Setting Up a Packet Radio Station

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You think packet may be fun to try? Here's what you need to know to get started.

A Few Basics

Packet radio requires a few basic components: a radio and antenna system, a TNC, and a computer to talk with it. The computer allows communication with the TNC, and the transfer of files, text, etc. The TNC converts those pieces of information into packets (something like unto an envelope) and then turns them into a sequence of audio tones through a known protocol: the AX.25 protocol, in this case. The radio takes those audio tones and transmits them over RF, and the process is reversed on the receiving side.

This is a simplified description of the topic, but it will suffice for this discussion.

To begin, a description of the radios required for packet radio shall be given.

Radios

Over the years, quite a few radios have been produced with the packetier in mind. Kenwood has manufactured several, including the TS-2000. The main features found on a packet-ready radios are connectors for external TNC's, 9.6kb connections, and built in TNC's. For the purpose of this article, the radios in the examples do not have built-in TNC's, and the setup will focus on 1200 baud packet.

1200 baud is the most common baud rate used in amateur packet radio, followed by 300 baud, which is usually only found on HF. In some situations, 9.6kb (or 2400 baud) is used on UHF and VHF. A higher baud rate requires more bandwidth and better band conditions (including less noise) than a lower baud rate signal/mode. Anything past 2400 baud—which is a bit of an oddity—starts to become a challenge, and requires radios with an audio output at a specific location in the signal chain of the receiver—and very good RF paths. The normal audio-out line won't work in the majority of cases with 9.6kb packet. Hence, the need for a dedicated output on 9.6kb ready radios.

Most radios can handle 1200 baud, on the other hand, by routing the TNC's audio in the mic port, and the audio from the speaker jack into the TNC. 300 baud packet can usually be used in the same way. Neither require anything out of the ordinary with regards to RF paths. These properties make 1200 baud and lower the most popular baud rates in amateur packet radio.

Internal TNC's make setup easier because they usually do not require the audio levels to be calibrated. The only other equipment needed to get on the air is a PC. However, the features of the internal TNC's tested by the author are severely lacking when compared to common external TNC's. The good news is, for 1200 baud or 300 baud packet, one usually doesn't need a special radio, let alone one with a built-in TNC. Even cheap UV-5R hand held transceivers have been used on 1200 baud packet, and nearly any mobile radio will perform satisfactorily on 1200 baud packet.

The most common shortcomings in radios are their speed. In packet, the delay between throwing the PTT line and the radio transmitting is critical for proper operation. Ideally there is very little delay. Too much delay and it eats up valuable air time on the frequency. (This is why VOX keying on packet is rarely well implemented.) Secondly, the amount of time it takes for the radio to go into receive mode after the PTT line goes off is important—also why VOX is a bad idea. With a high-speed transmitter and a slow receiver, you may chop off the beginning of the packet being sent back, requiring a repeat request, inducing delays.

Most of the modern radios tested by the author don't have much of an issue in either of these fields. Most hams already have equipment to get started on packet if they have an HT, mobile rig, or multi-mode all-band radio and a sound card interface.

The TNC: Old and New

In the early days of packet there were two options: a radio's internal TNC (like that found in the Kenwood TS-2000), or an external TNC like the PK-232. Both are still viable options for hardware TNC's. Many digipeaters (repeaters for packets) run hardware TNC's. These hardware modems, as they are sometimes called, can be useful when simplicity and reliability are desired: they may operate stand-alone (with a radio) in applications such as digipeaters and bulletin boards.

The Kantronics KAM series units, Timewave AEA PK-232's, and MFJ TNC's are all potential options for hardware TNC's. Manuals often include setup and connection procedures for the radio: this usually involves making an interface cable with AF in, AF out, PTT, ground, and possibly a DCD line. Most of the time the TNC will have a DB-9 connector that will require the use of a computer with a serial port, or more likely today, a USB to serial adapter. This are easily found for sale online.

However, most hams have a sound card interface, or a radio with one built in. These options are likely compatible with sound-card packet using a software TNC.

A software TNC is a software application such as SoundModem or Direwolf that performs the functions of a hardware TNC. Direwolf will run on Linux, Mac, and Windows. It isn't specifically tailored to connected mode packet (the focus of this article), but works well for certain applications. (The author uses this for software on a LinBPQ node, and has deployed it several times for different projects.) SoundModem is popular option for Windows users, and runs through WINE if used on Linux. It is more user friendly than Direwolf in that the configuration is done using a GUI, rather than by editing a text file. However, both interface to a terminal program (discussed shortly) in the same way, unless one decides to interface Direwolf into the Linux ax.25 network stack: if the installer wishes to do this, he won't need any warnings about the complexities of it.

Some research suggests that software TNC's perform better than hardware TNC's in certain situations. The author's sample group is limited in size, but his experience seems to support this.

The Computer and Software

If a hardware TNC is used, the only piece of software needed to get on the air is a serial terminal, such as PuTTY. Set the software as instructed in the TNC's manual, being sure to select the correct COM port or serial device the TNC is connected to. Then follow the instructions to calibrate audio drive levels, add callsigns, etc.

While a serial terminal (essentially a "dumb terminal") is acceptable for use, some users prefer a dedicated packet terminal, such as EasyTerm, or Packet Engine Pro. EasyTerm is a free software

available online, and runs on Windows, or Linux using WINE. It is more user friendly than a dumb terminal, and has a built in mailbox (like an email inbox that other users can access to leave you a message if you aren't at the computer), in addition to various other features. AGWTerm is another option.

If one chooses to use a software TNC, follow the setup instructions for the specific software selected. In most cases a virtual, networked, AGW-type TNC will be created on localhost, a computer's internal network. Then, setup a terminal program to connect to this networked TNC. Usually the connection will look like localhost:8000. With some effort it is possible to connect to a networked TNC on a different computer (ie. 192.168.88.45:8000) than the terminal program: the author uses this technique on his packet station. Usually, however, this is not necessary.

Some applications, such as Direwolf, will host a networked KISS TNC. If possible, use the AGW service instead: there is some functionality lost when using the KISS function (as with a hardware TNC).

There are several programs for use with Winlink 2000 email over radio. Winlink Express (formerly RMS Express) is a Windows program that interfaces to networked, hardware, or software TNC's. There are also programs for use on other operating systems, such as OutPost or PAT.

Programs such as EasyTerm or AGWTerm are better suited to manual, keyboard to keyboard communications in some situations than Winlink Express or Outpost Packet are. Regardless, once the TNC is configured, the terminal programs or application specific programs can be connected whenever or however desired.

Conclusion

Now that the radio, TNC, and computer are configured, it will take some time to get the settings fine tuned for maximum performance and reliability. For receive testing, the software and TNC should decode packets on the APRS frequency of 144.39 MHz, This frequency sometimes has more frequent traffic than 145.010 MHz, the standard packet frequency in Texas. Other packet users are often willing to help troubleshoot stations and provide input on station setup. Accessing local digipeaters or nodes is a good way to start, and be sure to make use of the mheard command on the TNC or the just heard lists: these let one see what stations are within receive distance from the station being configured and are a valuable tool to determine if transmitted packets are being decoded at other stations.

Until next time,

73 from KG5ZSU

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