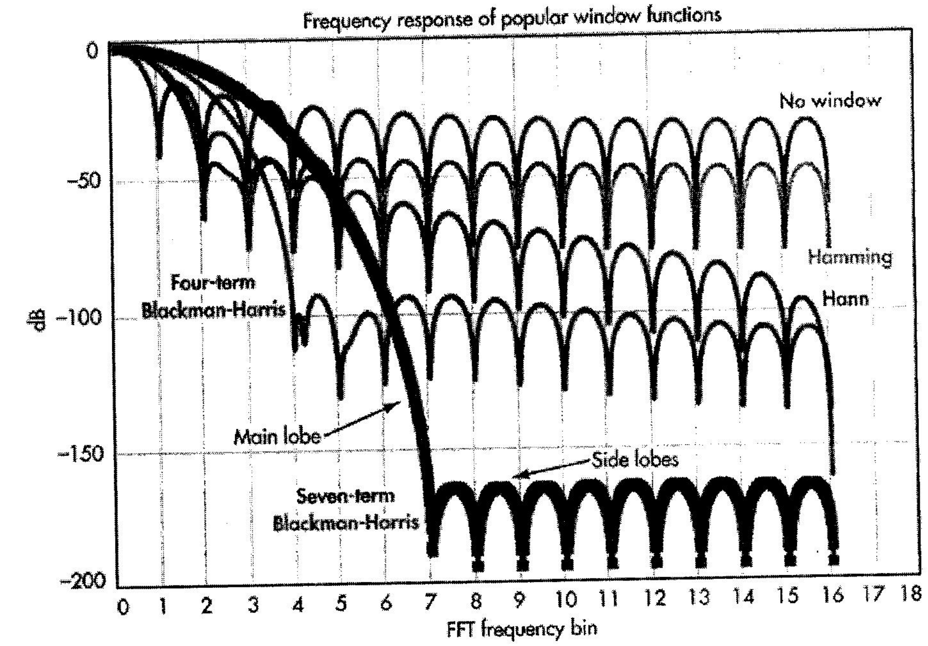
requirements (*Fig. 5*).



5. This plot displays the frequency response of a few popular FFT windowing functions. When choosing between the different window functions, a tradeoff is made between frequency resolution due to the main lobe spreading across bins and the side lobe attenuation. When testing the performance of precision ADCs with a single-tone sinusoidal signal, choose a window with a wide main lobe and very low-amplitude side lobes (high dynamic range) to accurately resolve the low-level noise and distortion components in the frequency spectrum.

In this application, a single-tone signal is used for dynamic testing of high-resolution ADCs. The optimal window function requires a high dynamic range to accurately resolve noise and distortion components in the frequency spectrum. Consider an ideal ADC, where the signal-to-noise ratio (SNR) is given as a function of the number of bits (N):

$$SNR_{Ideal} = 6.02\,N + 1.76\ (dB) \qquad (2)$$

Using Equation 2, the SNR for an ideal 14-bit ADC yields 86 dB, and the SNR for a 16-bit ADC is 98 dB. The necessary side lobe attenuation level should exceed the dynamic range of the ADC under test by some margin. The table lists parameters used to characterize the frequency response of a few windowing functions.

The Hann and Hamming windows do not offer enough side lobe attenuation to be used to test high-resolution ADCs. The four-term Blackman-Harris function has a side lobe rejection level that allows us to accurately test a 12-bit ADC converter. However, this window is not adequate to resolve the SNR of a 16-bit resolution ADC. The seven-term Blackman-Harris has enough dynamic range to resolve the FFT spectral components of a 24-bit resolution ADC.

When using a single-tone sinusoidal signal, the SNR, with respect to the carrier, is calculated as the ratio of power of the tone signal (PSignal) to the power of the noise components in the spectrum (PNoise), excluding the harmonics of the signal as shown in:

$$SNR_{dB} = 10\log_{10}(P_{Signal}/P_{Noise}) = P_{Signal(dB)} - P_{Noise(dB)} \qquad (3)$$

For example, if the seven-term Blackman-Harris window is selected, the fundamental and its harmonics will spread across the window main lobe width bins (±7 side bins around the signal). Therefore, prior to performing the SNR calculation, you need to remove these bins around the signals when calculating the noise power.

Processing loss is the reduction in SNR due to the signal spreading across the main lobe width. Because of this spreading in the signal power, a gain correction factor must be used to accurately compute SNR. The *processing loss* assumes the frequency of the test