filter

by Tony Bailey G3WPO

there were two supply rails at + and —6V.

The remainder of the circuitry utilises LF353 dual BIFET op-amps for low noise contribution. The first section of IC1 is configured as a high pass filter, with a —6dB cut-off at 300Hz, which reduces all signals below this frequency, but passes those above virtually unattenuated.

All the filter components were designed via a computer program to allow selection of values close to preferred value components. In some cases non-standad values of capacitors and resistors are needed, however, to maintain the required characteristics, and the parts list shows how these can be synthesised by series or parallel connection of two other values. It is important that the tolerances of the components are as specified — using normal carbon film resistors will result in inferior performance, with non-specified cut-off frequencies, varying gain, and wrong Q values. The capacitors should be 10% or better types — if you have a capacitance meter, they can be selected for best value.

The first of the low-pass sections follows in IC2b, with a nominal —6dB point of 2.2kHz. This will remove most of the high frequency chatter from a direct conversion receiver at output D, without impairing reproduced quality at all, and also reduce any hiss which may have been introduced by the receiver's IF or early audio stages. Signals higher than 2.2kHz are attenuated progressively as the frequency increases, those below are not affected.

To reduce the bandwidth slightly if needed to a nominal —6dB point of 2.0kHz, IC3a is cascaded with IC2b, improving the rolloff on the high cut-off side in the process. Audio intelligibility will still be satisfactory however. Further reduction in bandwidth is by another cascaded stage (IC3b), with a nominal cut-off of 1.5kHz. This is useful when there is a lot of interference about, but the received audio bandwidth is now a little narrow and the signal may sound restricted. With three filters now cascaded, cut-off on the high frequency side is very good. The 1.5kHz position is also useful for tuning around on CW.

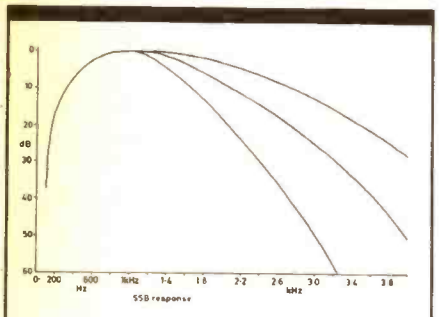


Fig. 2 Measured filter response

CW

For CW use, advantage is taken of the SSB filtering by passing all signals through the cascaded high- and low-pass sections prior to the narrowband CW filtering.

Filters for CW, with much narrower bandwidths possible, require a different approach to that for SSB. There are two schools of thought as to the type of filter required with some people preferring a similar type of filter to that of SSB ie. with a narrow but flat passband, so that some idea of activity near to the wanted frequency can be obtained while operating. This does have the disadvantage that signals very close in pitch to the wanted one cannot be eliminated very well.

The other approach is to have a 'peaked' passband. The problem in the past has been that to achieve very steep slopes to the skirts, the filter has to have a fairly high Q of around 10 or higher, which causes the filter to momentarily break into oscillation, or 'ring' as signals pass through it, with a very sharp response which can be tiring to listen to for long periods. This can be avoided by designing in a low enough Q to prevent this happening, while still maintaining adequate stopband rejection when using cascaded filter sections.

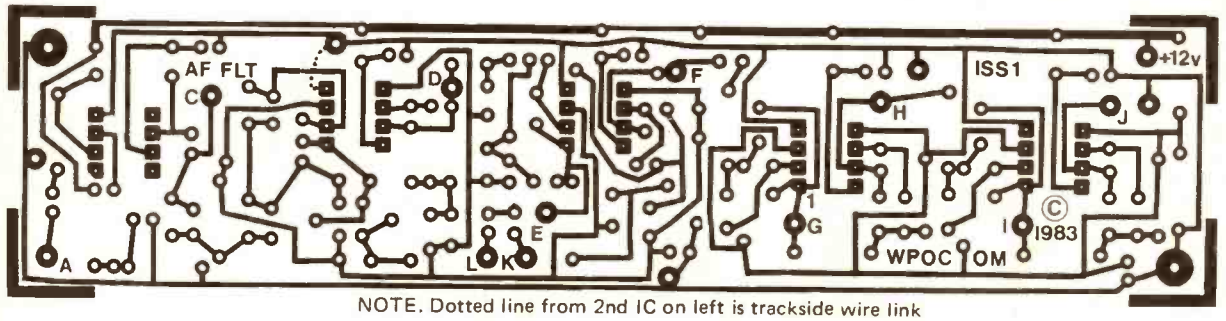
For the peak response sections used here, the Q is fixed at 4.5, with just sufficient filter gain in each stage to overcome the loss of that stage, at the fixed peak frequency of 800Hz. The —3dB bandwidth for one section is 170Hz.

The four cascaded sections of IC4a/b and IC5a/b are each identical (except for the input resistor which sets the gain without unduly affecting the peak response), with outputs available from each stage if required. With all four sections in use (output J) the response is very sharp, with very little tendency to ring if interference pulse are present.

Final output from the filter is taken via C31/R40 to isolate any of the outputs with dc voltages present from the subsequent audio circuitry.

Contruction

The construction of the filter is not particularly critical, either PCB or Veroboard type layouts are satisfactory. Leads should be kept short and all connections to the input and output sockets, and the switch, must be made with screened audio lead. The power supply used to drive the filter needs to be well smoothed. If



NOTE. Dotted line from 2nd IC on left is trackside wire link

Fig. 3 Printed circuit layout for active filter — track side