Elecraft SSB B/W Modification
(SSBCAPKT)
Installation Instructions

Parts Inventory

P/N	Description	QTY
E530016	100 pF, 100V,5%,NPO,0.1LS, CAP	2 EA
E530049	150 pF,100V,5%,NPO,0.2LS, CAP	2 EA
E530141	27 pF, 200V,5%,NPO, 0.1LS, CAP	2 EA
E530144	33 pF, 50V, 5%, NPO, .1LS, CAP	4 EA
E530152	39 pF, 50V, 5%, NPO, .1LS, CAP	6 EA

Introduction

The Crystal Filter Bandwidth Modification capacitor kit provides two options to change the original 2.1 kHz 6 dB bandwidth of the KSB2 SSB filter to either 2.4 kHz or 2.6 kHz. (**Note**: KSB2s shipped after July 12, 2004 now include the 2.4 kHz bandwidth components.) These modifications are not *required* for the K2 to function well in the SSB mode. Instead, they are intended for those who wish to optimize its performance to their personal preferences.

The 2.4 and 2.6 kHz bandwidth filters also require better matching of crystal motional inductance to minimize pass-band ripple. We have worked with our supplier to obtain crystals with better control of the motional inductance. The latest ones now make it possible to increase the SSB filter bandwidth up to 2.6 kHz. **The latest crystals (shipping with all KSB2s since May 2002) are marked with "ECS 4.9136-S" on each crystal.** O*lder crystals shipped before May 2002 marked with "ECS 4.91-20" or "ECS 4.91-0195" should be replaced when performing this modification.*

The older crystals work fine at a 2.1 kHz bandwidth, but are not optimum for wider bandwidths. If you want to add a wider SSB bandwidth enhancement to your KSB2, we suggest you order a new set of crystals from Elecraft. They are Elecraft Part #E850006 (7 matched crystals for the KSB2) or #K2KSB2XTLS (14 crystals for the KSB2 and the K2 CW filters.) See our spare parts order page at http://www.elecraft.com/order_form_parts.htm

Removing parts from the KSB2

The KSB2 is designed with much smaller pad sizes than the other boards in the K2 transceiver. For this reason it can be more difficult to remove parts without damaging the board. If you don't have a desoldering tool, cut the leads off the part and then pull out each piece of wire individually. You will lift pads on the KSB2 if you try to remove capacitors in one piece. Sacrifice the part and save the board. Crystals may be removed by desoldering the grounding lead on the top and then wiggling the crystal out by alternately heating each pad on the board.

The best way to remove parts from a KSB2 is to use a Hakko 808 (or equivalent) de-soldering tool. If you are interested, the Hakko 808 and tips for it are available at http://kiesub.com/hakko808.htm .

Crystal Filter Bandwidth Modification

The KSB2 filter as designed has a 2.1 kHz bandwidth. The response of a crystal ladder filter can be adjusted by changing the capacitors in the filter. The most critical capacitors are the ones that connect to ground between each pair of crystals. These capacitors set the coupling between the filter sections. The capacitors in series with a crystal modify the resonant frequency of each section, but are not nearly as critical in value.

The wider bandwidth filters require that the BFO be tuned to a higher frequency for receiving USB on the lower bands. For the 2.4 kHz bandwidth, the BFO must be able to reach approximately 4916.5 kHz and for the 2.6 kHz bandwidth it must reach approximately 4916.8 kHz. Be sure and check your maximum BFO frequency before attempting to use a wider filter bandwidth. To measure BFO frequency, attach your K2 frequency probe to TP2 and use CAL FCTR to read the BFO frequency. While in this mode, press BAND UP to set the BFO to its max frequency and BAND DOWN to set it to its minimum frequency. It may be possible to increase the maximum BFO frequency in a K2 by removing turns off of L33 or changing capacitor sizes without raising the minimum frequency too high. Contact support@elecraft.com if you have questions regarding changing the maximum BFO frequency.

The following table shows the new capacitors for each reference designator (CA, CP etc.) on the KSB2 board. Remove the old capacitors and install the new ones as indicated for your chosen bandwidth in the table. If necessary (as noted above) also remove and replace the crystals.

After installation you will need to re-optimize your USB and LSB transmit BFO settings (BF1t) in CAL FIL. See 'Transmit BFO Optimization' on page 22 of the latest KSB2 manual. (Available on our manual download web page at http://www.elecraft.com)

Nominal BW (kHz)	Predicted 6 dB BW (kHz)	Predicted Loss (dB)	Predicted Ripple (dB)	CA,CP (pF)	CB,CN (pF)	CC,CM (pF)	CD,CL (pF)	CE,CK (pF)	CF,CJ (pF)	CG,CH (pF)
Original	2.1	8.3	3.2	100	10	33	Short	47	56	47
2.4	2.4	7.5	1.5	39	Open	27	Short	39	100	39
2.6	2.65	7.3	1.9	39	Open	27	Short	33	150	33

App. Note: Using Spectrogram to make filter measurements

Spectrogram (http://www.visualizationsoftware.com/gram.html) may be used to measure the response of the K2 filters with your PC sound card. To make a measurement of a K2's filter, use the following procedure:

1. Connect a noise generator to the antenna input of the K2 (Elecraft N-gen etc.). Using antenna noise for this purpose will be much less accurate.

2. Connect the audio output of the K2 to the sound card input on a PC. If you use the headphone output of the K2 for this purpose, be sure to place a 10 ohm resistor to ground to avoid rolling off the high frequencies due to C105/C106.

3. If your K2 has a KAF2 or KDSP2 installed in it, be sure to put it in bypass mode. If left in line, the higher audio frequencies will be attenuated and will decrease your amplitude measurement accuracy.

4. Set Spectrogram at Scan Input to 22k Sample Rate, 16 bit Resolution, Line Plot, 90 dB Scale, 1024 FFT, and Average Count to 32. Then press OK. Move the slider at the right to the top of its range. The displayed spectrum should not exceed –30 dB or you risk overloading the sound card input.

5. Set the K2 to 7100 kHz. Turn AGC Off. Set the AF Gain to about its mid-point. Select the filter for which you wish to measure its frequency response. Adjust the RF Gain so that the maximum level displayed is –30 dB or less.

6. If you wish to see the KSB2 SSB filter response without it being modified by the K2's 2nd Xtal Filter, place 0.1uF caps across X5 and X6 on the RF Board.

7. When you have completed the measurements, return the KAF2 or KDSP2 , if present, to its normal mode.

8. Spectrogram provides an easy way to look at the filter responses of all of the K2's filters. You are limited to a dynamic range of less than 60 dB. The noise fluctuations will be several dB, but you can reduce this by increasing Average Count to 128. Additional reductions can be accomplished by averaging several sets of readings.