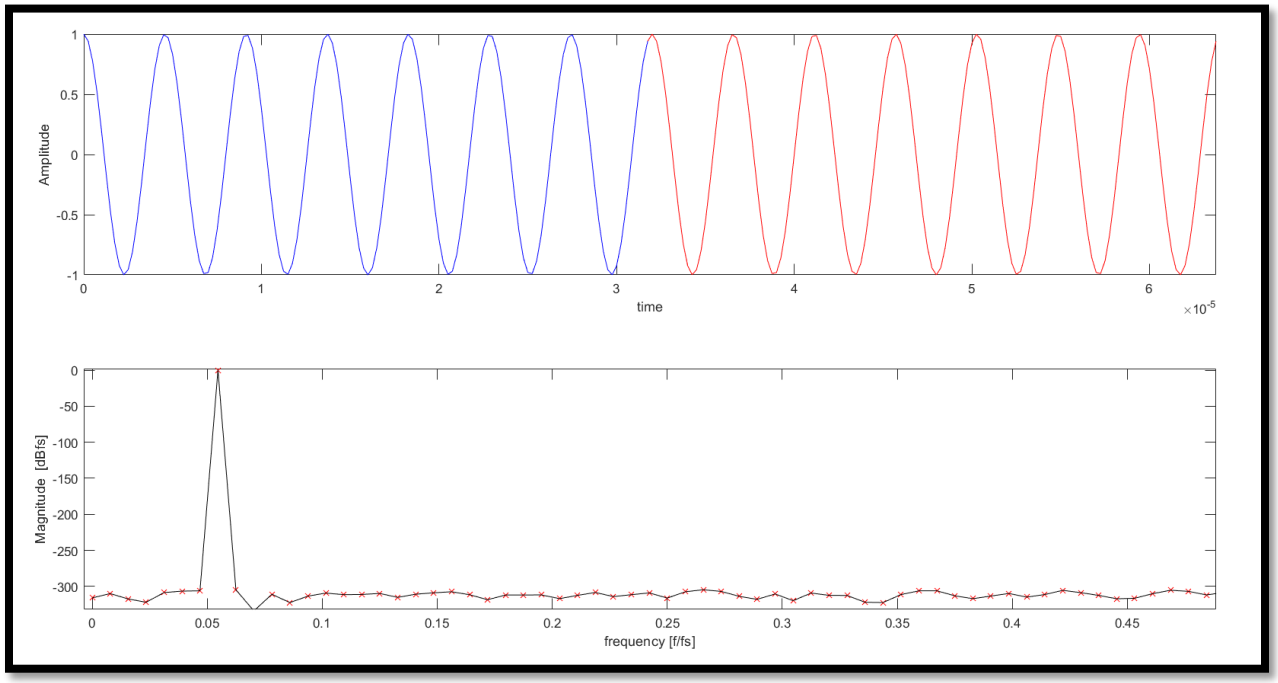
W2022 Siemens ADCs

Lab 1

Sampling and Quantization in MATLAB

Part I :



