

K2 CW Filter Alignment Procedures Using Spectrogram¹

ver. 5 01/17/2002

It will be assumed that you have already performed the RX alignment procedures in the K2 manual, that you have already selected the CW filter bandwidth (BW) for all filters you wish to use for CW reception, AND that you have (more or less) properly placed the BFO settings on the *correct side* of each of the CW the filters (CW Normal and CW Reverse)... not necessarily *exactly* where you want them, but close, using the directions provided in the K2 FILTER Alignment section of the manual. These steps are ESSENTIAL to help ensure that you set the filters correctly. **Also, be certain that your FCTR probe is connected to TP2 in the K2.**

If you have not already performed the steps outlined above, DO SO NOW, before continuing.

NOTE: If you have installed the KAF2 AF filter, **be sure** to set **AFIL** to **OFF** before you proceed to set the filters.

READ THIS ENTIRE DOCUMENT COMPLETELY one time, then return to step 1 and proceed with the alignment. These instructions *assume* that you have your filter bandwidths set to run from wide to narrow. If your bandwidths are reversed, you may wish to begin alignment with a filter selection other than FL1. The ORDER in which you select the filters is NOT critical, however, the order in which the steps are performed *is* critical.

When aligning the K2 CW filters for best reception, it is *essential* that the BFO be properly positioned within the passband of the CW filter. This means that not only must the received signal be centered within the filter passband, but that it also is positioned on the proper *side* of the CW filter passband.

First, a double-check to confirm BFO positioning within the filter:

- 1) Turn the K2 on, select the CW (Normal) mode, and tune to an **empty** spot on a band between 1.8 MHz and 18 MHz (preferably the 7 MHz band) where some background noise (but *no* signals) can heard. You must have some sort of an antenna (or a noise generator) connected to the ANT input of the K2 in order to obtain sufficient noise for the Spectrogram alignment.
- 2) On the K2, tap **[MENU]** and use **[Band+]** or **[Band-]** to scroll through the setting options, shown on the left side of the display, until you reach the **CAL** option.

Press-hold **[MENU]** until the cursor shifts to the right side of the display and then use **[Band+]** or **[Band-]** to scroll through the setting options on the right side of the display until you reach the **FIL** option.

Press-hold **[MENU]** until the display indicates a value of **FLn xxx**, where 'n' is a number 1 - 4.

- 3) Tap **[Xfil]** until your widest BW filter is selected (as indicated by the 'xxx' decimal value on the right side of the LCD display).
- 4) Tap **[Band-]** to switch to the BFO (**BFn**) display. You should now see a 3-digit numeric value between '000' and '255'. This is the BFO frequency value which is currently programmed into the Digital-To-Analog Converter (DAC) for the selected CW filter and filter bandwidth.
- 5) Using the VFO knob, set the DAC count to read "000" on the LCD display. This gives us a starting point.
- 6) Turn the VFO knob **clockwise** (increasing the 3-digit DAC value) until you reach an indicated "255" on the display. **As you tune** from "000" to "255", you will hear the 'tone' of the background noise go from a fairly high pitch, down to a low pitch, and then back up to a high pitch again. **RECORD** (on paper) the point at which the background noise is at it's **LOWEST** pitch. This marks the **CENTER** of the filter passband.

If you are attempting to align filters for the CW (**normal**) mode (and on 1.8 MHz thru 18 MHz), **all** 3-digit DAC counts **must** be **lower** than the DAC count you recorded for the filter center. If you are aligning the CW **REV** filters, all 3-digit counts must be **above** the DAC filter center count.

