



Tech Note

An Audio Notch and Band-Pass Filter for the K2

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The one feature I seem to use very often when operating my other rig is the audio notch filter. It is an interesting tool. For example, besides the obvious notching of offending signals in the pass-band, I find that for weak signals, sometimes putting the notch beside the signal helps you hear the target signal better. I think that what happens is the notch removes some of the noise near the audio frequency of the signal, improving the perceived "signal to noise ratio".

The slope of the notch function is 65Hz wide at about the -3dB points and gets narrower as it gets deeper. I couldn't measure the "bottom" of the notch with my setup using Spectrogram or with the meters I have in the shack. The signals that are notched do receive a great deal of attenuation, in the order of 30 dB or more. The IC specs predict -50dB of attenuation in this mode.

The filter also has a band-pass function, which has been fun to experiment with. It has been quite useful even with the narrow IF filter settings. It gives about 3dB gain to the signal you want, but it does attenuate the other frequency signals depending how far away they are from the center frequency. The slope of the Band Pass filter mode is about 115Hz wide at -3dB, with a total attenuation of -15dB or so for the rest of the audio band.

This circuit adds about 12 mA to the current consumption of the K2.

The Circuit

You will see from the schematic (attached below) that I retain the balanced audio to and from the Control Board by using op-amps. There is no on-off switch, so it is always "active". You take the filter "off line" by putting it in the notch mode and setting the frequency at one limit or the other. The LTC1059 chip is a switched capacitor filter, which uses a clock frequency to determine the resonant frequency. I used the 100X configuration, which makes the clock frequencies range from about 40,000Hz to about 250,000Hz, giving a filter resonance of about 400Hz to 2500Hz.

I used a TLC555 (CMOS 555 timer) as the clock generator. This part is good to about 2 MHz in the astable mode. VR1 controls the frequency by presenting voltage to the control pin. This



arrangement keeps the R/C circuit nice and tidy right by the IC, reducing radiation from that circuitry.

The circuit was designed to provide unity gain through the filter. If you are one of those that would like to have this circuit provide some gain to the audio section, I recommend that you adjust the value of the input resistors to either the input or output op-amp circuitry. Do not change the feed-back resistors as they are set to work with the biasing resistor values. To get more gain from this circuit design, change the input resistors to a lower value. (Remember op-amp theory, the gain is determined by the ratio of the input and feed-back resistors.)

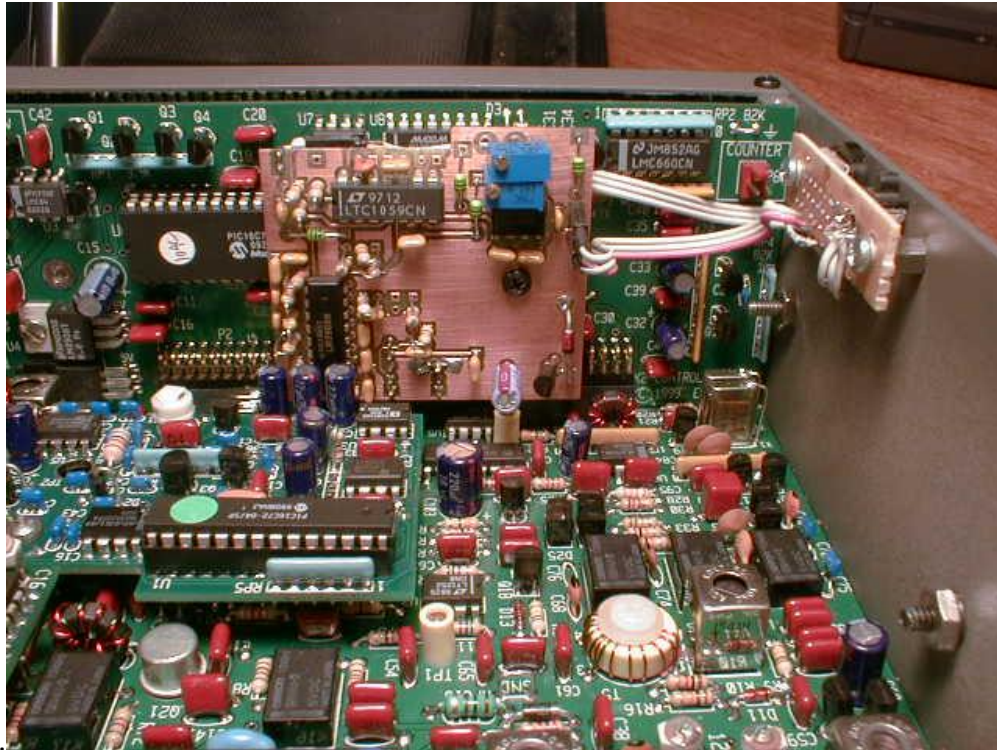
Installation

I elected to install this board inside my K2. The operating controls needed to be located where I could easily get to them when operating. As you can see from one of the pictures, the frequency potentiometer and the slide switch, both salvaged from a defunct cassette player, were installed on a piece of perf board. That, in turn was mounted to the inside top edge of the side panel. That would allow me to notch out a place on the top panel for each control. I used the left side since I am right handed and usually use my left hand to operate the radio.

