Audiofilter User Guide

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1. General Operation

Audiofilter is a simple digital filter of IIR-type (infinite impulse response) running on a PC with soundcard. The filter coefficients are generated in realtime from the user-defined filtershape. The Graphical User Interface (GUI) is shown in figure 1. Setting the filter response is explained in it's legend.

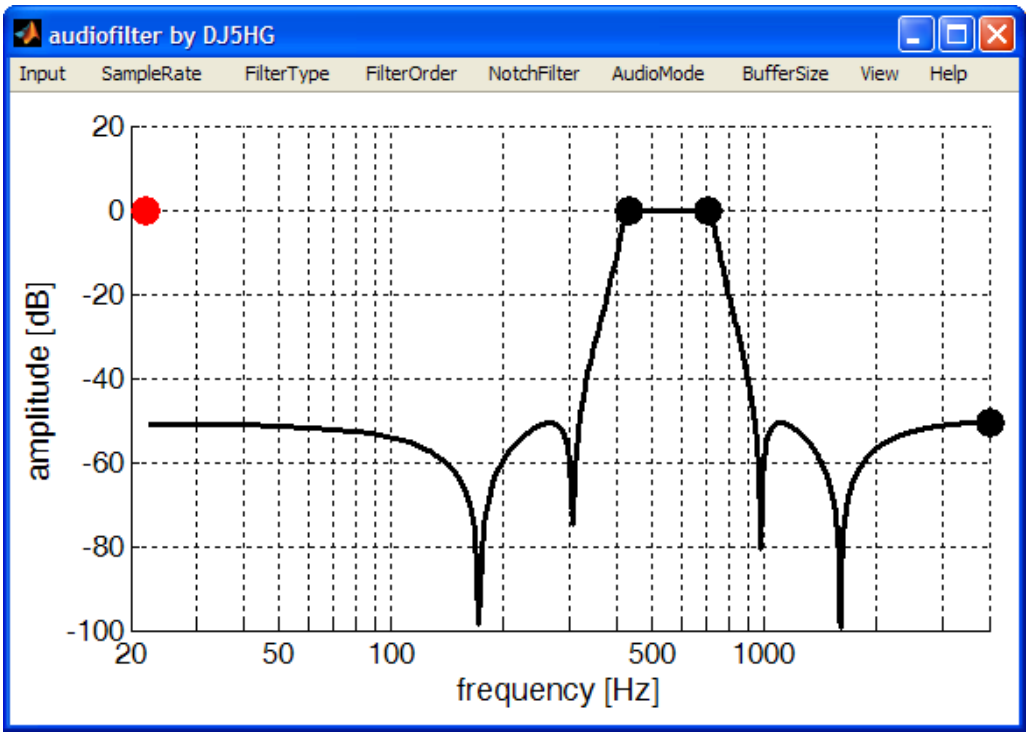

Figure 1. The Graphical User Interface (GUI) of audiofilter. Two black markers define the passband. They can be shifted with the mouse while the left mouse button is pressed. The black marker to the right sets the stopband attenuation. The red marker to the left is for tilting the passband.

Be aware of the fact that steep filter edges cause the filter to ring, especially if the transfer between passband and edge is not a smooth curve. The Butterworth filter type is the better choice in this respect. A good CW filter is of this type with an order of 10. The passband can be down to 160 Hz. Such a filter is shown in figure 2.

Useful elliptical filters can be generated down to a width of 30 Hz with order 2. An order larger than 4 usually causes irregular filter response, ringing etc.. Figure 3 shows a very narrow filter for CW-EME. Order 4 allowes a -6 dB bandwidth down to 18 Hz. For comparison, the elliptical filter of figure 4 of order 6 shows typical ringing in it's impulse response.

