

communication systems

PROJECT 2

Communication and Electronics Department

signals and systems (EEC 271).

Section 8

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Explanation:

we will implement a very simple communication systems, we try to send a sound file over a communication channel and then try to receiver it.

Transmitter:

At the first stage, which is called the transmitter. we will enter the sound file and prepare it for the transmission over the channel.

Results:

- Play the sound file through Matlab.
- Plot the sound file in time domain and the frequency domain.

Channel:

The channel has the following impulse response. At this stage, we will need to pass the sound

message over the channel. we have 4 options

for the channel impulse response.:

1. Delta function
2. $\exp(-2\pi \cdot 5000t)$
3. $\exp(-2\pi \cdot 1000t)$
4. `[2 zeros(1, Fs-2) .5]`

Then we will Try the four different impulse responses for the channel and compare the effect of the first three ones on the sound signal.

Noise:

The program has the ability to add noise (simply random signal) to the output of the channel.

The random signal generation is done as following: $Z(t) = \sigma * \text{randn}(1, \text{length}(x))$.

Where x is a vector represents the output of the channel.

The user should enter the value of the sigma at this stage.

The output will be a Gaussian distributed noise with zero mean and standard deviation of sigma.

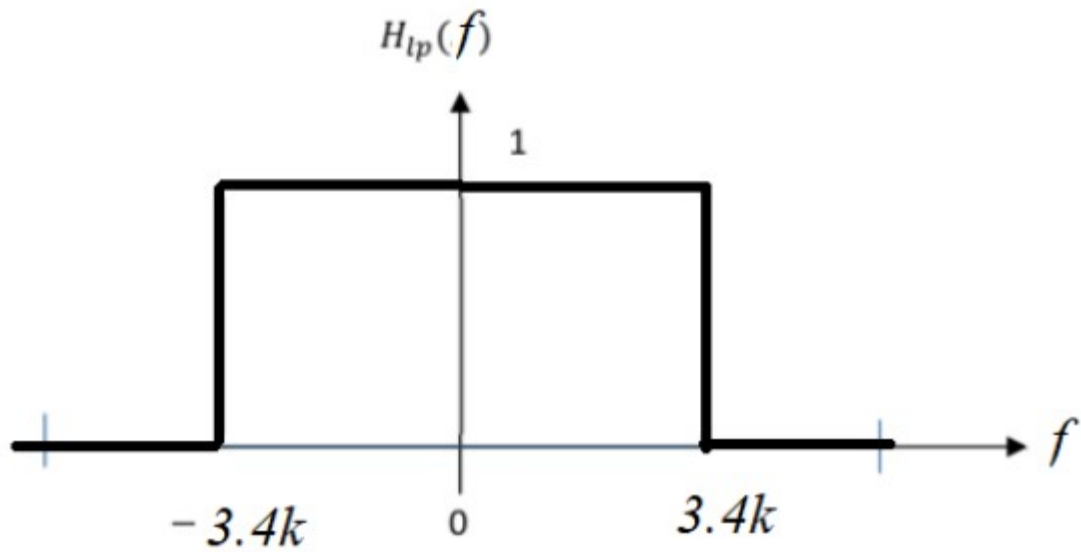
Results:

- Play the sound file after adding noise.
- Plot the sound file in time domain and the frequency domain.

Receiver:

In order to limit the effect of the noise,

1. we will construct an ideal low pass filter which has a cut off of 3400 KHz. The frequency response of the filter as shown in figure.



2. pass the noisy sound over the ideal filter.

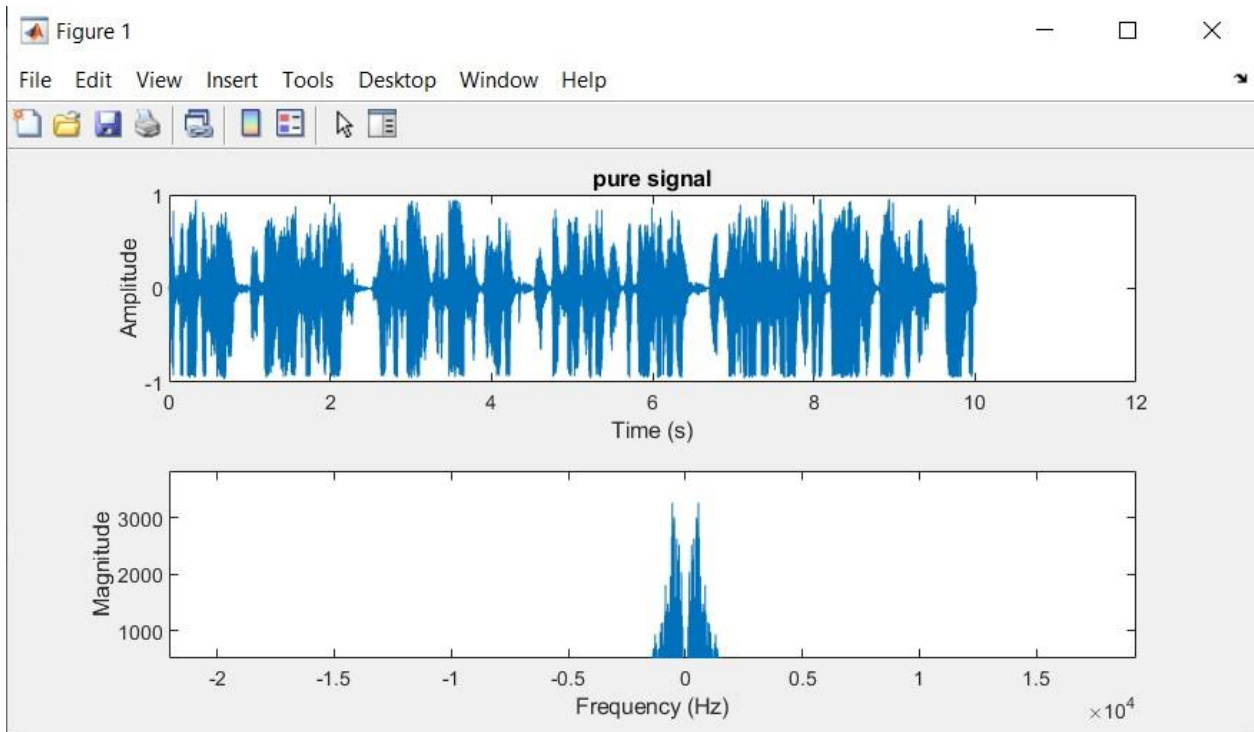
Results:

- Play the sound file after the filter.
- Plot the output sound file in time domain and the frequency domain.
- we will try this project for a music file and comment on the effect of the project when it is applied to both files (sound and music).

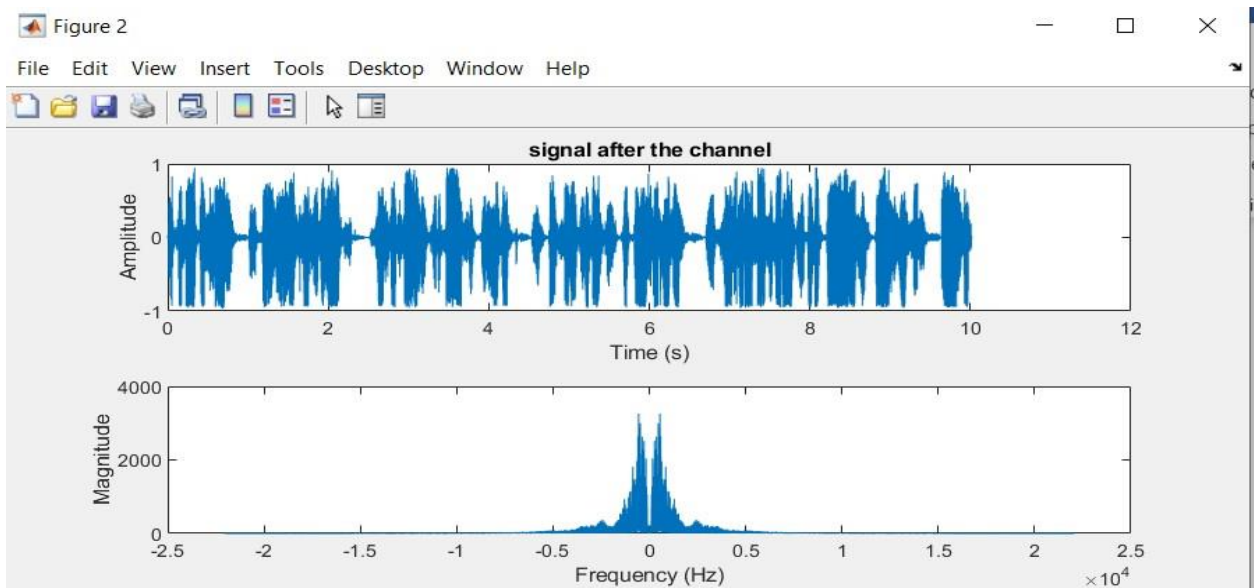
Test 1(Sound file):

1.We will choose a delta function, with $\sigma=0.01$.

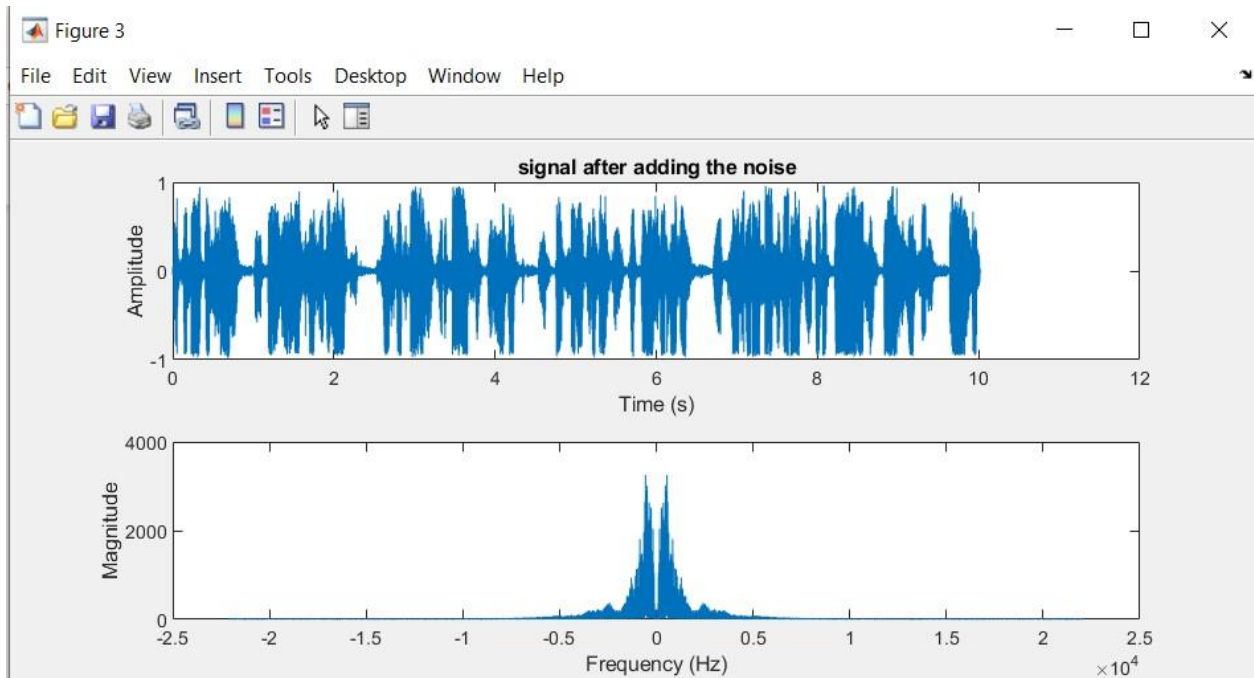
Plot the sound file in time domain and the frequency domain:



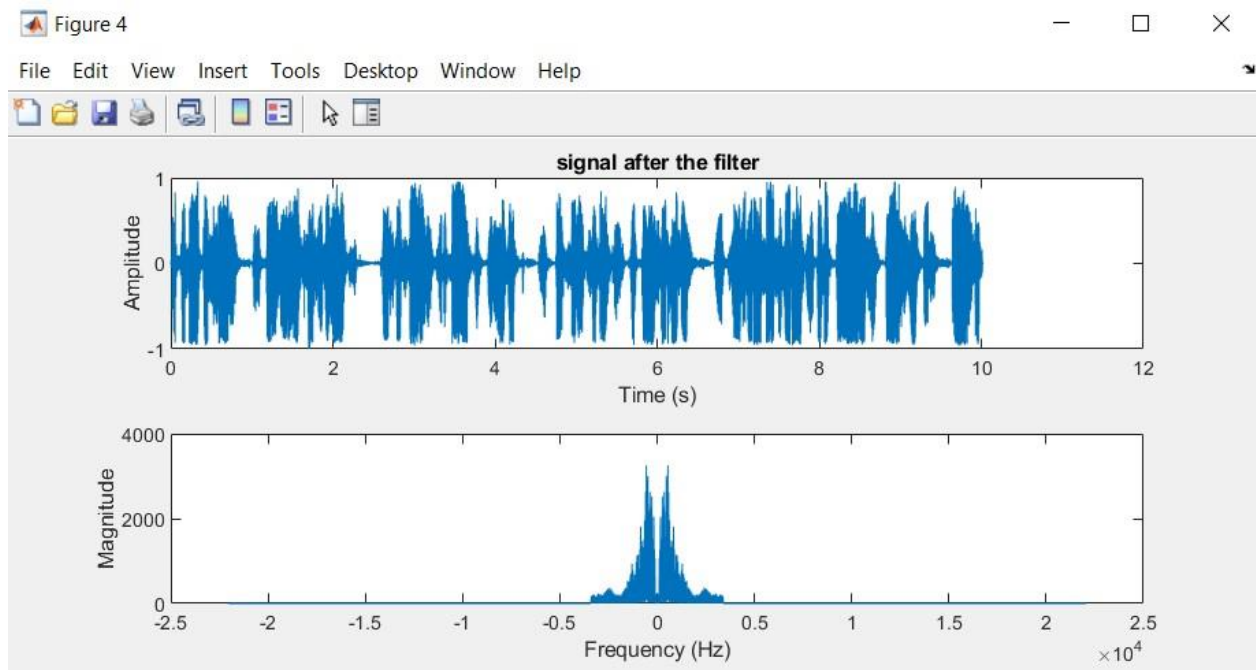
Then preparing it for the transmission over the channel:



After noise:

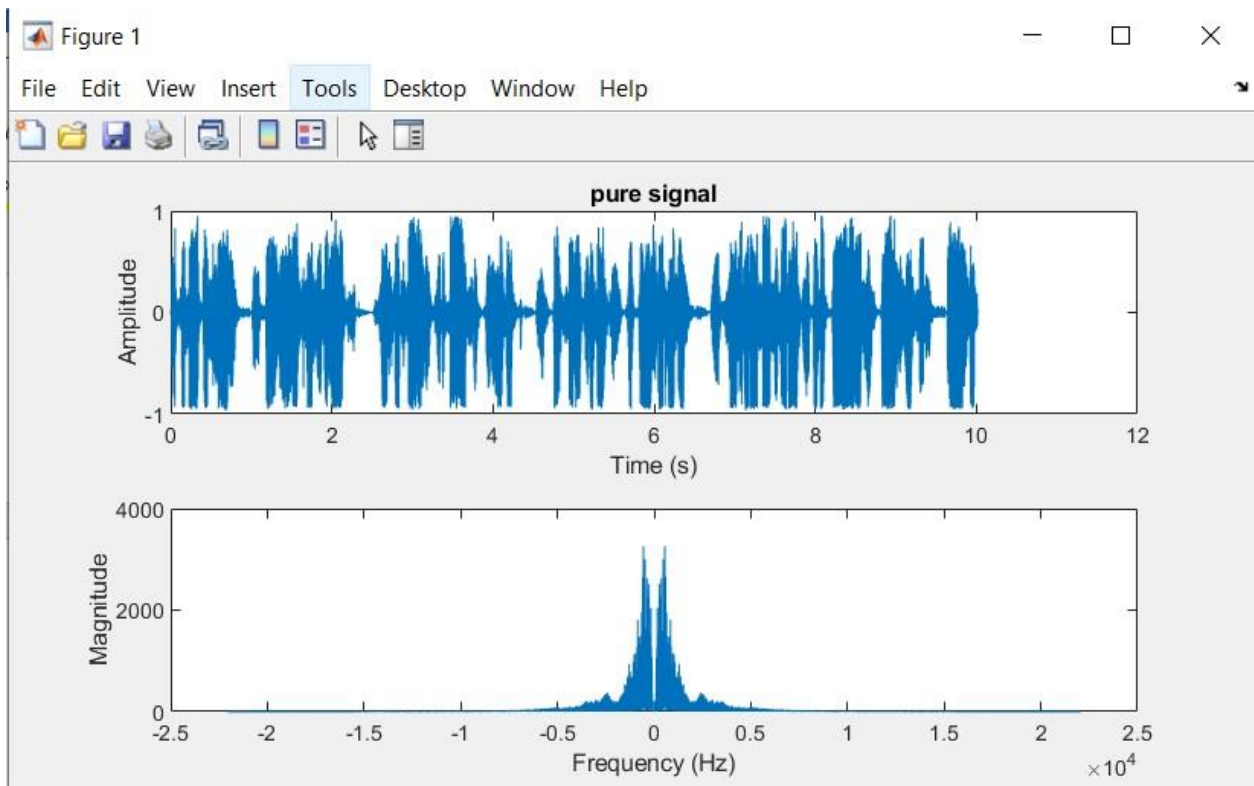


After the filter:

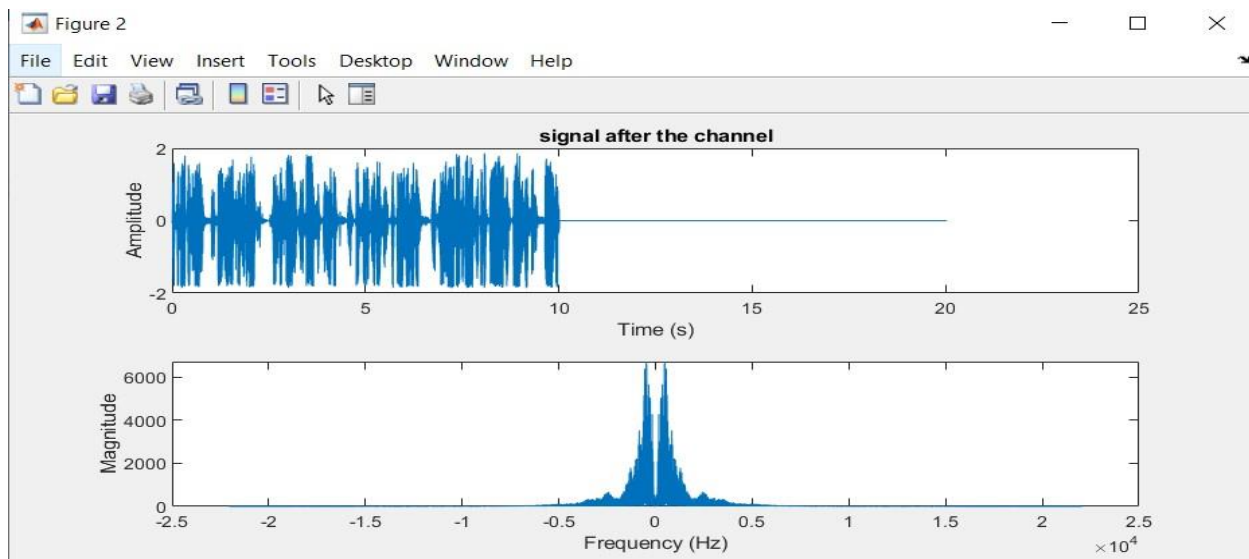


2. We will choose an exponential function with $W=5000$, with $\sigma=0.01$.

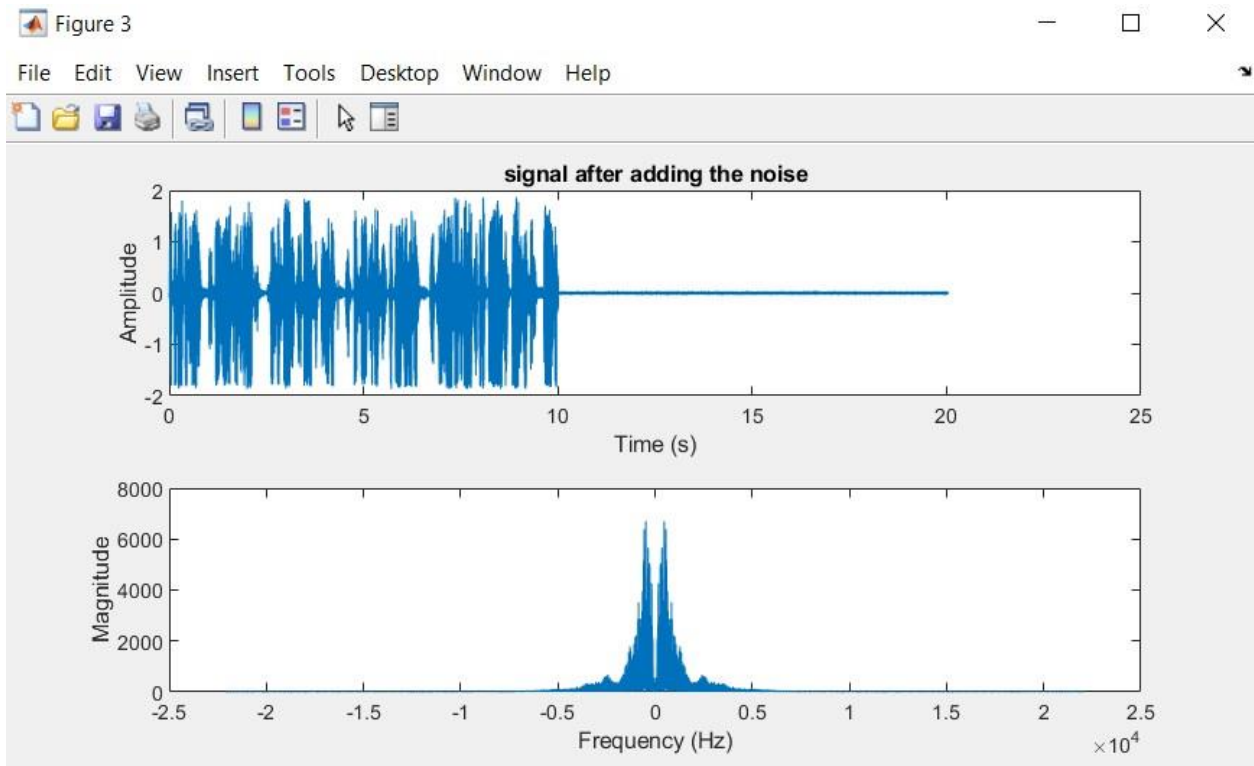
Plot the sound file in time domain and the frequency domain:



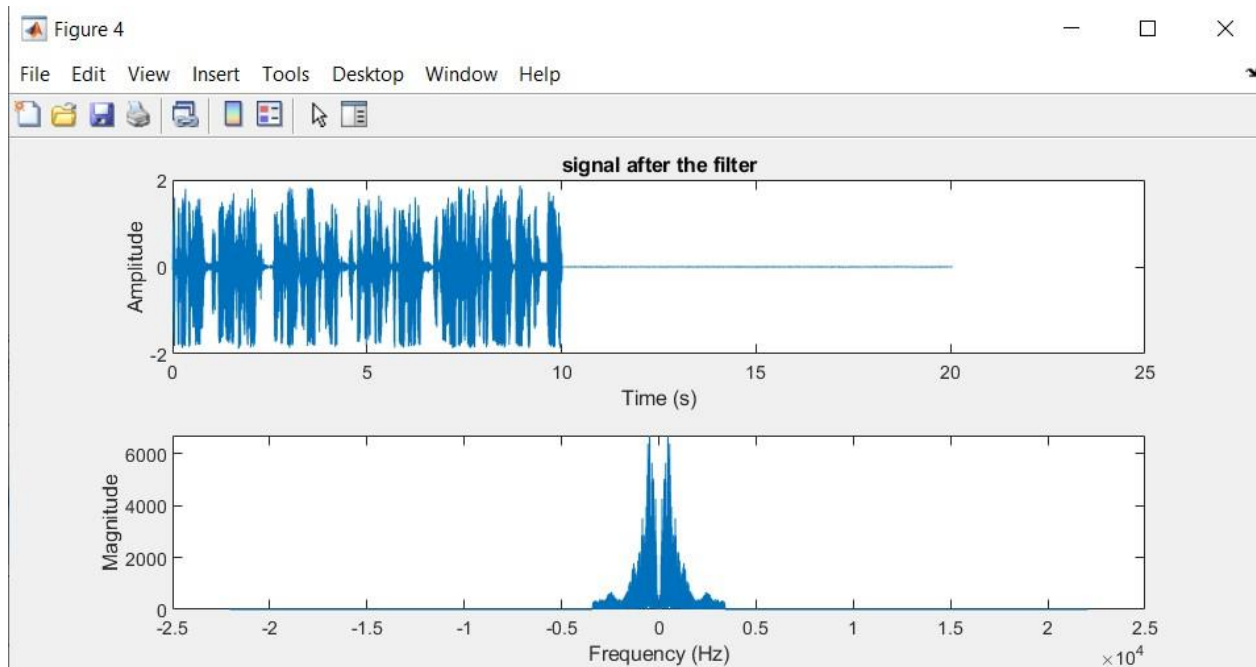
Then preparing it for the transmission over the channel:



After noise:

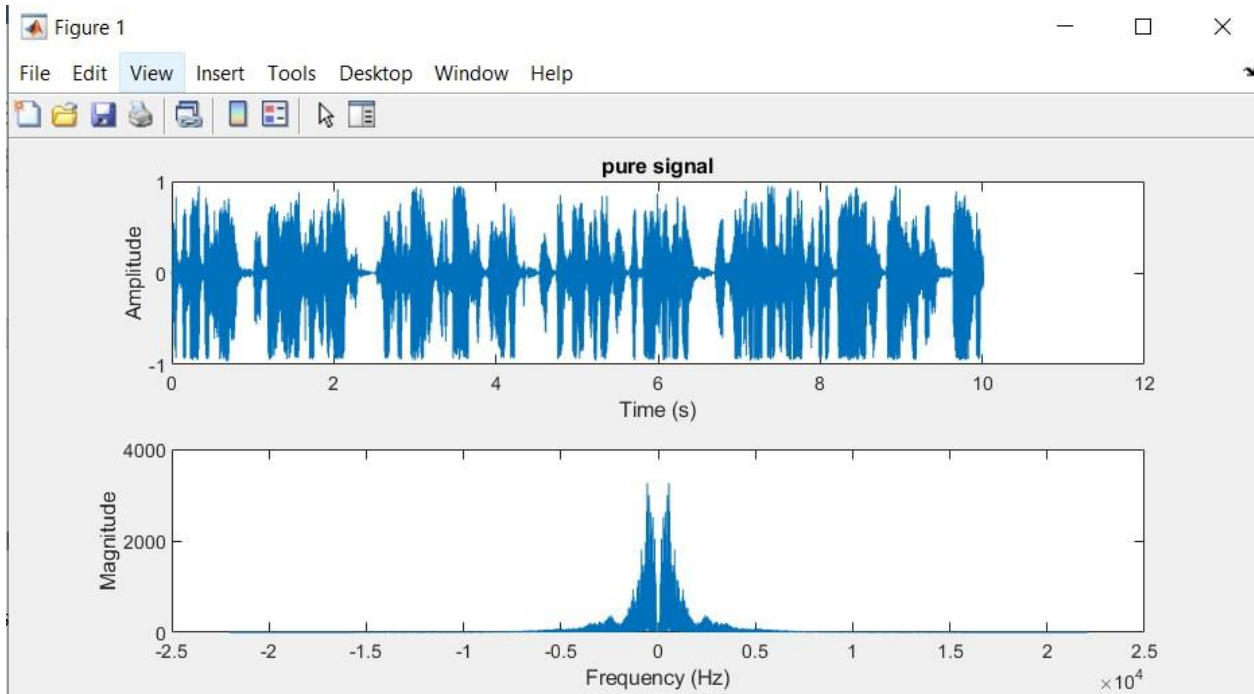


After the filter:

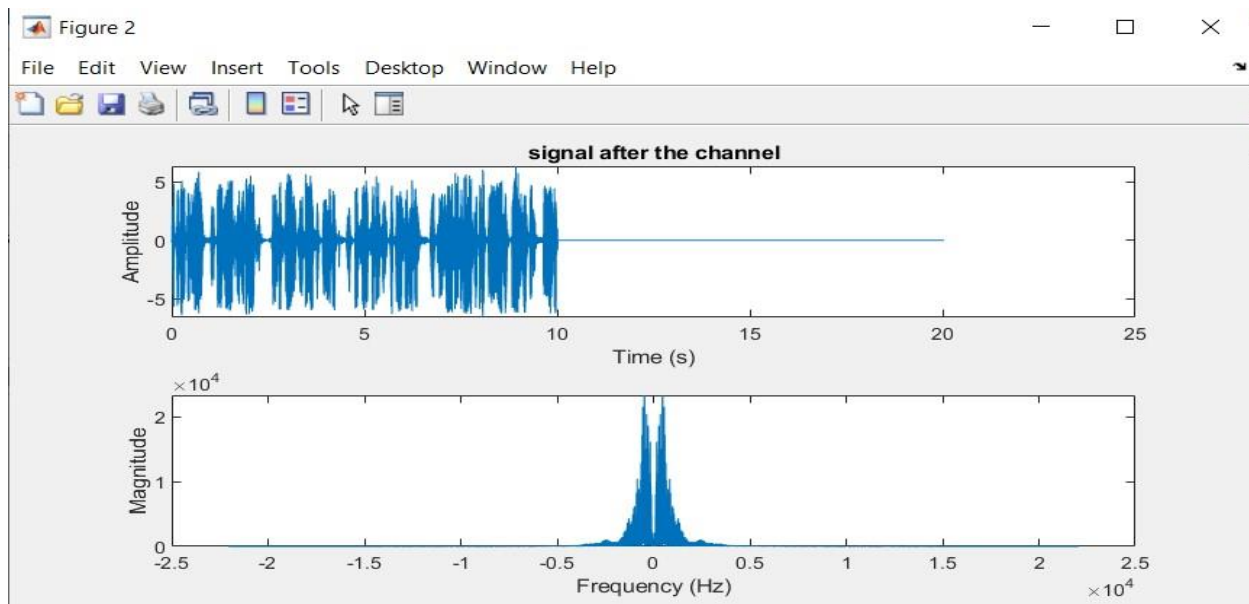


3. We will choose an exponential function with $W=1000$, with $\sigma=0.01$.

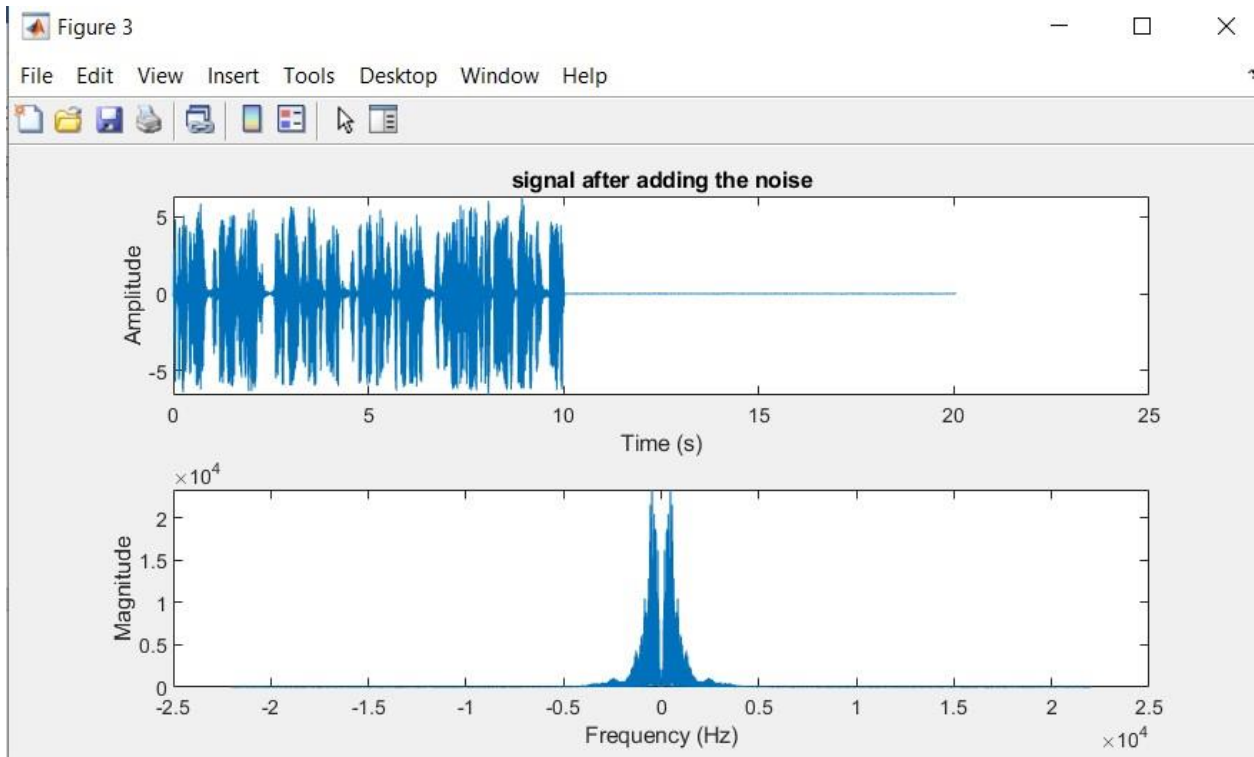
Plot the sound file in time domain and the frequency domain:



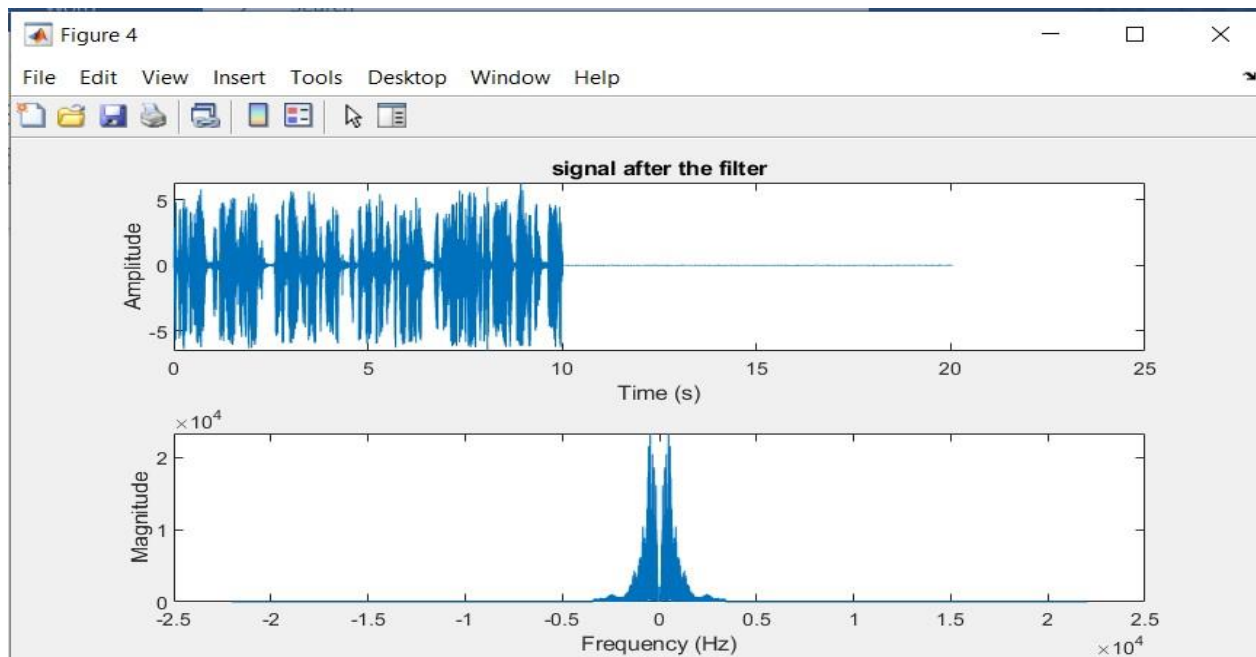
Then preparing it for the transmission over the channel:



After noise:

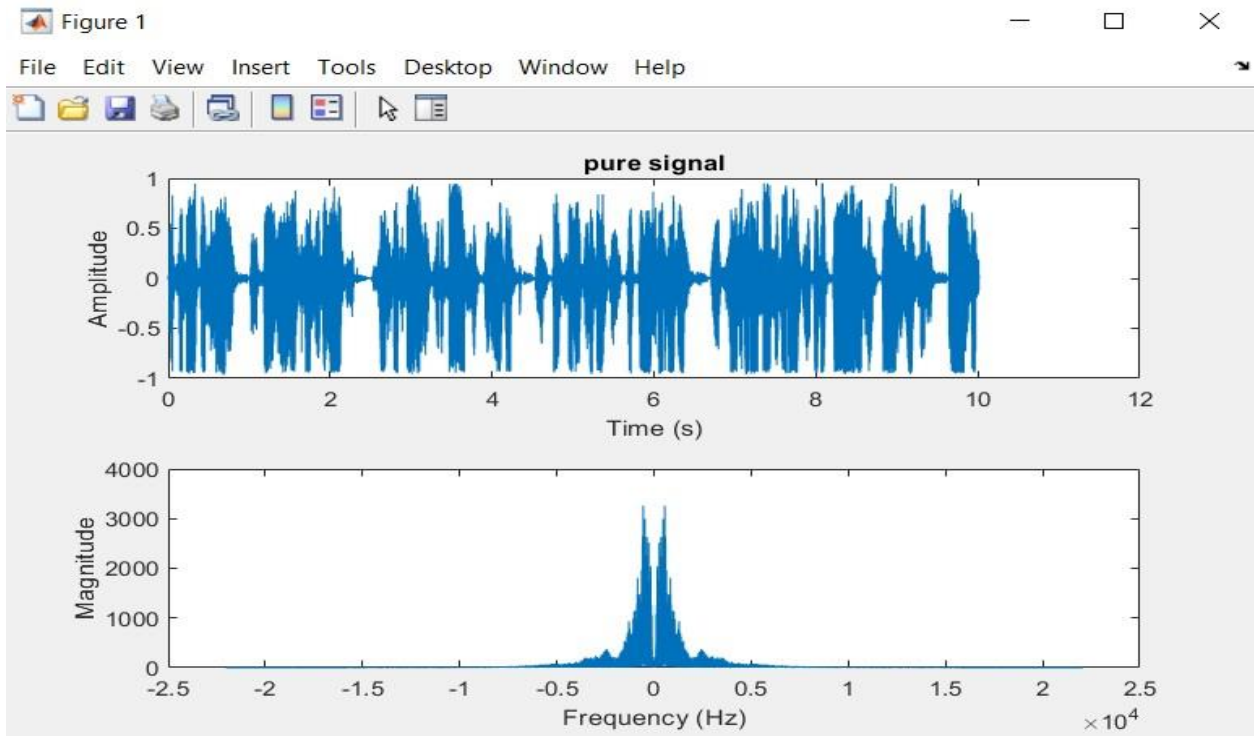


After the filter:

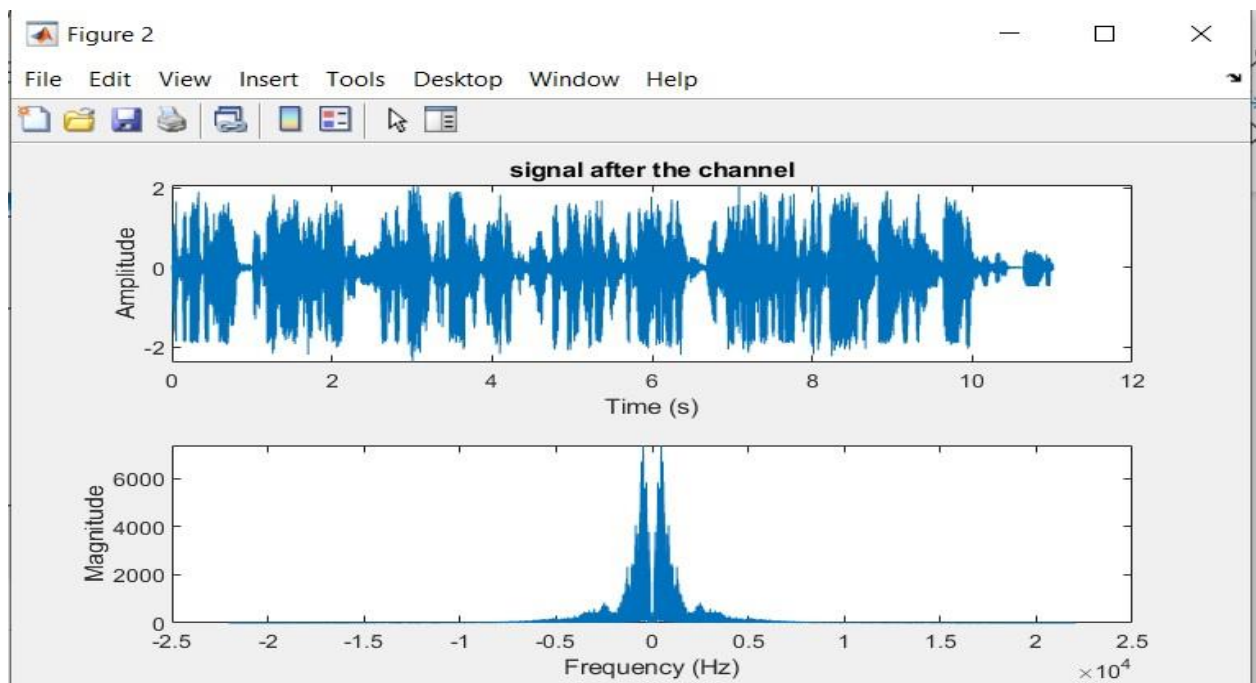


4. We will choose impulse response = $[2 \text{ zeros}(1, F_s-2) .5]$, with $\sigma=0.01$.

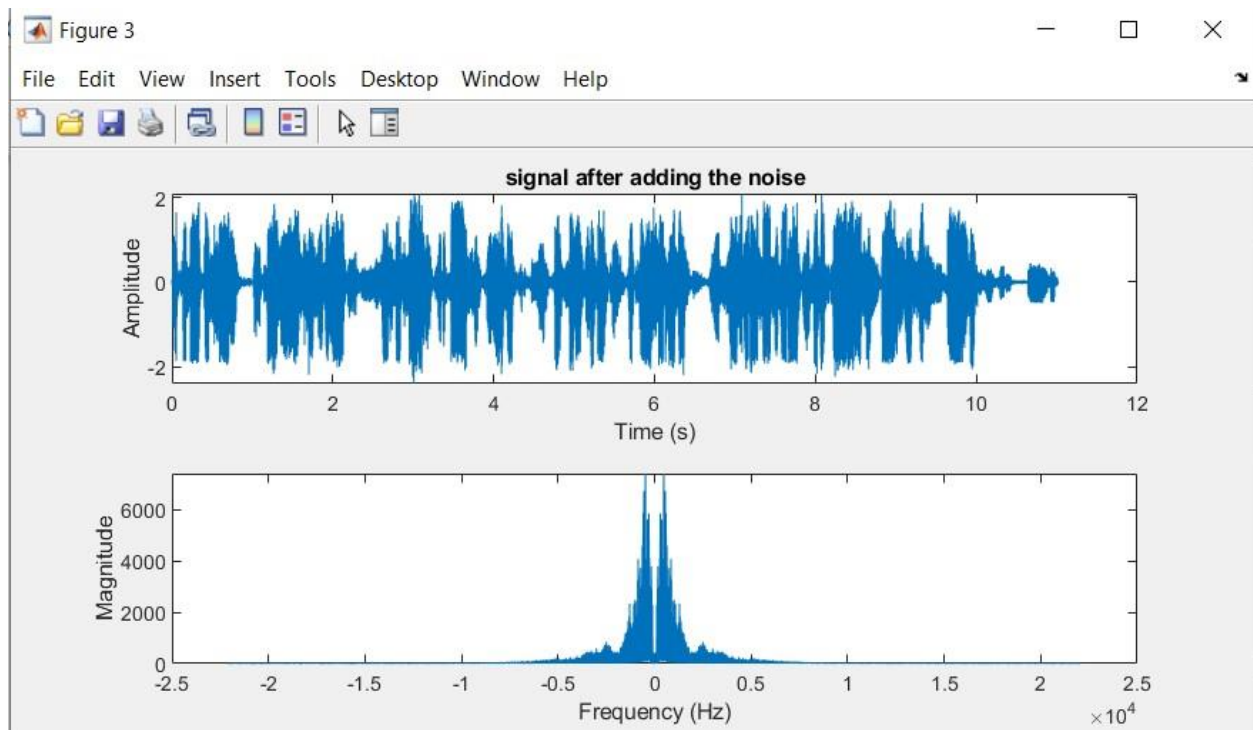
Plot the sound file in time domain and the frequency domain:



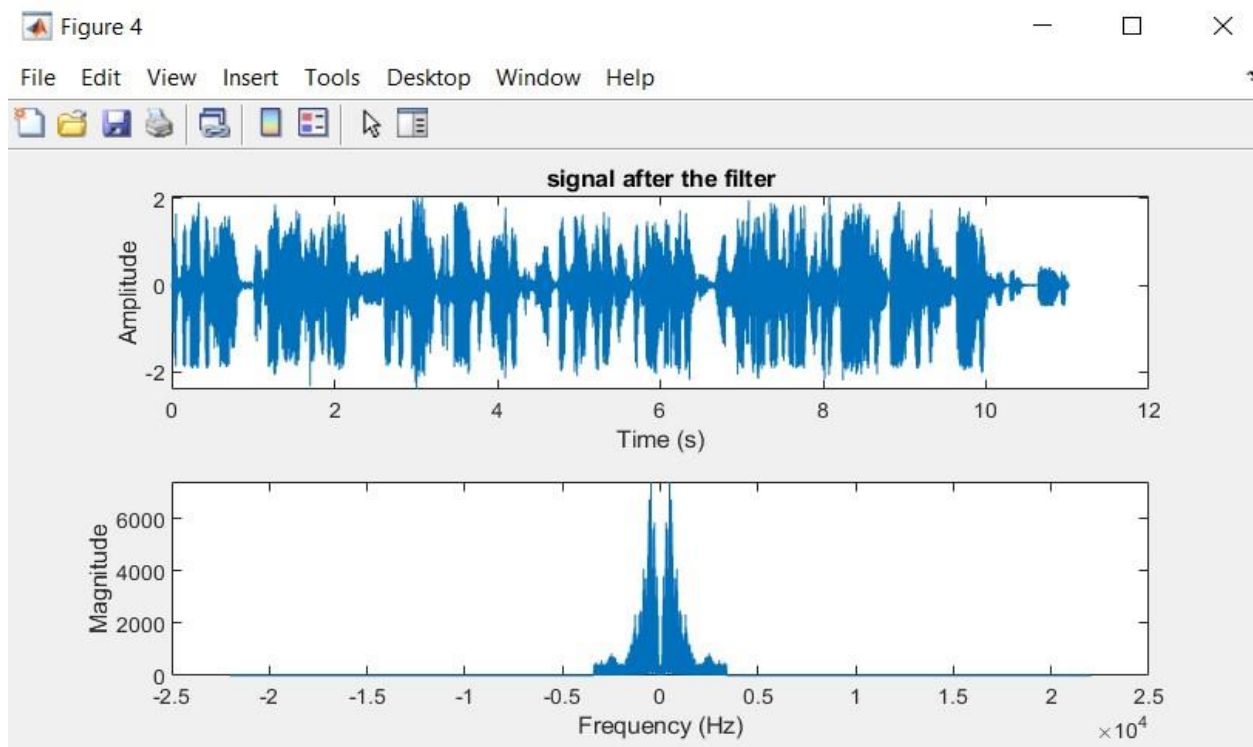
Then preparing it for the transmission over the channel:



After noise:



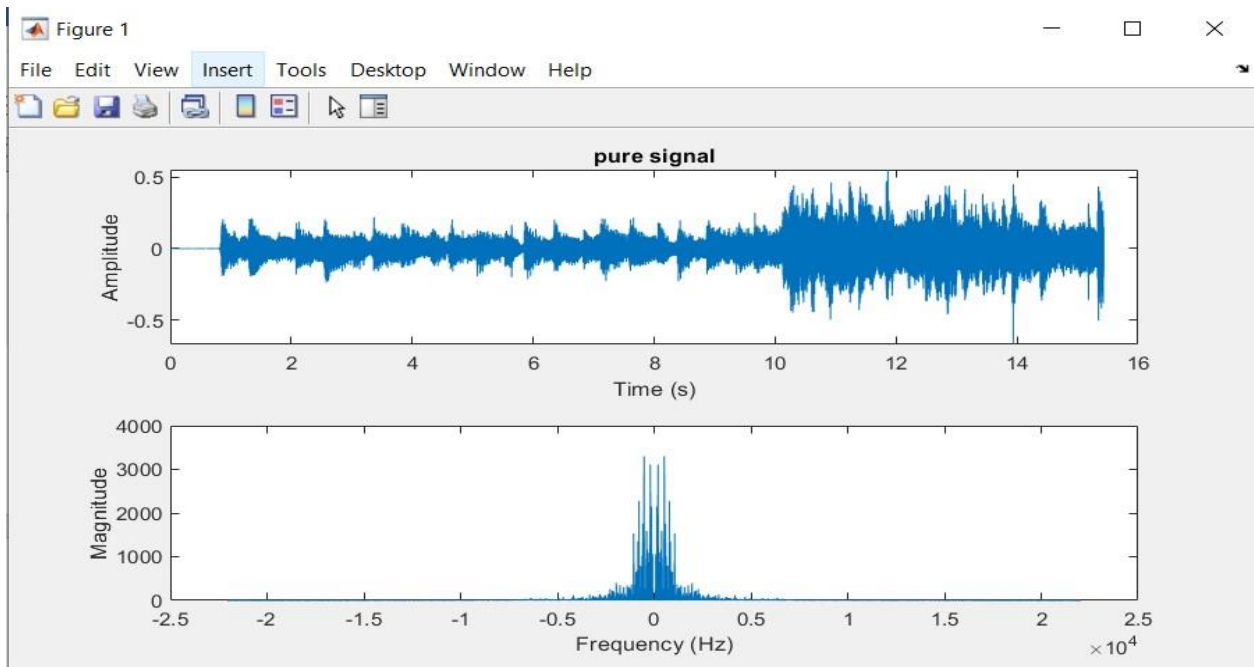
After the filter:



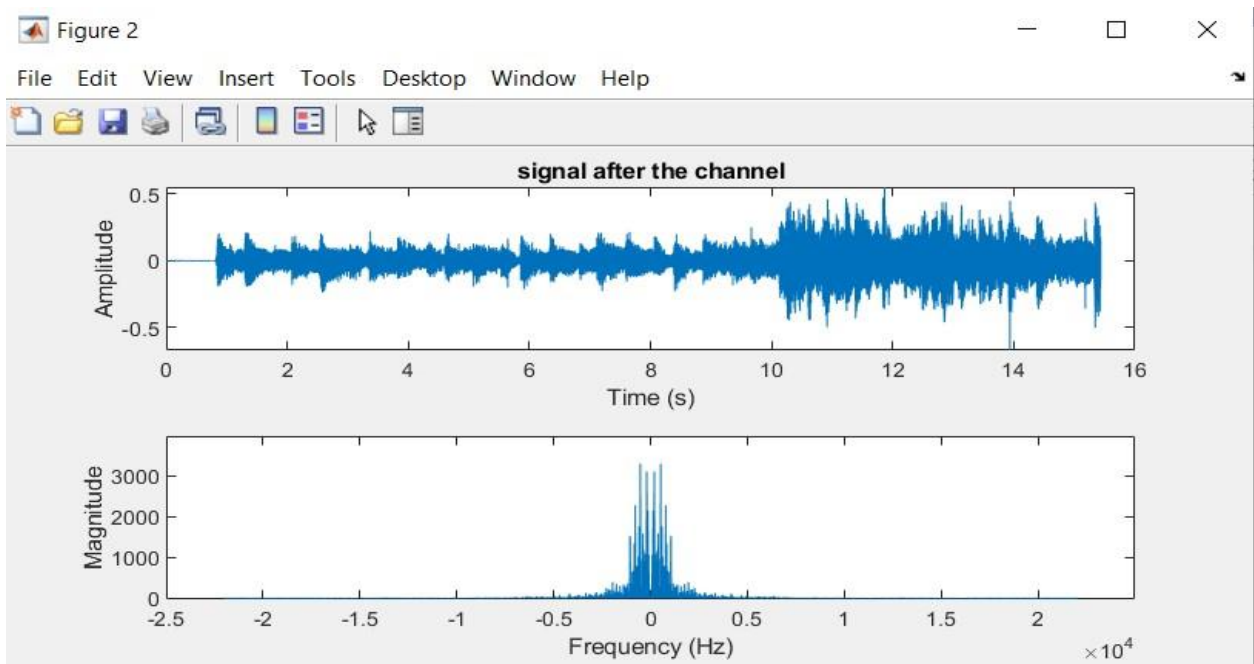
Test 2(Music file):

1. We will choose a delta function, with $\sigma=0.5$.

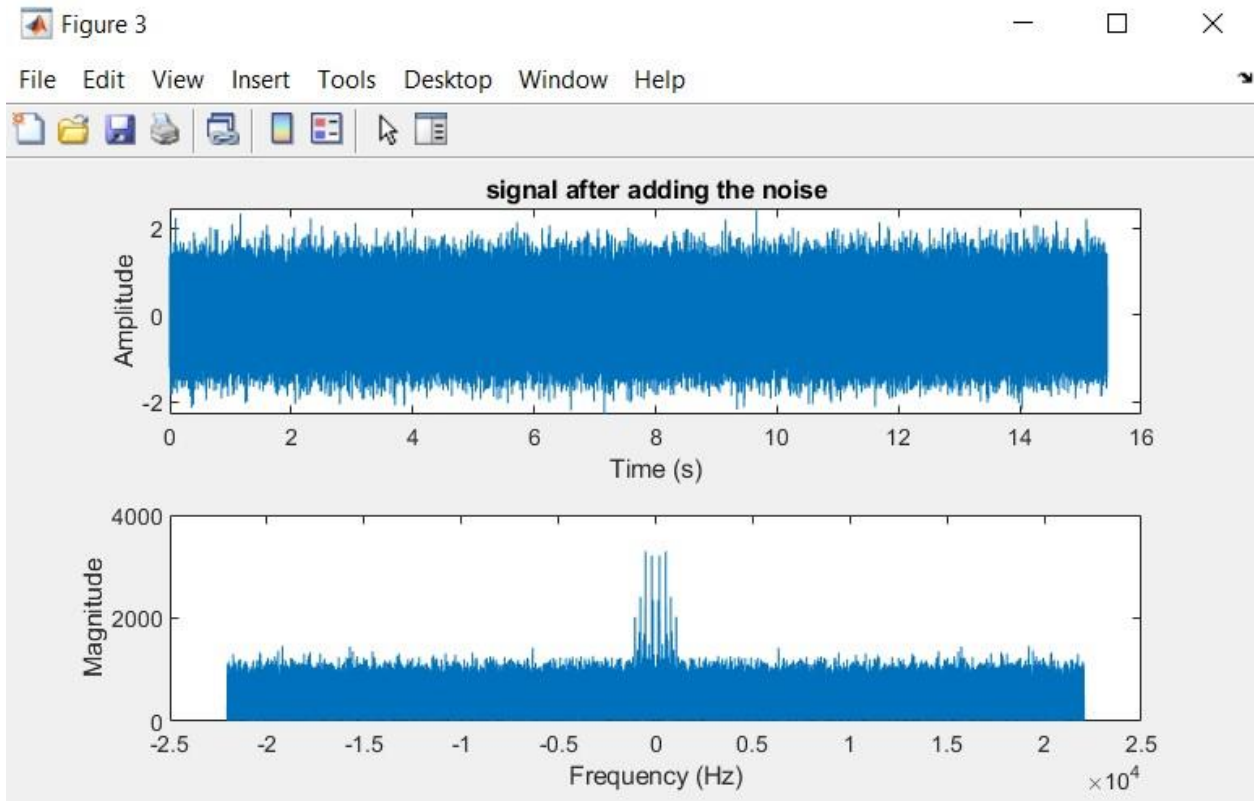
Plot the sound file in time domain and the frequency domain:



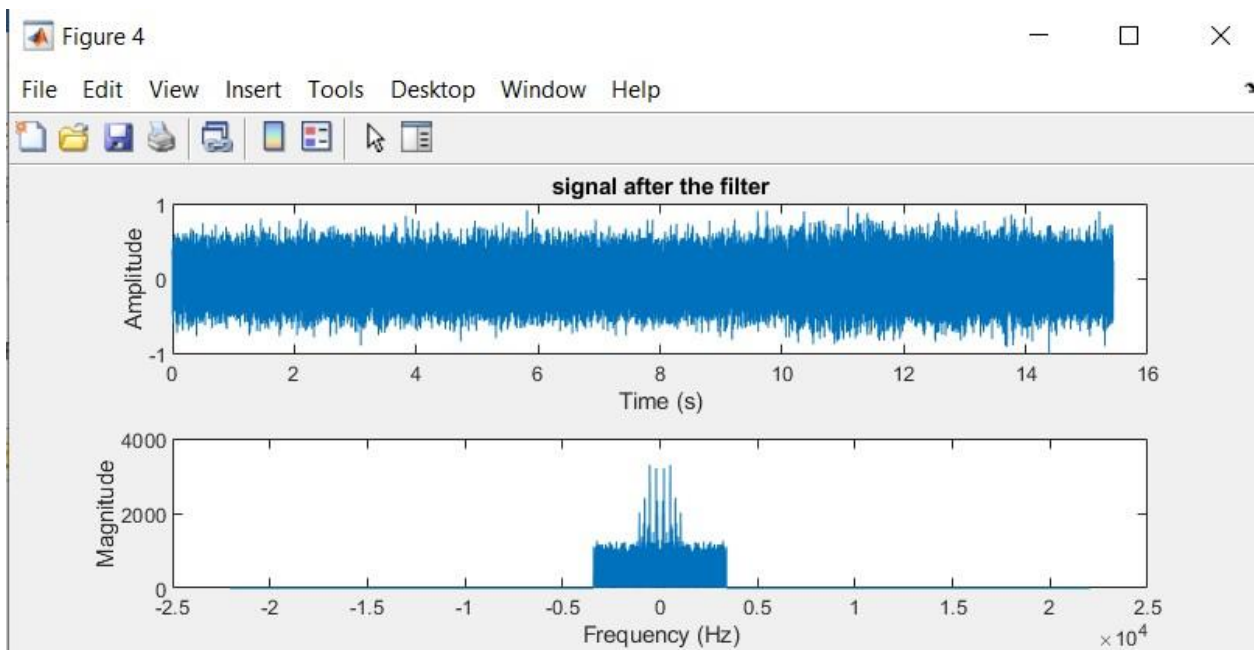
Then preparing it for the transmission over the channel:



After noise:

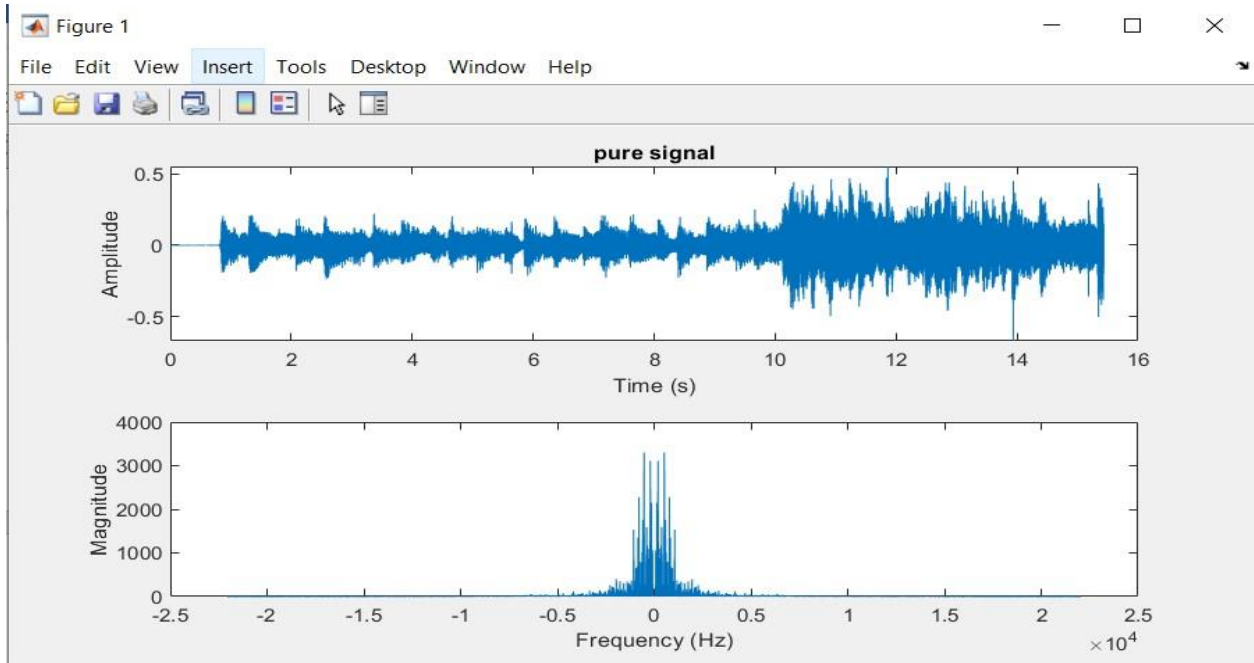


After the filter:

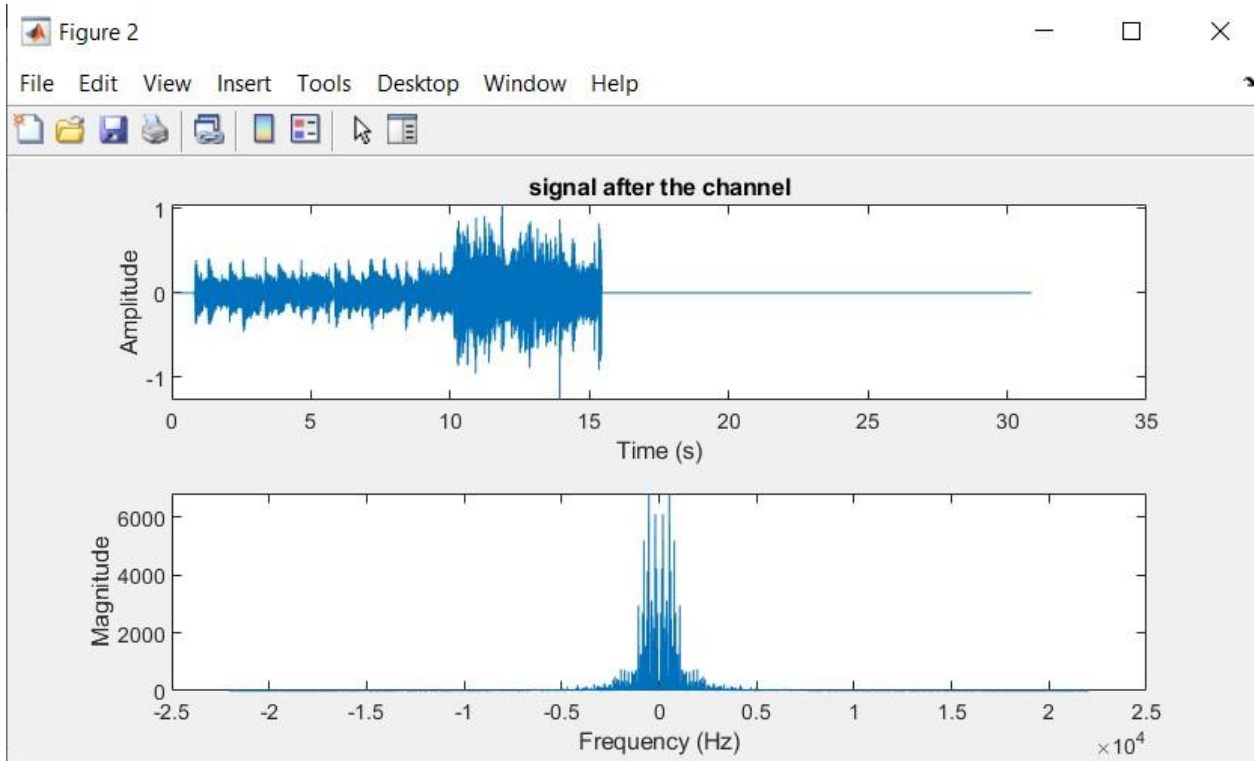


2. We will choose an exponential function with $W=5000$, with $\sigma=0.5$.

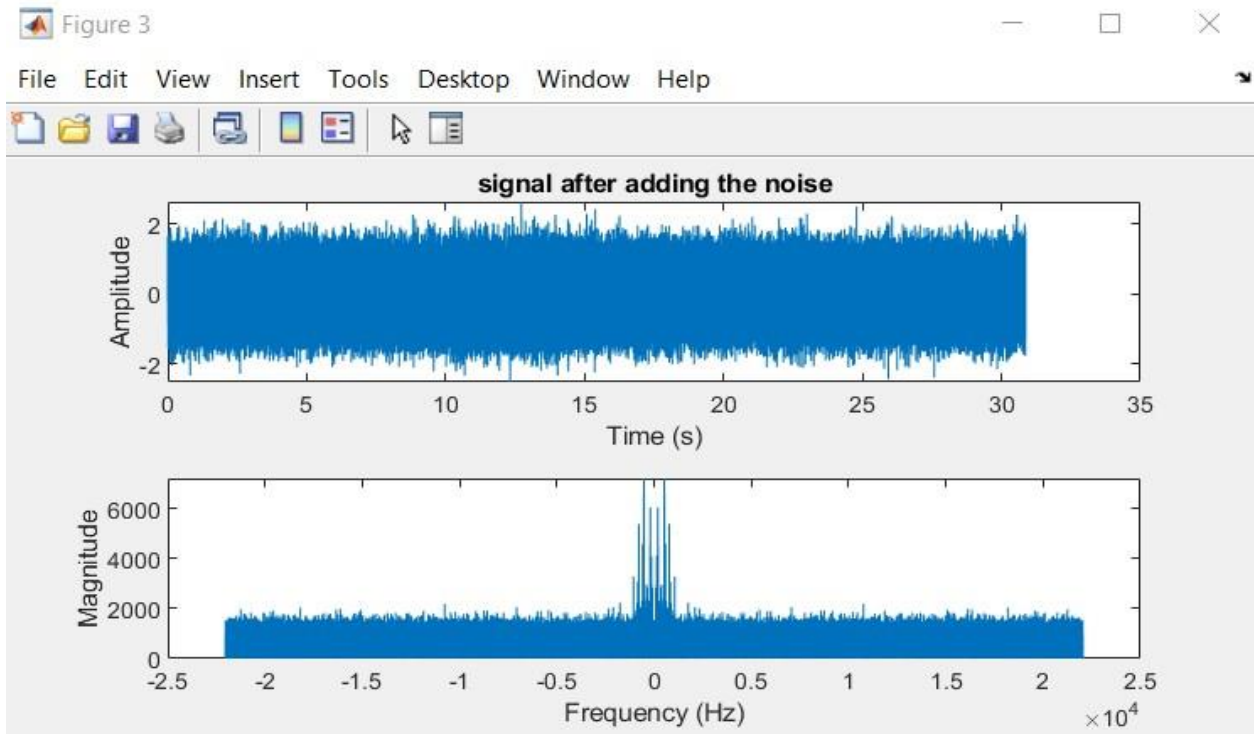
Plot the sound file in time domain and the frequency domain:



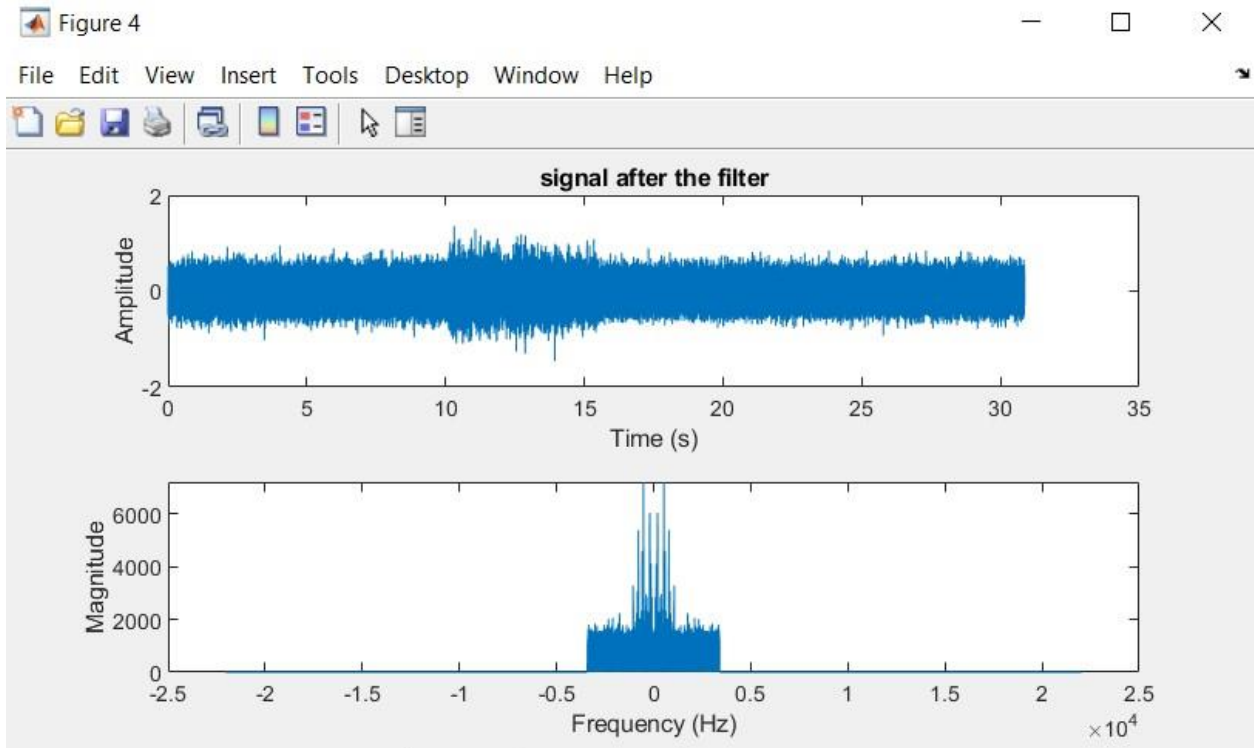
Then preparing it for the transmission over the channel:



After noise:

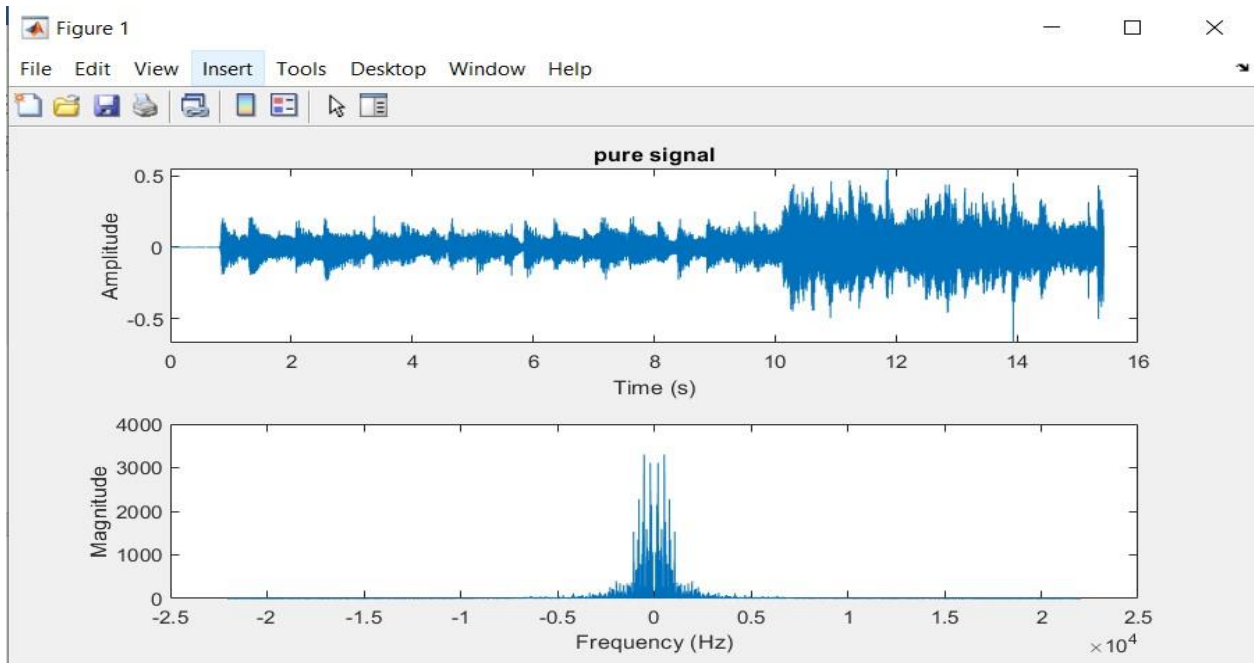


After the filter:

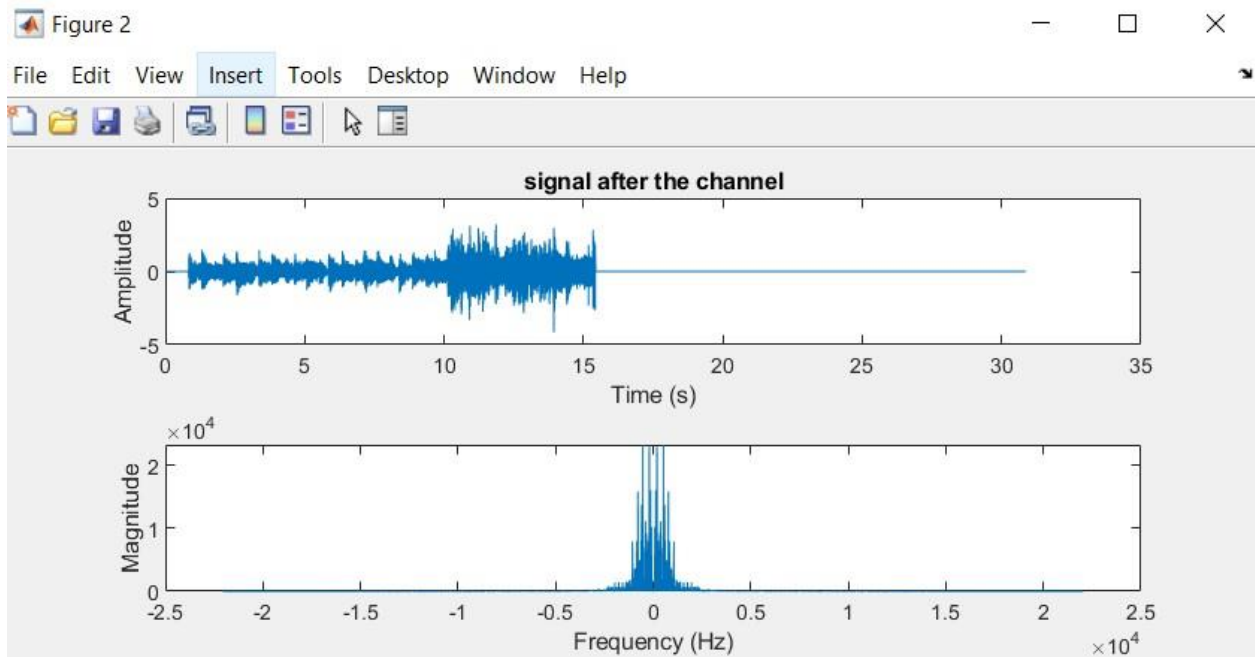


3. We will choose an exponential function with $W=1000$, with $\sigma=0.5$.

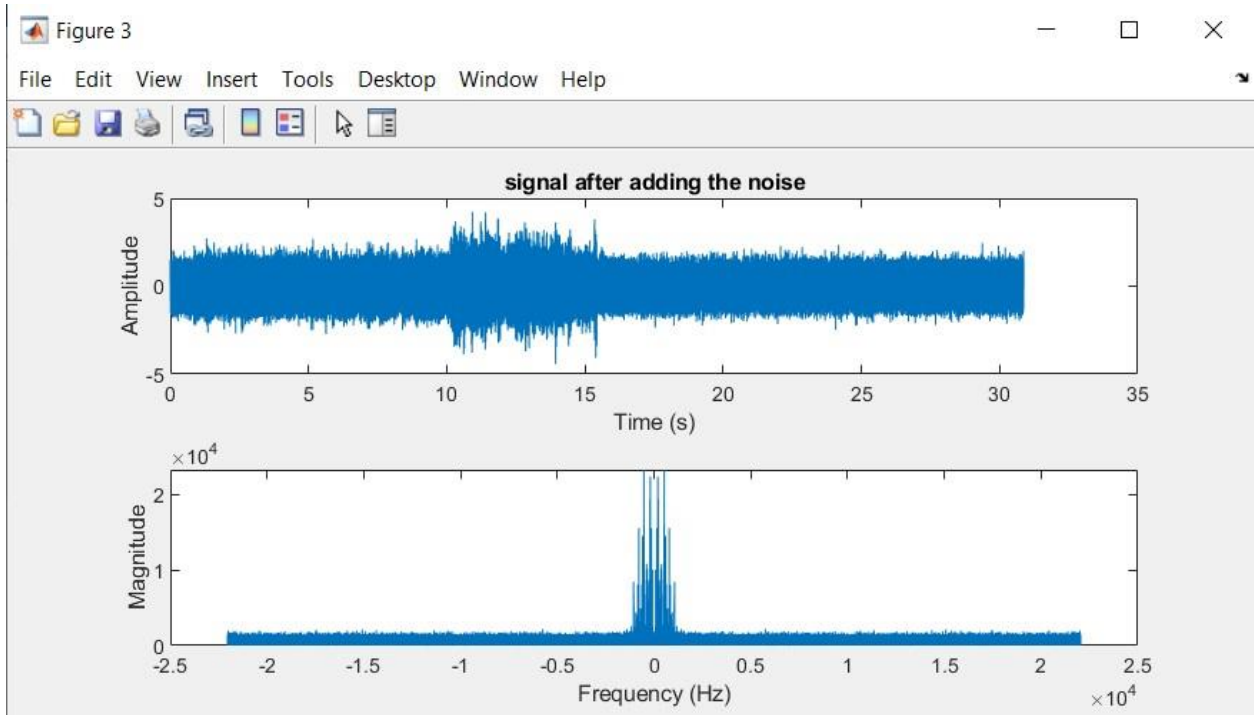
Plot the sound file in time domain and the frequency domain:



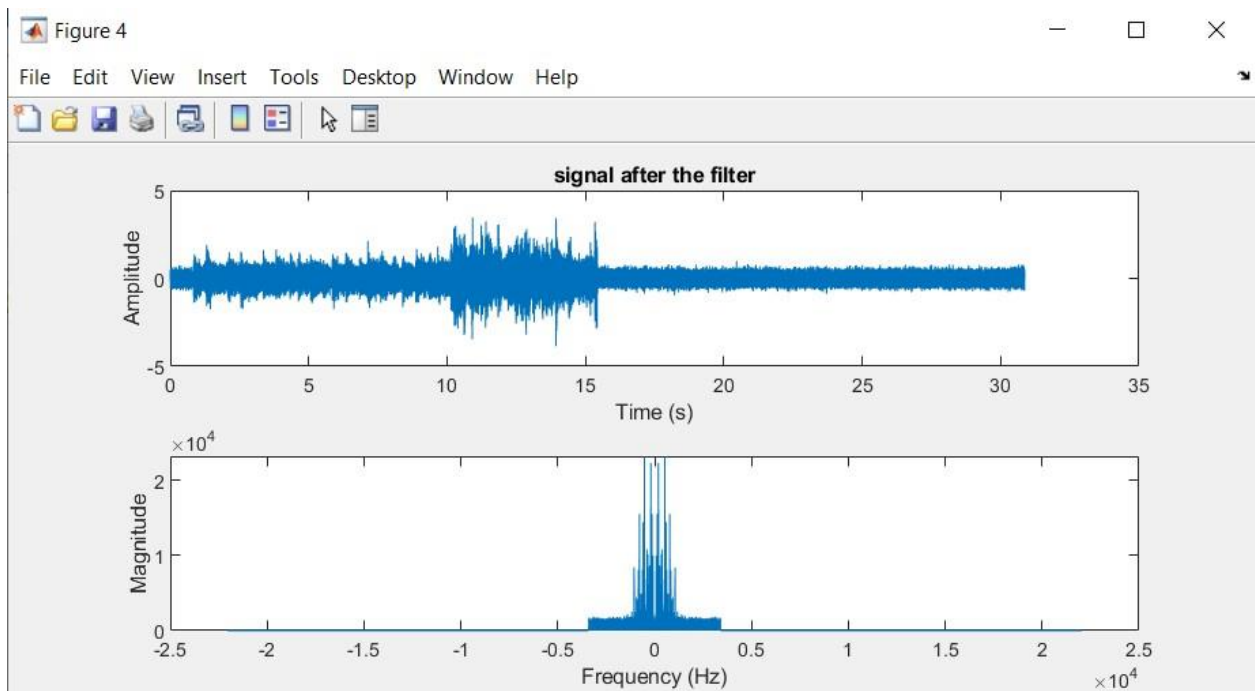
Then preparing it for the transmission over the channel:



After noise:

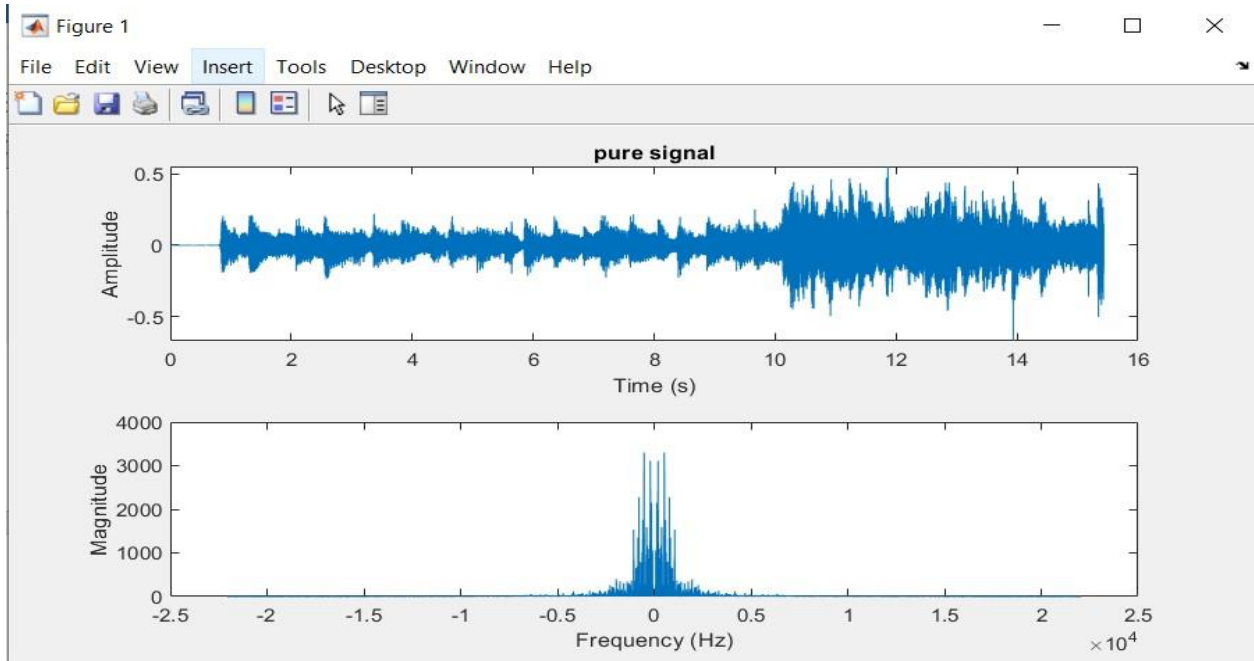


After the filter:

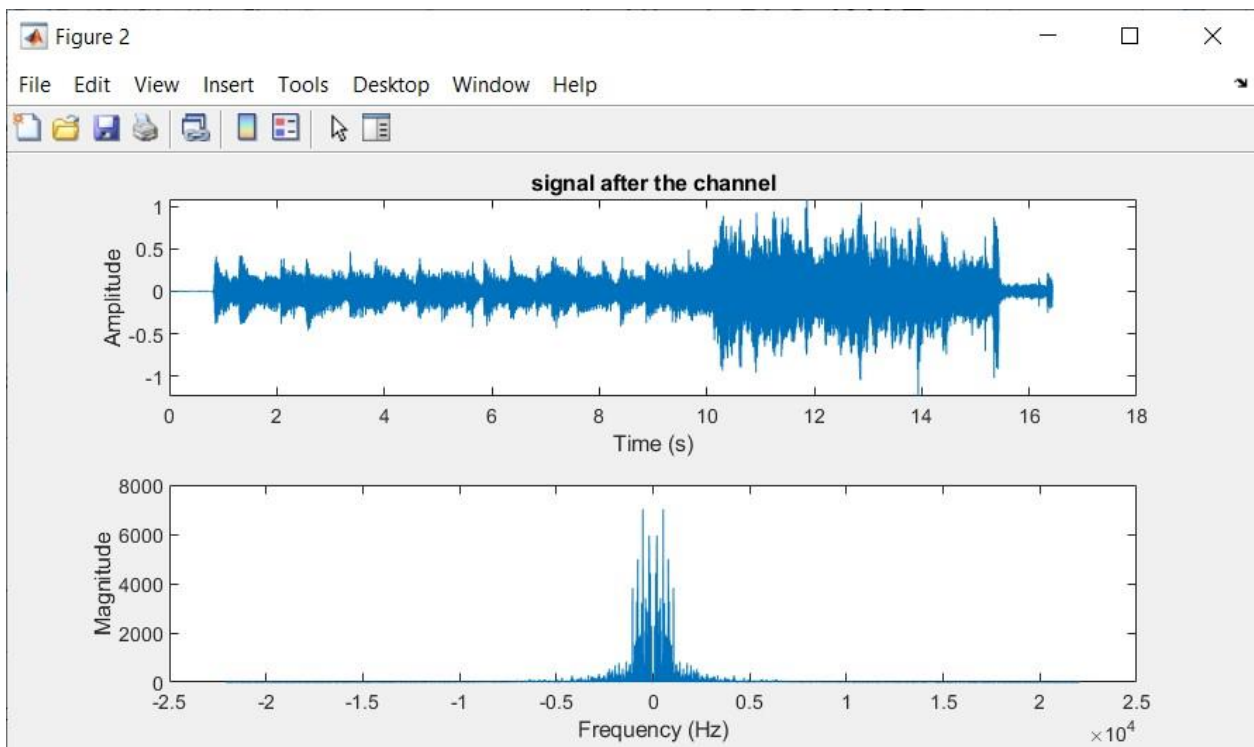


4. We will choose a channel with impulse response = $[2 \text{ zeros}(1, F_s - 2) .5]$, with $\sigma = 0.5$.

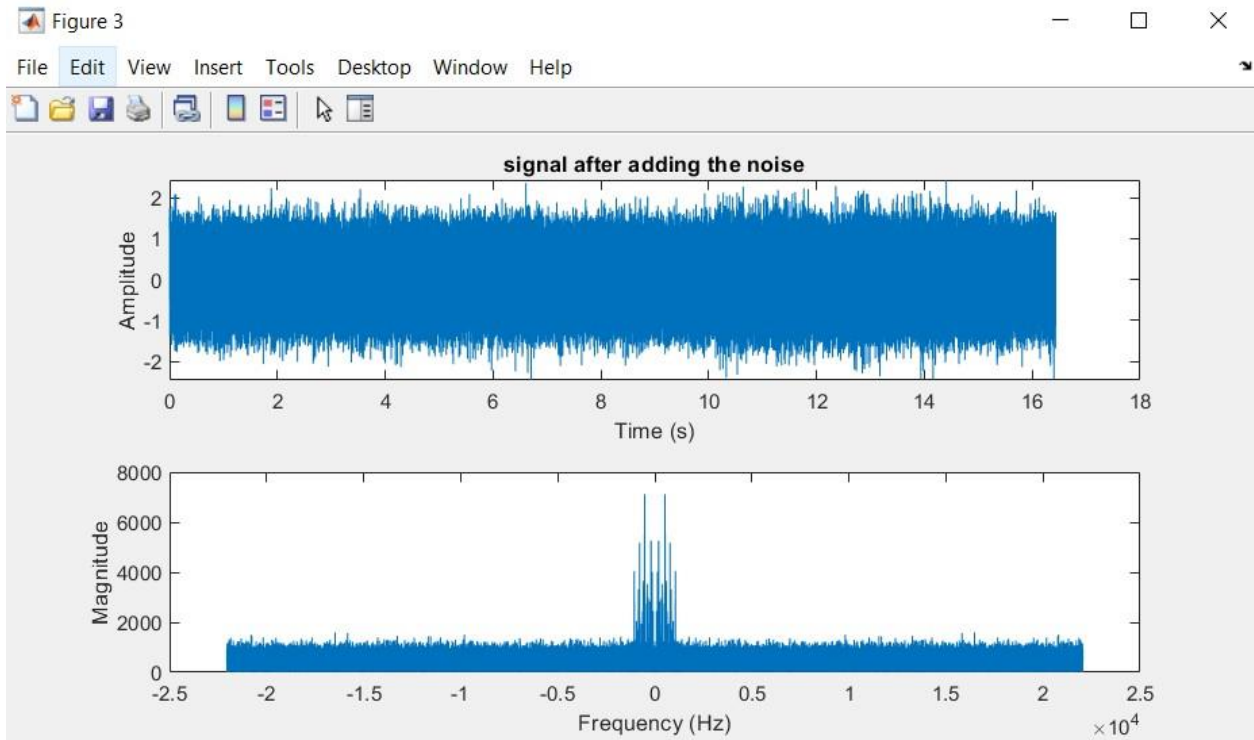
Plot the sound file in time domain and the frequency domain:



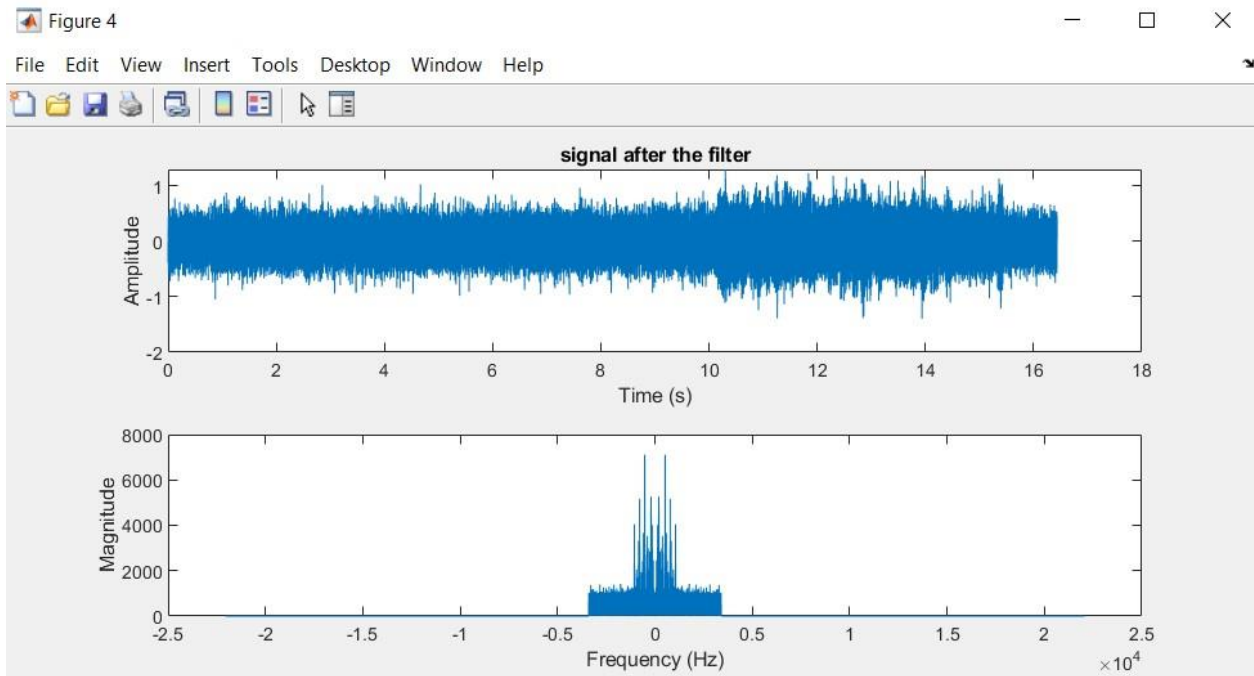
Then preparing it for the transmission over the channel:



After noise:



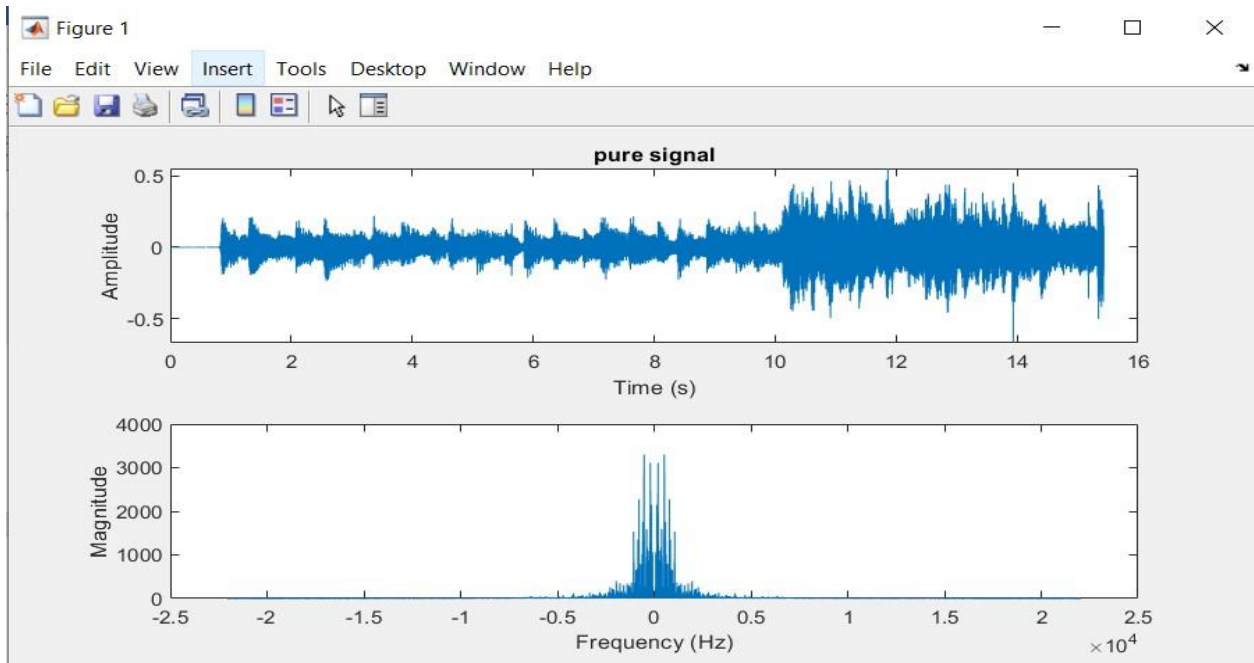
After the filter:



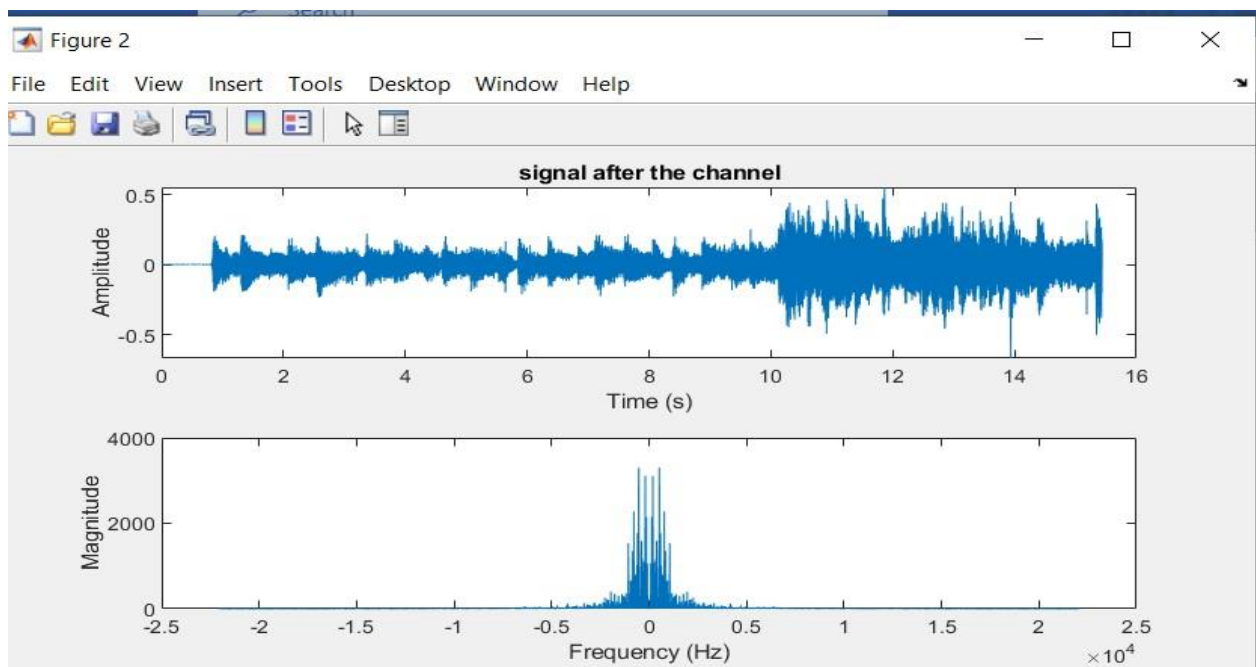
Test (Music file):

1. We will choose a delta function, with $\sigma=2$.

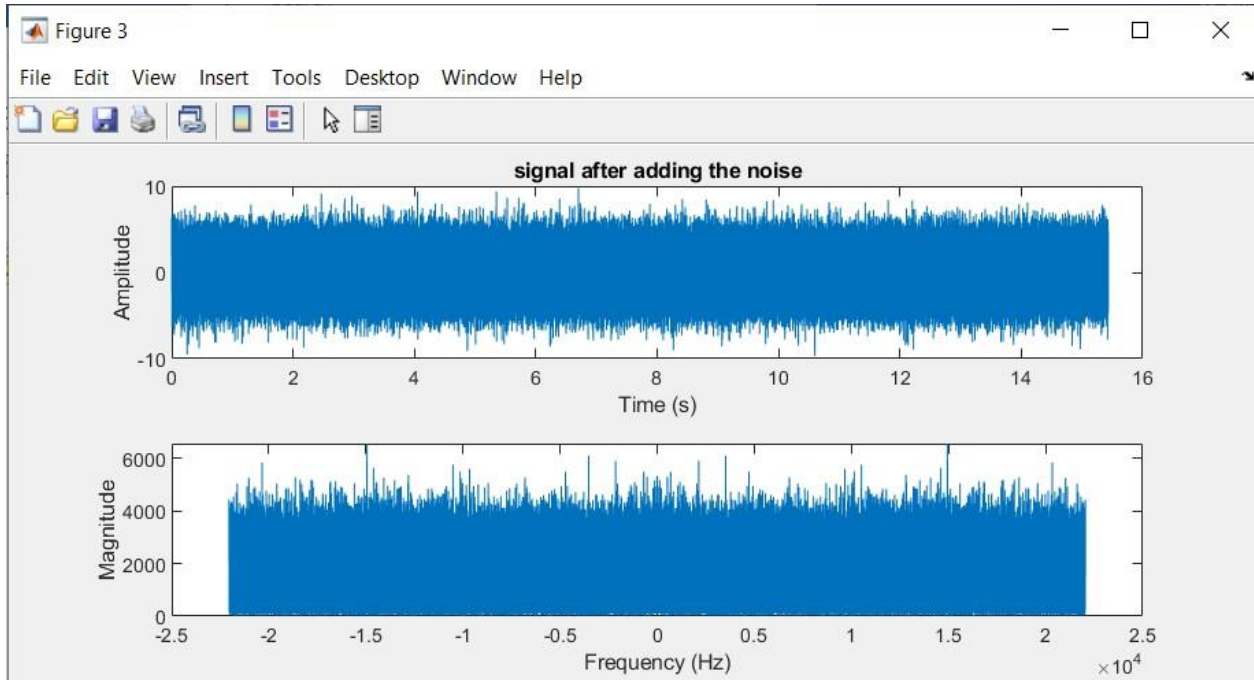
Plot the sound file in time domain and the frequency domain:



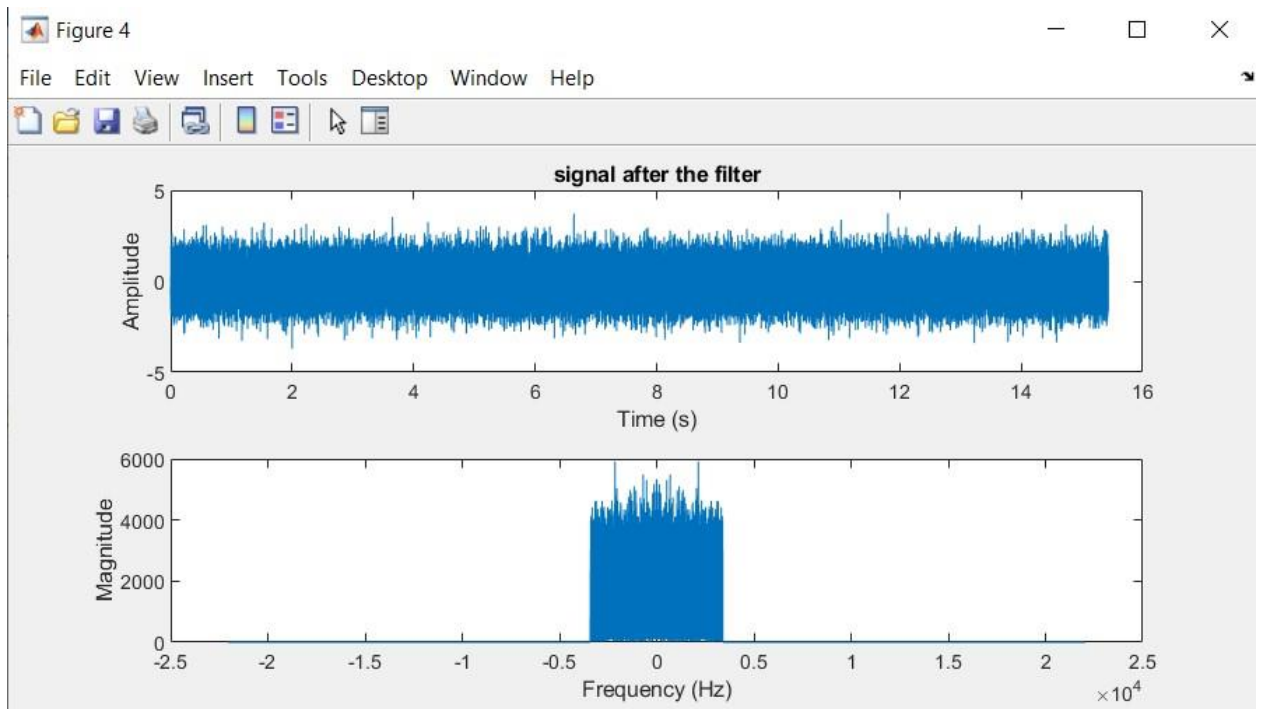
Then preparing it for the transmission over the channel:



After noise:

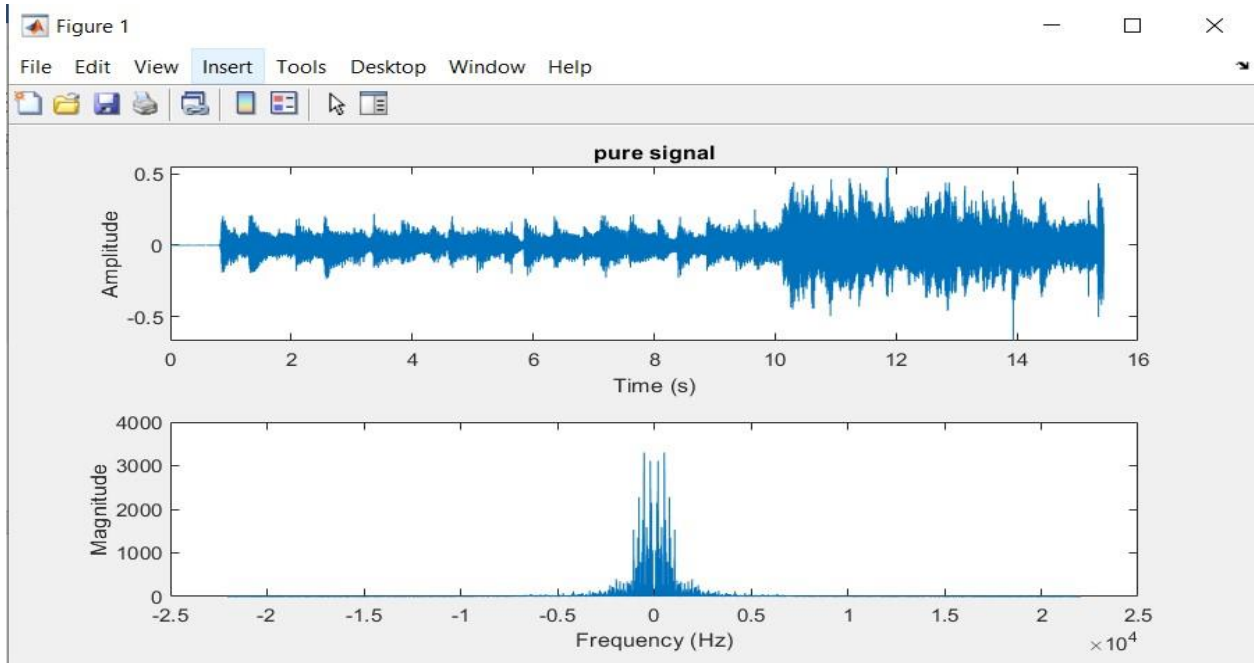


After the filter:

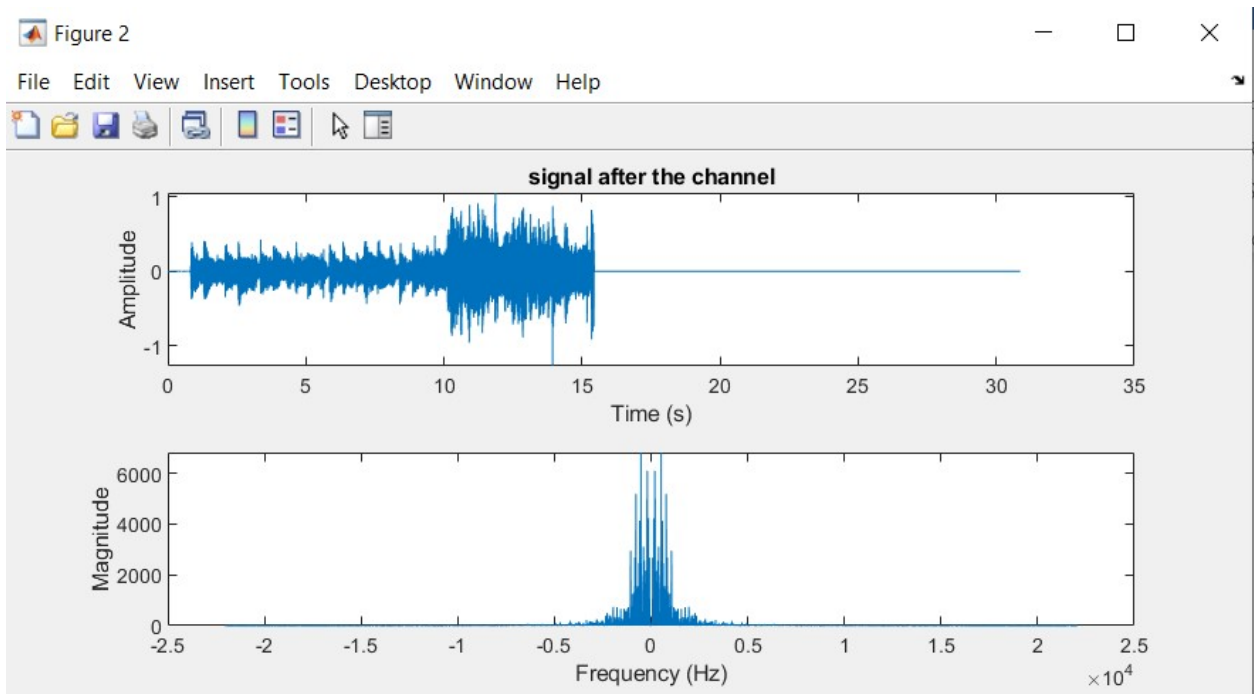


2. We will choose an exponential function with $W=5000$, with $\sigma=2$.

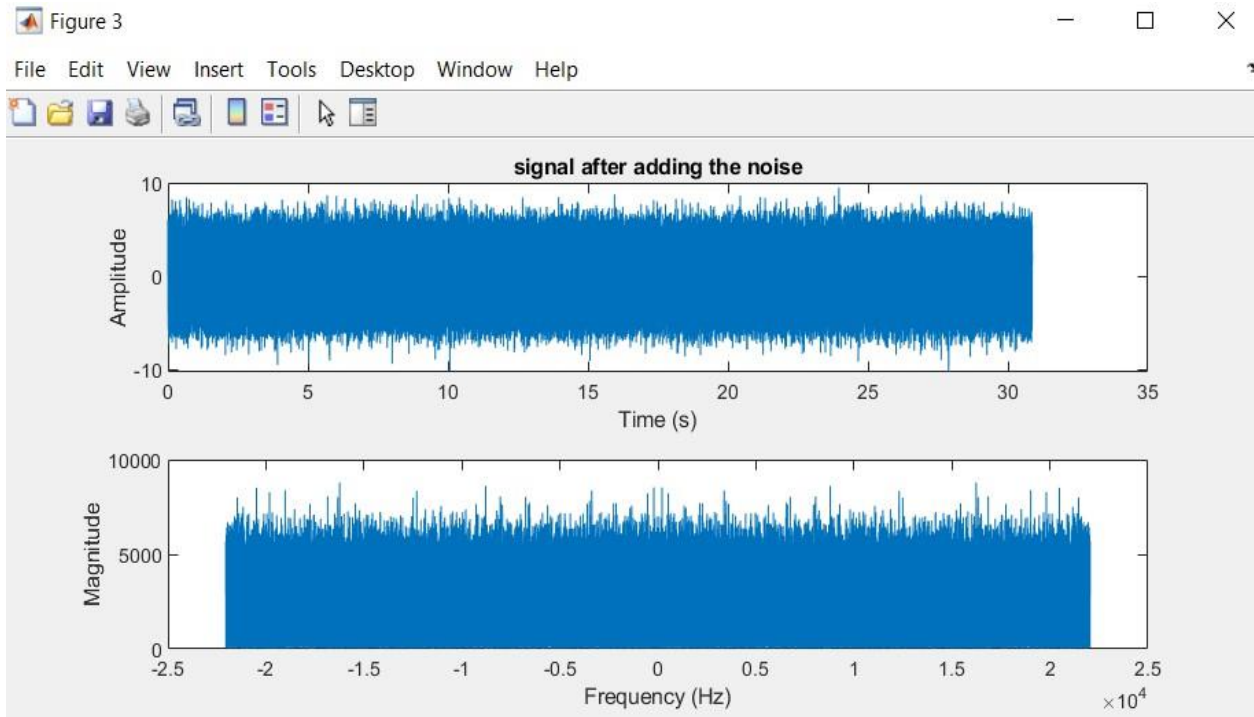
Plot the sound file in time domain and the frequency domain:



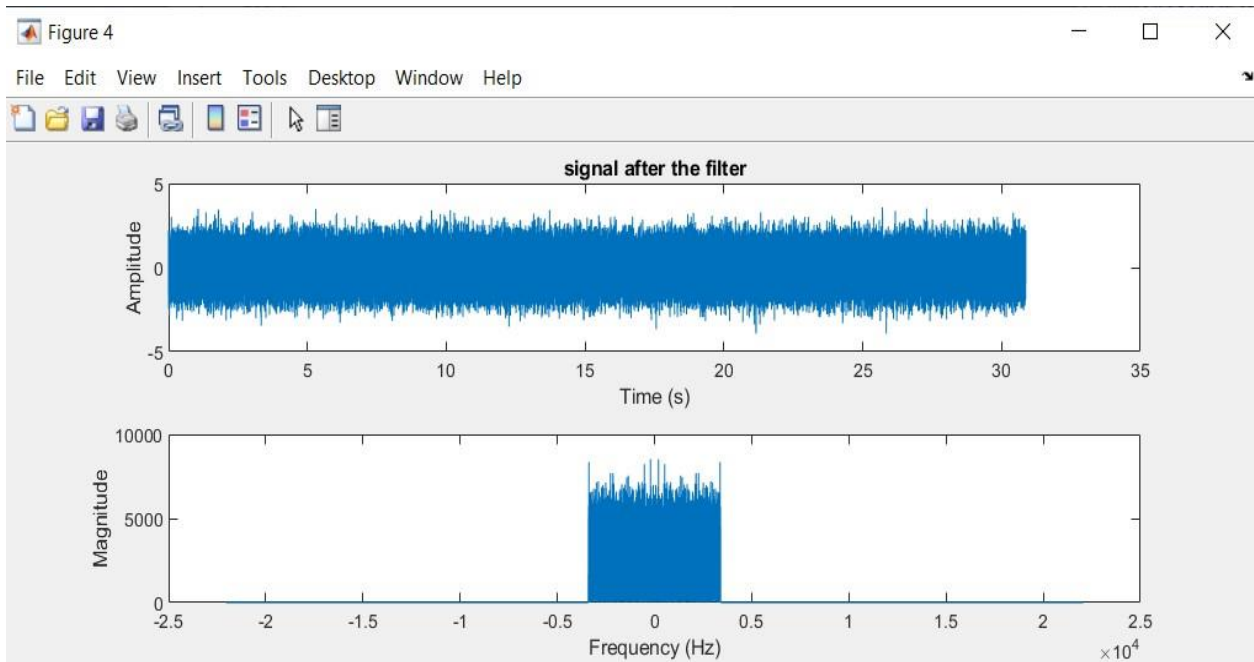
Then preparing it for the transmission over the channel:



After noise:

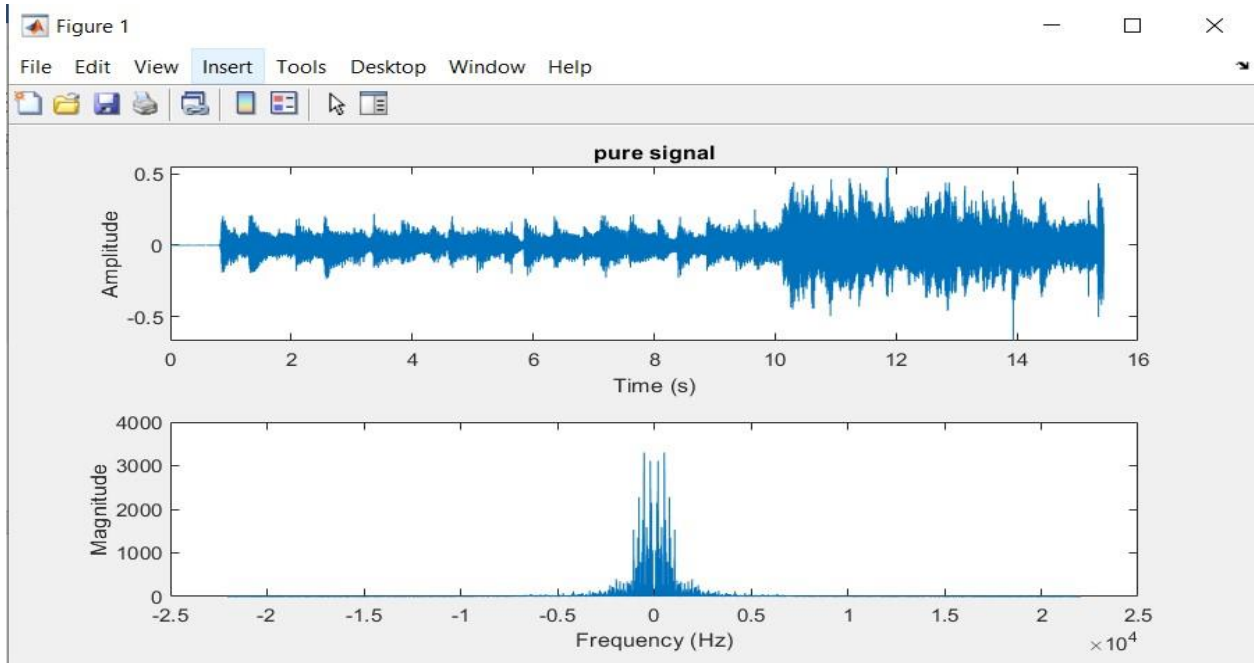


After the filter:

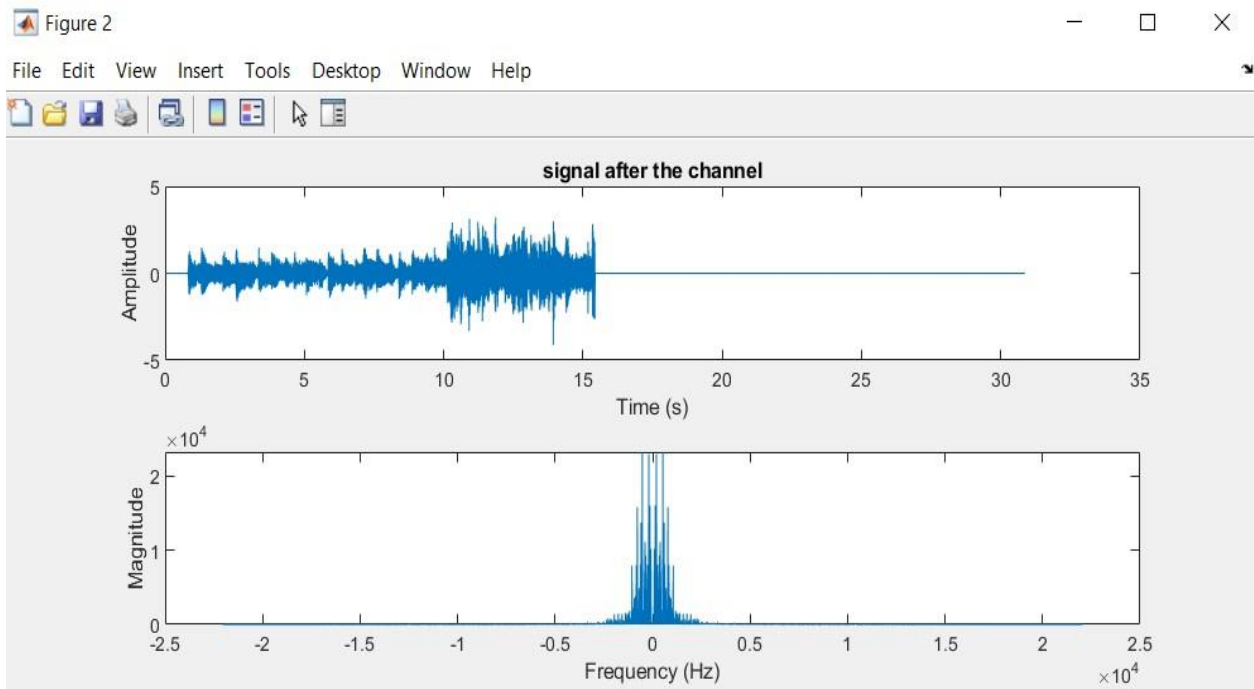


3. We will choose an exponential function with $W=1000$, with $\sigma=2$.

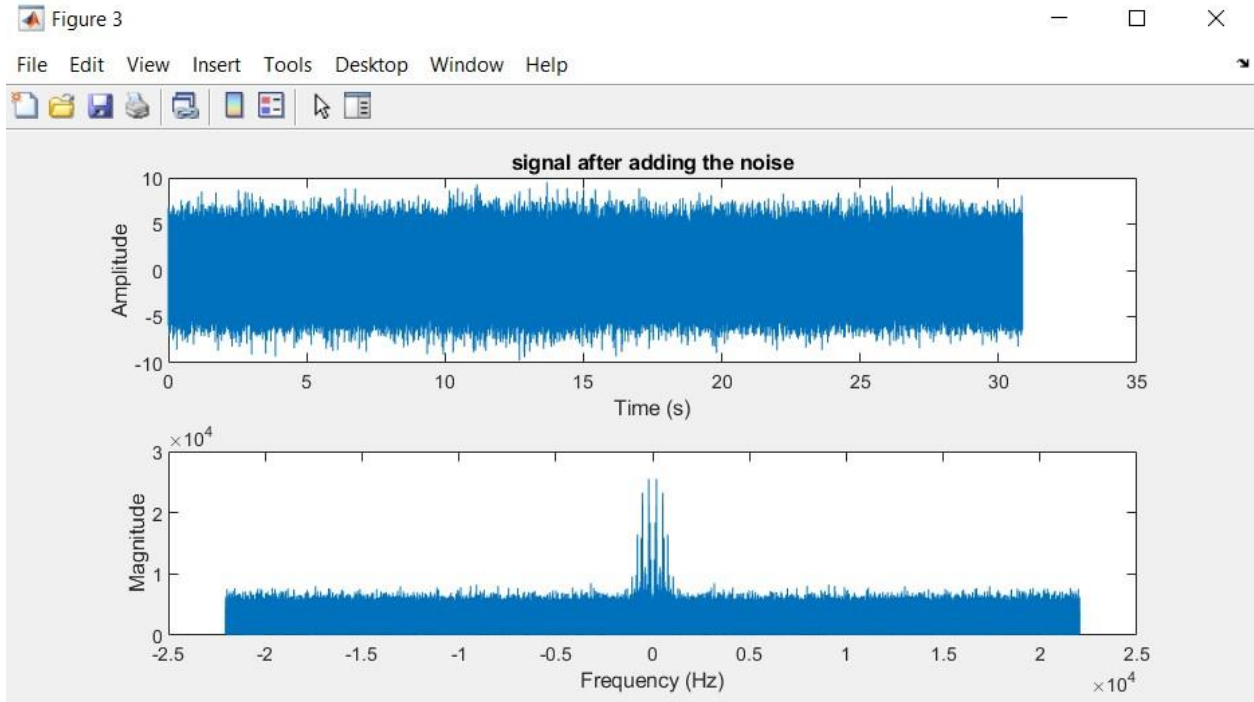
Plot the sound file in time domain and the frequency domain:



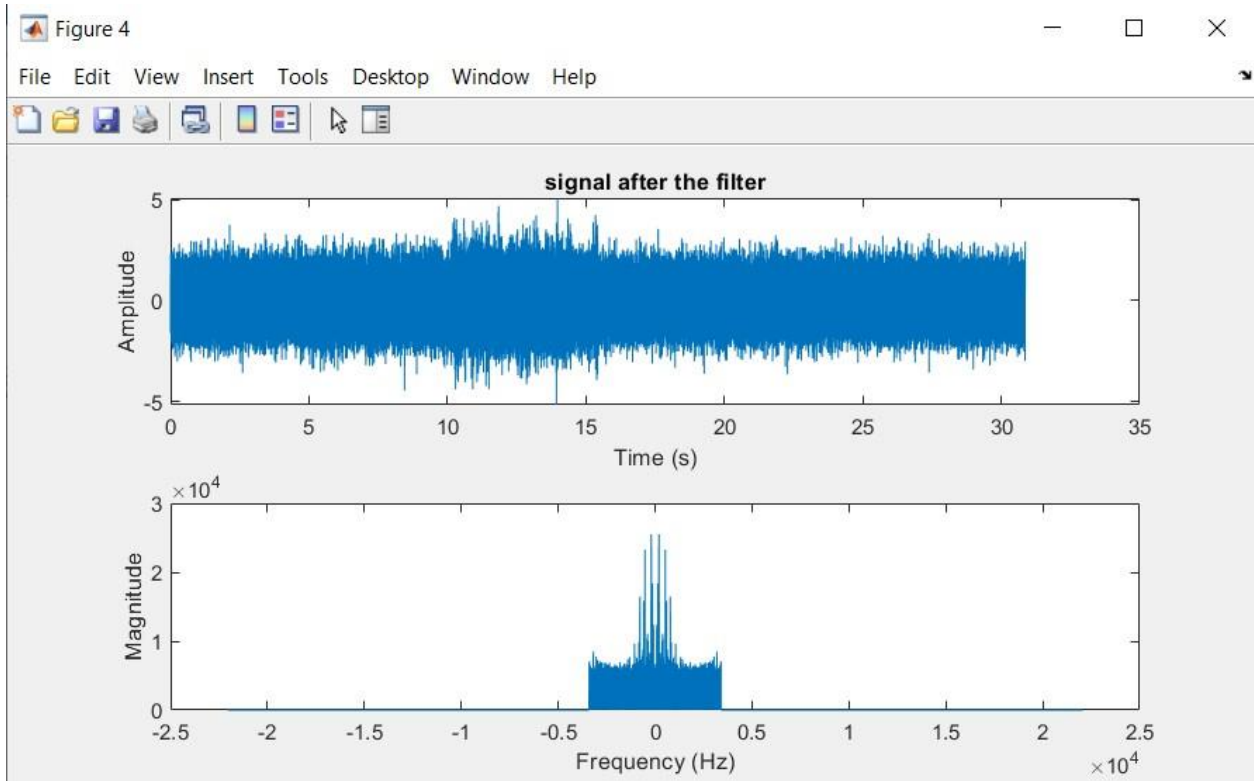
Then preparing it for the transmission over the channel:



After noise:

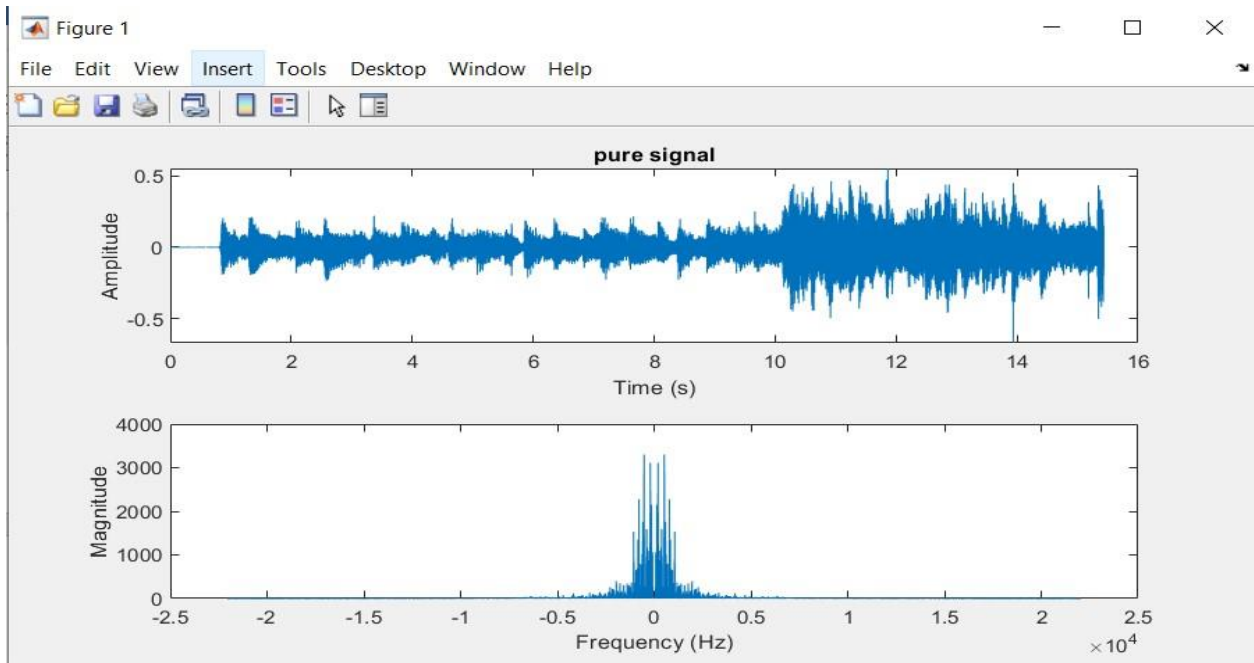


After the filter:

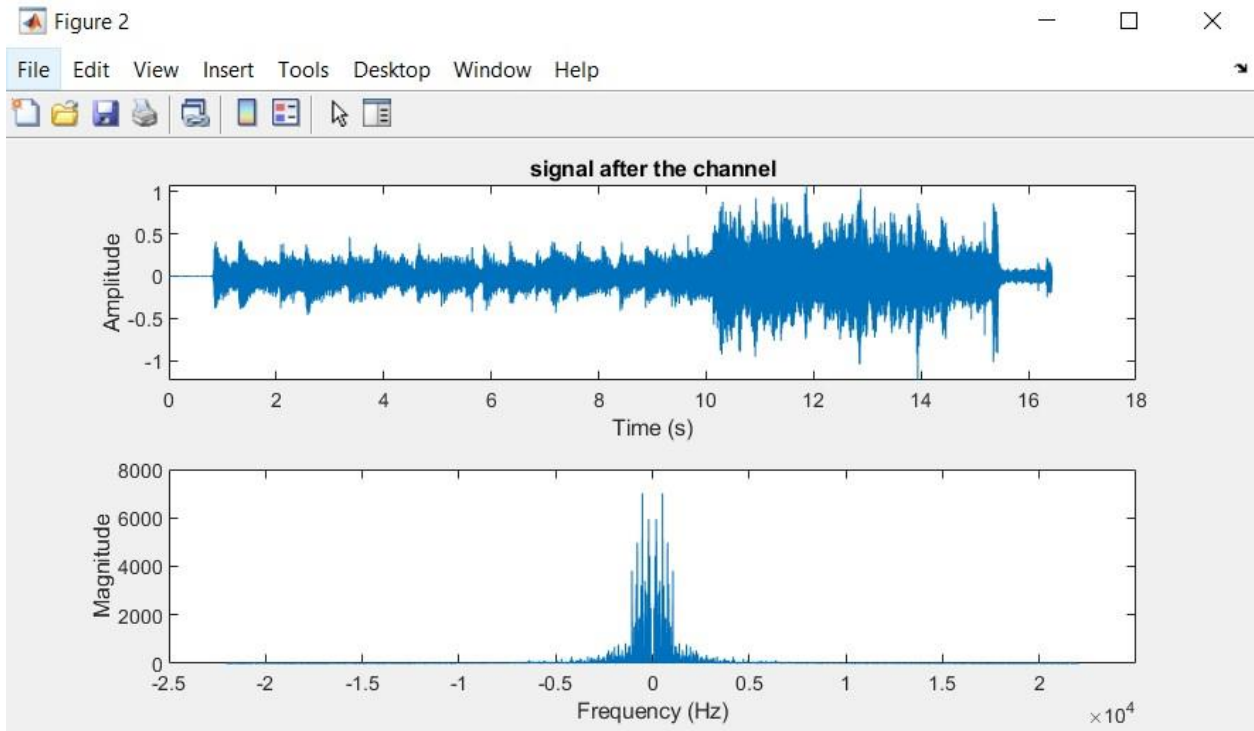


4. We will choose a channel with impulse response = $[2 \text{ zeros}(1, Fs-2) .5]$, with $\sigma=2$.

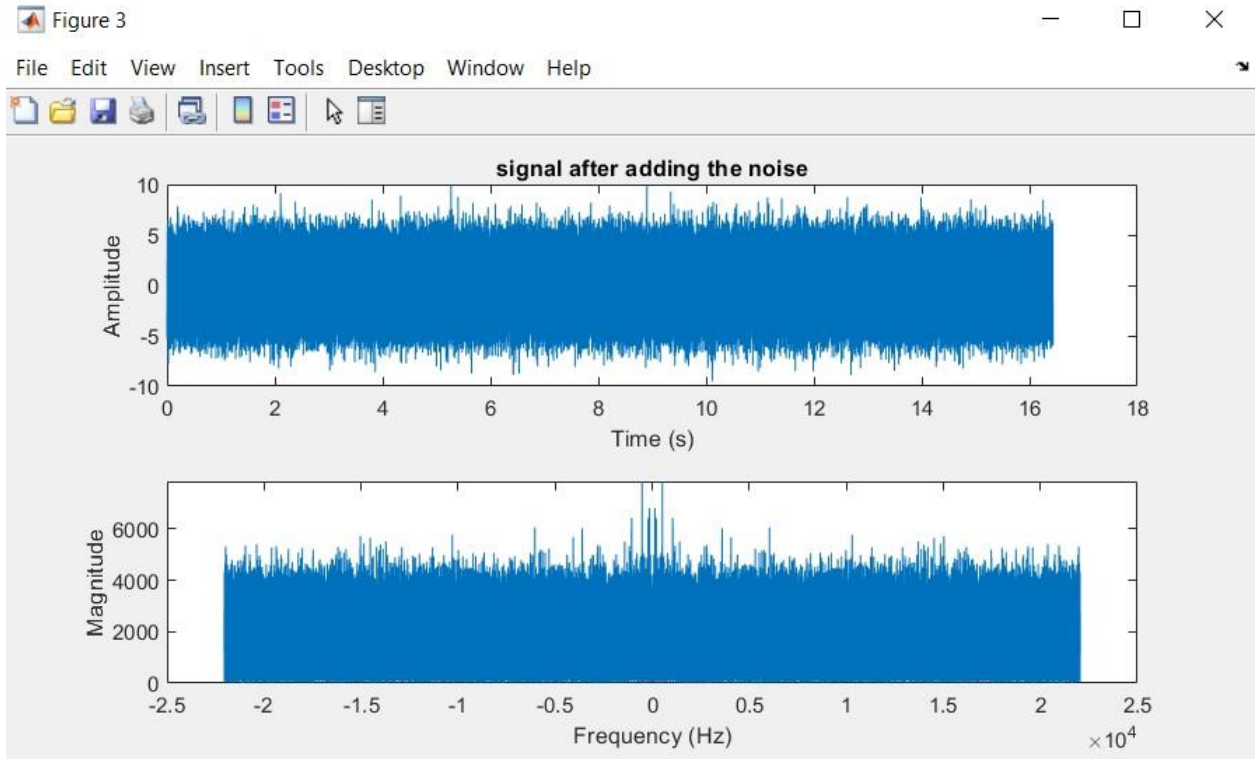
Plot the sound file in time domain and the frequency domain:



Then preparing it for the transmission over the channel:



After noise:



After the filter:

