Getting Started With Digital Modes

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August 10, 2013

Introduction

- This presentation covers station and computer setup for the popular HF ham radio digital modes JT65, PSK31, and RTTY using a soundcard.

What is JT65?

- JT65A protocol was developed by Joe Taylor, K1JT in late 2003 for EME (earth-moon-earth) communications.

- JT65 uses 60 sec transmit/receive sequences and structured messages.

- Exchanges the minimum information needed for a QSO (Call Signs, Signal Reports, Grid Squares)

- Digital signal processing and redundancy allow up to 80% of the message to be lost and still be decoded correctly.

More about JT65

- During 126 intervals of 0.372 sec the waveform is one of 65 pre-defined tones.

- Bandwidth is 177.6 Hz.

- Accurate computer time (within 2 seconds) is required.

- Sound of JT65:

What is PSK31?

- PSK31 was developed by Peter Martinez, G3PLX in December 1998.
- Allows "real time" keyboard chat between two operators. Other stations see your typing immediately.
- "PSK" Phase Shift Keying modulates the phase of a carrier.
- The symbol rate is 31.25 baud.

More about PSK31

- Typing speed is 50 wpm.
- Bandwidth is 62.5 Hz (about the same as 25 WPM CW).
- Uses varicode, frequently used characters are shorter than others.
- Sound of PSK31:

What is RTTY?

- After WW II, hams began using surplus radioteletype equipment.
- Allows "real time" keyboard chat between two operators. Other stations see your typing immediately.
- "RTTY uses a five-bit code (Baudot) to represent all the letters of the alphabet, the numbers, some punctuation and some control characters.
- At typical 45 baud each bit is 1/45.45 seconds long, or 22 msec
- Typing speed is 60 WPM.

More about RTTY

- Bandwidth is 250 Hz.

- The standard mark and space tones are 2125 Hz and 2295 Hz.

- RTTY can be sent using either FSK (on/off keying, typically from COM port or LPT port) or AFSK (audio from a sound card).

- Sound of RTTY:

Why use Digital Modes?

- The equipment needed to connect your rig to a computer is very modest, and can be homemade or purchased at low cost.

- The software needed is free or low cost.

- PSK31 and JT65 modes work well with low power and simple antennas. RTTY is a popular mode for contests.

- Many hams use digital modes on HF, and contacts can be made anytime.

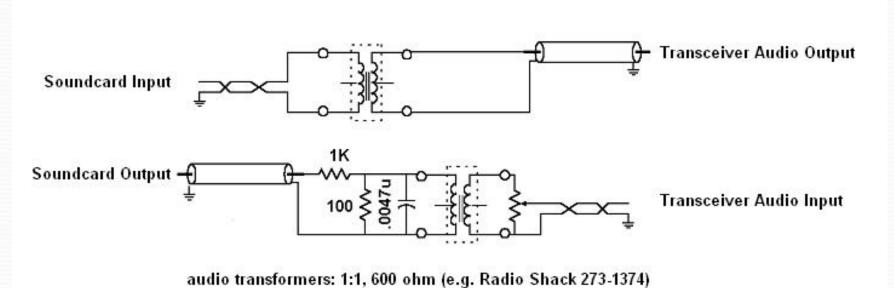- Doesn't require good hearing by users.

What Equipment is Needed?

- HF Transceiver capable of SSB and monitoring of ALC (can be an older rig, or beginner rig).

- Computer running Windows, Linux, or Mac OS.

- Soundcard Interface between the computer and the transceiver (can be homemade, and some rigs such as Icom 7200 have built-in USB interface). RTTY is generated using AFSK (audio frequency shift keying).

- HF antenna (simple wire antenna or vertical is fine).

- Software (free or low cost software is available).

- Optional hardware: CAT (computer aided transceiver control)

Homemade Interface

audio transformers: 1:1, 600 ohm (e.g. Radio Shack 273-1374)

KK7UQ

Commercial Interfaces

- SignaLink USB
  http://www.tigertronics.com/slusbmain.htm

- Rig Blaster
  http://www.westmountainradio.com/rigblaster.php

- Donner Digital Interface http://www.donnerstore.org/

The Computer

- For Windows a minimum 1.5 GHz dual core processor with 3 GB memory is recommended. Same for Linux.

- An external USB sound card or second internal sound card is recommended to avoid sending OS sounds over the air, and to allow ham software to use computer speakers.

- 16 bit (or higher) sampling rate recommended for sound card. WinWarbler and WSJT-X recommend setting the sound card to 16 bit, 48000 Hz (DVD Quality).