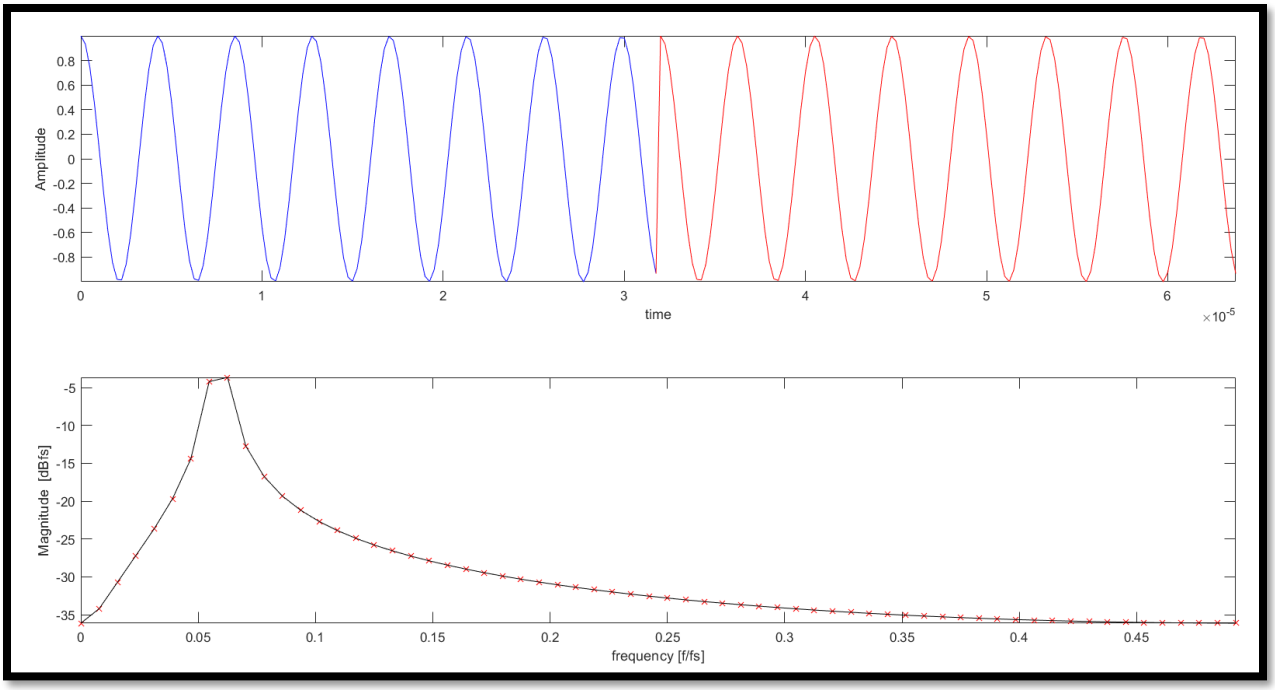
1-Power of the peak signal in dBfs : **$-9.64*10^{-16}$ dB**

2-Number of bins occupied by the test signal is : **1**

3- The noise floor (in dBFS) is : **300 dBfs**

4- If the sampling is ideal, what is the source of error that causes the noise floor? **The automatic Quantization by Matlab (64 bit).**

Part II:



1-Power of the peak signal in dBfs : **-3.66dB**

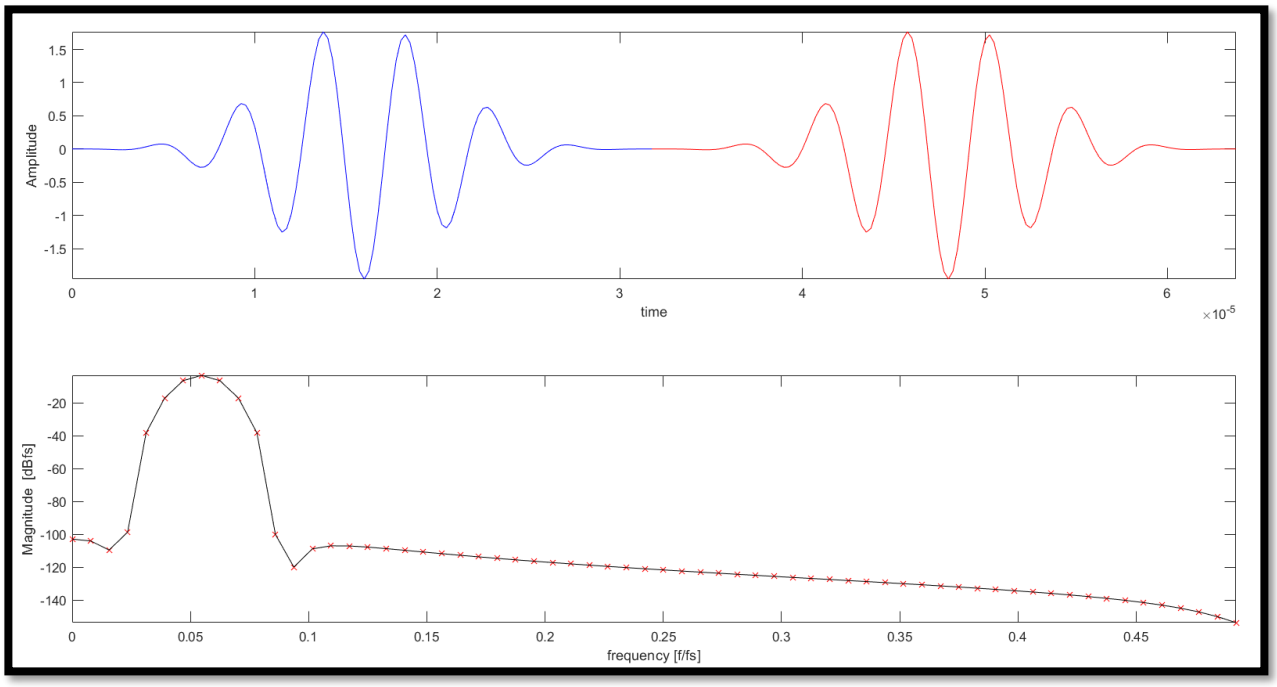
2-Number of bins occupied by the test signal is : **6**

