

Digital Communications

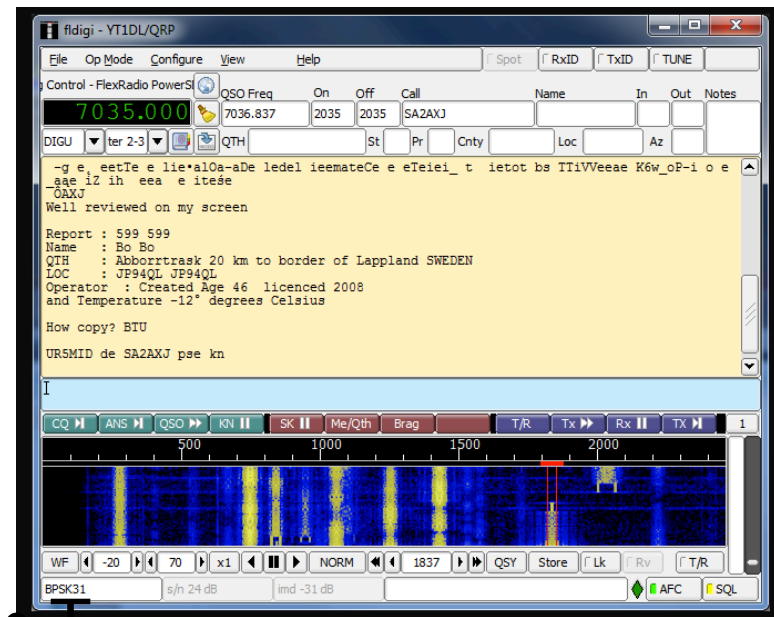
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Roland K. Smith
Call Sign: K7OJL

rolandksmith@gmail.com
(435) 849-1946

Digital Communications

- The original digital mode is CW (international morse code)
 - CW frequencies are from 50.0-40.1 MHz (10 meter band) and 144.0-144.1 MHz (2 meter band)
 - Many hams us an electronic keyer when sending CW
- A computer is used to generate and decode many other digital modes
 - The computer's sound card is used to send audio to the radio's microphone input, generate the PTT signal, and converts audio from the radio's speaker output into digital form



- The physical connection from the radio is to the computer's microphone or line input

T4A02, T4A06, T4A07, T8A02, T8D09, T8D14

Digital Modes Setup



Computer

Sound Card Interface

Isolates the computer from the Radio
Generates Push to Talk

Computer sound output goes thru interface to Xmitter
microphone in

Radio speaker output goes thru interface to computer
microphone or line input



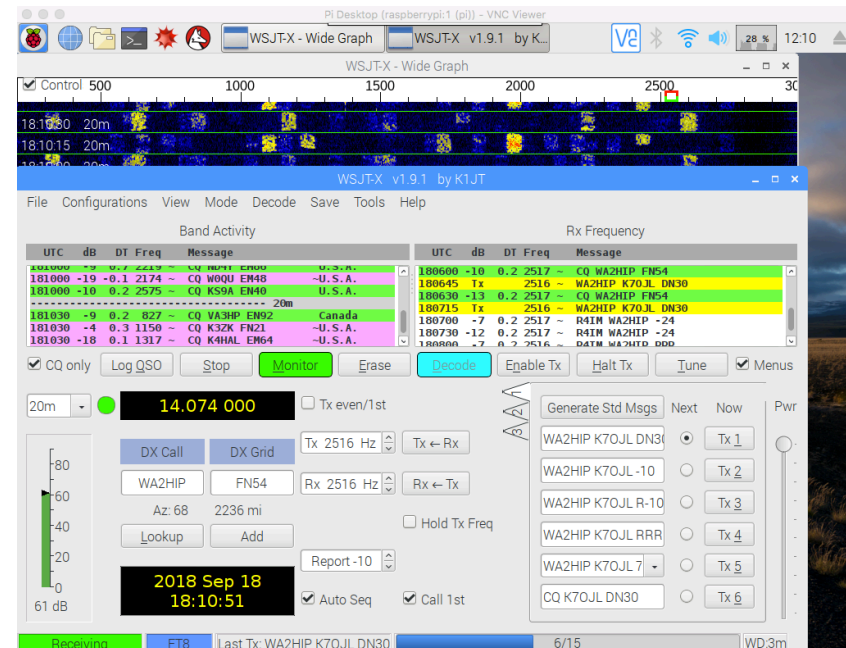
Transceiver



T4A04, T4A06, T4A07

New Digital Modes

- Digital modes include Packet Radio, IEEE 802.11, JT65, FT8, PSK (phase shift keying), and many more
- FT8 (pictured to the right) is one of the newest, enabling communications in very low signal-to-noise conditions transmitting and receiving in 15-second windows
- Joe Taylor K1JT has developed a suite of low SNR applications used for moon bounce (EME), weak-signal propagation, meteor scatter, and others
- Some modes include check sums for error detection, automatic repeat requests (ARQ) in case of error, and header records containing metadata about the transmission



