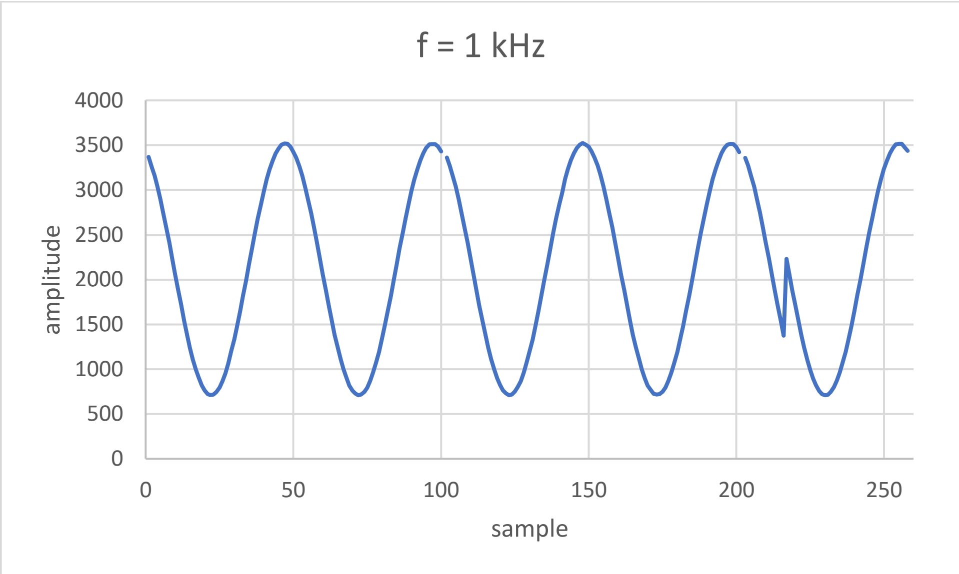
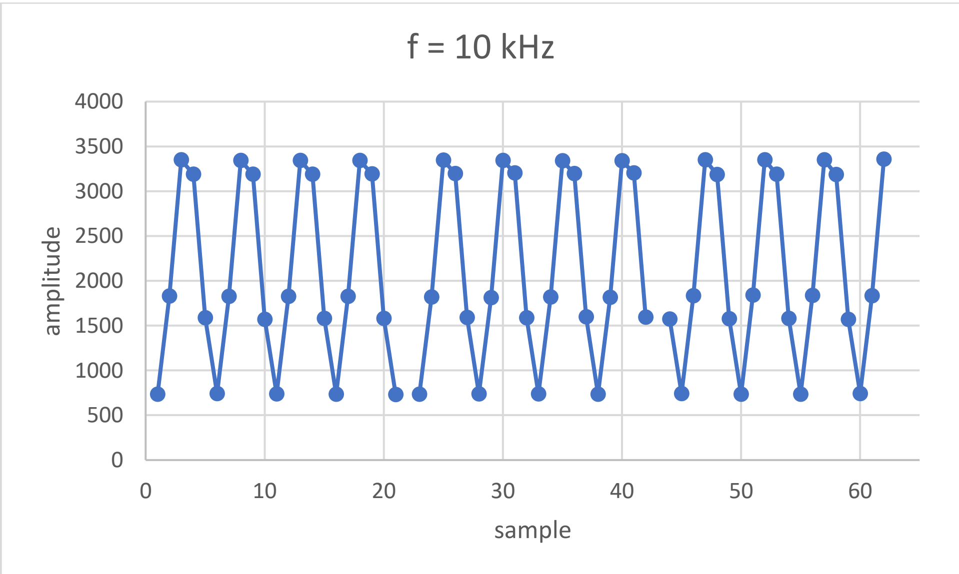
1. Introduction