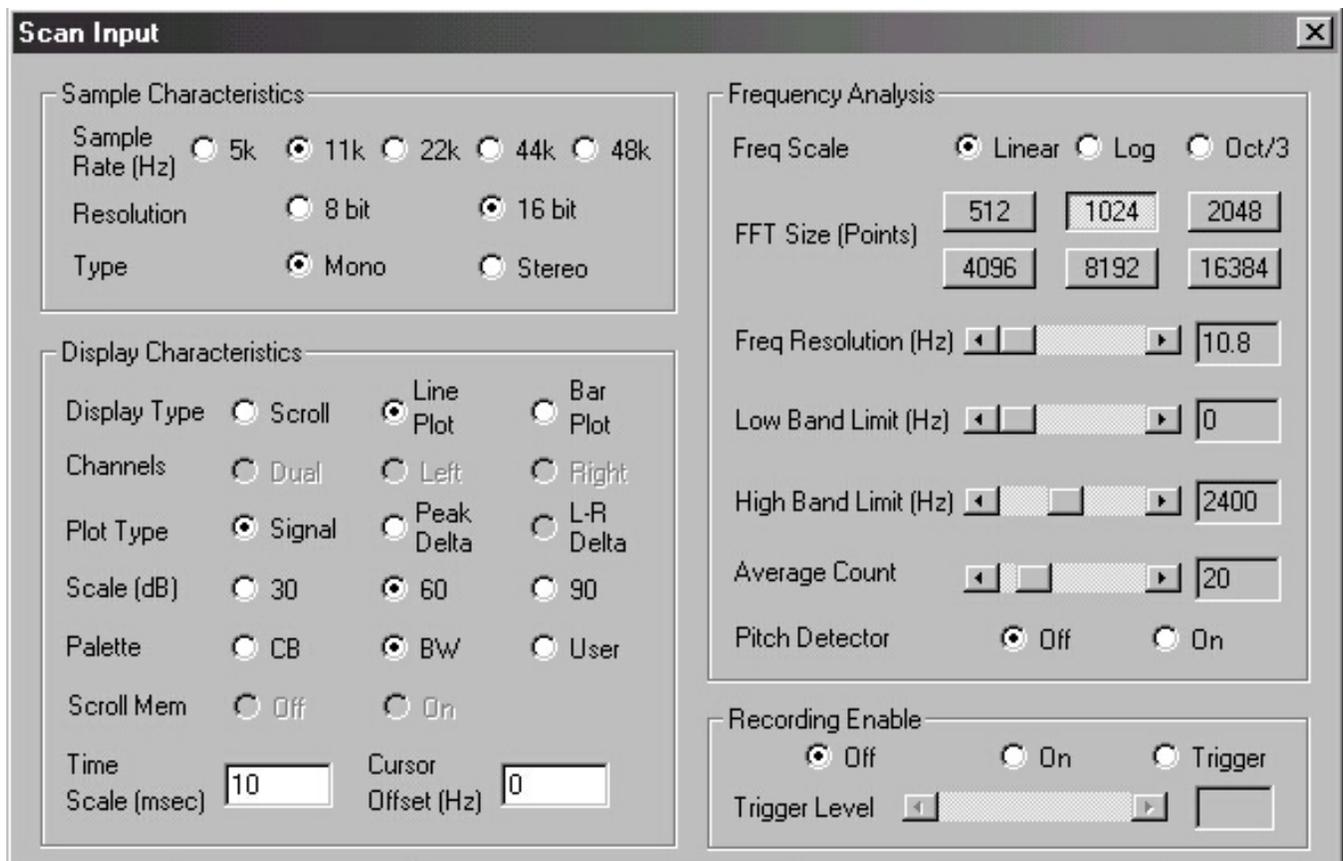
Depending upon which filter mode you are setting, if the DAC count for that mode (and that specific filter) is NOT properly above or below filter center, all you need to do is to adjust the VFO knob to cause the BFO (and the DAC count) to shift to the other side of the DAC filter center count, then proceed with fine tuning of the BFO setting, using Spectrogram.

