An HF Primer

Part 1

Having obtained a callsign, established a station and erected an antenna, the next step is to learn how to operate it. This requires an ability to adjust equipment to transmit a clean signal, as well as a knowledge of basic operating procedures. Part One will focus on the latter, while Part Two looks at some of the specialised operating activities, such as DXing, awards and contests, enjoyed by amateurs. this series concentrates on SSB (voice) and CW (morse), both of which can be used by Foundation licensees.

Which band?

Amateurs have a range of bands from which to choose. Thus, at any one time, a well-equipped amateur station can contact stations over various distances by selecting the right band. Band conditions vary according to the season, time of day and sunspot activity. Foundation licensees can use the following HF segments:-

- 3.500 - 3.700 MHz (80 metres)
- 7.000 - 7.300 MHz (40 metres)
- 21.000 - 21.450 MHz (15 metres)
- 28.000 - 29.700 MHz (10 metres)

In very general terms, the lower frequency bands (such as eighty metres) are most used at night, while the higher bands 10 and 15 metres) are more active during the day.

40 metres is an in-between band, permitting short and medium distance coverage during the day and long distance contacts at night.

10 and 15 metres are greatly affected by sunspot numbers, with the ability to make DX (overseas) contacts on them peaking in years of high solar activity.

At the moment, we are approaching the peak of the eleven-year sunspot cycle, so we can look forward to improving conditions in the next few years. At this phase of the sunspot cycle, 15 metres is likely to yield more DX contacts than 10 metres for the Foundation operator, though ten metres can still be productive, particularly during major contests.

Around mid-winter and mid-summer, ten and six metres come alive due to a phenomenon known as 'sporadic-E'. Sporadic-E occurs during all phases of the sunspot cycle and permits distances of approximately 500 to 2000 kilometres to be covered, even with just a few watts and simple antennas. It can occur at any time, but is more prevalent during the day.

The time of day is an important determinant of band conditions. While local contacts are possible on eighty metres during daylight hours (particularly in winter), it is during the evening that the band finds most use, with distances of up to 3000 kilometres being typical when conditions are good. More typically, a 10 watt Foundation licence station can expect regular contacts up to 500 to 1000 kilometres in the evening. An important advantage of eighty metres is the almost blanket coverage that is obtainable; this is in contrast to the higher bands where a 'skip-zone' exists between the limit of ground-wave coverage, and where the sky-wave, reflected from the ionosphere, returns to earth.

40 metres during the day permits the sort of contacts you can get on 80 metres at night, though it's easier to have longer distance contacts (eg 1000 - 3000 km) with low power. At night overseas stations can sometimes be contacted but there can be a lot of interference and 80 metres can be better for contacts within Australia. For cross-town communication (say up to 20-30 kilometres), any HF band will provide results, though ten metres is preferred, because of its lack of crowding, low band noise, and relative efficiency of mobile antennas. Somewhat longer distances can be spanned on eighty metres, or else on the higher bands when sporadic-E propagation is apparent. DX contacts are most prevalent on 15 and 10 metres (mainly during the daytime), but could be possible on eighty metres if you possess an antenna whose radiation pattern is concentrated at low angles.

Which band is best to start on first? My pick would be 40 metres, since it is capable of short, medium and long distance contacts at various times of the day. Its antenna requirements are also less onerous than 80 metres, and many good contacts can be made with 10 watts. A video demonstration of 40 metres is available below.

My second preference would be 80 metres. However (a) if you have very little room, (b) you are more interested in overseas contacts, or (c) it's a high sunspot year, 15 metres might be chosen instead. 10 metres also has its moments and is made more accessible as many 27 MHz CB antennas can be converted for use on this band.

The antenna

It is assumed that an antenna has already been erected. If not, some ideas are given at First Contacts. The typical Foundation station may include a dipole or inverted vee for 80 and or 40 metres, a trap vertical or small beam for 10 and 15 metres, and a groundplane, discone, J-pole or similar antenna for VHF/UHF, with different capabilities on different bands in line with the operator's interests. All these antennas can be constructed at home; details are provided on numerous websites and in magazine articles or antenna handbooks.

Making contacts

There are more similarities between HF SSB and CW operating procedures than there are differences. In both cases, it is wise to tune across the band you intend to use prior to transmitting. This provides a general impression of band conditions.

