An Experimental Weaver Receiver

Volker Aurich DK3PK

Abstract Once in my life I wanted to build an SSB receiver using the so-called third or Weaver method. I started with the example of G0UPL and modified it in two ways. Firstly I used integrated switched-capacitor low pass filters and secondly I added an HF preamplifier in order to reduce radiation of the vfo frequency in the antenna and to get some gain control.

HF mixer

Like G0UPL I use bilateral switches of type 4066 (74HCT4066) which are switched by quadrature signals generated with two flip-flops 74ACT74. I omitted the choking coil. The gain of the differential amplifiers is 220 and their corner frequency is lower than in G0UPL's cicrcuit.

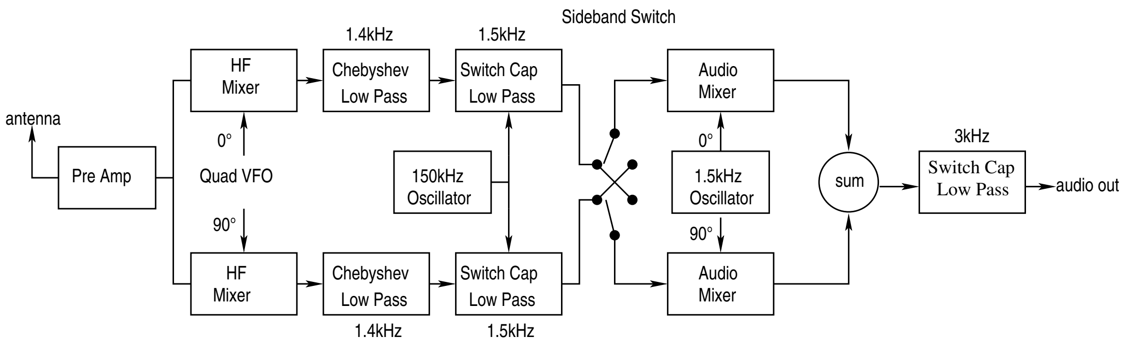
Audio channels

Both audio channels are identical. Each channel uses an integrated switched-capacitor filter of type MAX7400. This is an elliptic low pass filter of 8th order. Its corner frequency can easily be adjusted because it is a hundreth of the clock frequency. We chose 150kHz as clock frequency which results in 1.5kHz corner frequency. Because of these filters the receiver has an excellent selection.

To avoid alias effects in the MAX7400 the maximal frequency of the input signal has to be limited. This is achieved by putting in front of it an analog Chebyshev low pass filter of 2nd order which has a -3dB corner frequency of 1.4 kHz and a gain of 100.

HF preamplifier

In a weaver receiver the vfo frequency for the mixers lies in the center of the received ssb signal. A preselection filter cannot avoid that it may be radiated by the antenna. Therefore a preamplifier is used to reduce it. Moreover the preamplifier compensates mixer losses. With increasing amplitude of the audio output of the receiver the gain of the preamplifier is reduced. This is necessary because the switched capacitor filters have a limited dynamic range. Their input signals should stay between 0 and 5V.



Remarks

1. Deviations of the channels in phase and amplitude result in unwanted audio frequencies mirrored symmetrically to the center at 1.5kHz. With the potentiometer Pot which sums the channel outputs a suppression of 30dB can be achieved for both sidebands. 35dB are possible if an additional amplitude correction is done for one channel before the sideband switch. But 30dB are good enough for nice voice signals.

2. The switched capacitor filter after the audio mixer eliminates mixer components above 3 kHz.

3. The 1.5kHz oscillator signal into the audio mixer is almost not audible in the audio output.

4. Lowering the 150kHz clock frequency decreases the receiver bandwith and the audio output symmetrical to the center of 1.5kHz.

5. In theory no preselection is necessary if the vfo quadrature signals are pure sinus signals andhttp://www.dk3pk.de/ham/Einkorn/einkorn.html the mixer performs an ideal multiplication. For switch mixers, however, a preselection should be used because by this kind of mixer all harmonics, especially the odd ones, are also mixed in the audio range. Nevertheless the receiver performs surprisingly well on long wire antennas without any preselection.