Using Spectrogram, here's how to proceed:

- 1) Download *Spectrogram*¹ from:

<http://www.visualizationsoftware.com/gram.html>

- 2) Install *Spectrogram* onto your Hard drive, in its own subdirectory ('folder' for the Windows-challenged). I named my subdir C:*Spectrogram*, but of course, you may use whatever name you wish.
- 3) Prepare and attach a jumper cable from either the K2 speaker or headphone output to your sound card input. MIC input may work better than LINE input, but try each and use the one that gives the best drive to the sound card.
- 4) Turn the K2 on and connect it to an antenna (or noise generator). Tune the K2 to a band (between 1.8 MHz and 18MHz) which will produces the most background noise. Set the AF Gain to somewhere between 7:00 and 12:00, and tune the receiver to a frequency where there are NO signals (only noise).
- 5) Start *Spectrogram* running. If you have not created an icon on your desktop through which to start *Spectrogram*, you can always start it via the RUN command on your Start Bar.
- 6) Press **[F3]** to start a spectral scan (**[Esc]** to STOP a scan). The first screen presented to you is the *Spectrogram* Scan Input (setup) screen. (Note: Spectrogram v6.2.2 was used for these examples. If you are using an older version, some of the Scan Input controls may not be available, but this is OK since they will not be used in these examples.



Example 1: Spectrogram Scan Input (setup) Screen

- 7) Set the following parameters: (others may work as well, or better, these will help you get started)

Sample Characteristics

Sample Rate: **11kHz**

Resolution: **16 bit**

Type: **MONO**

Display Characteristics

Display Type: **LINE**
Channels: **N/A**
Plot Type: **Signal**
Scale (dB): **60**
Palette: **BW** (for black lines on white background)
Scroll Memory: **N/A**
Time Scale: **10mS**
Cursor Offset: **0 Hz**

Frequency Analysis

Freq Scale: **Linear**
FFT Size: **1024**
Freq Resolution: **10.8Hz** (slider to left edge)
Low Band Limit: **0**
High Band Limit: **2400 Hz**
Average Count: **20** (Start with this value. If you find that the display is too 'noisy' (too active), you may increase it to over 100. Increasing the value will cause the display to take longer to 'build'.)
Pitch Detector: **OFF**

Recording Enable: **OFF**

- 8) Press **Enter** to start the *Spectrogram* software running and displaying the spectrum of the audio input.
- 9) Click-hold and drag the scroll bar on the right side of the *Spectrogram* window to the top of the window
- 10) If you are using ambient band noise, adjust the **AF Gain** on the K2 to the point where you have a spectral display which extends **at least** halfway up the left hand scale (between -50dB and -40dB). If you are using a noise generator, turn it on and adjust the **AF Gain** to a level of -40dB to -20dB.
- 11) At this point, click on the **Pointers** menu option and select **BLACK CROSS**.
- 12) Again, click on the **Pointers** menu option. Select **FREQ MARK** and set **Freq 1** to the CW numeric value which **MATCHES** the SIDETONE frequency you have selected for your K2 (the sidetone you wish to hear when you are receiving CW). I use 600Hz, but everyone's ear is a little different, select the sidetone most pleasing to your ear.

Press **Enter** to return to *Spectrogram*.

- 13) On the K2, tap **[MENU]** and use **[Band+]** or **[Band-]** to scroll through the setting options on the left side of the display until you reach the **CAL** option.

Press-hold **[MENU]** until the cursor shifts to the right side of the display and then use **[Band+]** or **[Band-]** to scroll through the setting options on the right side of the display until you reach the **FIL** option.

Press-hold **[MENU]** until the display indicates a value of **FLn**, where 'n' is a number 1 - 4.

- 14) Tap **[Xfil]** until your widest BW filter is selected (indicated by the value on the right side of the LCD display).

