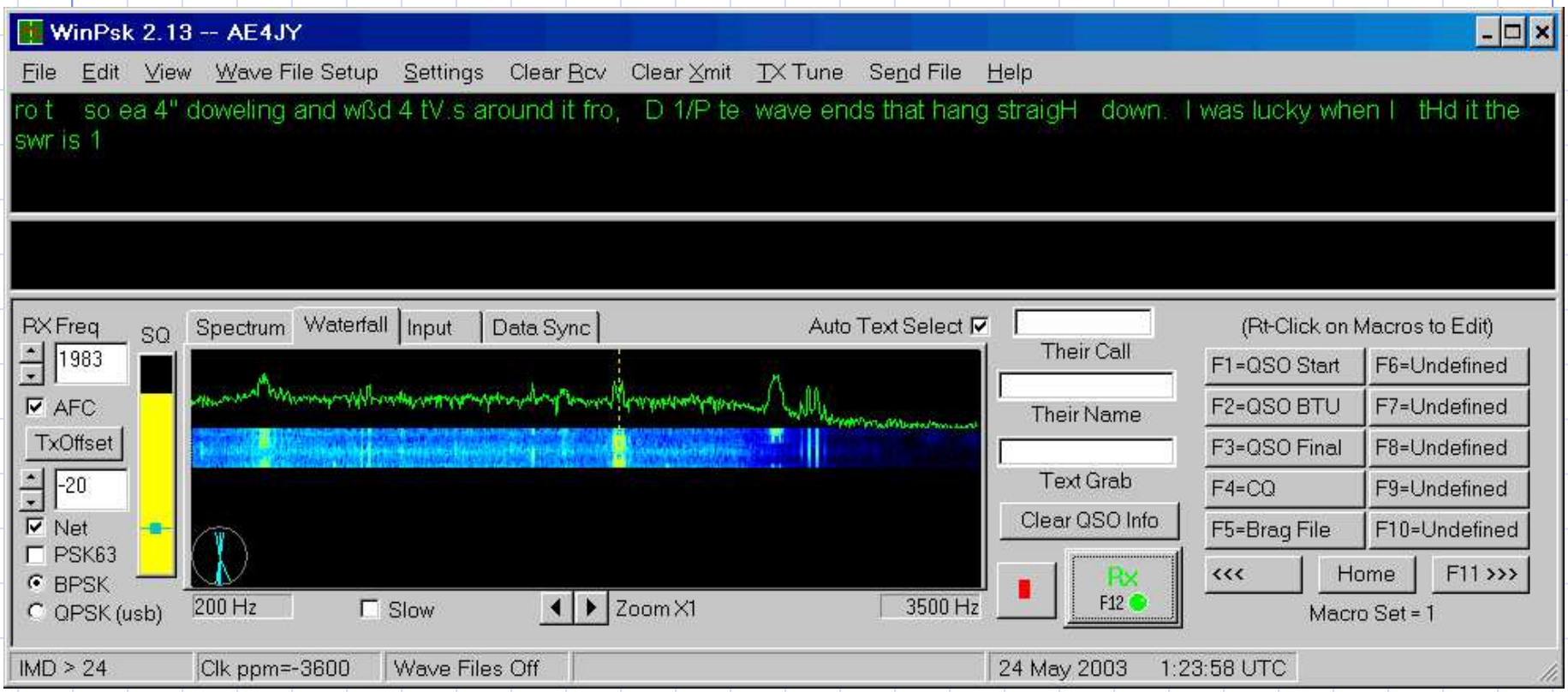
# Digipan 2.0


WM2U - DigiPan
File Edit Clear Mode Options View Channel Lock Configure Help
CQ 2 de 1 Ernie BTU CQ DX QRZ loc:10x: Brag T/R Clear 070 Club internet
Call: Name: QTH: Rec'd: Sent: Band: Notes:
DJ8RP Harald Germany 599 599 20m
NAME is Harald Harald and
my QTH is Moenchweiler JN48FC Moenchweiler JN48FC
south west DL, near the boe der to FRANCE and SWISS.
BTU Eraie, WM2U DE DJ8RP pse K Ke o ee
KK5LQ DE KA5FJA Ke oeeeiica tael leat yol with the beaeet seAe. You are pretty wide on the signabut I thought it was the distance that was tte cause. BTU KA5FJA DE KK5LQ 1oes, eOK...I'mt tunning
DJ8RP de WM2U hello name here is Ernie Ernie. QTH is Ballston Lake, NY. Saratoga County. loc: FN32cv. 10x 54583. □so btu DJ8RP DE WM2U®
DJ8RP de WM2U hello Harald good to cu in new York today. ur 599 599 and sigs look excellent.
14070
14071
14072
* DJ8RP (Harald)
TX
RX: 1402.6 Hz
Swap
IMD:
Sq
AFC
Snap
BPSK
02/24/2001
18:14:42 z

# WinPSK 2.1.3



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# Operating

- Use USB
- Can use SSB or CW Filters for Contesting
- For PSK, lower case is FASTER (varicode)
- Adjust Audio Levels
  - Avoid Hum and Noise
  - Don't Overdrive
  - Use PROC as an XMIT ALC
- Use Software for Fine Tuning

# References

- Web Sites
  - www.fars.k6ya.org/docs/digital (Links)
  - aintel.bi.ehu.es/psk31.html (official site)
  - www.psk31.com (general information)
  - www.w5bbr.com/soundbd.html (interfaces)
  - www.qsl.net/wm2u/psk31.html (general)
  - www.mymorninglight.org/ham/psk.htm (Elmer)
  - www.qsl.net/zl1bpu/MFSK (MFSK article)

# HF Frequencies

- 160 m @ 1838 KHz
- 80 m @ 3.580 MHz
- 40 m @ 7.070 MHz (region 1 7.035 MHz)
- 30 m @ 10.142 MHz
- 20 m @ 14.070 MHz
- 17 m @ 18.100 MHz
- 15 m @ 21.070 MHz (official 21.080)
- 18 m @ 24.920 MHz
- 10 m @ 28.120 MHz

# VHF Frequencies

- 6 m @ 50.290 MHz
- 2 m @ 144.144 MHz
- 1.25 m @ 222.07 MHz
- 70 cm @ 432.2 MHz
- 33 cm @ 909 MHz

# Conclusions

- New Modes Bring Vitality to the Hobby
- Easy and Inexpensive to get Started
- Encourages Experimentation