Perhaps you have just gotten yourself a new HF radio and have an urge to try packet on the lower frequency bands. Maybe you have a Technician class license and want to try packet on 10 meters. This chapter attempts to provide information for you to get started without making too many big errors.

The author is not an expert on HF packet. He has operated on HF through some VHF/HF gateways (but that is not quite the same as doing it directly on HF). Tom Rickert, N7CPA, has been indispensable in providing much of the information which appears here.

12.A EQUIPMENT

Equipment, of course, is one of those subjects of endless ham conversation. This section will avoid specific brand-name recommendations and try to provide some general guidelines.

12.A.1 Radios: A radio is a radio, isn't it? Well, yes and no. There are some general characteristics which make some radios more suitable than others for packet use. Lets consider some of these.

Stability is very important. Very few older non-synthesized radios are adequate in this department.

Smooth tuning is important. 10 hertz or finer tuning step size makes things easier.

An auxiliary jack on the rear of the radio is handy. But a caution is in order. Many newer radios permit packet access though the auxiliary jack while the microphone attached to the front of the radio. This permits simple up/down tuning at the operator's fingertips with control buttons in the microphone. But, with many of these transmitters, when the transmitter is keyed, the transmitter accepts (and transmits) all input signals. Thus, the transmitter can transmit both packet tones and microphone audio at the same time. As a result, if you are not careful, a connected microphone can transmit room sound along with you packet tones!

12.A.2 TNCs: Are there special TNC requirements for HF operation? Yes! And No! If you are going to operate on 10 meters only, operation with VHF settings is permitted (that is, 1200 baud rf data rate). In this range of frequencies, you can use your VHF TNC.

For operation on frequencies lower than the 10 meter band, you need a TNC which provides 300 baud and the standard tones used for HF operation. This need not be a multi-mode controller unless you also wish to operate RTTY, AMTOR, etc. There are a number of TNCs which provide this capability. Appendix 2 (in Volume 2) provides some detailed information.

One TNC feature which simplifies HF operation is a tuning indicator. While this feature is certainly not necessary, it does remove a lot of the frustration, especially when you are beginning.

12.A.3 Terminals: There is no reason for there to be any difference between the terminal you use on VHF and on HF. There are, however, terminal programs which simplify the change between VHF and HF. See Appendix 1 (in Volume 2) for some suggestions in this regard.

12.A.4 Antennas: Section 3.E discussed antennas on VHF. In general, the same can be said on HF.

Directional antennas provide gain and reduced noise but cause some stations to be hidden from you. Non-directional antennas require no rotating and are good in any direction but sometimes provide weaker signals.

12.A.5 Station Layout: Section 4.L discussed station layout. Several points deserve emphasis here.

Computers and TNCs create spurious radio signals. These signals tend to get stronger as you get closer to the actual operating frequencies (of the computer and TNC). Thus, you can expect some of these to be bothersome on HF. Careful grounding of equipment may help significantly in this regard.

Transmitter output powers tend to be higher on HF than VHF. 100W or more is not uncommon. This may, in some situations, make a computers and TNCs more susceptible to interference from your transmitter. Experience has shown that use of an elevated beam antenna usually produces fewer problems. But antennas with sections which are near ground level (such as "slopers") are quite capable of delivering interfering signals to video displays, computers, and TNCs.

12.B TNC SETTINGS

RF baud rate was just mentioned as a TNC difference between HF and VHF. There are also several parameters which are set usually differently on HF than they are on VHF.

PACLEN is usually set much lower on HF. Values of 30 are often recommended but common practice and experience suggests that values near 60 are quite adequate. With a packet header of 25 or so characters which are not counted as part of the packet length, the efficiency of a packet containing only 30 information characters is quite low.

RETRY values are usually increased on HF. A full 15 retries may not be enough! For TNC2s, *RETRY 0* causes the TNC to take as many retries as necessary and many users take this route. While the impact on a busy frequency is not very desirable, it is up to you to determine whether or not this is justified in your case.

