## **Active Audio CW Filter by 4F3EW**

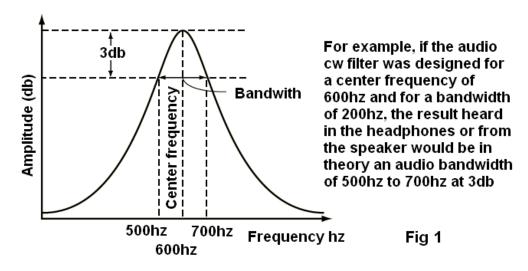
My name is John and I am the holder of the callsigns 4F3EW (Philippines) and GM4DKO (Scotland).

The idea behind this article is to bring to the attention of any radio amateur who does not have a internal cw filter installed in their transceiver, and who would like to operate on cw, to have a look at external Active Audio CW Filters. The cost of buying a dedicated internal CW filter and perhaps lack of technical expertise to open their expensive rig and install the filter will deter many, so an external narrow audio filter for CW will be the ideal choice.

This is the type of cw filter that I use and which I find adequate for my operating. In my case, the Icom cw filter for my present transceiver, the Icom IC-718, would have cost \$170 to \$209 (Mar 2016) that is 1/3 of the cost of the actual transceiver. I would also have had to buy the cw filter from overseas which could add additional costs due to any shipping and import charges. With the Icom IC-718 I would have had to open up the transceiver, tilt a circuit board, remove some ribbon connectors and a couple of transistor heat sinks before soldering the Icom cw filter in place. It therefore made sense for me to look at audio cw filters before I bought the transceiver.

A good cw filter in the IF section is usually more desirable and usually performs better than a external audio cw filter, however I find using a audio cw filter is adequate for my cw operating needs and at a much less cost.

But first what is an external audio cw filter? A external audio cw filter is a way to add narrow audio filtering to the audio output of any transceiver or receiver, the audio filter is usually placed between the audio output from the transceiver phone socket and the operators headphones or an external speaker, and using an audio cw filter also reduces qrm/qrn (fig 1)



An external audio cw filter is also transferable between transceivers, which is useful in giving the radio amateur a wider choice when it comes to buying, say, a new or second hand transceiver without an already installed cw filter.

When doing the research for Audio CW Filter on the internet, I found lots of information including audio cw filter reviews, video demonstrations of different audio cw filters in use, technical articles on audio filtering. Some radio amateurs have published their own circuit designs, and there is audio filter computer software.

I also found that I had the choice of buying a ready built audio cw filter, building one myself from a kit, building from a published circuit design or installing PC software. I decided to build the audio cw filter from a kit.

Before looking at audio cw filters, I had decided that my preference was if possible to find a external audio cw filter, which had a fixed bandwidth and fixed center frequency. There are other audio filters which allow the varying of one or both of these parameters and some filters also have peak, notch and DSP, while others are tunable CW/SSB audio filters. I also wanted an audio filter which I could switch between narrow (cw) and wide (ssb) like I would do if I have a cw filter installed in the transceiver.

After doing the research I found two audio cw filter kits which met my criteria. There are other audio cw filters available but I decided to concentrate on these two.

One was the Hi-Per-Mite (HPM) from The Four State QRP Group at \$35 (Mar 2016) and the other was designed and supplied by Russ Ramirez, KOWFS at a cost of \$17 (Mar 2016) both inclusive of shipping to the Philippines.

I had already bought the HPM kit at a lower cost of \$26 in 2015, and I decided also buy the audio cw filter kit from KOWFS for either my main audio cw filter or as a back-up for the HPM and with both kits I did not pay any import charges in the Philippines.

HPM and KOWFS filter comparisons? I am comfortable using either filter and there are other audio cw filters which the potential user may wish to consider. (My first get out clause).

There are differences between the HPM and the KOWFS audio cw filters, the main differences as of Mar 2016 are....

HPM bandwidth 200hz, center frequency 700hz , the signal gain is selectable by resistor selection from 0db in steps to 50db and a volume control can be added. DC Power: 5 to 13 VDC, <15 mA

KOWFS bandwidth 100hz, center frequency 650hz with a built in signal gain of 10db, DC power: 5-12 VDC, operating current about 500uA.

