Additional notes for the VK3YNG MK4 Foxhunt Sniffer

1) You will need two good quality type AA Alkaline or Lithium batteries. Do not use standard "heavy Duty" or zinc carbon batteries.

2) The rear panel uses Nutserts which can come out if too much force is applied. Do not push down hard on the screws when undoing them.

3) Two Velcro strips are provided on the sniffer for quick release from an antenna. Only peel off the protective backing when you are ready to mount the sniffer on an antenna mounting plate.

4) The CD supplied contains the instruction manual and schematics. You will need Acrobat reader to view them. This can be downloaded from the Adobe (http://www.adobe.com) web site.

Happy hunting,

Bryan, VK3YNG.

http://www.users.bigpond.net.au/vk3yng/foxhunt

Using the MK4 foxhunt receiver to hunt short pulsed transmissions

The VK3YNG MK4 foxhunt sniffer (V2.2 or later) has a special mode for hunting very short duration "pulsed" or "pip"-like sounding transmitters.

These beacons have transmission times of typically around 40 milliseconds and are often used for tracking animals, rockets and model aircraft.

These short transmissions can be very hard to deal with when listened to in the standard tone modes on the VK3YNG sniffer. The transmission is usually so short that the user cannot distinguish the audio tone pitch to determine a direction. The sniffer has a new "peak extend" mode which stretches out the received pulse so that its signal level and resultant tone can easily be determined.

Setting up Peak Extend mode

To successfully look for these very short duration transmissions, the sniffer needs to be set up in "peak extend" mode with a range down delay of 5 seconds. To set this mode:

- Make sure the sniffer is turned off
- Press and hold the "6" button on the sniffer
- While holding this button, power up the sniffer with the "M" button
- The sniffer will beep and briefly display "J"
- Press the "7" or "dset" key. The sniffer will display "d".
- Press the "5" key
- The sniffer is now configured for "peak extend" mode

The peak extend mode only needs to be set once. The sniffer will remain in this mode for each subsequent use until another filter mode is set.

For pulsed transmissions that only occur every few seconds or longer apart, it may also be useful to activate "Peak hold" mode. For more information on this mode, consult the sniffer operation manual.

Note that if the sniffer is to be used for finding longer pulsed intermittent or continuous transmissions, the peak extend mode may be confusing. For hunting these signals, filter modes 1 through 3 are recommended. Filter mode "1" is the factory default. Also a range down delay of 5 seconds may be too long. A setting of around 2 seconds may be more appropriate. For more information please refer to the sniffer operation manual.

Using the Sniffer

Using the sniffer to locate a signal source is straightforward and intuitive. Just remember the motto "**highest range then highest tone**". Once the sniffer is powered up and the frequency or channel selected, operation is effectively hands free.

Power control and receive mode.

The sniffer is capable of receiving in 4 standard modes. These modes are *Tone, AM, Unmuted FM* and *Muted FM*. Pressing the "M" button powers up the receiver and cycles through these receiving modes. In most cases the *"Tone"* mode will be used to determine signal directions. The sniffer indicates this mode by briefly showing "t" on the display after the "M" button is pressed. Pressing and holding the "M" button for more than a few seconds will power down the receiver.

Channel selection

The receiver always powers up on the mode and frequency stored in channel 1. There are a total of 6 programmable channels on the sniffer. Recalling any channel is just a matter of pressing the appropriate channel button. For information on setting channel frequencies please refer to the sniffer operation manual.

The range display

The range display is effectively a measure of how much signal the sniffer is receiving. In effect it tells you how close you are to the signal source.

- 0 = Extremely weak signal or no signal
- 5 = Close to a medium power signal
- 9 = Very close to a very strong signal

The maximum number displayed when you point directly at a very close signal source will vary depending on how strong the transmitter is. A bit of practice with a typical transmitter will help you determine how the range display indication varies with distance.

Note: When you first set the frequency in peak extend mode, it may take a few pulses before the tone is properly heard, especially if the pulse duration is very short. It can take a few transmissions for the sniffer to determine the proper range to use. Once it has done so, the tone will be heard clearly.

Direction Finding Techniques

Using the sniffer for direction finding takes a little practice, but it doesn't take long at all to become proficient enough at it to find any beacon.
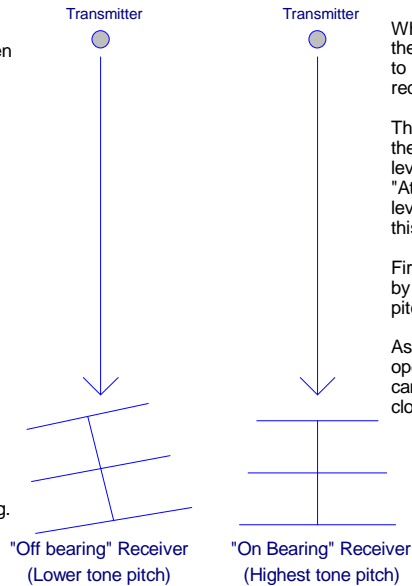
When trying to determine the signal direction, always swing the antenna from left to right over an arc of between 90 and 180 degrees through the "peak" of the tone pitch.

Transmitter

Transmitter

When heading towards the transmitter the pitch of the signal tone will continue to increase to a point just before the receiver saturates.

The processor inside the receiver sees the signal has reached the saturation level and automatically adds "Attenuation" which reduces the signal level. You will notice two things when this happens.

For a continuous signal, swing the antenna back and forth continually while walking towards the transmitter.

For intermittent pulsed signals, the same thing applies except that you will need to try different directions and wait for each transmission. Compare the tone pitch for the different directions and head towards the direction that gives highest pitch.

Every 10 steps or more, do a full 360 degree rotation to make sure that you haven't overshot the transmitter or followed a reflection or false bearing.

Firstly, the "range" display will increase by one range. Secondly, the tone pitch will suddenly drop.
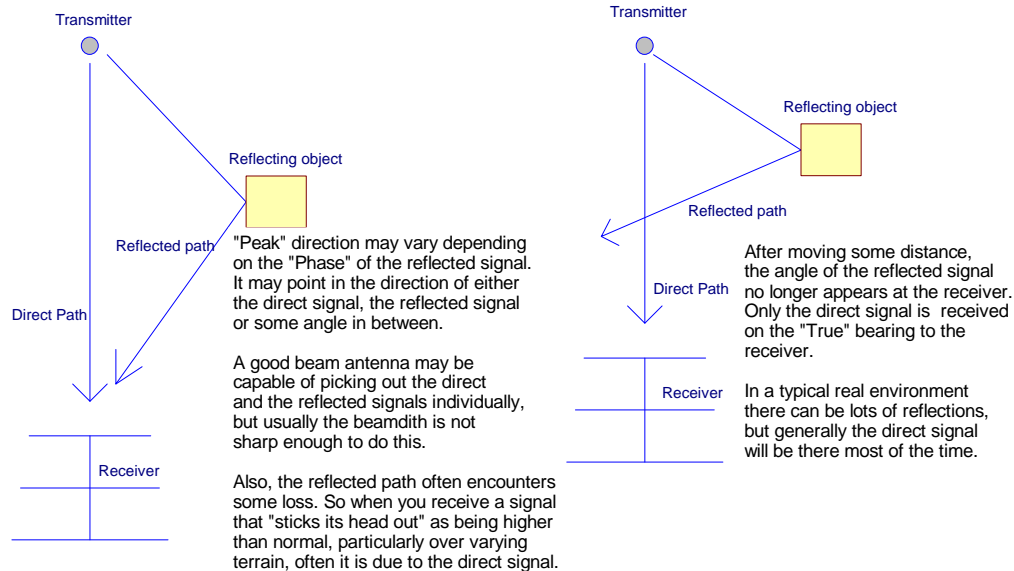
As you get closer to the transmitter, this operation will happen more often and can help give an idea of how much closer the transmitter is.

"Off bearing" Receiver
(Lower tone pitch)

"On Bearing" Receiver
(Highest tone pitch)

A few tips to remember:

- Always hold the receiver so the display can be easily seen and the speaker easily heard.
- Always keep sweeping the receiving antenna from left to right over a 90 to 180 degree arc while approaching a transmitter or signal source.
- Every few minutes, do a slow and complete 360 degree spin to ensure that you have not "overshot" the signal source or been fooled by a strong or local reflection.
- Always remember the motto *"Highest range then highest tone"* while using the sniffer.

The Multipath problem

The major problem to contend with at VHF and higher frequencies is a phenomenon called "multipath". This is where signals reflect off other objects such as metallic structures, hills and even vegetation. Signals in this case either skew or appear to come from multiple directions, hence the term "multipath". Signals in this case can either skew or appear to come from multiple directions. A good antenna can help sort out some reflections from the wanted signal, but in many cases reflections become something that you just have to deal with.

Transmitter

Reflecting object

Reflected path

Direct Path

Receiver

"Peak" direction may vary depending on the "Phase" of the reflected signal. It may point in the direction of either the direct signal, the reflected signal or some angle in between.

A good beam antenna may be capable of picking out the direct and the reflected signals individually, but usually the beamdith is not sharp enough to do this.

Also, the reflected path often encounters some loss. So when you receive a signal that "sticks its head out" as being higher than normal, particularly over varying terrain, often it is due to the direct signal.

Transmitter

Reflecting object

Reflected path

Direct Path

Receiver

After moving some distance, the angle of the reflected signal no longer appears at the receiver. Only the direct signal is received on the "True" bearing to the receiver.

In a typical real environment there can be lots of reflections, but generally the direct signal will be there most of the time.

The useful thing to know about reflections is that they come and go. In most cases if you always make the effort to determine the *strongest* signal, you will eventually end up at the signal source. With a bit of practice you can get fairly good at working out which signal is a reflection is which is a direct signal. The major thing to remember is to keep moving. Even if you do start following a reflection, you probably won't be doing so for long.

Multipath is a bit more difficult to deal with for intermittent signals but the techniques are the same.

Final Comments

With a bit of practice, hunting any signal source should be simple and straightforward with the MK4 sniffer. The peak extend mode makes hunting for short pulse signals almost as easy as continuous ones.

Once the receiver is properly set up, there should be no need to do any adjustments from the time the signal is first received through to when the transmitter is found. Using the MK4 sniffer to quickly and successfully find any signal source should be easy for anybody regardless of age or technical background.

VK3YNG Foxhunt Sniffer Instruction Manual

(Updated version for version 4.2 hardware and V4.2.01 or later firmware***)
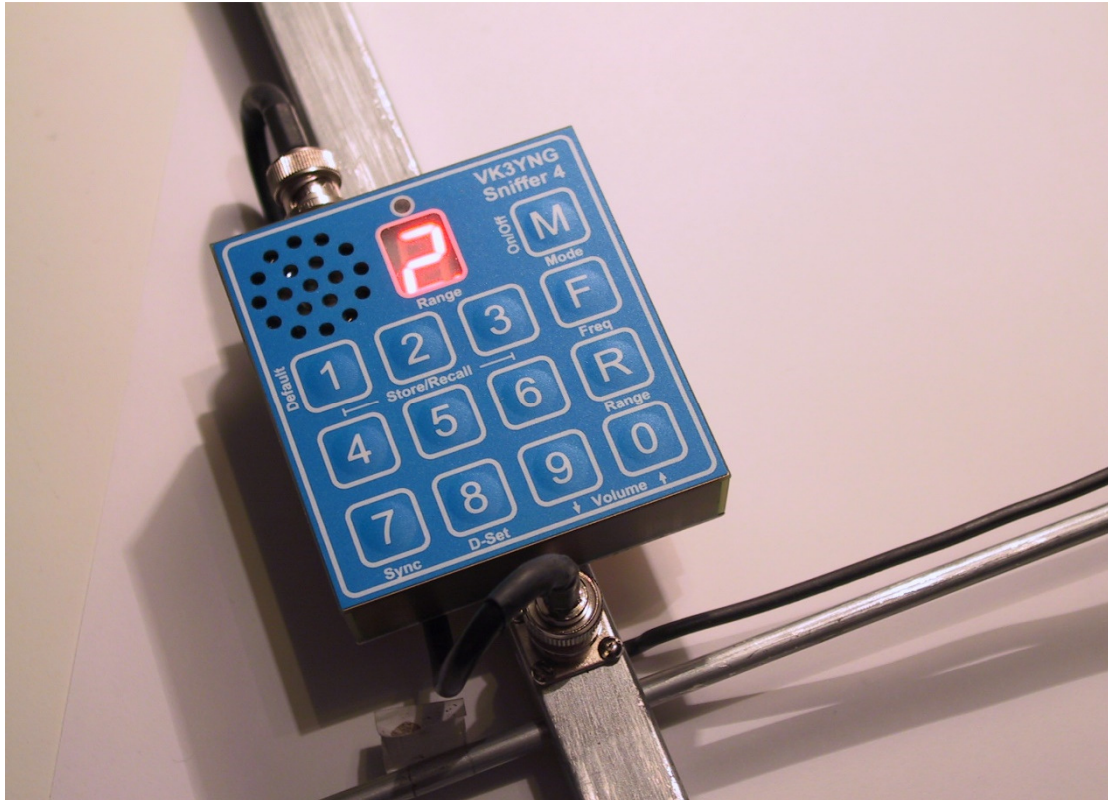

The VK3YNG Foxhunt Sniffer is a specially designed synthesised VHF direction finding receiver covering 120MHz and 144MHz bands.

The receiver is designed for quickly finding the direction of beacons or hidden transmitters. Anything from distant weak signals to very close "sniffing" of transmitters running many watts of output power can be pin pointed accurately without suffering "overload" problems that plague other designs. Full auto-ranging operation allows the operator to quickly and intuitively locate the source of a signal without twiddling knobs or watching meters. The operator is freed to concentrate on more important things such as negotiating terrain or reading maps.

***Note: *A number of features have changed since earlier versions of the sniffer were released. This manual reflects operation of version 4.2 hardware and cannot be used for all versions of the MK4 sniffer. For a copies of earlier sniffer manuals please refer to the VK3YNG foxhunt web site (see the end of this manual).*

Introduction

The VK3YNG sniffer is designed to allow quick, easy and accurate determination of the direction of a transmitted signal in either the 120-123MHz or 143-150MHz bands. The sniffer provides enough sensitivity to determine the direction of a signal from many kilometres or miles away. This is useful for ARDF, Radio Sport and general commercial or Civil Air Patrol use. It also provides enough attenuation to accurately determine the direction of signals right up to the source of the signal without suffering from overload or compression effects.

Attenuation (signal reduction) is provided automatically in steps of approximately 15dB each time a particular signal strength threshold is reached. The number of 15dB steps of attenuation is shown on an LED display. For example, a display value of zero indicates maximum sensitivity, where a value of 9 indicates a close or very strong signal that requires approximately 135dB of attenuation.

Signal strength indication is provided by an audible tone that increases in frequency (pitch) with increasing signal level. This is done because the human ear is a much more sensitive to changes in pitch than sound level. There is also no inertia or overshoot problems as tend to occur with signal meters. A special software algorithm ensures that the received signal strength tone does not suffer from "compression" effects that occur at higher signal levels with some designs.

Auto Power Down

The sniffer will automatically power down if either of the following two conditions are met:
1) There has been no key pressed for at least 10 minutes.
2) There has been no "upward" progression in range for at least 10 minutes.
The sniffer will give five short beeps just before the unit powers down.

Low Battery Indication

The sniffer functions accurately to supply voltages down to approximately 2.3 volts. Below this the accuracy becomes compromised or the sniffer may power itself down.

When power has dropped to 2.3 volts or lower, the display decimal point is enabled to warn the user that batteries are in need of replacement.

Display Brightness

A high efficiency Seven Segment Orange LED is used for the range display. It has two brightness settings, one for daytime use and a significantly reduced brightness level for night use. A light sensor located immediately above the display automatically determines the brightness level.

Reduced Functionality mode:

This mode may be useful for children or first time operators. It allows the sniffer to be used in its most basic format and hides all programmability options from the user. This mode is very useful for scout foxhunting for example. For this reason, many refer to this mode as "Scout Mode". This mode also has some special features to aid beginners.

Quick Button Reference:

The following table gives quick index to key functions in both normal and reduced functionality modes.

Button	Operation in Normal mode	Operation in reduced functionality mode
1	Recall channel 1 (Hold to store frequency/mode)	Recall only channel 1
2	Recall channel 2 (Hold to store frequency/mode)	Recall only channel 2
3	Recall channel 3 (Hold to store frequency/mode)	Recall only channel 3
4	Recall channel 4 (Hold to store frequency/mode)	Recall only channel 4
5	Recall channel 5 (Hold to store frequency/mode)	Recall only channel 5
6	Recall channel 6 (Hold to store frequency/mode)	Recall only channel 6
7	Band Scan or ARDF mode Start of cycle Synchronisation function.	No function
8	Range down Delay Set/Display. 1 to 5 seconds. 0=peak hold mode. (7-9 are special functions)	Battery level
9	Volume Down	Battery level
0	Volume Up	No function
R	Manual Range set/disable	No function
F	Frequency Entry (4 digits follow)	No function
M	Power/Audio Mode Select (Tone/AM/FM, Hold for power off)	Power On/Off only (instant power off)

Alternative Key Functions:

The default operation mode of the sniffer can be reconfigured by holding down certain keys while powering up the unit. The sniffer will maintain this operation mode for subsequent power up/down cycles. Even if batteries are removed.

Button	Display during power-up	Function if pressed during power-up
1	N	Filter "A", Minimum Tone filtering. (fastest response)
2	O	Filter "B", Medium Tone filtering
3	P	Filter "C", Maximum Tone filtering (slowest response)
4	A	**A**RDF mode. Synchronised at power-up. Sync key is used to re-sync the transmitter cycle.
5	C	S**c**an mode. Sync key is used to scan for strongest signal between frequency stored in channels 5 and 6.
6	J	Filter "D", Tone Extend Mode. Used for very short duration signals.
7	H	Normal operation. Resets all options below:

8	L	**L**ow-Tone mode (RSSI tones at quarter frequency. Resolution slightly reduced at low tone frequencies)
9	G	Mt **G**ambier mode (10 fixed channels)
0	o,d,b,A	LED display brightness mode (**d**ull/**b**right/**A**uto)
F	S	Reduced key functionality mode ("**s**cout" mode)
R	T	Enable morse code announcement **t**ones

Detailed Button Operation

M *Mode/Power switch:*

Power On:

Pressing this button once powers on the unit to the frequency and mode stored in memory channel 1.

Mode Selection:

Pressing this button momentarily while the unit is powered up cycles the unit through its operating modes and briefly displays the selection on the display. The modes cycle through in the following sequence: "**A**" – AM reception, "**U**" – Unmuted FM reception, "**F**" – Muted FM reception and "**t**" – Signal strength Tone. The cycle then repeats. When headphones are used, one channel is always set to give signal strength tone, while the other channel follows the selected mode. This is useful for hunting different continuous carrier transmissions where the transmitters' identification is given using either AM of FM modulation.

FM Mute:

The Muted FM mode offers a pseudo FM mute function to mute all receiver audio when the sniffer is not receiving a signal. This is a signal based (rather than noise based) mute that activates whenever the received signal is below the lower range threshold on ranges 1 upward and is always active on range 0.

Power Off:

Pressing and holding the Mode button for greater than 1 second will power down the unit. In reduced functionality mode, the unit will power off immediately when the Mode button is pressed. The mode switch operates only as a simple on/off switch in reduced functionality mode.

1 through 6

Memories

Buttons 1 through 6 allow storing and recalling of memory modes and frequencies.

Recall functions.

Pressing any of the buttons 1 through 6 in normal operation mode will recall the frequency and mode stored in non-volatile memory. In normal operation mode, the display will display the last 4 digits of the selected memories frequency in kilohertz. For example, a stored frequency of 147.425MHz will flash up the sequence "7 4 2 5". The first two (100 and 10) megahertz digits are inferred by first entered digit as per the following table:

Setting of "MHz" digit	Band selection
0, 1, 2	120-122.995MHz
3 through 9	143-149.995MHz

The recalled frequency is not displayed in reduced functionality mode.

Store functions

Pressing and holding any of buttons 1 through 6 will result in the selected frequency and mode being stored in the selected memory. The button must be pressed and held until two short beeps are heard in succession. This confirms that the data has been committed to memory.

The Store function is disabled in reduced functionality mode.

 Sync Button

ARDF Sync:

This facility is used to synchronise the receiver for use in international style (ARDF) foxhunting for a one-minute cycle, five-transmitter system.

In ARDF mode this timer is automatically synchronized when the receiver is switched on. Three short beeps are generated as confirmation of this mode. Pressing the Sync button re-synchronises this timer. Three short beeps are given to confirm this button has been pressed. The sync button should be pressed at the start of transmitter one's cycle.

At 50 seconds into the cycle, the sniffer will generate three short beeps giving 10 seconds warning that the current transmitter's cycle is about to end. If the sniffer is currently receiving at range 1 or lower, at four seconds before the completion of the current transmitter cycle the sniffer broadcasts a number of beeps corresponding to the number of the transmitter in the cycle which is about to commence. The pitch of these beeps is set slightly lower than the "50-second" beeps. The display also briefly flashes the number of the next transmitter. If a range down delay (d-Set) of zero is selected and the sniffer is not currently configured for manual ranging, the sniffer will automatically select range zero at the start of the next transmitters' cycle regardless of the current signal strength.

The ARDF sync mode is entered by pressing and holding the "4" button during power-up. It is cancelled by returning to Scan mode.

Band Scan:

When ARDF mode is not selected, the "7" key performs a basic band scan operation where the sniffer hunts for the highest signal between the two frequencies stored in channel locations 5 and 6. The highest signal found is stored in channel 4. The scan will ignore any signals within approximately 10KHz of the frequency stored for channel 1 and the signal must be detectable at range 2 or higher to be stored.

This operation takes some time to complete, especially if there is large frequency difference between channels 5 and 6. The scan function works best for continuous signals and may not properly detect intermittent transmissions. Channel 5 must be lower in frequency than channel 6 and both frequencies must be within the same band (i.e. 120MHz or 140MHz)

The SCAN mode is entered by pressing and holding the "5" button during power-up. It is cancelled by entering ARDF Sync mode. Scan mode is the factory default.

Other functions:

Holding the "7" key during power-up cancels the Low RSSI Tone mode, disables Morse code tones, sets LED brightness to "auto" and disables Reduced Key Functionality (scout) mode. In this mode the signal strength tones function normally

and the maximum signal strength pitch is 8KHz. This mode is set as the factory default. (*Note: this facility operates differently in older firmware versions)

This key is disabled in reduced functionality mode.

8 *D-Set button*

Ranging up on the sniffer happens automatically with minimal delay. To implement short term peak detection, there is an intentional delay before the sniffer ranges down. This delay is programmable between 1 and 5 seconds using the D-Set button. For beginners, a value between 3 and 5 seconds is recommended. For more advanced users, 1 or 2 seconds gives better results. When hunting intermittent and very short duration transmissions such as those used on dog collars or wildlife, 5 seconds or "peak hold" mode (see below) is recommended. The factory default is 2 seconds.

To set the range down delay, press the "D-Set" button. The display will respond by displaying the letter "d". Pressing buttons 0 through 5 will then set and store the new range down delay.

Pressing the D-set (8) button twice will briefly display the current range down delay in seconds. The display then reverts to displaying the current range.

Setting a range down delay of zero disables down ranging. In this case the sniffer operates in a "peak hold" mode and down ranging is disabled. Manual ranging is disabled and pressing the "range" button will reset the current peak hold range to zero. This mode is useful when hunting extremely intermittent signals such as dog collar, wildlife or model aircraft beacons.

Holding the "D-Set" key during power-up causes the sniffer to operate in lower tone RSSI mode. This mode may prove useful to those who have difficulty hearing higher audio frequencies. In this mode the signal strength tone frequencies are divided by 4. The top tone pitch is limited to about 2KHz and resolution becomes slightly limited at the lowest tone frequencies. (Note: this mode has no effect on the pitch of supervisory beep and tone frequencies)

This key is disabled in reduced functionality mode.

Special note: "Dset 0" in "Scout" mode:

In version 3.0 or later, if peak hold mode (Dset 0) is selected before the sniffer is set up for reduced functionality ("scout") mode, the peak hold behavior behaves slightly differently. If a strong signal disappears for more than 5 seconds, the sniffer will range down by **one range only**. As with normal peak hold behavior it will stay there until the range is reset or the channel or frequency is changed.

This operation was added to give beginners a second go at a signal source if they happen "over shoot" it and the signal falls below the current peak range.

Uptime indication:

Pressing the "D-Set" button then pressing "7" will display 4 digits indicating the number of hours and minutes since the receiver was powered up. This can be useful for ARDF events where the user may have forgotten to synchronise their watch.

Relative Battery Voltage indication:

Pressing the "D-Set" button then pressing "9" will display two digits giving an indication of the relative battery capacity in percentage terms. 99% indicates a full battery while 0% indicates the point where sniffer operation is significantly compromised. The sniffer may power itself off before reaching 0%.

In reduced functionality (scout) mode, battery capacity is displayed by just one pressing of the "D-Set" button. (Since in this mode D-Set options are NOT made available to the user)

Firmware version indication:

Pressing the "D-Set" button and then pressing the "F" button will display 4 digits which indicate the installed firmware version.

 ## 9 0 *Volume Control*

During normal operation, the "9" and "0" buttons allow the setting of volume. The display briefly shows the new level and reverts to displaying the current range when the button is released. These buttons are disabled in reduced functionality mode.

 ## R *Range Control*

Normally the sniffer automatically selects the best range for the currently received signal. In some situations it may be necessary to range the sniffer manually. The range control button can be used for this purpose. This button also controls a number of other features depending on the mode selected.

In auto-ranging mode, pressing this button briefly displays the letter "r" in the display, and then the display reverts to displaying the current range. Pressing any digit then manually selects the range. The display briefly displays "r" followed by the selected range. The sniffer remains in manual ranging mode until defeated by pressing the "R" button a second time. This re-enables auto-ranging.

Holding this key during power-up enables announcements of range, frequency and various other functions using morse code. This feature has been added to assist blind operators using the receiver. *(Note: This is a new feature in version 4 and its operation is subject to change. More information on its operation will be available on the web site. Powering up with the "7" button pressed disables morse announcements. See the section on the "Sync" button for more information.)*

This key is disabled in reduced functionality mode.

Peak Hold Mode

This range button also resets the peak range hold function if the down range delay (D-set) is set to zero. In peak hold mode, manual ranging is disabled.

Peak range memory

If the range button is pressed twice in succession, the display will briefly show the maximum range the sniffer has achieved since power up or the last successful frequency change. *(In version 3.0 or later, pressing "Dset" and then "Range" also performs this same operation)*

In ARDF mode, (see Sync button section) the peak range value is automatically reset near the end of the next transmitter cycle. This is very useful if there is a need to check what range the sniffer got to just before the previous transmitter finished its cycle.

This function is not available when Peak Hold mode (dSet=0) is selected.

 ## F *Frequency Entry*

The sniffer can operate at any frequency in the range 120.000-122.995 and 143.000 - 149.995MHz* in 5KHz steps. Pressing the "F" button initiates frequency entry. The display confirms this by displaying "F". The sniffer then expects four digits to be keyed in to set the desired frequency. If an error occurs while entering frequency, the letter "E" is briefly displayed and the sniffer then reverts to the previous operation frequency. The first digit sets both the 1MHz frequency and the band. 0 through 2 sets the 120MHz band. 3 through 9 set the 140MHz band.

Factory default frequencies

Memory	Frequency	Mode
1	145.300MHz	Tone
2	145.700MHz	Tone
3	144.250MHz	Tone
4	146.500MHz	Tone
5	121.500MHz	Tone
6	146.575MHz	FM

Note: 121.5MHz is used as an international personal, maritime and aeronautical distress beacon frequency. With an appropriate antenna, the sniffer can be used to locate the homing frequency of PLB, ELT and EPIRB emergency beacons.

For the scan function to work correctly, the frequencies stored in channels 5 and 6 should be in the same band. This is not the case for the factory default configuration.

Direct frequency entry is not permitted in reduced functionality mode.

(*Note: Some special versions of the sniffer operate with different frequency ranges to those indicated above. The label on the rear of your sniffer will indicate the frequency range your sniffer covers.

Some special "narrowband" versions also allow 1kHz resolution. In this case the fourth digit entered can be any number from "0" to "9" instead of only "0" or "5".

2.5kHz resolution can be available for some special builds. In this case "2" and "7" are also valid and correspond to xxx.xx25 MHz and xxx.xx75 MHz respectively.)

Configuring the Sniffer

The MK4 sniffer has a number of configurable features. Some of these have already been described in the previous sections. The rest are explained here.

Tone (RSSI) Filtering:

There are four levels of filtering available on the MK4 sniffer. These are selected by holding buttons 1, 2, 3 or 6 when powering up the sniffer. The sniffer will retain this setting until the next time it is changed.

Minimum filtering (1):

This level of filtering is the same as the original MK4. It offers the fastest and most accurate tracking of the received signal level. On transmitters with a high AM component (Such as ARDF transmitters), the tone can become quite "thick" sounding as the tone tries to partially track the modulation. In this case filter modes 2 or 3 are recommended. Setting "1" is the factory default.

Medium Filtering (2):

This level of filtering offers the best compromise between response time and Amplitude modulation (AM) filtering. This is the most recommended setting.

Maximum Filtering (3):

This mode provides maximum filtering of the received signal and is similar to that of the VK3TJN/XAJ Ultra-sniffer. While this mode offers the best smoothing of received signals it can significantly "blur" the definition of short duration pulses.

Peak Extend mode Filtering (6):

This is a special mode for use with very short duration repetitive signals such as those emitted from dog collar, wildlife or model aircraft transmitters. The transmitters used are typically very low power and transmit for around 40 milliseconds every second or two. The tone pitch and therefore signal direction can be very hard to determine using the above filtering modes.

This special mode extends the time of the peak level of the received signal so that the user can easily compare the signal level from different directions.

ARDF/Scan Mode:

ARDF Mode (4):

Holding the "4" button while powering up puts the sniffer into ARDF mode. In this mode the sniffer will power up giving three beeps and will synchronise the ARDF timer. For more information see the section on the Sync Button.

Scan Ready (Non-ARDF) Mode (5):

Holding the "5" button while powering up puts the sniffer into scan ready mode and disables ARDF mode. In this mode the sniffer gives a single beep during power up and the sync button executes a band scan function. This is the factory default. For more information see the section on the Sync Button.

Low Tone Mode (8):

In this mode the signal strength tone frequencies are divided by 4. See the description of the "Dset" button for more info.

Gambier Mode (9):

This is a special mode for Australian Championships "fox-or" foxhunting. In all numeric keys including "7", "8", "9" and "0" keys are reallocated as fixed frequency channel recall buttons. The sniffer is set up to recall a set of 10 frequencies that match the transmitters used in the Mount Gambier event. This is done without affecting the frequencies stored in the 6 standard memories. Resetting from this mode (by powering up with the "7" key) will revert back to the previously programmed settings. Note that when this mode is set the functions normally allocated to these buttons (Sync, Dset and Volume) are not available.

Channel Key	Frequency	Channel Key	Frequency
1	144.000	6	145.250
2	144.250	7	145.300
3	144.500	8	145.500
4	144.750	9	145.700
5	145.000	0	145.750

These frequencies are fixed. There is no facility for storing different frequencies in this mode. However, selection of a different audio mode (AM/FM/TONE) can be stored permanently by pressing and holding any one of the first six (1..6) buttons. This stored mode setting only applies in Gambier mode.

When the sniffer is reset (powering up using the "7" button) it reverts back to the settings stored in the individual channel memories. But if the sniffer is set back to Gambier mode (power-up "9") it will recall the audio mode that was previously saved. The audio mode setting is NOT cleared by the reset function.

Display (and keypad) LED brightness (0):

This key is a toggle for the brightness level of the display and keypad channel indication LEDs if this option is fitted.

This button cycles between "Dull" (display "d"), "Bright" (display "b"), "Off" (display "o") or "Auto" (display "A"). "Off" and "Dull" settings are provided to reduce battery consumption in low light conditions or when the option is not required. The "off" setting only applies to the keypad LEDs if fitted. For the range display operates the same as the Auto setting. The Auto setting is the factory and user reset default.

The "Reset" power up key (7) sets the keypad LEDS to "Auto" brightness. Gambier mode defaults to "full" brightness.

Reduced Functionality Mode (F):

In this mode, most of the special features of the sniffer are disabled. This mode is useful when a newcomer or a scout group etc uses the sniffer. (Hence why some users call this "Scout Mode") Memories can only be recalled and most of the other keys, including volume control are disabled. The power button only acts as a simple on-off and the mode of operation is defined by what is stored for each channel.

To set the sniffer in reduced functionality mode, press and hold the "F" button while powering up.

To cancel reduced functionality mode, press and hold the "7" key while powering up.

Range Tones Announce (R):

Enables the "range tone announcement" mode. See the description of the Range key for more info.

Function Reset (7):

This key resets or cancels the following modes if they are set:
1) Low Tone mode,
2) Range Tones (Morse) Announce,
3) Reduced Functionality (scout) mode,
4) Gambier Mode
5) Sets keypad LEDs to "dull" brightness (if option fitted)
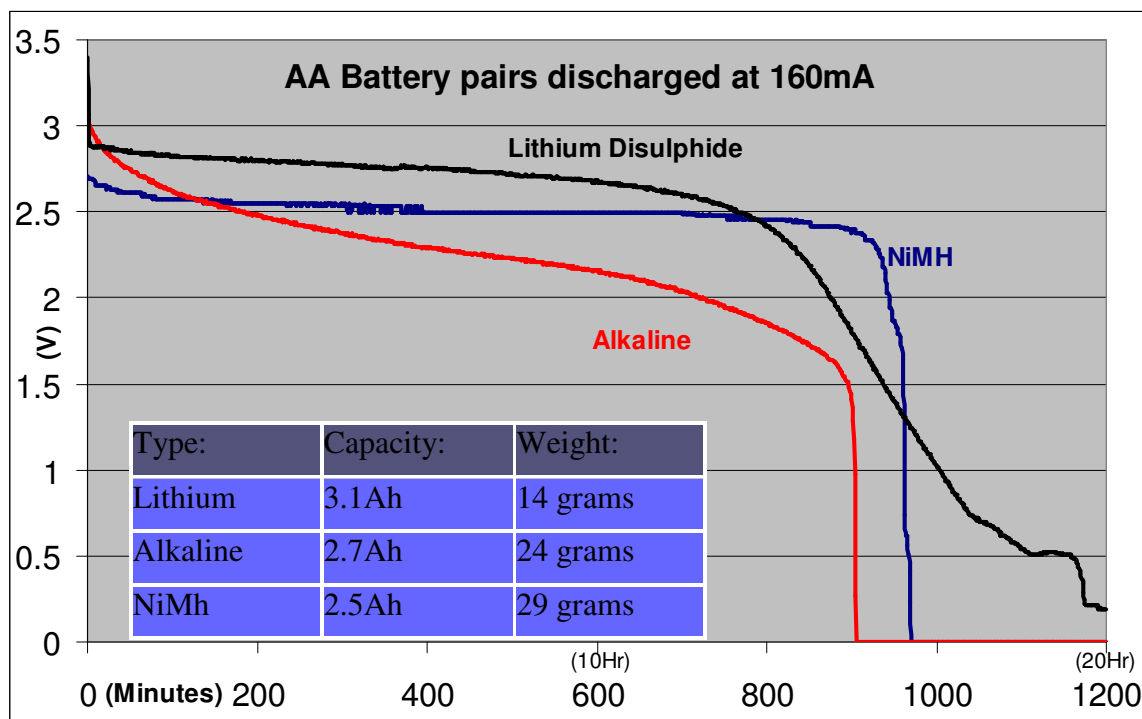6) ARDF mode. (V4.1.00+ firmware only)

Battery Selection and Maximizing Battery Life

There are a number of solutions for extending battery life with the sniffer. The most critical one is the volume setting. Battery life is reduced considerably when using the internal speaker on a high volume level with a continuous signal. Use the lowest volume level possible when using the internal speaker or use external headphones. The display also operates at a higher intensity level for daytime use that puts more load on the battery. Typically night time only operation increases alkaline battery life by about 30%.

Zinc Carbon and General Purpose Manganese, or so called "Heavy Duty" batteries are not recommended. The internal resistance of these batteries is too high to get reliable operation from the sniffer. Also these batteries often leak when they go flat and damage components. **Use of these batteries will void the sniffers warranty.**

This version of the sniffer can run off higher capacity NiMh batteries. These batteries may be considered to save on battery costs if the sniffer is used very regularly. But performance will not be as good as Alkaline. Because of the lower terminal voltage (1.2V) the sniffer will always indicate these batteries as partially depleted, (normally around 50%) even when fully charged. The battery "%" reading is based on the Alkaline discharge curve. When the batteries go flat the sniffer will stop operating abruptly with little or no warning. The sniffer also provides no means of charging these batteries. They must always be removed for charging.

There are other battery technologies now becoming available. These options can be considered provided the total terminal voltage never exceeds 4.2 volts. Unlike the previous version (4.1), version 4.2 of the sniffer **can** use single use Lithium batteries. **Rechargeable Lithium-Ion batteries MUST NOT be used** as the terminal voltage of a single cell (3.7V each, 7.4V for a pair) is way too high for the sniffer. The excessive voltage from using a pair of these batteries will damage the sniffer!

AA Battery pairs discharged at 160mA

Type:	Capacity:	Weight:
Lithium	3.1Ah	14 grams
Alkaline	2.7Ah	24 grams
NiMh	2.5Ah	29 grams

The above graph shows the discharge rates of the typical battery options. It shows that the single use Lithium and 2500mAh NiMh can significantly outperform even the best alkaline batteries. New low self discharge offerings like the Panasonic "Eneloop" or Eveready "Recharge Extreme" can be considered if you use the sniffer regularly and wish to save money in the long run.
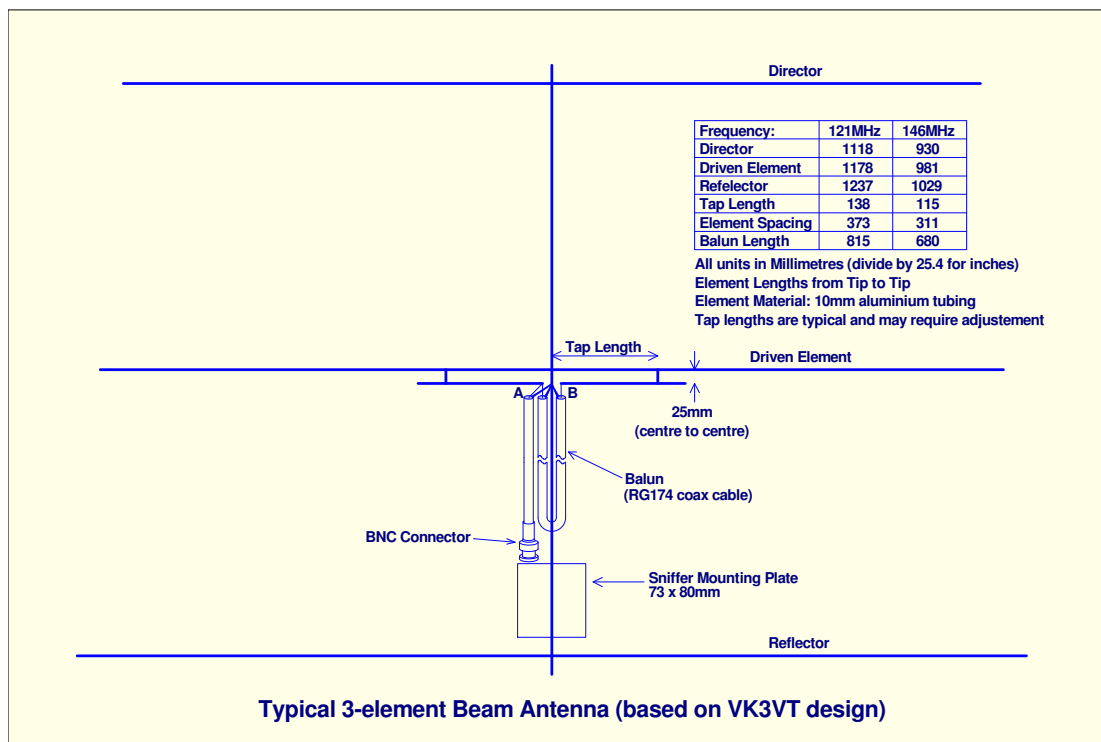
The lower published per cell terminal voltage of NiMh (1.2V) can become irrelevant as time increases since the voltage is essentially constant. A downside is that the weight of these high capacity rechargeable batteries is around twice that of Lithium. Standard NiMh rechargeable batteries are not recommended for infrequent use. The self discharge rate of these batteries will mean that they will go flat after sitting unused in the sniffer for only a few months where Alkaline batteries will maintain their usability for a much longer period.

Note also that due to the higher terminal voltage, Lithium batteries will always report full battery and won't give much warning when they are about to reach the end of their life.

It is always recommended to remove batteries of any type when the sniffer is not in use for extended periods. Also this is often a requirement if the sniffer is to be transported by aircraft.

Sample antenna designs

The antenna design is largely a matter of personal choice. For portable use, designs vary between two and four elements. More elements give better directivity and more precise bearings but are more difficult to carry around. For most situations, three elements offer a good compromise. Here is an example of antenna designs for 120 and 146MHz.

Director

Frequency:	121MHz	146MHz
Director	1118	930
Driven Element	1178	981
Refelector	1237	1029
Tap Length	138	115
Element Spacing	373	311
Balun Length	815	680

All units in Millimetres (divide by 25.4 for inches)
Element Lengths from Tip to Tip
Element Material: 10mm aluminium tubing
Tap lengths are typical and may require adjustement

Tap Length — Driven Element

A B

25mm
(centre to centre)

Balun
(RG174 coax cable)

BNC Connector

Sniffer Mounting Plate
73 x 80mm

Reflector

Typical 3-element Beam Antenna (based on VK3VT design)

Specifications:

Frequency Coverage	120-122.995MHz, 143-149.995MHz in 5KHz steps
Channel Bandwidth	16KHz
Sensitivity	Better than -120dBm
Maximum signal level	+26dBm
Power Supply	3VDC (2xAA Alkaline or Lithium penlight cells)
Battery Life*	Typically 3+ hours (alkaline), 14+ hours (Lithium)
Memories	6, programmable (stores mode and frequency) or 10 fixed.
Receive modes	AM, FM, Signal strength Tone
Max RSSI frequency	Programmable 2KHz or 8KHz
Size	76mm(W), 80mm(H), 25mm(D) not including BNC connector
Antenna Connection	BNC
Headphone Connection	3.5mm stereo

*Note: Battery life is dependant sound level and display intensity. See section on battery life.

VK3YNG Sniffer MK4 - Block Diagram
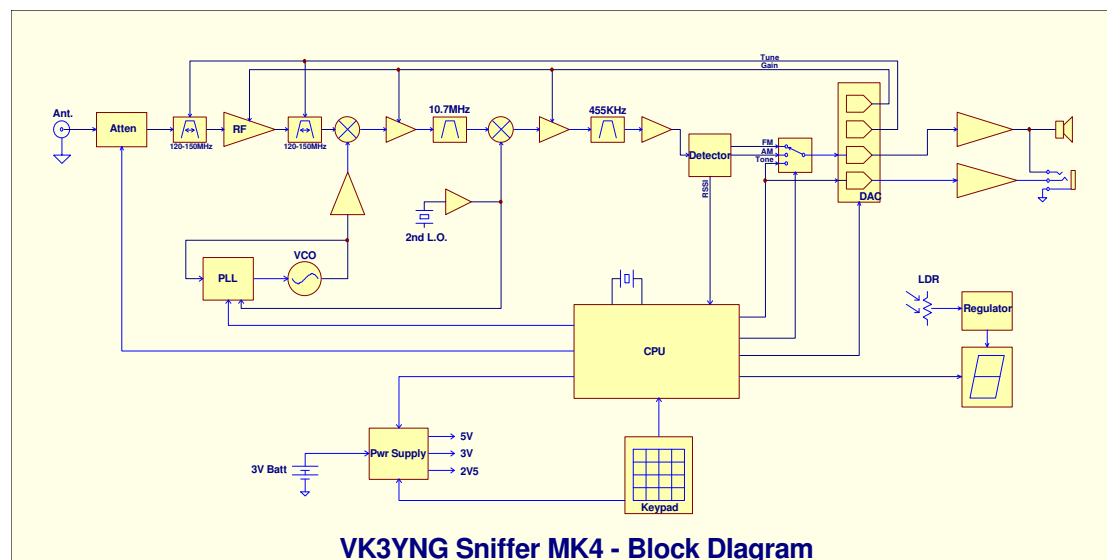
Links:

More information on foxhunting and techniques can be found on these web sites:

Australian ARDF website:
http://www.ardf.org.au

Joe Moell's Foxhunting website. (A very good foxhunters resource)
http://www.homingin.com

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