12.C FREQUENCIES

Packet on HF in the United States is limited to frequencies denoted as DIGITAL by the Federal Communications Commission. The general practice has been that on each band, the RTTY-like signals (RTTY, AMTOR, etc) occupy the lower half of each digital sub-band and the packet-like signals occupy the upper half.

Not all nations recognize the same frequency conventions. Even if there is a packet signal somewhere else (where you are licensed to operate), you may not have the right to operate packet there.

12.C.1 1200 Baud: operation is permitted only on 10 meters. The frequency range in which the FCC permits operation is 28.190 MHz to 28.205 MHz.

12.C.2 300 Baud: operation is permitted on each of the HF bands from 10 meters down to 160 meters (including the newer WARC bands).

12.C.3 H.F Packet Band Plan: The following is the packet band plan recommended by American Radio Relay League. Along with the frequencies are noted some of the common usages.

10 METERS

28.101 300BD
28.103 300BD
28.105 300BD
28.107 300BD BBS FORWARDING
28.109 300BD BBS FORWARDING
28.111 300BD BBS FORWARDING
28.190 1200BD BBS FORWARDING
28.195 1200BD
28.200 1200BD

12 METERS: NO ESTABLISHED BAND PLAN

15 METERS:

21.100 & below; BBS FORWARDING
21.101 300BD
21.103 300BD
21.105 300BD
21.108 300BD

17 METERS: 18.101 300BD
18.103 300BD
18.105 300BD
18.107 CLOVER OR PACTOR
18.109 CLOVER OR PACTOR

20 METERS: 14.000 & below , FORWARDING; AMTOR,RTTY,PACTOR KYBRD
14.101 300BD
14.103 300BD
14.105 300BD
14.107 300BD FORWARDING (SOME KBRD)
14.109 300BD FORWARDING ONLY
14.111 300BD FORWARDING ONLY
14.113 300BD FORWARDING

30 METERS: 10.141 300BD
10.143 300BD
10.145 300BD
10.147 300BD FORWARDING
10.149 300BD FORWARDING

40 METERS: 7.100 AND BELOW BBS FORWARDING
7.101 300BD (SOME FORWARDING ON)
7.103 300BD (ALL 40 METER FREQ BUT)
7.105 300BD (BUT GOOD KEYBOARRDING)
7.108 300BD

80 METERS: 3.610 TO 3.616 300BD

160 METRS: NO BAND PLAN

12.D OPERATING PRACTICES

Single Side-Band (SSB) is used on all HF bands. The lower sideband is used even though voice communication may use different side-bands on different frequencies.

Propagation changes for packet the same way it does for other modes. Do not be surprised at the sudden loss of a link.

On HF, there are many transmitters which are hidden from you. The may be hidden by virtue of your antenna directivity. They may also be hidden because of propagation. In other words, your conversation with a station in Europe may be interfered with (not intentionally of course) by stations in Africa or Asia which you simply cannot hear but which the station at the other end can.

While tuning indicators can be very helpful as can frequency lists, the proper tuning criterion in the end is best copy. The TNC tuning indicator should get you close; usually you can trust it. But some-times, you may find that tuning up or down a very small amount may reduce retries and the best on-screen copy.

You may occasionally find signals which sound like very good packet signals and produce very good S-meter readings. A tuning indicator may, however, show erratic response or no response at all. This is thought to be the result of multi-path in which the signal arrives after following two different routes. These routes may be around the earth in opposite directions. They may take a different number of bounces between the earth and the ionosphere. But in either case,the result is the same; there are two signals which interfere with each other. Sometimes a directional antenna may help sort out the signals.

Do not use RIT or filter shifts which are available in some transceivers.

On HF, CQ is sent by placing the TNC into converse mode, then just type *`CQ CQ DE yourcall.`* This will be sent as a UI frame and anybody monitoring will see it. If you also have *`UNPROTO CQ`* set, the UI frame will be addressed to the callsign CQ.

