Open Configurable Networks Lab0

Todo: Identify a real-world radio frequency signal of your choosing and investigate it! You can choose any signal you wish, so long as its operating frequency is within the range of your SDR receiver. Feel free to consult with your instructor if you have doubts whether your preferred signal is appropriate for this exercise. Submit the following for your observation as a short report via blackboard:

1. **center frequency of the signal**

   According to the radio map, I chose RTE Radio 1 signal around the Dublin city, which frequency is 89.1Mhz, 89.5Mhz. We set the center frequency as 89.1Mhz, and we can observe the signal around 89.1Mhz and 89.5Mhz obviously.

   We also observed the signal around 315MHz as personal Transmitters.

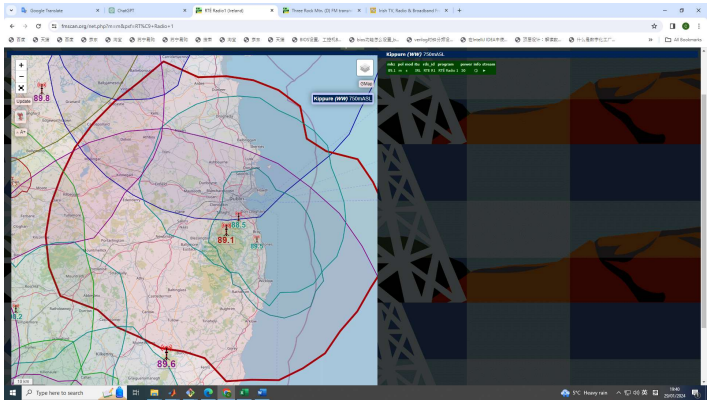

Fig1 Radio Map

2. **screen capture of the spectrum analyzer window showing the signal**

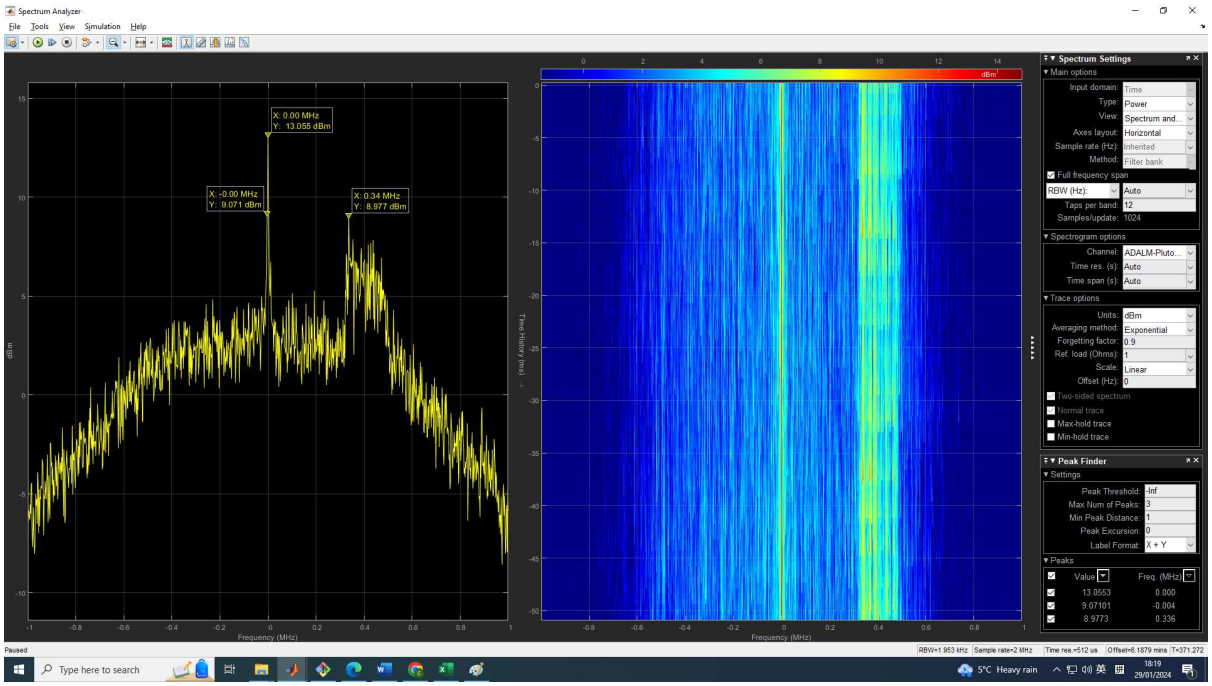

Fig2 Spectrogram (center frequency = 89.1Mhz)