Assuming the transceiver and/or antenna tuning unit are properly tuned up (a process which, if performed on-air at all, should be done on a clear frequency at low transmit powers), the process of seeking contacts can begin. There are three main ways of obtaining contacts. These are as follows:

Responding to a CQ call

Tuning across the band may reveal one or more stations calling CQ. A CQ, which is a general call to all amateur stations, is your invitation to respond. Such a response takes the form of sending the other station's callsign, followed by your own, perhaps sent several times if signals are weak.

If the calling station is VK6AA, and your callsign is VK1AA, your response on SSB could be:-

VK6AA, THIS IS VICTOR KILO ONE ALPHA ALPHA, VK1AA.

On CW, you would send:-

VK6AA de VK1AA VK1AA VK1AA K

In this case, 'de' means from, while 'K' is an invitation to transmit (or 'over' on voice)

If the station replies to another station, you may wait until the contact finishes, or move to another frequency. On the other hand, the calling station may ask 'QRZ?'. This indicates that the station heard a signal, but was not able to decipher the callsign. The correct procedure in this case is to repeat your call, possibly speaking (or sending) a little slower this time.

Calling CQ

If no other stations are calling CQ, it is a good idea to issue a call yourself, especially if you have reason to suspect that the band may be open (eg hearing beacons on 10 and 15 metres). After selecting a clear frequency, it is polite to ask if it is in use. On SSB, this is accomplished by announcing your callsign and asking if the frequency is occupied, while CW operators simply send 'QRL?'. If no response is received, the frequency is yours to use.

The length of CQ calls depends on band activity and conditions; if band occupancy is sparse, a longer CQ call is suggested to attract the attention of the casual listener tuning across the band. In order to maximise the chance of obtaining contacts, and to minimise interference with other operators, the Amateur Radio bandplans should be adhered to at all times. Essentially this means not operating SSB on frequencies reserved for CW or digital modes. Bandplans are on the WIA website.

On SSB, a typical CQ call is as follows:-

CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ THIS IS VK1AA, VICTOR KILO ONE ALPHA ALPHA, VK1AA, CALLING CQ AND LISTENING

(before calling, make sure you are on the right sideband - LSB for 80m, USB for 15/10m)

A CQ call on CW may be:-

CQ CQ CQ DE VK1AA VK1AA VK1AA K

Higher speed operators may choose to make their calls longer, to increase the chance of the call being heard. However, this should not be overdone; hearing 20 CQs before a callsign is sent will cause most listeners to seek contacts elsewhere.

'Tail-ending'

An effective means of obtaining contacts (especially if using low power) is by the use of 'tail-ending'. This means listening in to a conversation, and calling one of the stations involved immediately after the contact ends. Timing is important here, particularly if unable to hear all stations on frequency. When 'tail-ending', the call made can be just as if one was answering a CQ. If used with care, 'tail-ending' is probably the best way to make contacts on the HF bands.

During the contact

Once contact has been established, the first few exchanges normally entail a swapping of RST signal reports, names and locations ('QTHs') with the other station. From this point, the conversation may extend to the antenna and equipment, and the seemingly ubiquitous weather report. Discussion beyond this point is a matter for those concerned, though amateur regulations and ethics mean that some topics may be best left alone. As you will occasionally find out amateurs vary in their ability to civilly discuss controversial matters!

The purpose of signal reports (see Table Four) is to give your contact some idea of how their signals are being received. Signal reports on phone consist of two digits. The first of these is readability (R), on a scale of 1 to 5. The second figure given is the strength (S) of a signal, this time on a scale of 1 to 9. The third digit, used by CW operators to indicate the purity of the received tone, is also on a scale of 1 to 9. Because of the quality of most modern equipment, reports of less than T9 are rare.

Some tend to accept the S-meter as gospel, without realising that S-meter calibrations vary between transceivers. Cases of people refusing to give signal reports if a signal (though perfectly readable) is not moving their meter's needle are not uncommon. If in doubt as to what report you should give, it is best to ignore the meter on your transceiver entirely.

Ending a contact

If the time that it can take is any guide, many people have trouble ending contacts. On CW, this manifests itself in the endless repetition of 73, BCNU, CUL, CUAGN and other solecisms, while on SSB, many a fictitious saucepan must have boiled over! Try to end contacts cleanly and keep the number of 'final-finals' to a minimum; this makes it easier for other stations who might want to call one of those about to depart.

Many on-air examples of HF operating appear at youtube.com/vk3ye

Conclusion

This article, has provided some pointers on basic operating techniques. Read on to Part Two, for more detailed information on DXing, contests and award hunting.

