

Newcomers and Elmers Net: Digital Modes Part 1 Robert AK3Q 12.1.13

Digital Modes on HF

With the marriage of computers and radios over the last several decades, there are more digital signals than you can imagine, and most of them are in the HF frequency range.

-- Amateur radio folks as well as commercial, military and governments use modes like PSK31, RTTY, MFSK, Olivia, Hellschreiber, SSTV, digital voice and more.

-- I want to introduce the topic here and talk a bit about the hardware required for these modes. Your computer's soundcard can be put into service for receiving these digital signals along with software packages to decode the text.

-- Several programs such as [fldigi](#), [DM780](#), and [DxLab](#) give a lot of options for receiving various digital modes.

-- Strictly speaking, you do not have to have your radio connected to a computer to get digital modes to work, but you will get better results.

Computer/Audio Connections

There are several options for this depending on the radio you have and how you use it.

-- Standard portable radios or desktop radios without a computer interface/CAT connection will need to be connected through a "Line Out" connection or through a speaker/headphone connection.

-- Depending on how your radio is designed, usually a line out connection is the best way to go if available, as these typically have a steady output level which can then be manipulated as needed using the computer volume controls.

-- If you only have a headphone jack or a speaker jack then the output will be controlled by your radio volume control, and sometimes this can overwhelm a computer input connection.

-- Speaking of the computer input, here you have several options as well, usually a "Line In" connection or and/or a "Mic" connection.

-- "Line In" typically works best, but if there is not one available, you can use the "Mic" input. It will be more sensitive than the "Line In", but quite usable.

-- If you have no way to go directly from your radio to a computer input, another method is to record the audio from your radio and then play it back into a computer's built-in microphone, such as one on a laptop or tablet running digital mode software.

-- (An audio recorder might also be handy to record signals for later playback when you are not able to have a computer handy.)

Assuming you have a computer/CAT interface connector on your radio you can get the appropriate data cable to go into either a serial or USB interface on the computer.

- This can get a bit tricky if your cable only comes with a serial port connector and your modern computer does not have a serial port!
- You will need a USB/serial port converter with the appropriate drivers to create a "virtual" serial port.
- This is not as difficult as it sounds, but it does create some headaches if the drivers/chipset combination does not work with your operating system. -
- There is plenty of information on the Internet about these issues, so do some research before purchasing your cables.
- Just keep in mind since the serial port is created in software rather than being actual hardware, the virtual driver can get corrupted in memory more easily, so sometimes a computer reboot is in order.
- Once everything is set up and working properly you really won't have many issues unless you change your configuration or change USB ports for the connection.
- Depending on the driver/software combination changing USB ports between uses could change the communications port number as the computer thinks you have added another port.

The best radio/computer option, but more expensive, would be to have a dedicated audio card for the digital modes, such as a Rigblaster, Signalink USB, or similar device.

- The advantage here is that the soundcards are designed to have adequate signal processing capabilities, taking some of the load off the computer's internal soundcard, and they are accessible since these units are external devices.
- Where things can get a bit tricky is in the audio settings of your computer's operating system.
- Follow the manufacturer's recommendations closely if using an external soundcard, and if using a computer soundcard with line inputs or mic inputs, get familiar with how to adjust these settings in the advanced menus.
- Some software/hardware combinations can be difficult to get set just right. Fortunately this is usually a one-time thing unless you change something, but don't be surprised if things take a bit of tweaking.
- Also almost all of the software and hardware out there have extensive user-bases, and plenty of help is available online.

Digital HF Modes

Digital modes on HF frequencies are varied and plentiful.

- One of the more exciting features of digital modes is that they do not need high power to work around the world

- 30-35 watts is usually all that is required; in fact, much more than this and your signal gets distorted, causing problems for others
- While a relatively new field as far as radio goes, there have been a number of modes developed which are considered old standards, with many other new modes coming almost daily.
- This will in no way be an exhaustive listing, but I will cover some of the more common and/or user-friendly modes to get you started.

RTTY

RTTY, or radioteletype, was the primary means of digital communications from the 1940s until the 1980s, and is still in use today.