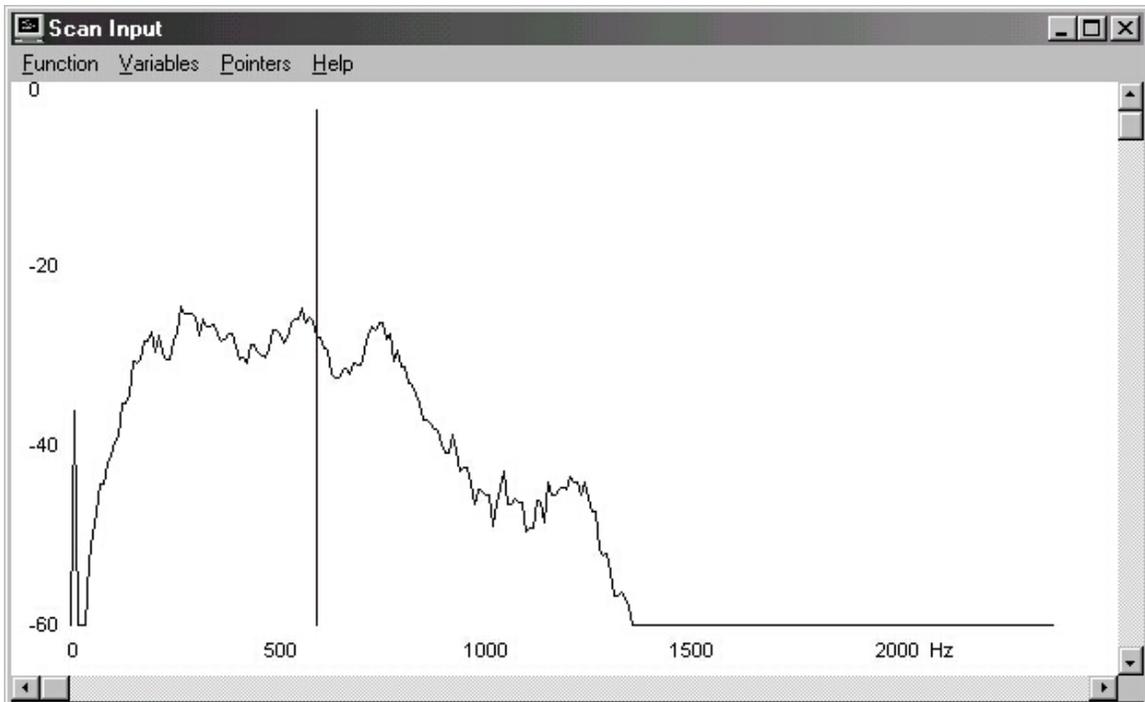
At this point, if you wish, you may rotate the VFO knob to change and set the desired bandwidth for the selected CW filter.

Repeat this step, selecting each successive filter, until you have confirmed that all filter bandwidths are set properly.

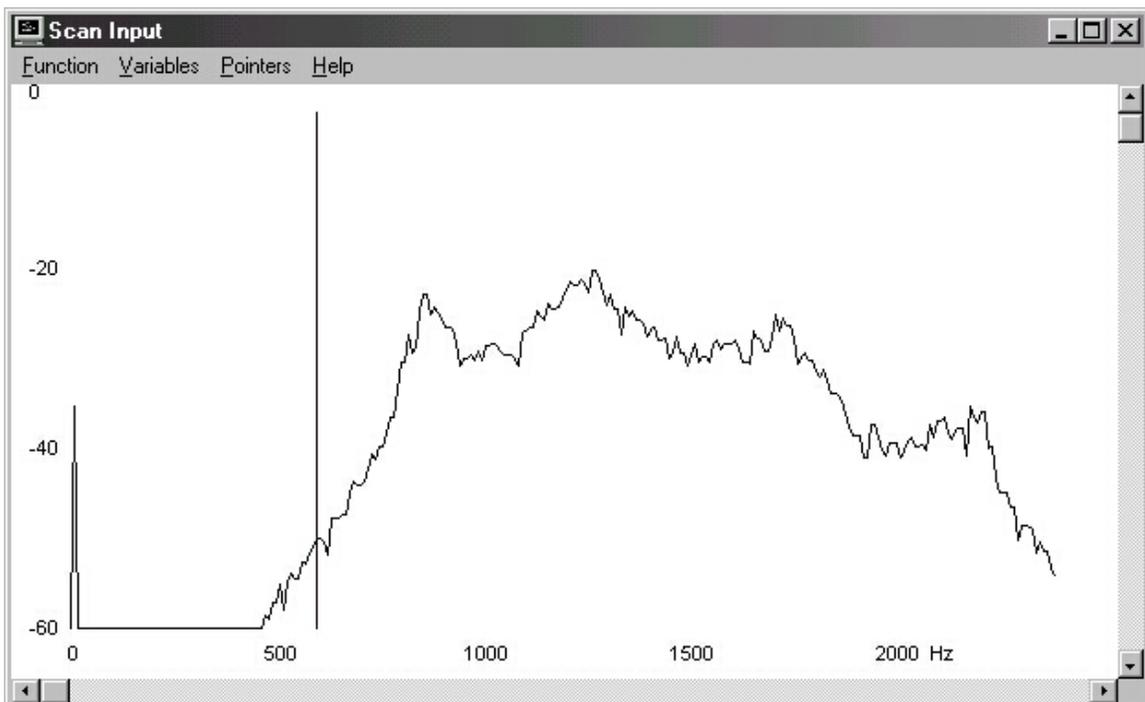
- 15) Tap **[Band-]** to switch to the BFO (**BFn xxx**) display.
- 16) Refer to Examples 2 & 3, below, for an approximation of what you may now see on your *Spectrogram* display, these examples are for the CW Normal mode and a requested bandwidth (BW) of 1.8kHz.