Construction; the HPM comes with a 2.0" x 1.5" PCB and uses 34 components (including 2 x IC's), the KOWFS comes with a 1.75" x 1" PCB and uses 15 components (including 1 x IC). Both do not use SMD's or toroids, can be powered from a 6 or 9v battery supply and both require a suitable enclosures.

With both filters I used the same plugs, sockets and switches, so the diagrams and construction of the enclosure are the same for both filters and could be also applicable for other audio cw filters.

I assembled both filters and found both worked with a 6v battery supply (4 x 1.5v AA batteries housed in a 6v battery holder).

For illustration purposes I will refer to the KOWFS filter, to assemble this filter, I bought.....

- 1 x DPDT 6 terminal on / on mini toggle switch.
- 1 x SPST 2 terminal on / off mini toggle switch.



2 x 3.5 mm mono sockets.2 x 3.5 mono jack plugs.Transceiver phone mono jack plug.9V PP3 battery plus the connector.

Using the DPDT 6 terminal on/off mini toggle switch allows me to listen to either the wide audio from the transceiver or narrow audio from the filter.

I had a suitable plastic enclosure  $(4.5" \times 2.5" \times 1.25")$  available which would house the KOWFS PCB and due to the small size of the enclosure I used a 9v battery. For the HPM, I had a larger plastic enclosure and used 4 x 1.5 AA batteries.

I wanted to place the DPDT and SPST switches on top of the enclosure lid and the 2 x 3.5 mm sockets in the side, this meant having to figure out what goes where inside the enclosure and the position of the DPDT and SPST switches on the lid, making sure that when the enclosure lid was closed there was clearance underneath for the PCB and 9v battery. Having figured this out, I fitted the switches on the lid and the sockets in the enclosure.

To solder the components on to the filter PCB, I assembled my soldering set up.......See Fig 2 and Fig 2A

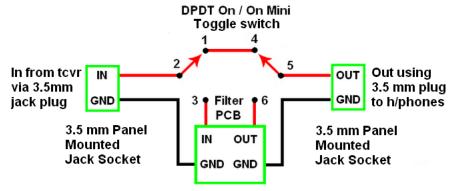




Both kits are fairly straight forward to assemble, thinking twice before soldering, using IC sockets and being careful when it came to the soldering due to the proximity of the components, hence my use of the magnifying glass. With the KOWFS kit, due the size of the PCB, the resistors had to be mounted vertically. With both kits I was unable to distinguish the color coding on some of the small resistors so I had to use my multimeter to confirm the resistor values.

After soldering the components on to the PCB, I soldered 4 pieces of wire (say 6" length), one wire to each input/gnd and output/gnd holes on the PCB and soldered the 9v battery holder wiring to the PCB + and gnd.

Fitted the PCB in the enclosure and soldered the wiring from the PCB to the DPDT and to the 3.5 mm sockets......See Fig 3



The illustration shows the DPDT switch selected to listen to the transceiver audio wideband.

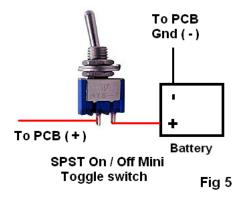
Fig 3 Note: The permanent link between terminals 1 and 4

Depending on the DPDT (On/On) switch position, the result heard in the headphones will be either...

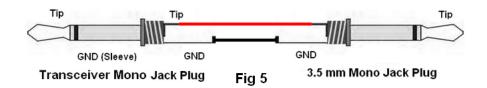
On - The filter wideband audio via terminals 1 and 4 or

On - The filter narrow audio via terminals 3 and 6

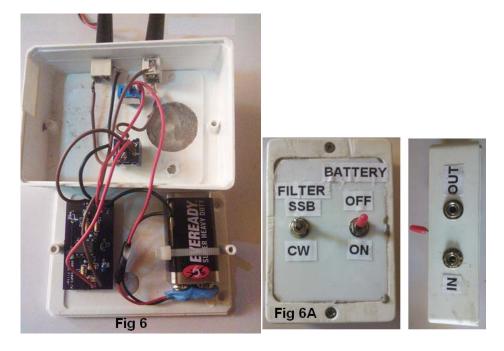
Connect the battery holder to the PCB with the + wire going via the SPST switch to the PCB +......See Fig 4