12.E KANODES ON HF

KaNodes and digipeaters are quite frequently used on HF. You might review their operation in earlier chapters (sections 3.C and 10.A). Some additional notes are pertinent here.

12.E.1 Beacons: KaNodes have a fairly distinctive beacon.

```
N7CPA>ID
N7CPA/R NBG/D N7CPA-1/B N7CPA-3/G N7CPA-7/N

N7KMM>ID
N7KMM/R JOE/D N7KMM-1/B N7KMM-3/G SPRING/N
```

The format for these beacons is as follows: the identifier followed by /N is the node name. It can be either an alias or a callsign. This is what you connect to for connection services.

The identifier followed by /B is the BBS (mailbox). This is what you connect to to leave or get mail. SSID of 1 is commonly used.

The identifier followed by /D is the digipeater. This is what you use to digipeat. In general, other SSIDs of this call will not digipeat!

The identifier followed by /R is the basic identification of the node. This is usually the callsign without any SSID.

The identifier followed by /G is the gateway. Using this callsign permits one to digipeat from one side of the KaNode to the other. For example, suppose that you are on HF and happen to be on the same frequency as W9AA-3/G. Also, suppose that N9ZZ is accessible on the VHF side of the W9AA KaNode. You can use the following connect command: *C N9ZZ v W9AA-3* . W3AA-3 will hear this connect request and serve as a digipeater, digipeating from (in this case) the HF side to the VHF side. If the VHF path is good, N9ZZ will hear this digipeated connect request and respond. The same process works from the VHF side to the HF side.

12.E.2 Node Connects vs Digipeating: The comments concerning node connection vs digipeating in sections 3.C and 3.D apply equally in HF. There are though, as one might expect, some special considerations.

Digipeating is undeniably faster when it comes to establishing a link.

You simply type out the connect string with all the digipeaters and, if it all works, back comes the acknowledgement. When you use node connection services, you get back the logon message from each one, then tell it the next connection, and so on. So, if speed of setting up the link is a major issue, digipeating will win out.

But if you expect to carry on an extended conversation, using node connection services is superior. The number of packets cluttering the frequency are reduced because retries are handled between the two points where the failure actually occurred. Using digis requires each error correcting retry to be resent from one end all the way to the other. Using the connection services of KaNodes does not add the networking overhead characters used by Net/Rom nodes so the penalty is very small. On top of this, the stay-connected feature of a KaNode can really help; this is discussed in the next section.

12.E.3 Stay Connected: KaNodes have a very interesting feature known as stay-connected. If you ask a KaNode to connect you to something else (either on the same frequency or on the cross-frequency) and the link fails, that resulting disconnect ripples back to the KaNode and it, in turn sends a disconnect on to you. This is the way a "normal" (that is, not stay-connected) connect works.

But if you tell the KaNode to connect you to something else and to stay connected, the disconnect from the far side of the KaNode stops right there. The KaNode notifies you with a special message. The following example shows the result of a stay-connected connect between the node ALBOR (origin) and the node MOORE. The link was setup and operated, then failed.

```
###DISCONNECTED BY MOORE AT NODE ALBOR
ENTER COMMAND: B,C,J,N,X, or Help ?
```

This message shows that a disconnect (for any reason) happened beyond ALBOR. The result rippled back to that point but stopped.

This connection was established from the VHF side of ALBOR by using the command *X MOORE S*.   The *X*, as discussed earlier is the cross-connect command. This is followed by the name or callsign of the station being connected to. What is different is the ending *S*. This last character indicates that the connection is to be made as a stay-connected type.

12.F SUMMARY

Operation on the HF amateur bands requires some equipment which is slightly different than that used on VHF. Radio baud rates are different as are tone frequencies. Beyond this difference and the requirement for a stable and easily tuned HF transceiver, the equipment needs differ little from VHF.

Operating frequencies are limited and the propagation has all of the vagaries of other HF modes. There are a number of operating strategies which are unique on HF. Likewise, the extensive use of KaNodes serves to add to the differences between VHF and HF.