Note: In the graphic alignment examples which follow, I state that the example illustrates a filter which is '**more or less**' properly tuned. I do so because, while the filter may be tuned as closely as possible to the setting

you wish to attain, the +/-20Hz ambiguity of the BFO tuning steps may not allow you to adjust the setting more precisely. Thus the 'accuracy' of the example is a matter of the opinion of the individual user.

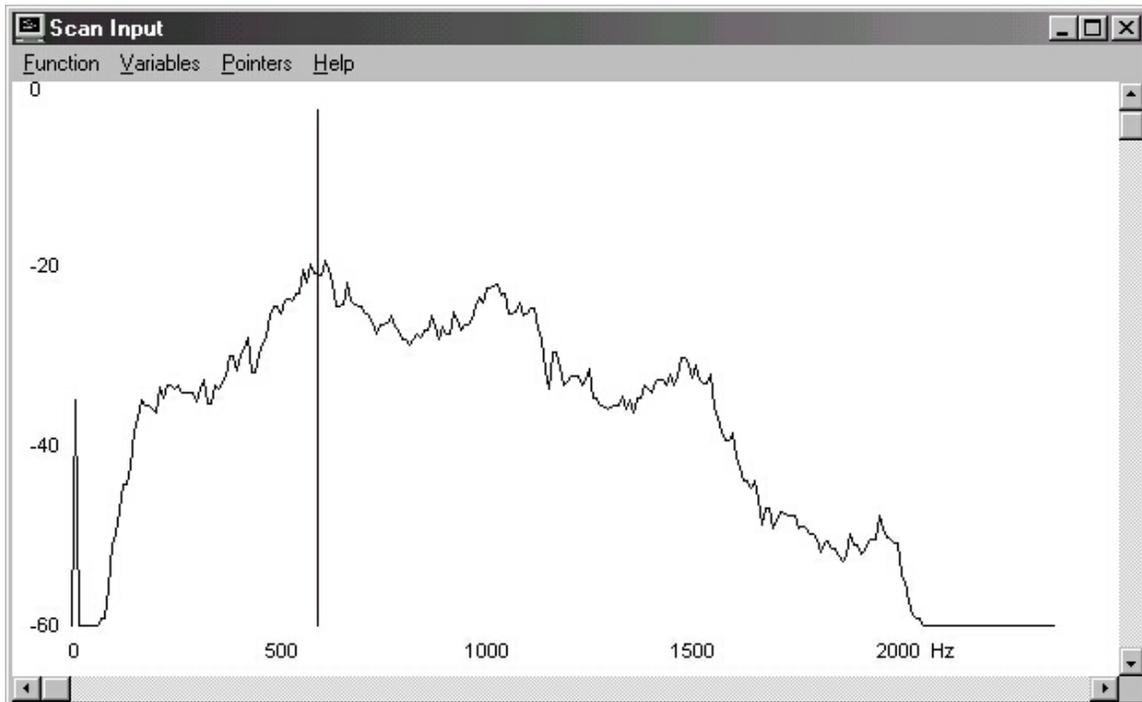


Example 2 – CW Normal, 1.8 kHz BW, tuned too low within the filter bandpass.



