HSP43220 - Design of Filters With Output Rates <2 (Passband + Transition)

April 1998 TB311.1

One of the design rule checks in DECIMATE™ is that the output rate must be greater than 2 times the sum of passband + transition band. For the informed user, violation of this rule is a valid design choice. Suppression of this rule check in DECIMATE is not possible, but design of such a filter using DECIMATE is possible.

The general solution is to use DECIMATE to design a filter with an output rate that is twice the desired rate, or a integer multiple of the desired rate that is >2(pass + trans). Outside of the Design Module the FIR decimation rate is increase by the factor needed to achieve the desired output rate. The new filter response is obtained graphically.

Consider a filter with a passband of 70kHz and a transition band of 60kHz. The desired output rate is 200kHz. DECIMATE requires an output rate of >260kHz, an output rate of 400kHz is chosen (see Figure 1 below and FILTER 1 page 2).

By increasing the FIR decimation by a factor of 2, the folding point ($f_S/2$) is moved and the desired output rate is obtained. The filter response can be generated graphically. The aliasing component is represented by the dotted line (see Figure 2 below).

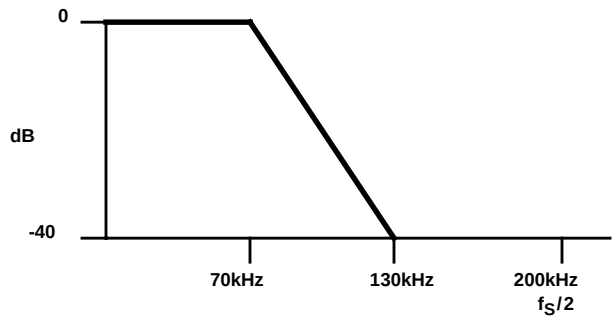

FIGURE 1.

Notice in FILTER 1 the stopband attenuation was limited to 40dB (FIR_CK=CK_IN). Because the FIR decimation was increased from 5 to 10, there are more taps available with FIR_CK=20MHz. Using Equation 2.0 from the 43220 Data Sheet, we see how many taps are available.

$$2\left(\frac{20(10)(10)}{20} - 10 - 4\right) = 172$$

We can therefore, use FILTER 2 which uses 151 taps and has 96dB stopband. The part will of course be programmed for FIR decimation rate of 10 and an FIR_CK of 20MHz is used.

To correctly simulate or generate PROM files for the “new filter” the *.DAR file must be edited. The corrected value for FDRATE on line 1, column 4 is entered. The correct output rate and FIR_CK rate are entered on the next to the last and the last line of the *.DAR file.

The above procedure works for standard or Precomp FIR. Remember the maximum*3*- FIR decimation rate is 16.

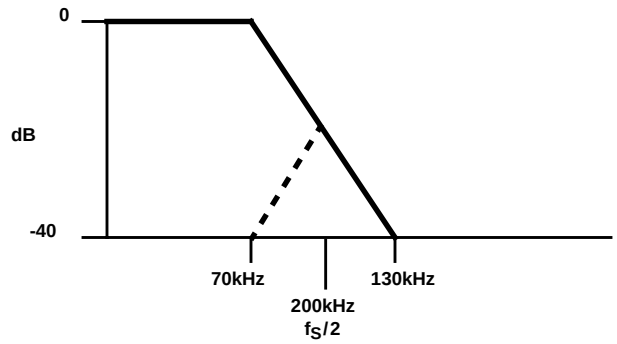

FIGURE 2.

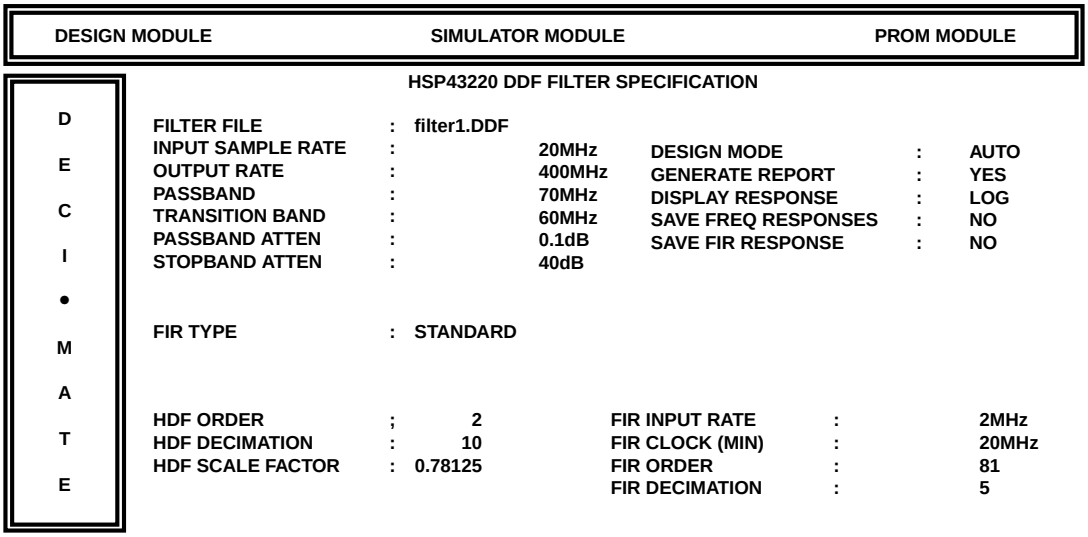

FIGURE 3. FILTER DESIGN USING STANDARD TECHNIQUE

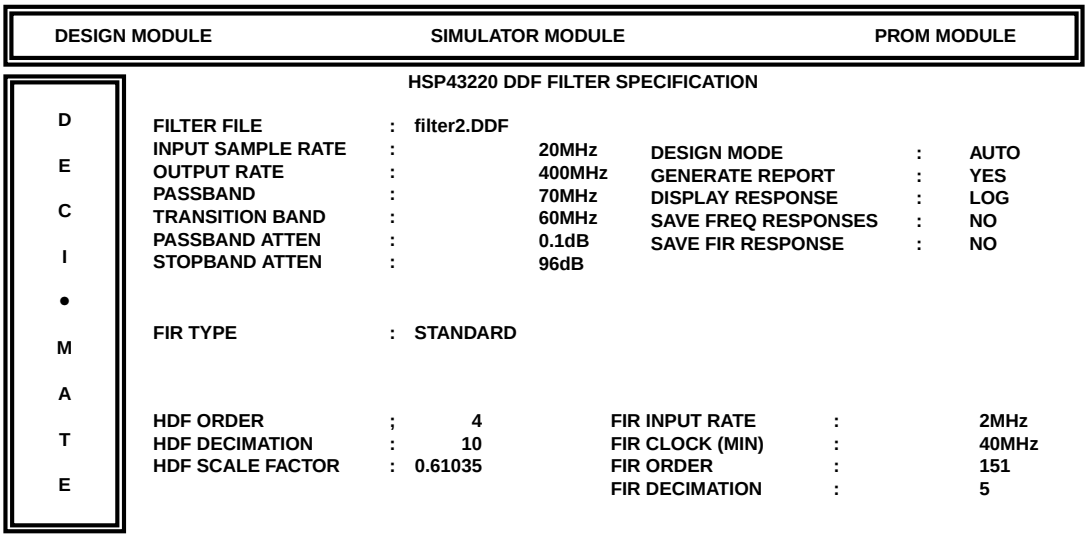

FIGURE 4. FILTER DESIGN DISREGARDING FIR CLOCK (MIN)