Soldered the 3.5 mm mono jack plug to the headphone wiring and the other 3.5 mm mono jack plug to the transceiver mono jack plug ......See Fig 5



First sigh of relief the soldering has been completed, and I connected the battery......See Fig 6 and Fig 6A



Connect the filter to the transceiver......See Fig 7



To test both kits, I plugged in the 3.5mm mono jack plugs into their respective filter enclosure sockets and the transceiver mono jack plug to the transceiver phone out socket.

Switched the transceiver on, switched the filter battery ON and when switching the DPDT switch back and forth I could hear in my headphone the audio wide band from the transceiver in the one position and the audio narrow band from the filter in the other position, showing the filter was working.

I marked the DPDT toggle switch filter as SSB (audio wide band, filter by pass) and CW (audio narrow band), the SPDT battery toggle switch as ON and OFF and the enclosure side sockets as IN and OUT.

Second sigh of relief the filter is working, next.......

I selected the transceiver to CW, I left the cw pitch/tone of the transceiver at my preferred 700hz and I switched the DPDT to By Pass (which I had marked as SSB) and with the battery OFF, tuned around listening for a cw signal. When one was heard, I tuned for the strongest signal from the target cw signal, switched the filter battery to ON and the DPDT switch to CW and I was more or less zero beat on the target cw transmitted signal, and I was now ready to give a call. With the transceiver selected to CW, battery ON and DPDT to CW, I was then ready to call CQ.

HPM and KOWFS filter comparisons? I am comfortable using either filter and there are other audio cw filters which the potential user may wish to consider.

To sum up. If you have no internal cw filter installed in your transceiver and are deterred from operating on cw due to the cost of such a filter or hesitant about

installing a cw filter in your transceiver then buying a external audio cw filter is well worth considering, this is the route I too

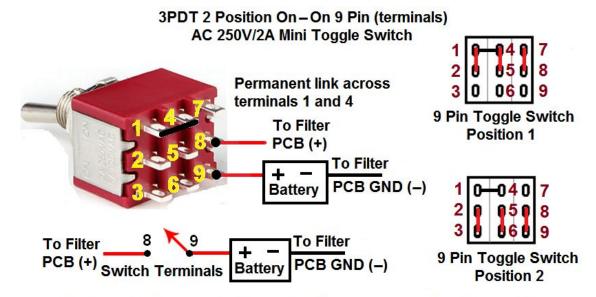
There could be mistakes and errors as this article is only a guide.

Here the age is 74 years old (2016)

73 es lots of enjoyment with the hobby de John 4F3EW /

GM4DKO.....March 2016

Audio CW Filter continued (see below)



The 9 pin mini toggle switch is wired the same as for the 6 pin toggle switch with the terminals 8 and 9 on the 9 pin toggle switch being used to switch the battery + supply On/Off to the filter PCB

With both audio cw filters, I replaced both the filter and battery switch with one 3PDT 2 Position On-On 9 Pin (terminal) AC 250V/2A Mini Toggle Switch.

Using the one 9 terminal mini toggle switch gave me the choice....

Switch position (1) listen to the transceiver audio output with the audio cw filter switched Out

(audio cw filter by-passed) and the battery switched Off.

or

Switch position (2) listen to the transceiver audio output with audio cw filter switched In and the battery switched On.

The 9 terminal toggle switch was wired as for the 6 terminal switch in the original article with terminals 8 and 9 being used to switch the battery On/Off.

Observation: Switching from position (1) to position (2) with the Hi Per Mite filter I found that there was say a 1 second delay,

this was acceptable for having the convenience of using the one switch instead of the two switches, when using the KOWFS filter there was no noticeable delay.

With both filters I am using 4 x 1.5v AA batteries housed in a 6v battery holder.

There could be mistakes or errors and this addition was written to provide information only.

73 de John.....4F3EW

Third sigh of relief, this article is finished.