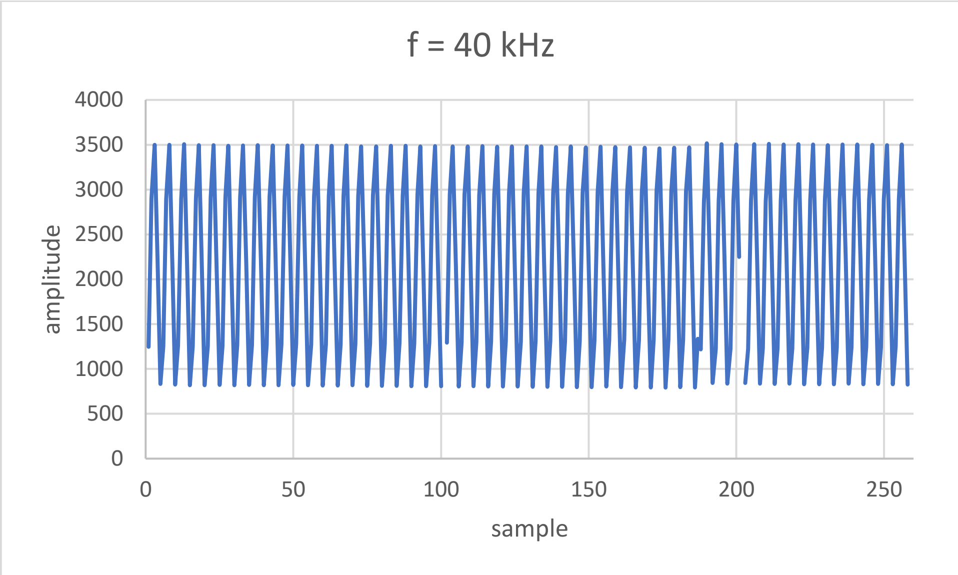
The aim of the laboratory was to familiarize with the principles of ADC. Using Analog Discovery 2 as a sine wave generator, we had to read STM32 ADC input. In first part ADC sampling rate was 50 kHz, driven by Timer3, then in second, ADC used DMA with oversampling x16, which gave again sampling rate equal to 50 kHz.