The internally mounted board fits right on the Control Board and uses the audio filter option headers for insertion into the audio path. The board is held in place by using the audio filter option stand-off location between the two electrolytic capacitors.

Some have written me about out-boarding the filter and this is certainly an option that works. When I was testing the filter, I used long wires connected between the Control board and the filter board with no apparent effects on performance of the filter or the K2. I would recommend shielded wires in this application.

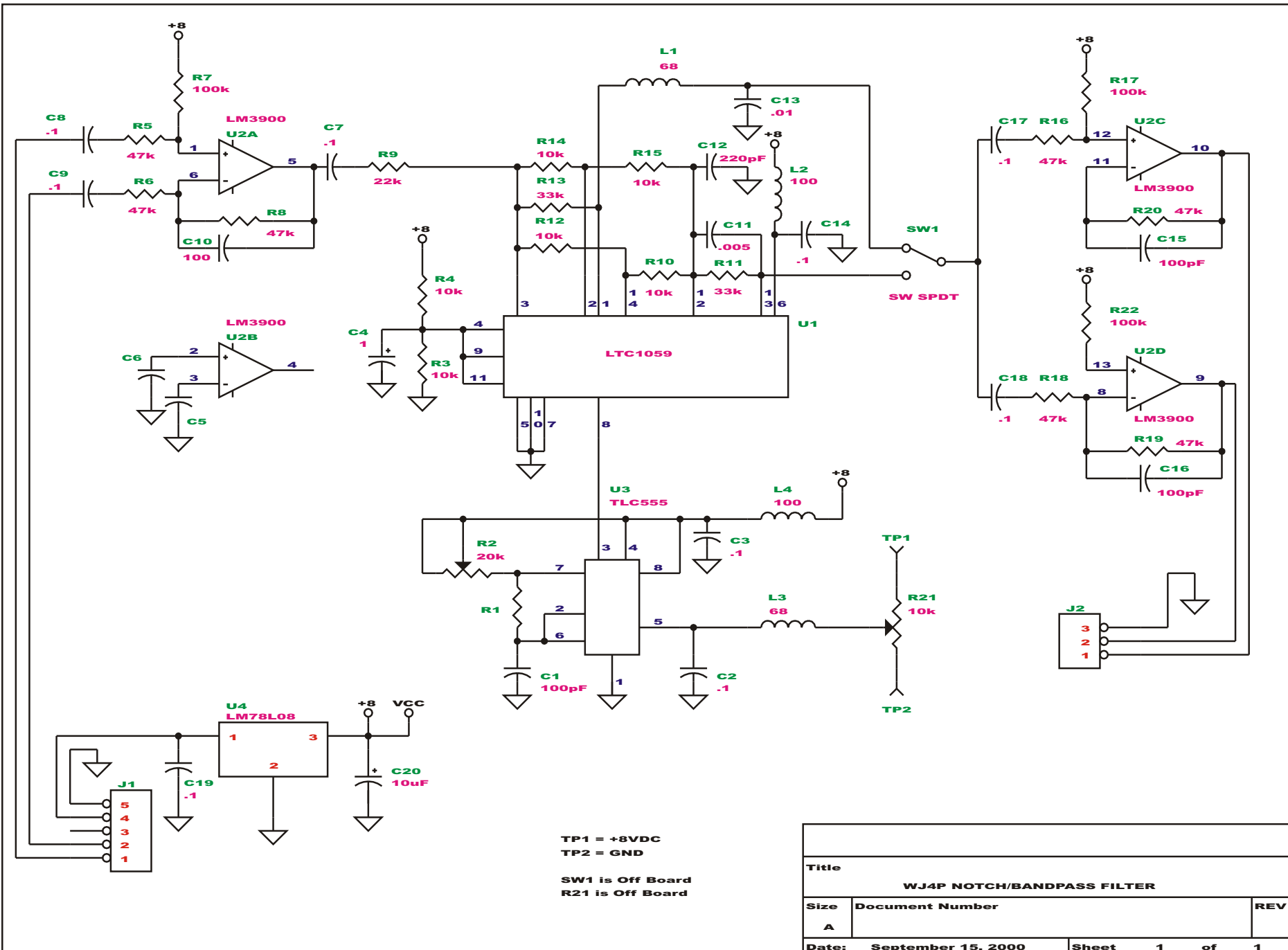
Even though this is an audio circuit, it uses a fairly high frequency clock signal, so it is important that when you build the circuit you keep the LTC1059 connections as short as possible. The clock signal from the 555 timer should also be very direct and short. Also, if possible, use a ground plane to protect signals from coupling in unwanted ways



Board installed inside K2.



K2 case with added notch controls.



TP1 = +8VDC
 TP2 = GND

SW1 is Off Board
 R21 is Off Board

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| Title | | |
| WJ4P NOTCH/BANDPASS FILTER | | |
| Size | Document Number | REV |
| A | | |
| Date: | September 15, 2000 | Sheet 1 of 1 |