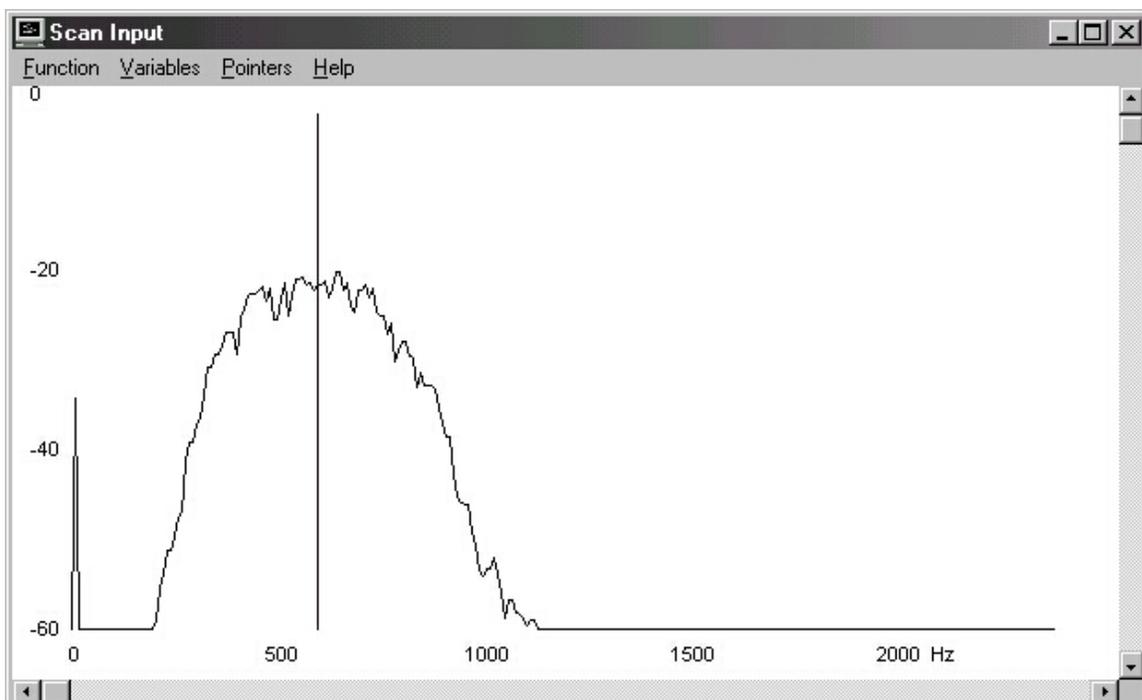
Example 3 – CW Normal, 1.8 kHz BW, tuned too high within the filter bandpass.

- 17) Adjust the VFO knob (which now adjusts the BFO frequency) to bring the lowest frequency peak of the spectrum display so that it is centered on the vertical Freq (sidetone) marker as shown below in Example 4.
Note: As illustrated below, a bandwidth (BW) greater than 1.0 kHz may demonstrate multiple peaks. If given a choice, select the lower of the higher-level peaks. Narrower BWs will generally not show multiple peaks.