Software

- WinWarbler supports PSK31 and RTTY on Windows. I use it with associated DXKeeper logging software, which allows me to easily confirm QSO via LoTW, eQSL, or paper/bureau. http://www.dxlabsuite.com/

- WSJT-X implements JT65 and JT9 for Windows, Linux, and Mac OS. http://physics.princeton.edu/pulsar/K1JT/wsjtx.html

- Dimension 4 runs as a service on Windows to synchronize your computer's clock (required for JT65) http://www.thinkman.com/dimension4/

Software (other choices)

- Ham Radio Deluxe is the most popular software for PSK31 on Windows. It also supports RTTY and many less used digital modes. Version 5.24-38 is the last free version. The current version 6 sells for $99.95. HRD uses QRZ XML callsign lookup, which costs $29.95 per year. http://www.hrdsoftwarellc.com/

- JT65-HF (ongoing development discontinued) is the most popular software for JT65 on Windows. http://jt65-hf.com/downloads/

Software (other choices)

- Fldigi supports PSK31, RTTY, and many less used digital modes for Windows, Linux, and Mac OS-X. http://www.w1hkj.com/

- Several popular logging software packages support PSK31 and/or RTTY:
  - Logger32 http://www.logger32.net/index.html
  - N1MM Logger http://n1mm.hamdocs.com
  - Amateur Contact Log http://www.n3fjp.com/index.html

Hardware Installation

- Typically sound card interface manufacturers provide decent install instructions:
- Tigertronic SignaLink
  http://www.tigertronics.com/sl_suprt.htm
- West Mountain Radio
  http://www.westmountainradio.com/content.php?page=support

Additional Software

- When operating JT65, the helper application JT-Alert http://ham-apps.com/ interfaces with either WSJT-X or JT-65HF and provides audio and visual alerts for:
  - Your Callsign decoded (someone calling you).
  - CQ & QRZ.
  - Wanted Callsign.
  - Wanted Grid (by Band).
  - Wanted US State (by Band).
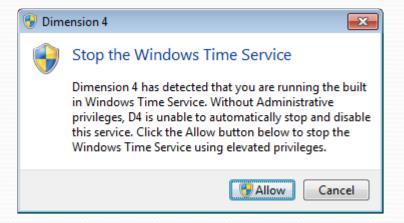 - Wanted DXCC (by Band).
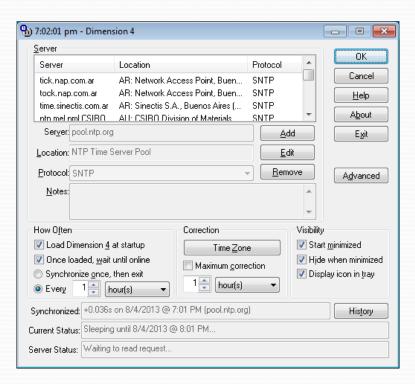 - Wanted CQ Zone (by Band).

Software Installation

- Installation instructions are available online:
- WinWarbler (DXLab) http://www.dxlabsuite.com/
- WSJT-X has a detailed User's Guide
  http://physics.princeton.edu/pulsar/K1JT/wsjtx.html

Dimension 4 Install

- Dimension 4 (or equivalent) is needed on most computers when operating JT65 so that the computer time is within a second of the other ham's computer time.
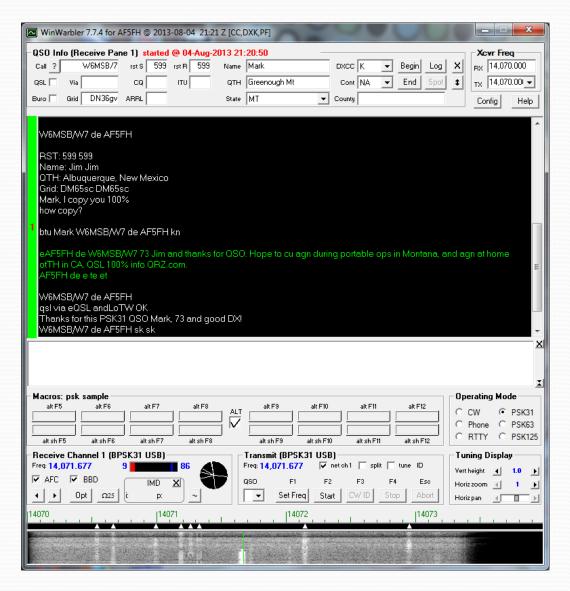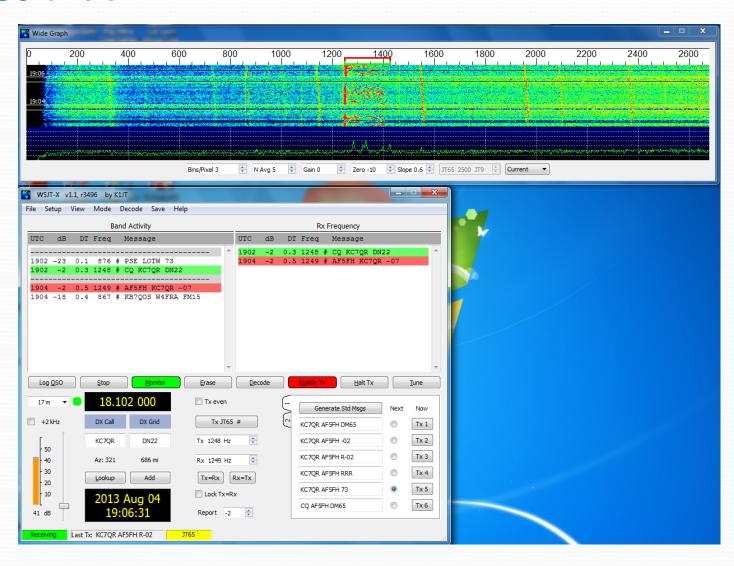
Additional Help

- Besides talking with folks at your local ham radio club, you can get help online. There are forums and groups for DXLab (WinWarbler), JT65, HRD (Ham Radio Deluxe), etc.