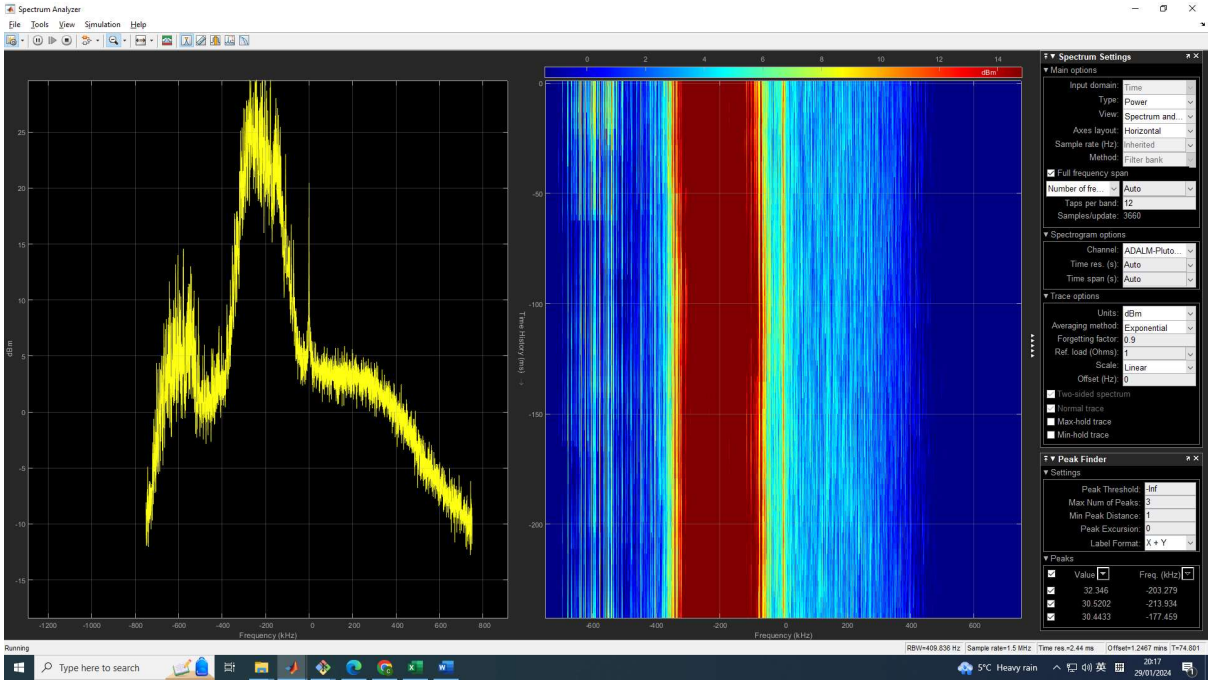

Fig3 Spectrogram (center frequency = 315Mhz)

3. estimate of the signal bandwidth

The bandwidth of the signal which central frequency is 89.5Mhz is obvious and it is around 0.2Mhz, the bandwidth of 89.1Mhz will be less and hard to observe in this scale.

If we observe Personal Transmitters 315MHz, the bandwidth is much easier to talk as about 200kHz.

4. Describe any characteristics of the signal based on your research of the signal/ system or based on your observations of its spectrum. It is OK if you don't fully understand the details at this stage.

The signals in each frequency band are transmitted separately through frequency separation. The energy within the corresponding bandwidth is high and has some periodic characteristics. There is almost no energy outside the bandwidth range.

5. Observations from sub-section 3.1.VI

5.1 What happens to the spectrum plot when you adjust the Center frequency parameter?

Compare with the figure before, we change the center frequency, and we can see that the image will shift horizontally as the signal is adjusted as the figure below.