- While the technology of digital modes has come a long way since RTTY, it is still considered a very robust mode for long-distance communication.
- Many governments, military, and amateur radio operators still use the mode, and the Coast Guard and other weather services still use it as well.
- There are regular RTTY contest weekends, and some amateur radios still come with RTTY decoders built in for listening purposes.

One RTTY weather service is the German Meteorological Service, on the following frequencies:

Callsign	Frequency	speed/shift
DDH47	147.3 kHz	50 baud/85 Hz
DDK2	4583 kHz	50 baud/450 Hz
DDH7	7646 kHz	50 baud/450 Hz
DDK9	10100.8 kHz	50 baud/450 Hz
DDH9	11039 kHz	50 baud/450 Hz
DDH8	14467.3 kHz	50 baud/450 Hz

Table Courtesy Wikipedia

[Sample RTTY Audio](#)

PSK31

Without getting into all of the technical details of PSK31, this is a very robust mode which has become extremely popular for amateur radio work

- The bandwidth requirements are quite small, but accuracy is quite good.
- *PSK* stands for phase-shift keying, referring to the modulation method, and 31.25 is the bit rate.
- The software on the receiving end must synchronize with the transmitting software so that it knows what to expect.
- All of this is done through the software and is transparent to the user.

One of the reasons for the popularity of PSK31 has been the development of the waterfall (or panoramic) view of signals.

-- Early PSK software was somewhat difficult to tune because the bandwidth of the mode is so narrow.

-- By using a panoramic view of the audio (much like a spectrum analyzer) one need only "point and click" to adjust tuning to receive the signal.

[Sample PSK31 Audio](#)

PSK31 Frequencies

Frequency Amateur Band

1.838 MHz 160 meters

3.580 MHz 80 meters

7.040 MHz 40 meters (*region 1*)

7.035 MHz 40 meters (*regions 2,3*)

10.142 MHz 30 meters

14.070 MHz 20 meters

18.100 MHz 17 meters

21.080 MHz 15 meters

24.920 MHz 12 meters

28.120 MHz 10 meters

50.290 MHz 6 meters

Table and image Courtesy of Wikipedia

There are numerous variations of PSK31 for specialized uses and higher speeds, but the most widely used is still PSK31.

-- If 100% copy is necessary, PSK31-F incorporates forward error-correction, meaning it checks itself to ensure all characters have been received properly before moving on to the next block.

-- This ensures the complete message is copied, assuming the signal can make it through.

Like almost all of the digital modes, the greatest strength of using a computer to send signals is the computer's amazing ability to recognize signal patterns far below levels distinguishable by the human ear.

-- What we only hear as static, synchronized software can process signals well into the noise and still get a clean copy.

-- In this way digital modes have surpassed Morse Code for sheer ability to be heard under difficult conditions, but Morse Code is still supreme in terms of allowing the human ear to process the signal without a computer.

PSK31 on HF – A Typical Session

- get software installed and audio connections set
- set the radio to USB; set filters to voice (or wide)
- tune radio to 14.070 (day) or 7.035 (night) and listen for whistles; if all you hear is normal static, there could be a lull or something is not set right with the audio
- run the software—should see a waterfall display with yellow lines with a light blue background (typically—some software may be different)
- click on one of the lines with the mouse and then read the text in the test window
- practice just receiving and getting comfortable with the controls of the software, and learn the flow of conversations
- you will notice common abbreviations like "BTU" for Back to You, and PSE K to indicate you are finished sending your text
- also people usually send important information twice to ensure it gets through in case of static or other interruptions e.g. AK3Q de AB3XYZ AK3Q de AB3XYZ; or CQCQCQ de AK3Q CQCQCQ de AK3Q PSE K
- when ready to transmit make sure power is set to 35 watts or so, and make sure you understand how your software options for sending the text—it may send as you type, or allow you to type and then send; most people send as they type so the other person knows you are still there
- most of the software also allows you to put repetitious information in a macro/keyboard shortcut which makes things more efficient and easier

This would be the first mode I would start with since it is popular, relatively easy, and a lot of information is available for various software packages to make sure you have things setup correctly

- don't worry about making mistakes – I have told people many times I am new to this or that mode, and people are very understanding
- most folks are very welcoming into the digital club, regardless of mode