References

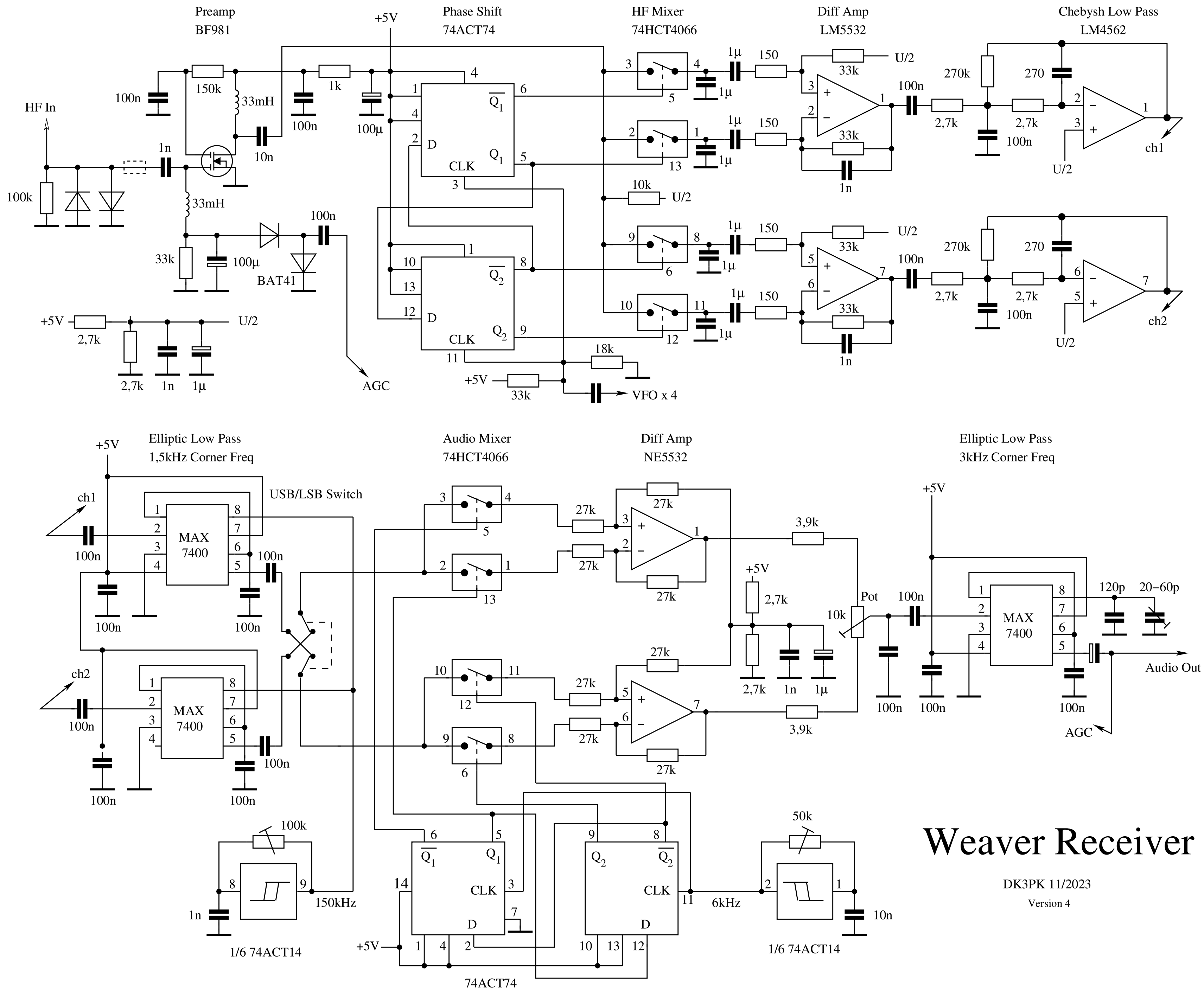
G0UPL has on his website a detailed analysis of his 10m weaver receiver and a list of articles about weaver receivers.

http://www.hanssummers.com/weaver/weaverrx

http://www.hanssummers.com/weaver/weaverlib

Quite interesting is the lecture *Moderne Direktmisch-Empfänger zum Selbstbau* which Jo Becker, DJ8IL, has given on the *2. Kurzwellentagung 1993* in Munich. A script is contained in the proceedings of the conference (but alas in german).

In 1999 I build a quite simple tiny DSB-receiver for 20m using a MAX7400 low pass filter. Look at http://www.dk3pk.de/ham/Einkorn/einkorn.html (alas again in german).



Weaver Receiver

DK3PK 11/2023

Version 4