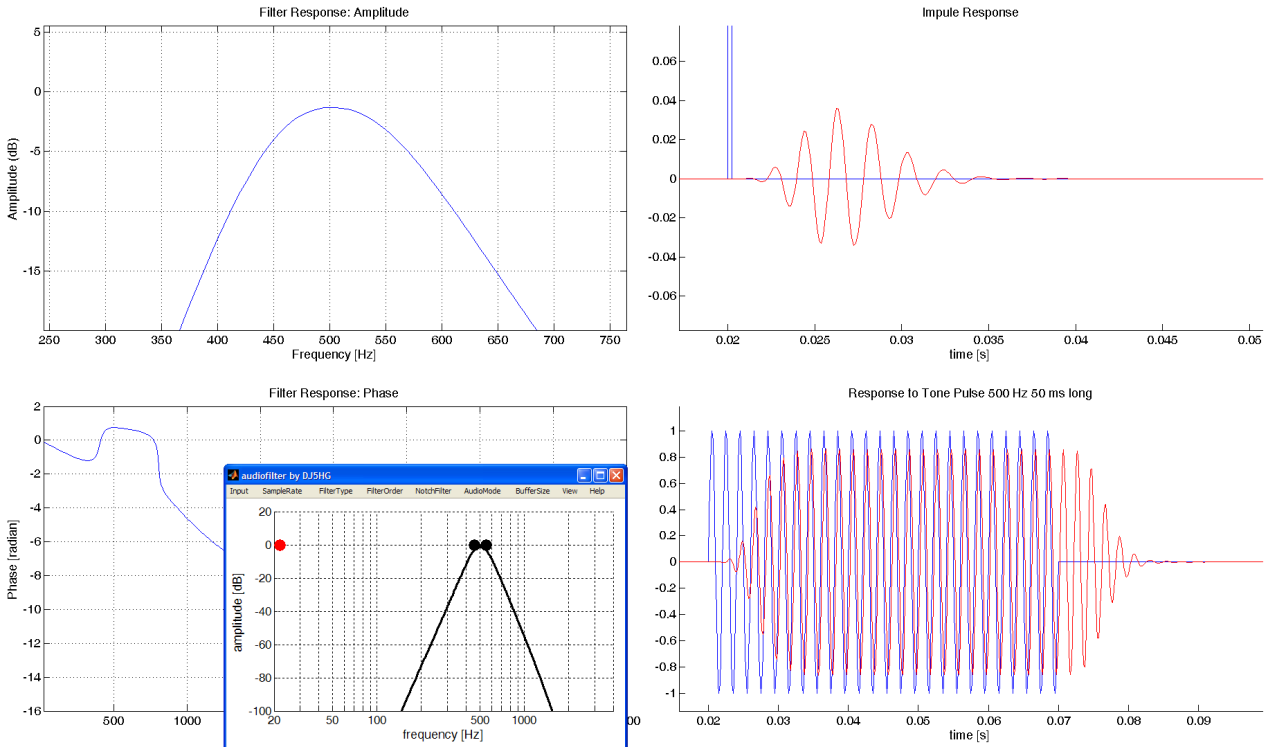

Figure 2. The filter GUI in front of the output of the menu item "View / show filter response". The actual filter is of Butterworth-type with filter order 10. Both upper graphs are zoomed by the zoom function of the generated window. The filter response is characterized by a fast decay at the trailing edge.