3- The noise floor (in dBFS) is : **35 dBfs**

4- If the sampling is ideal, what is the source of error that causes the noise floor? **The automatic Quantization by Matlab (64 bit),in addition to that the** $\frac{f_{in}}{f_s} \neq \frac{M_c}{M}$ **where :**

f_{in} ***is the testing tone frequency and*** f_s ***is the sampling frequency and*** M_c ***is number of cycles in data window and M is the recorded length*** .

Part III :



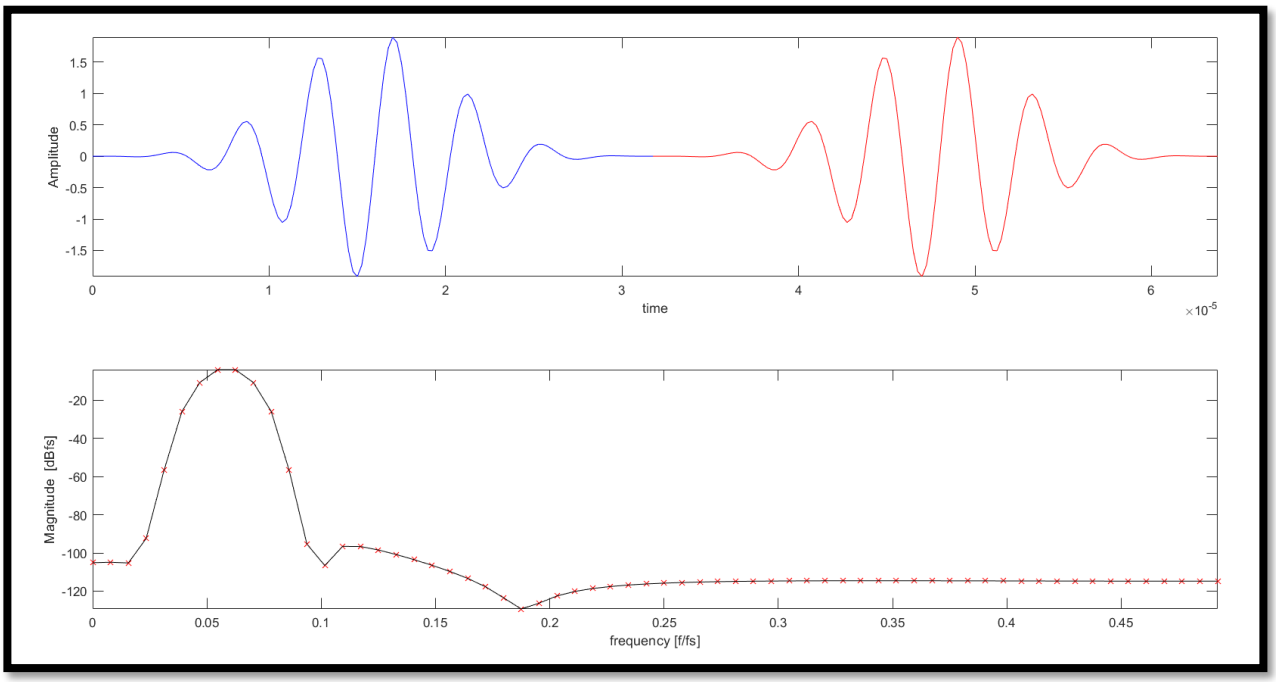
1-Power of the peak signal in dBfs : **-3.13dB**

2-Number of bins occupied by the test signal is : **7**

3- The noise floor (in dBFS) is : **150 dBfs**

4- If the sampling is ideal, what is the source of error that causes the noise floor? **The automatic Quantization by Matlab (64 bit), and due to the data windowing the signal won't be perfect continuous sine wave , so the noise floor is better than rectangular window and worse than in the case of perfect continuous sine wave .**

Part IV:



1-Power of the peak signal in dBfs : **-3.94dB**

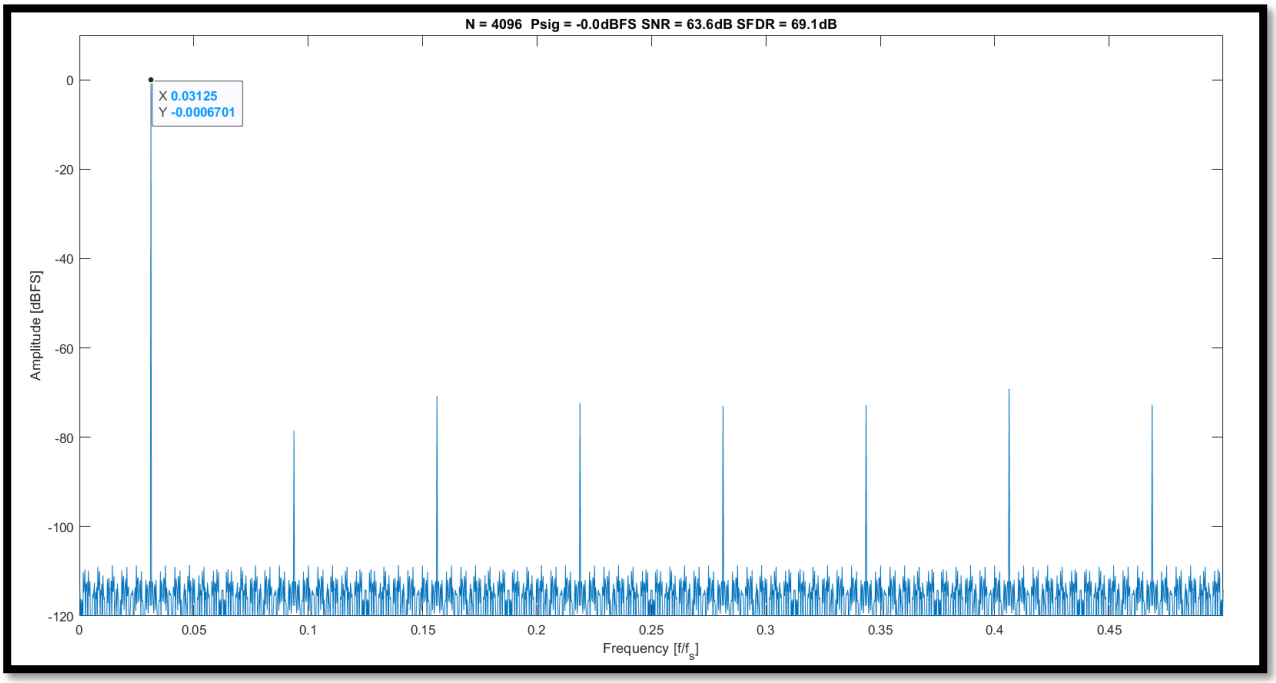
2-Number of bins occupied by the test signal is : **8**

3- The noise floor (in dBFS) is : **130 dBfs**

4- If the sampling is ideal, what is the source of error that causes the noise floor? **The automatic Quantization by Matlab (64 bit), and due to the data windowing the signal won't be perfect continuous sine wave , so the noise floor is better than rectangular window and worse than in the case of perfect continuous sine wave , in addition to that the** $\frac{f_{in}}{f_s} \neq \frac{M_c}{M}$ **where :**

f_{in} is the testing tone frequency and f_s is the sampling frequency and M_c is number of cycles in data window and M is the recorded length .

Part II (Quantization):



1-Is there distortion components ? why? Yes , there are distortion components due to that the ratio between $M_c and\ M$ is integer value so there is correlation .