2. Results

2.1. ADC without DMA





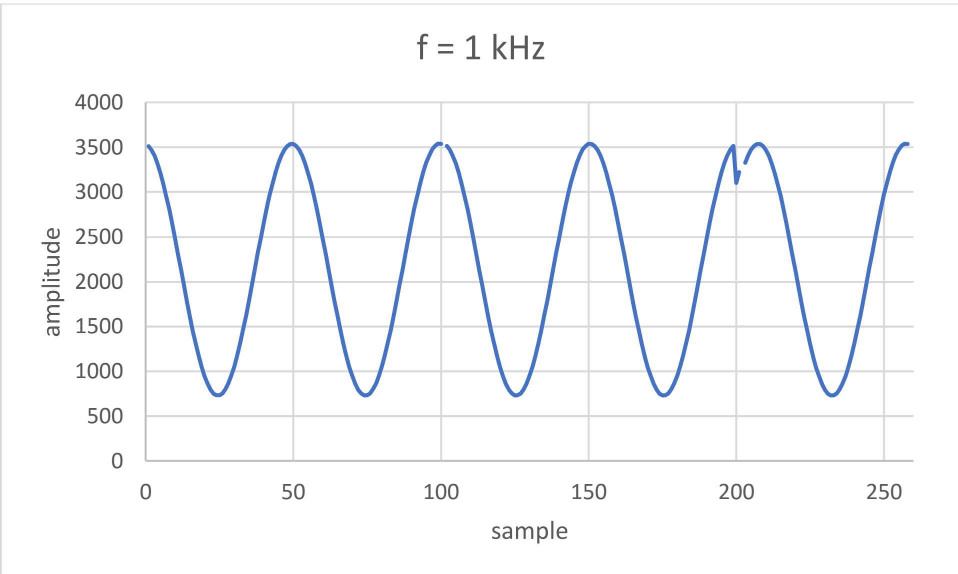


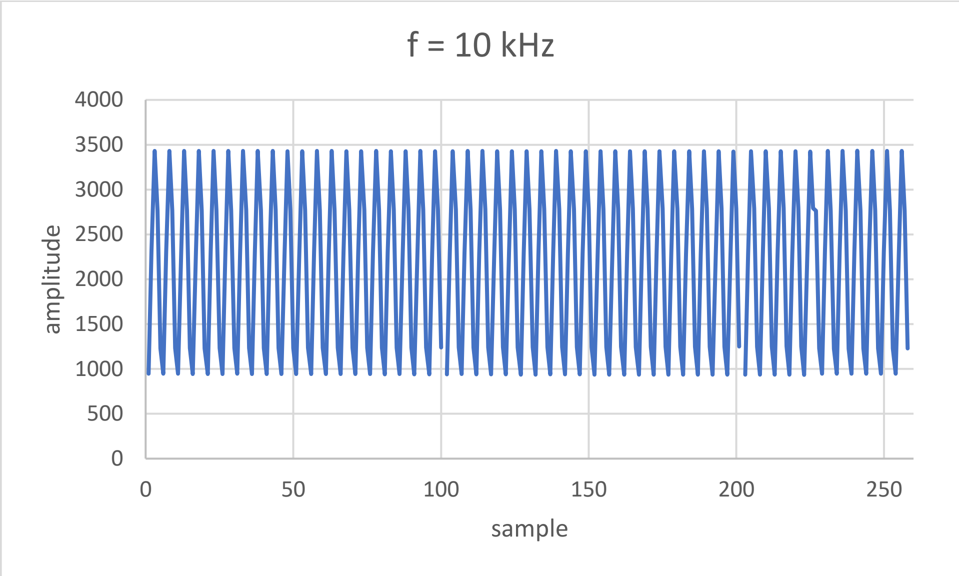
Given that the sampling rate is 50 kHz, and for example in 1 kHz signal we can see a period equal to around 50 samples, we can calculate that the frequency is indeed equal to 1 kHz. Using the same method, third signal frequency is equal to around 10 kHz, when it should be 40 kHz. This happens because Shannon-Kotelnikov theorem is not fulfilled. According to it, to sample 40 kHz signal, sampling rate should be at least 80 kHz, while 50 kHz was used in laboratory. This is known as aliasing.

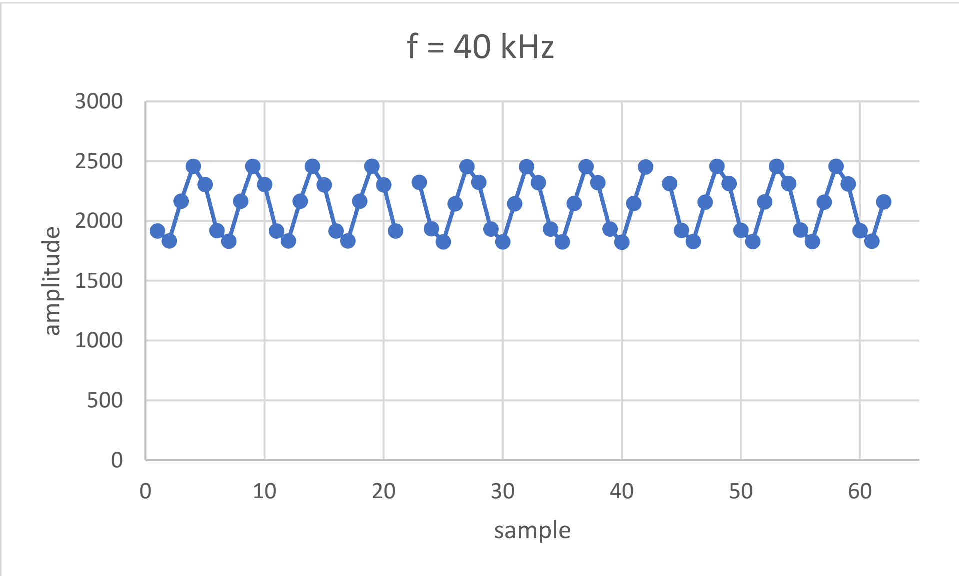
NOTE: second signal has lower number of samples due to some error while copying data from IDE.

It is worth noting that the shape of signal is not ideal – it is best seen on the 1 kHz signal. There is a peak in one place of sine wave. This is caused by the storing buffer not being checked if it achieved its end (uint8_t so 255) after which the counter should be reset. This way the signal flow is not continuous.

2.2. ADC with DMA







In the second part, results are quite similar – signals for 1 and 10 kHz are sampled properly, while last one (40 kHz) is not ideal. Again, because sampling frequency is equal to 50 kHz. Increasing it to 80 kHz should help. Oversampling helps increase SNR so the advantages of this method should be seen after using FFT to check for harmonics. DMA itself improves performance because data is saved directly in memory, bypassing processor.