- http://groups.yahoo.com/group/dxlab/

- https://groups.google.com/forum/#!forum/jt65-hf
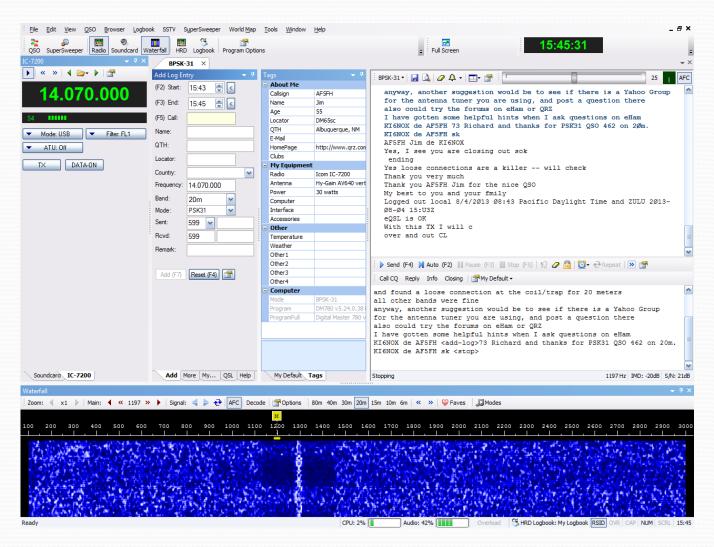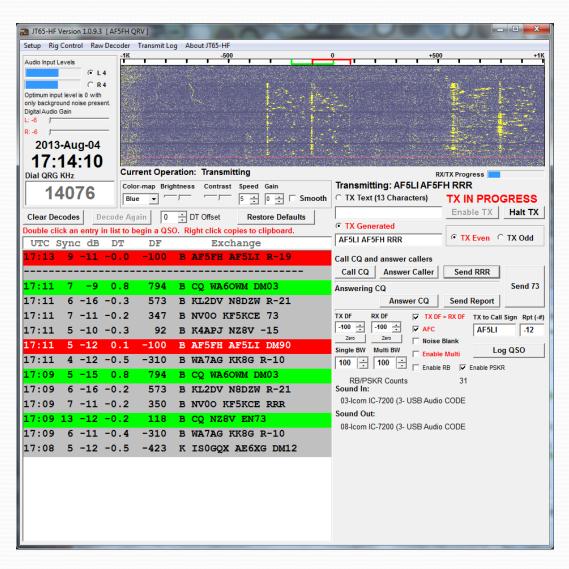
- http://forums.hrdsoftwarellc.com/

WinWarbler

WSJT-X

Ham Radio Deluxe

JT65-HF

Find Your Grid Square

- Digital Mode software will ask you your grid square during installation. Find your grid square from your call sign or street address:
http://www.levinecentral.com/ham/grid_square.php

Amateur Radio Ham Radio Maidenhead Grid Square Locator Map

Enter any address, city & state or zip: [   ] Submit

or Enter any call sign: [af5fh]   Data provided by QRZ.com

or Enter any a 4 or 6 character grid square: [   ]   Clear

Call AF5FH found for JAMES KAJDER
Address found: 13205 Hugh Graham Road NE Albuquerque NM 87111 United States
Latitude: 35.1201 Longitude: -106.491
Accuracy: High - Address

Grid: **DM65sc**

Tuning Up

- Too much audio output from your soundcard will distort your signal.

- Typically, we set RF Power output from the transceiver to 100%, and adjust audio output from soundcard to achieve desired power output. ALC should be zero.

- With my vertical antenna, typical power output for JT65 is from 10 to 25 watts; PSK31 is from 20 to 40 watts; RTTY from 50 to 70 watts. Your power output will vary depending upon the efficiency of your antenna.

Suggested Operating Frequencies

JT65 HF	PSK31	RTTY
3576 kHz	3580 kHz	3580 to 3600 kHz
7076 kHz	7035 kHz	7080 to 7100 kHz
10138 kHz	10140 kHz	
14076 kHz	14070 kHz	14080 to 14100 kHz
18102 kHz	18100 kHz	
21076 kHz	21070 kHz	21080 to 21100 kHz
24917 kHz	24920 kHz	
28076 kHz	28120 kHz	28080 to 28100 kHz

Closing Thoughts

- When using PSK31, use lower case whenever possible. Different characters are represented by a variable-length combination of bits called Varicode. Lower case letters have the shortest patterns and are the fastest to transmit.

- Please upload your log to Logbook of the World (LoTW) and eQSL.cc (The Electronic QSL card center). The logging programs with DXLab and HRD make it "one button click" to upload.

- Hope to see you on the bands!