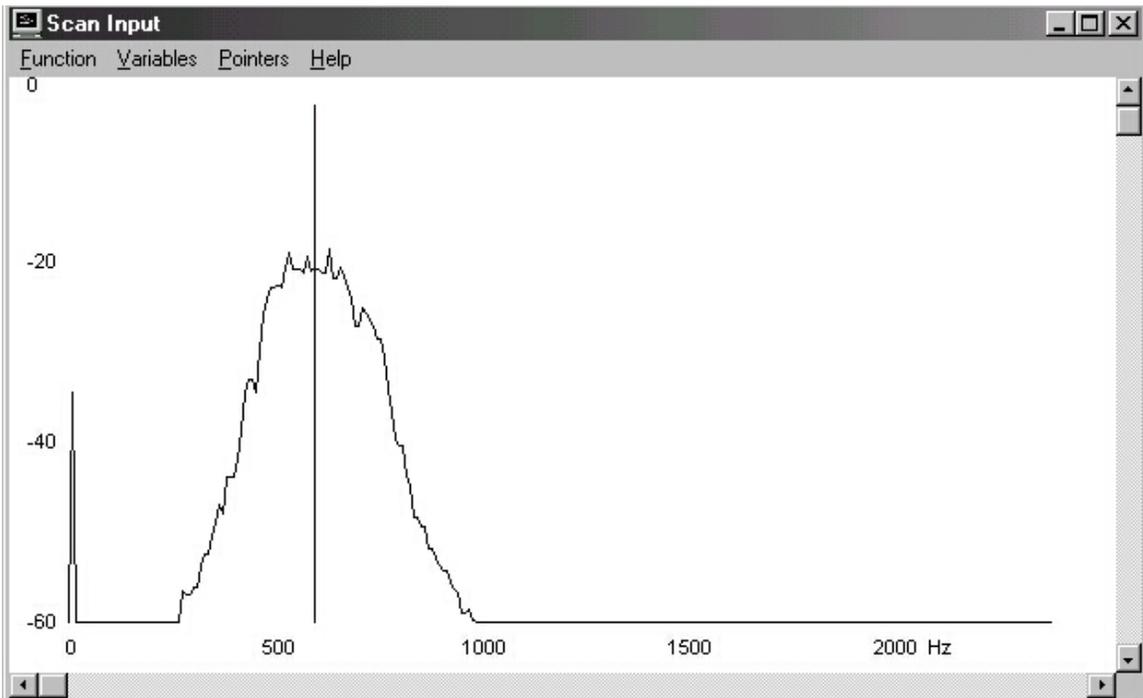


Example 4 – CW Normal, 1.8 kHz BW, more or less properly tuned.

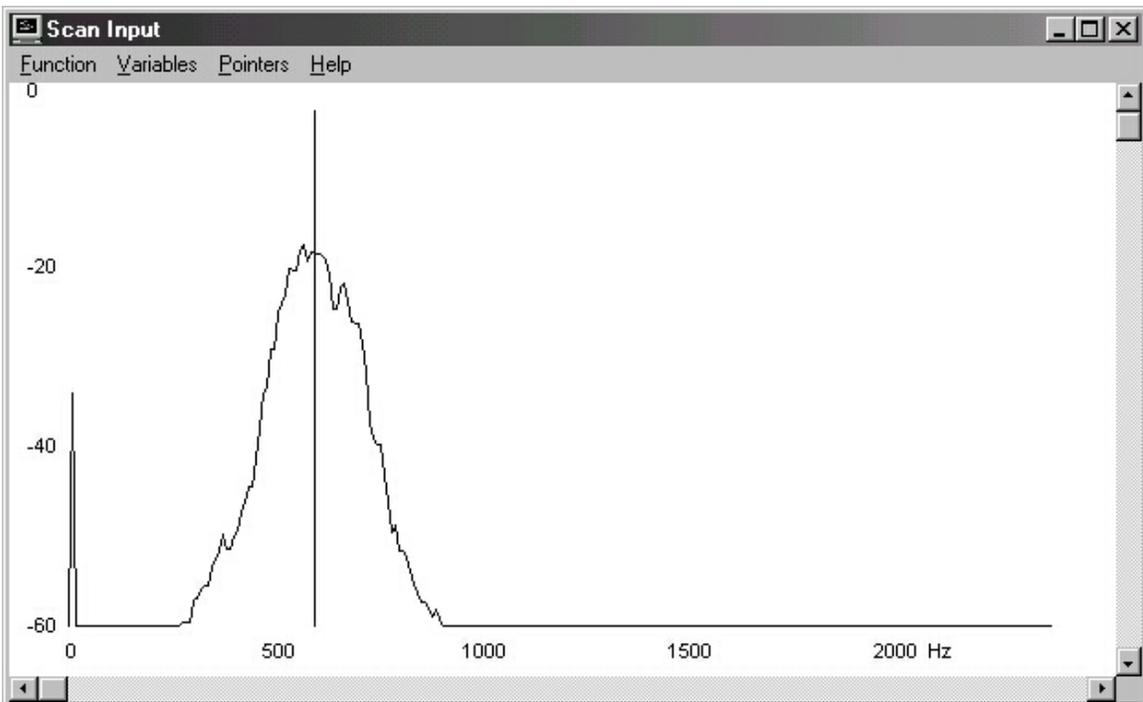
- 18) Tap [Xfil] to switch to the next filter selection. Tapping [Xfil] at this point will not only change to the next filter selection, it will also SAVE the settings you just selected for the current filter.
- 19) Repeat steps 17 & 18 for each remaining filter selection. See Examples 5 - 7, below, for examples of properly tuned 1.0 kHz, 400 Hz & 100 Hz filters