Appendix: Abbreviations and Prosigns

Table One: Morse Procedural Signals (Prosigns)

CQ A general call to all amateur stations
AR end of message, full stop
K "over", invite any station to transmit
KN A specific station only to transmit
BK invite receiving station to transmit
R all received OK
SK end of contact
CL going off the air (clear, switching off)

Note that all two-letter prosigns are sent with the letters merged together (except CQ).

Table Two: Commonly used Q signals for Morse

QRL?: Is this frequency in use? (use this just before calling CQ).
QRM: Man-made interference (eg other stations on/near your frequency).
QRN: Natural interference (eg thunderstorm activity)
QRO: High(er) power.
QRP: Low(er) power - normally 5 watts or less.
QRQ: Send faster (eg QRQ 12: please send faster at 12wpm).
QRS: Send slower (eg QRS 8: please slow down to 8wpm).
QRT: Stop transmitting.
QRX: Please wait (eg QRX 1: please wait one minute).
QRZ? Please call again (used when a station has responded to your CQ call,

but you missed their callsign).
QSB: fading signals.
QSK: 'break-in mode' - your equipment allows listening while sending.
QSL?: Can you acknowledge receipt (of message)?
QSO: conversation.
QSY: move to another frequency (eg QSY 3530 means QSY 3.530 MHz).
QTH: transmitting location.

Note: The above lists the most commonly used Q-codes for amateur CW operation. The meanings shown are those that are most used on-air, and vary slightly from the definitions in the standard handbooks. To ask a question, simply attach a question mark (?) to the Q-signal; for instance, QRQ? means 'Shall I send faster?'. While Q-signals are sometimes used on SSB, plain English is probably as effective in most cases.

Table Three: Common abbreviations for Morse
(Morse code's version SMS TXT abbreviations - some are even the same)

ABT About
AGN Again
AS (please) wait
CQ Calling any station
CUL See you later (similar to BCNU, HP CU AGN, etc)
ES And
FB Fine Business, excellent
GM(N) Good morning (night)
GUD Good
HR Here; Hear
HW How
NR Number (used in contests)
PSE Please
RST Signal report (see later)
SIG Signal
SRI Sorry
TKS, TNX, TU Thank you
UR Your; You're
VY Very
WKD Worked
WL Well; Will
WX Weather

Abbreviations for other words exist, but their use is less prevalent than those in the list presented here. Their use can make CW communication faster and more pleasurable, particularly at slower speeds.

Table Four: Standard Readability and Strength Scale (source: ARRL Handbook)

Readability

1 unreadable
2 barely readable, occasional words distinguishable
3 readable with considerable difficulty
4 readable with practically no difficulty
5 perfectly readable

Strength

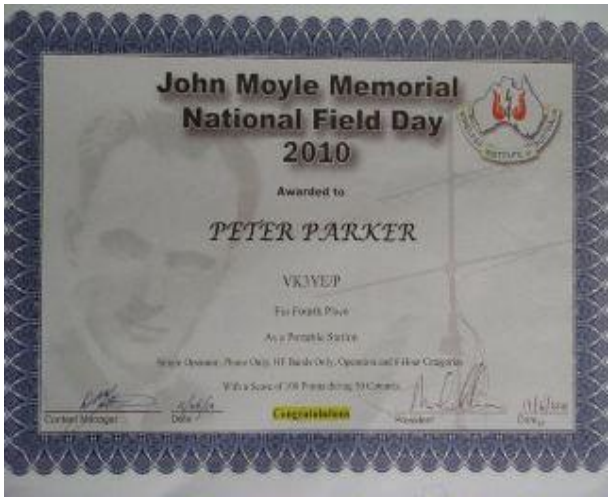
1 faint signals, barely perceptible
2 very weak signals
3 weak signals
4 fair signals
5 fairly good signals
6 good signals
7 moderately strong signals
8 strong signals
9 extremely strong signals

Tone

Scale of 1 to 9. Nearly all signals today are T9.

An earlier version of this article appeared in *Amateur Radio* June 1996. It has since been updated to reflect licensing and other changes.

Part 2



DXing

In amateur parlance, DX means long distance, normally defined by HF operators as being outside one's continent. There are many amateurs who, after establishing a station, enjoy talking around the world. DX operators have a variety of motives; some like experimenting with antennas, while others prefer to chase various operating awards.

As well as having an efficient station, good operating skills are important for the successful DX-er. These include a knowledge of radio propagation, being able to discern weak signals, a habit of listening around the band before transmitting, and a sense of timing when calling another station. Clear pronunciation, the use of standard phonetics on SSB, and steady sending on Morse are the hallmarks of the good operator.

Active DXers place great importance on contacting remote, obscure islands. Sometimes, groups of DXers may organise special voyages (called DXpeditions) to such islands, so that other amateurs may work them. These DX peditions are very costly, and organisers often solicit donations from amateurs and commercial sponsors.

When a signal from a DX-pedition is heard, there are often many stations trying to make contact. Quite appropriately, this wall of QRM is called a 'dogpile'. DXpedition stations may operate 'split-frequency'. This means that you listen on one frequency and transmit on another. For this reason, serious DXers use transceivers with dual VFOs.

Being able to be heard by a DX station is a matter of strategy and timing; the station might have a particular pattern of operating that you can exploit. When called by a DX station, make the contact brief, as you would in a contest, as many others may be waiting for their turn.

The impression gained so far is that the DXer is a rather competitive, solitary operator. This is not always so; some DXers hunt in packs. Several nets for amateurs who enjoy working DX, exist on the bands. In addition, DXers have set up spotter websites that alert users when a distant or rare station appears on the band. However this relies on someone being there to tune around and listen and it might as well be you.

Contests

A contest is an organised event where the aim is to make the most number of contacts within a given period. Apart from being an exciting and absorbing activity in its own right, contesting allows you to test the efficiency of your station, together with operating skills. With there being many stations on the

air at the one time, a contest is an ideal opportunity to have contacts with various countries or call areas so that you can work towards many of the awards on offer.

While most major contests run for 24 hours, some short contests ('sprints' or 'scrambles') run for only an hour or two. These short contests have simple rules, and are good fun.

Contest contacts are much shorter than most other amateur radio contacts; all you need to exchange with the other station is a five or six digit number, consisting of a signal report followed by a serial number starting at 001. This serial number increases by one for every contact you make, thus you might send 57003 to the third station you work in a contest. The object is to make as many contacts as possible within the contest period.

The following is a typical example of an SSB contest exchange between VK1AA and VK6AA.

(VK1AA): *CQ CQ CQ RD CONTEST, THIS IS VK1AA.*
{VK1AA seeking a contest contact}

(VK6AA): *VK6AA*
{VK6AA responds}

(VK1AA): *VK6AA, THIS IS VK1AA. My NUMBER TO YOU IS 57011*
{VK6AA's signal is 5/7, VK6AA is VK1AA's eleventh contact in the contest}

(VK6AA): *THANK YOU FOR THE 57011. MY NUMBER TO YOU IS 58001*
{ {VK1AA's signal is 5/8, this contact is VK6AA's first in the contest}

(VK1AA): *58001 RECEIVED. 73 AND GOOD LUCK IN THE CONTEST.*
{Contest contact ended successfully and both stations enter the contact in their logs. VK1AA continues calling CQ, while VK6AA looks for other stations calling CQ}

On CW, the procedure is similar, except there is a heavy use of abbreviations to save time (see Part One). Very often, nines are sent as 'N', and zeroes as 'T'. Thus, the first station you work might receive a '5NNTT1' number from you, which is the equivalent of a 59001 report on phone.

To formally enter a contest, a log of all contacts must be emailed or posted. A sample log sheet, suitable for most contests, is shown in Figure 1. Normally, a front summary sheet, which shows your name, callsign, total score and declaration that you operated ethically is stapled to the front of the log - the format for this is generally specified in the contest rules.

The major WIA-sponsored Australian contests are as follows:-

* Remembrance Day Contest (August)

* VK-ZL-Oceania DX Contest (October)

* Ross Hull VHF/UHF Contest (December/January)

* VHF/UHF Field Day (Summer, Winter, Spring)

* John Moyle Field Day (March)

In addition to the above are smaller contests run by local clubs or special interest groups. These are often confined to one or two bands and may be for a few hours only. Certificates are awarded to contest placegetters. Contest rules and results can be found at www.wia.org.au.

FIGURE 1 - SAMPLE CONTEST LOG SHEET

Name----------Callsign----------Contest----------

Date----UTC----Band---Mode---Callsign------RST/no. sent----RST/no. rec--------Points

_____
_____
_____
_____
_____
_____
_____

This log sheet is typical only, but should be acceptable for most contests. Read the rules applicable to the particular contest for more information.

Awards

An award is a certificate received for having contacted a specified number of stations in a certain geographic area, or on a particular mode. They range from the local club award to the internationally-recognised, and from the easy to the almost impossible.

The most well-known international award is the DXCC (DX Century Club), issued to those amateurs who have proved that they have contacted at least 100 countries. Other awards gaining prominence are 'Summits of the Air' (SOTA) and 'Islands of The Air' (IOTA) award for contacting a specified

number of mountain summits or islands.

The WIA has its own awards program, with certificates issued free to members. Its awards include:-

* WIA DXCC

* Worked All VK Call Areas (WAVCA) Awards (VHF and HF)

* Worked All States (VHF)

* Australian VHF Century Club

* WIA Antarctic Award

* WIA Grid Square Award

Refer to the WIA website for further information on the above awards. Those interested in collecting awards should maintain a log of stations worked.

Note that verification of contacts, for instance through QSL cards, is required to show proof of having worked a station; log entries alone are not sufficient. In some cases various forms of electronic QSLing may be accepted; read award conditions carefully.

The sound of local and international HF contests

(See this article at www.vk3ye.com for YouTube recordings of local and international contest activity)

QSLing

A long-standing tradition has been to exchange QSL cards after the completion of a contact. The practice comes from the days when working DX (usually with low power and home made equipment) was much more of an achievement than it is today. Many overseas stations tend to be almost obsessed with QSLing, to the point that they ask for a card even if filling in and sending the card takes longer than the original two-minute contact. In contrast, many VKs are more laid back, only sending cards for the more memorable contacts. It may be for this reason that we have the reputation of being bad QSLers.

Nevertheless, QSLing is almost mandatory for those who aspire to collect awards, which normally require cards to show evidence of contacts claimed. Also, the new amateur will often want to decorate the shack with cards received from distant countries. After a wall has been 'wallpapered', the

novelty often wears off, with many an amateur storing cards in shoe boxes in a seldom-opened cupboard.

Active HF amateurs always keep a stack of their own QSL cards, even if they were only sent infrequently for prized contacts. Cards should be of postcard size, and include your callsign, address and (preferably) your Maidenhead grid square locator number. It should include spaces for the callsign worked, UTC date and time, signal report, band, and mode used. Spaces on the card for your equipment, antenna and power output are also desirable.

There are two ways of sending cards. They may be posted via the normal mail system. While fast, it is expensive. Fortunately, the WIA and its sister societies have established QSL bureaus for use by members. These bureaus send and receive QSL cards in bulk, so postage costs are reduced. Though sending cards 'via the bureau' is slower than QSLing 'direct', the money saved is considerable, particularly if you are an avid DXer.

QSL Bureaus consist of two sections; Inwards and Outwards. The Inwards section receives cards from overseas and interstate, and distributes them to members, while Outwards accepts cards from you and forwards them to bureaus in other states/countries. Further information on the WIA website.

An increasing number of amateurs are not bothering with paper QSL cards. Instead they use eQSL or ARRL's Logbook of the World. As mentioned before it's worth checking the QSL policies of any awards you wish to claim before deciding on how you'll QSL.

QRP

QRP operation is the use of low transmit powers. Its adherents gain a special pleasure from working across the country or across the world with a couple watts of power. QRP, defined as the use of five watts or less on CW, and ten or less on SSB, is ideal for portable operation, where lightweight transmitting equipment must be used. In other words all Foundation licensees are automatically QRPers, at least on SSB. In addition, the low-cost and simplicity of QRP equipment makes building one's own transceiver a practical proposition, particularly for CW operation.

Practically the full range of operating activities, such as DXing, contesting and VHF operation can be done with QRP. An efficient antenna and good operating skills are required for maximum success. Ownership of special equipment is not required; QRP can be obtained from many 100 watt transceivers that can be turned down to 5 or 10 watts output.

QRP in Australia is promoted by the VK QRP Club, which publishes a quarterly magazine, runs nets and sponsors contests for QRP operators. More information on QRP, including video demonstrations of contacts, appear on www.vk3ye.com .

Conclusion

These articles have, I hope, given you a better knowledge of HF operation. As well as reading about it, the best way to learn is by listening and operating yourself. Extensive further information is contained on this and other websites.

An earlier version of this article appeared in *Amateur Radio* August 1996. It has since been updated to reflect licensing and other changes.

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