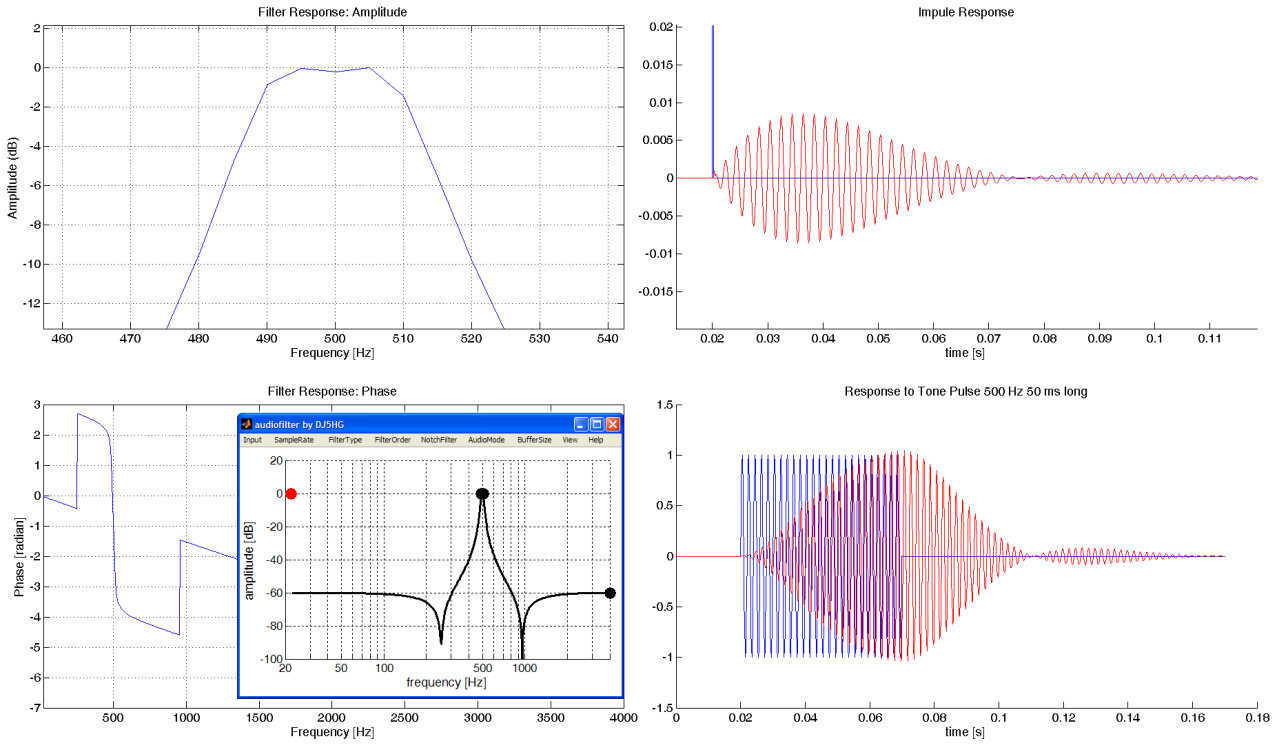

Figure 3. A very narrow CW-filter for EME use (35 Hz at -6 dB). It is an elliptical filter of order 2. The trailing edge shows a slight ringing.

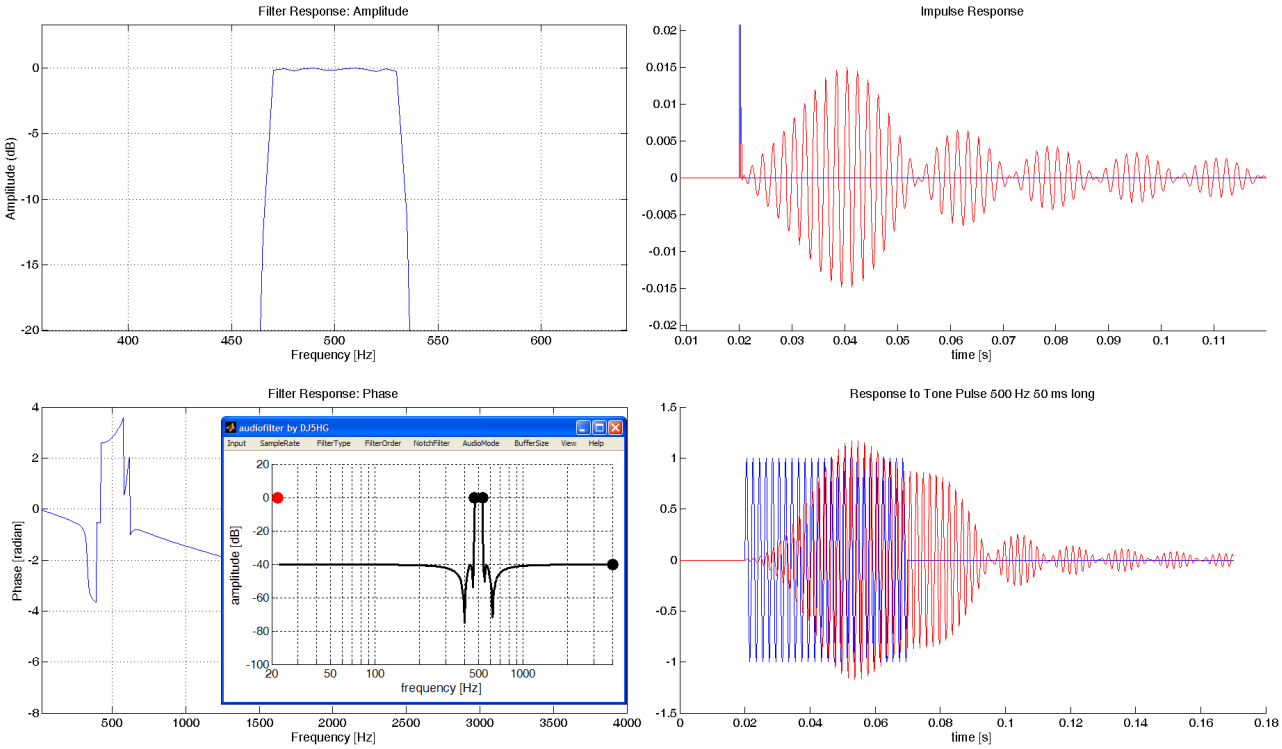

Figure 4. Sharp and steep filter edges lead to ringing as is obvious here in the impulse response.