Example 5 – CW Normal, 1.0 kHz BW, more or less properly tuned.



Example 6 – CW Normal, 400 Hz BW, more or less properly tuned.



Example 7 – CW Normal, 100 Hz BW, more or less properly tuned.

- 20) When tapping [Xfil] returns you to your first filter selection, press-hold the [CW RV] button to select the CW Reverse filters. Repeat steps 17 - 19 for these filter selections, **except** that you may NOT be able to select the *highest amplitude* peak for the widest CW Rev BW setting without ending up with the BFO somewhere within the passband of the filter. As a result, I suggest you select a lower frequency peak, even though it may not be the highest peak. At wide bandwidths, this should not cause a significant tuning problem and it will help to ensure that your BFO is outside the skirts of the crystal filter. All other selected filter bandwidths should tune pretty much identically to those set for the CW Normal filters, **except** that **all** CW REV BFO values will be **above** the DAC value for filter center.

- 21) Once all the filters have been set **and** you have tapped [**Xfil**] one last time to save the final setting, I would suggest that you review each filter's setting, to confirm that it is set properly. Then tap [**MENU**] to return to normal K2 operation.

You are done!

A few parting shots...

Remember... while all filter selections should now appear to be relatively close to each, with regard to the tone you hear from the received station as you cycle through each filter, the received tones may not be *identical*. There is a chance that the received tones can be off as much as +/-20Hz as you cycle through the filters. This does NOT mean that you have done anything wrong, just that there is the possibility of a frequency step disparity brought on by the counting limitations of the digital-to-analog converters (DAC) used in the rig. Regardless, the received tones should be quite close together as you step through the available filter settings.

Finally, remember that the tonal difference of received signals when switching between CW (normal) and CW REV is not only dependent upon the DAC, but also upon how well you have managed to zero beat the received signal against your sidetone. A small offset to one side or the other of the sidetone frequency will be reflected by an equal and opposite offset when you switch from one sideband to the other (CWN to CWR).

Enjoy.

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Notes:

- ¹ *Spectrogram* (for PC compatibles only) is available from:

<http://www.visualizationsoftware.com/gram.html>

however, the most recent release of this software is **no longer** freeware and is available for a \$25 fee, a small price to pay for such a helpful alignment tool. A 'limited-use' (demonstration) version of *Spectrogram* also available from the author. This version allows you to use the software for ten (10) minutes at a time, thus requiring you to close the program and re-start it if you must use it longer than ten minutes. In actual use, once you become familiar with the software, ten minutes is MORE than ample time to adjust all of the K2's filters, as the entire process can usually be completed in about 5-6 minutes time.