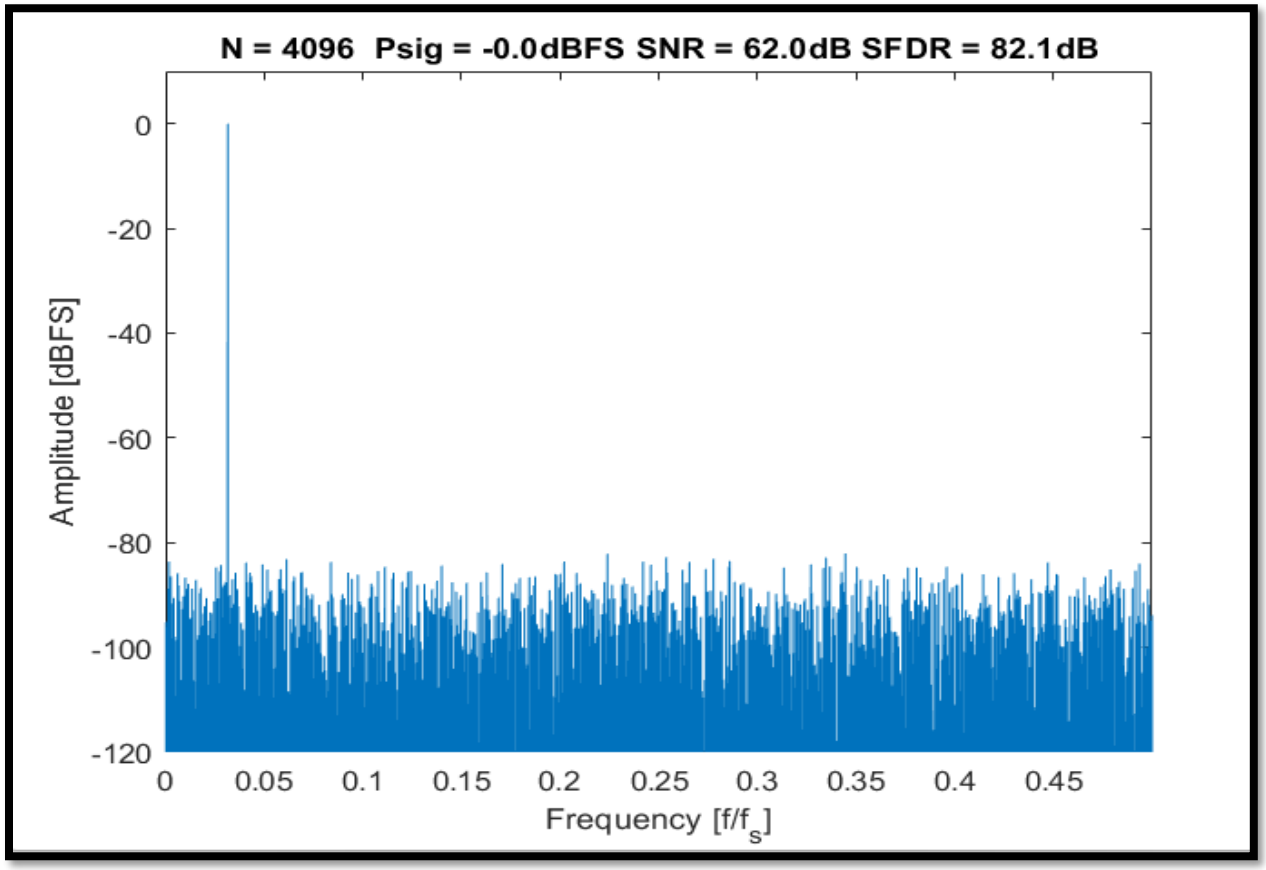
2-From Matlab SNR=63.6 dB , analytically 6.02*10+1.76=61.96 dB

3- From Matlab the noise floor is about -110 dBFS

but analytically it is equal to -61.96-33= -94.96 dBFS

4- How much is the SFDR? Why? Is almost 70dBFs and this is because largest harmonic is almost -70dB

Part II:



1-Is there distortion components ? why? No , there aren't distortion components as there is no correlation as $\frac{M_c}{M}$ is prime number.

2-From Matlab SNR=62 dB , analytically 6.02*10+1.76=61.96 dB

3- From Matlab the noise floor is about -110 dBFS

but analytically it is equal to -61.96-33= -94.96 dBFS

4- How much is the SFDR? Why? Is almost 82dBFs and this is because largest harmonic is almost -82dB .

comment on SFDR:SFDR increased by 12 dB in 2nd case as the power of the harmonics spread at all spectrum .