2. Notch Filter

Set the notch filter to "ON" using the menu. Then a green marker appears at the bottom of the GUI. It defines the frequency to be notched. Move it with the mouse. Figure 5 shows an example.

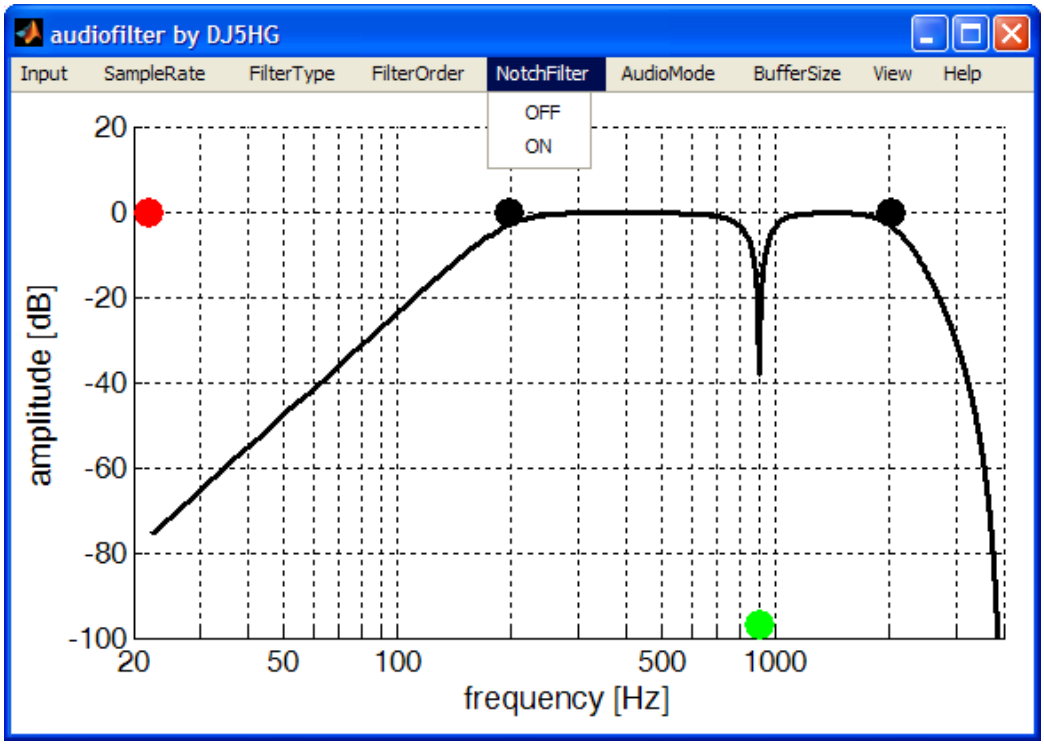

Figure 5. A Butterworth filter for human speech with passband 200 Hz ... 2000 Hz and notch at 900 Hz.

3. The Menu

The menu items are self-explaining in respect of their operation. But some additional words may help:

If you run a parallel workload on your computer the filter may have dropouts on the output. Then try a larger buffer (which increases the delay between input and output). Also a lower sample rate can possibly be used to decrease the workload of the filter itself.

IIR filters can be instable and lead to oscillations at full volume. So be careful with your headphones or Speakers. Also the filter design may result in irregular responses if the filter order is too large. Choose the menu "view / show filter response" for detailed properties of the actual filter (examples in figures 2, 3).

For teaching purpose the absolute value of the complex transfer function of the filters can be plotted over the z-plane. The figure is a 3-D-plot which can be rotated by the mouse. The frequency response is given by this function over the unit circle (marked as the black circle in the hilly terrain). The upper peaks (poles) are caused by zeros of the denominator and the down peaks are caused by zeros of the nominator polynomial of the transfer function.