DIGITAL COMMUNICATIONS

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Disclaimer:

These are my comments on digital communications and are not necessarily all there is to know on the subject. As with everything computer related — there are at least six ways to do the same thing. Given this caveat, let me say this is opinion and not the complete story. I only relate to you my experience of 5 or more years using digital modes to give you the benefit of my experience. I will leave the rest for you to research as you see fit.

BASIC TERMS:

DIGITAL COMMUNICATION refers to the translation of text or data into digital information to be transmitted by conventional modulation methods. Amateurs have about seven frequently used modulation methods including AM, FM, SSB, FSK, and CW to name only a few.

I.E. The digital pulses of digital information are used to modulate the transceiver using modes common to ham radio. Some digital methods use CW. Yes CW Morse code is a digital mode! Some modes use Frequency Shift Keying (FSK). Some modes like RTTY can use more than one method - FSK or AFSK. AFSK is a method where audio frequencies are shifted instead of carrier frequencies.

Regardless of mode, digital pulses are used to send information (data or text) by conventional modulation methods.

The conversion of digital data to transmitted data is performed either by hardware or software (and in rare cases both).

The external hardware is known as a TERMINAL NODE CONTROLER or TNC. Often it is just referred to as a modem. Remember that modem is an acronym for modulator-demodulator. The TNC function is the digital side of the hardware black box the modem is the analog audio side.

The TNC will decode the incoming audio data stream and provide a digital signal that the computer will understand and can display. If you have ever used packet, you know it takes a TNC to hook up to the radio and to the computer. Audio signals to and from the radio are converted in the TNC and provide the digital output to the computer for your packet program. The SCS Pactor III TNC is of the same type modem/controller units only using the proprietary PACTOR III protocol instead of packet and at a considerably higher cost.

The software solution involves using a computer with a sound card. The computer becomes a modem/TNC. The computer sound card output (usually for speakers) is connected to the microphone input of the radio and the audio output of the radio (often the headphone or ext spkr) is connected to the line input of the computer sound card. This connection method is used for at least 20 of the 37 or so digital modes for ham radio. This interface arrangement provides the hardware connections for PSK, MFSK, AFSK and other audio based digital modes.

Modes such as RTTY and digital FAX can use FSK and must have a digital connection from a serial port on the computer, to the FSK input to the radio (if it has one). The radio provides the carrier frequency shift given digital data signals at the FSK port. The received digital signals are then interpreted for display by software on the computer in the same way as AFSK signals are used.

This week we will look at one digital mode in wide spread use and examine the commonalities with all digital modes.

PSK31

This digital mode is a very narrow band PSK mode for text transmission in keyboard to keyboard QSO and automated text mailbox applications. The normal bandwidth is about 150-200 Hz when adjusted to modulate your transceiver properly. The normal character send rate is about 30-31 characters per second — hence the 31 at the end of the PSK designation. There is also a PSK63 and PSK125 for faster symbol rates although with a much broader bandwidth of 300-500 Hz.

This mode attempts to send digital signals by shifting a continuous audio frequency in phase by 180 degrees. Each digital transition from 0 to 1 corresponds to a shift in phase from 0 to 180 degrees in phase of the audio signal. This is an extremely efficient transmission method in that power is in a very small spectrum and not spread out as is SSB speech. Normal communication can be obtained with 20 watts or less of power. This mode can be transmitted using several modulation methods including SSB, AM, and FM. This makes it suitable for just about any band that digital signals are allowed on for hams. Just as with CW, signals can be stacked very closely together without causing interference to adjacent signals. The caveat to this mode is that the rig used must have very good stability and audio quality in order to transmit and receive the phase shifted information properly. This is not possible with most older tube based equipment on a practical level.

Computer software programs are available now that will decode multiple PSK transmissions simultaneously in what is known as a panoramic view. The first time you see this in action it may be confusing but it is quite impressive.

Because PSK31 and the other PSK modes work well with very low power, it has gained a good reputation as being an ideal DX mode and is very popular. PSK signals can be heard on several bands. The trend lately is to use the 070 region of each band. For instance on 20 meters, 14070 is well populated. On 40 meters 7070 is also used, and so on. The CW/data portion of all bands will find some use of PSK31.

The downside to this protocol is that it is not very noise tolerant and is not error correcting. You will notice this when

conditions are noisy on the band and the computer begins to show mistakes in the text.

A very close relative of PSK is QPSK. This mode also uses the phase shift scheme but only shifts 90 degrees instead of 180. This mode has gained some popularity lately due to the improvement in decoding software. QPSK software is now available in error correcting versions. PSK mail is also available as QPSK. This is quite a reliable and easy text mail delivery method when automated. It enjoys the same low power â€“ high capture rate of PSK but includes the security feature of error correction.

Improvements in software have also been made that allow SOME non-text data to be transmitted in PSK. This is limited to only certain types of non-text data and the transmission time is extremely slow in comparison to other more capable modes.

All in all PSK is a fun and easy way to get into digital communications if you know how to type. It can be a pain if you cannot type. But have no fear there are other digital modes that do not require you to type that much.

A good way to get a look at PSK31 is to connect your rig audio output (headphones, ext. spkr or audio output) to the computer sound card line input with a simple adapter cable made or purchased. Download from the Internet multi-mode programs like Digipan, MultiPSK, or MixWin. With little time spent on setup you will begin to receive PSK31 text on your computer. All that is left to do to get on the air is to connect the speaker output from the computer to the mic input or audio input of your rig. If you are really frugal, you don't even need to spend the money on an interface box. Simple adapter cables with the proper plug types at each end will work. I have even been able to rubber band the microphone to the computer speakers and manually switch to transmit. Many QSO sessions have been made this way and there is nothing wrong with it. This works fine with PSK31, and other keyboard modes that do not have fast turn around times. It will not work with semi-automated modes like AMTOR or PACTOR.

I encourage you to experiment with the digital modes in receive to get the feel of each mode before trying to get on the air in QSO. You will learn the sounds of the transmitted signals and the methods and practices of each mode.

Just stay with us for more next month on other interesting digital modes. We will have something for you as we go along. If you missed some of this, I will make a printed version available if you email me a request.

I am also a technical specialist so you can email me with your technical problems as well.