- Multipath signals will seriously degrade reception and increase error rates

T3A09, T3A10, T8D01, T8D08, T8D12, T8D13

Automatic Packet Reporting System

- APRS is an application capable of providing real-time tactical digital communications together with a map showing the location of stations
 - Requires a GPS receiver to provide position information to the transmitting application
- Popular mobile text messaging application
- Many amateur weather stations use APRS to send their weather information to various weather data systems



- [https://aprs.fi/#!
addr=salt%20lake%20city%20C%20out](https://aprs.fi/#!addr=salt%20lake%20city%20C%20out)

T8C09, T8C11, T8D02, T8D03, T8D05

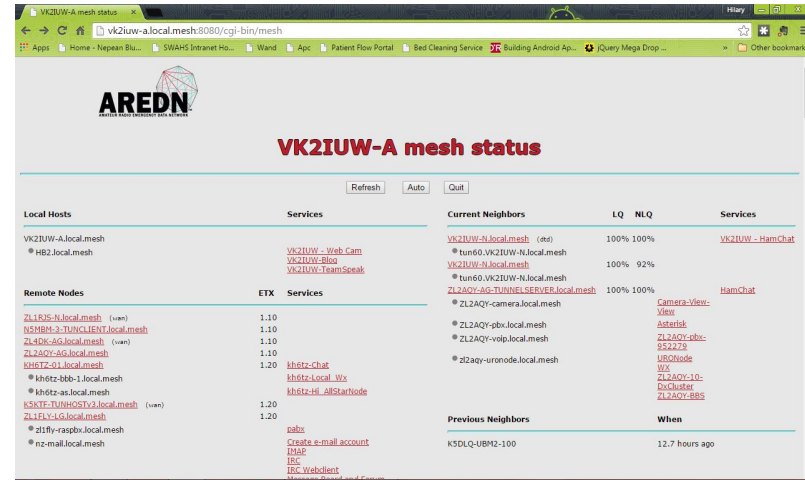
Other RF Digital Modes

- Digital Mobile Radio (DMR)
 - Two “time multiplexed” conversations on a 12.5 kHz channel
 - Users connect to “talkgroups” which are conference rooms for like interests
 - Talkgroup ID’s must be programmed into the radio to access
 - Inexpensive cost to play
- D-Star
 - Developed in Japan, supported by ICOM, Kenwood, and Elecraft
 - Has very fast data transfer capability
- System Fusion
 - Developed by Yaesu and proprietary to Yaesu
 - Growing in popularity
- DMR, D-Star, and System Fusion are all incompatible with each other

T1B09, T2B07, T8D01, T8D07

Mesh Networking

- Commercial WIFI gear (part 90 equipment) repurposed to work on amateur frequencies (part 97)
 - Several WIFI channels are within amateur radio bands
- Makes a self-healing, multi-path routing, high-speed data network
- Amateur Radio Emergency Data Network (ARDEN) is where the firmware and additional information is available



T8D12

Some Other Digital Mode Information

- PSK (phase shift keying) is a very popular keyboard to keyboard protocol as well as the ability to transfer files
- IRLP (internet radio linking project) is a technique to connect amateur radio systems, such as repeaters, using Voice Over Internet Protocol (VOIP). A popular IRLP repeater in our area is on 449.425(-) connected to the Western Reflector
 - DTMF (dual-tone multi-frequency) tones, similar to the touch tones on a phone) tones are used to connect and disconnect reflectors
- Echolink is another VOIP system. There are Echolink applications that can run on your laptop or smart phone. Registration is required before using Echolink (to prove you are a licensed amateur).
- There are online services, printed directories, and subscription services to find repeaters and VOIP services

T2B06, T8C06, T8C07, T8C08, T8C10

And Finally, Amateur TV

- Slow scan tv as well as fast scan systems are available
 - Analog only at the moment. Hams are working on a non-patented digital codec
- NTSC is the standard for fast scan color analog signals
- Typically used on the 70cm band and higher frequencies.
- Fast scan tv has a bandwidth of about 6 MHz (that's why they're on the higher frequencies!)



**Jot down any questions
you may have to ask
during the online meeting**