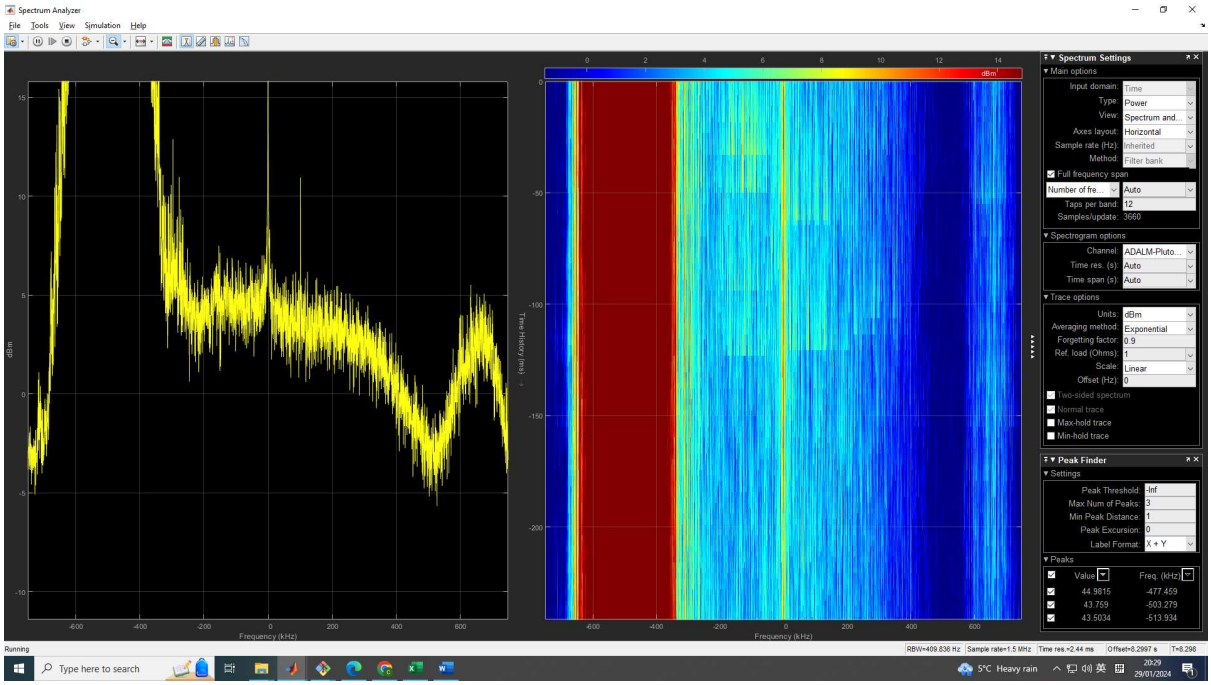

Fig4 Spectrogram (center frequency = 315Mhz, shift center frequency)

5.2 What happens when you adjust the Gain parameter?

We decrease the Gain from 50 to 30, signals with weaker amplitudes around are filtered out and are no longer clearly visible on the spectrogram, we are much more focus on the main signal.

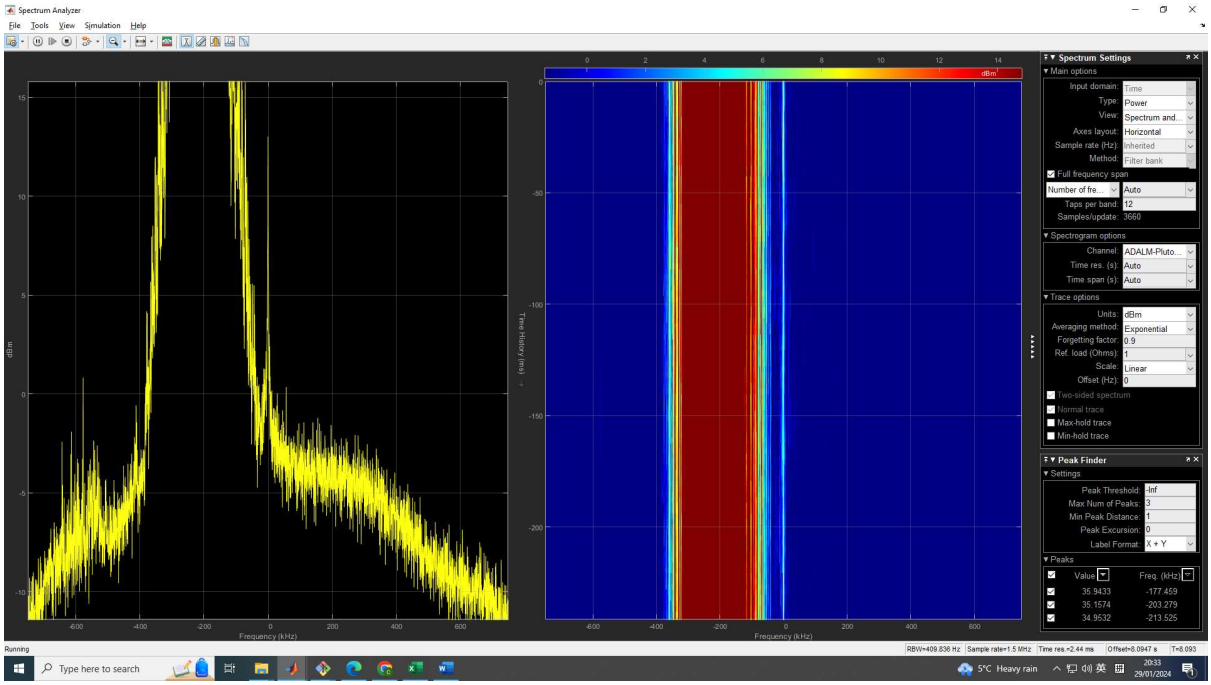

Fig5 Spectrogram (center frequency = 315Mhz, decrease gain)

As we increase the gain from 50 to 60, more signal from side lobe is being focused, all of them are painted in red in the spectrum which means they have a higher power. This will make it harder to distinguish the channel.

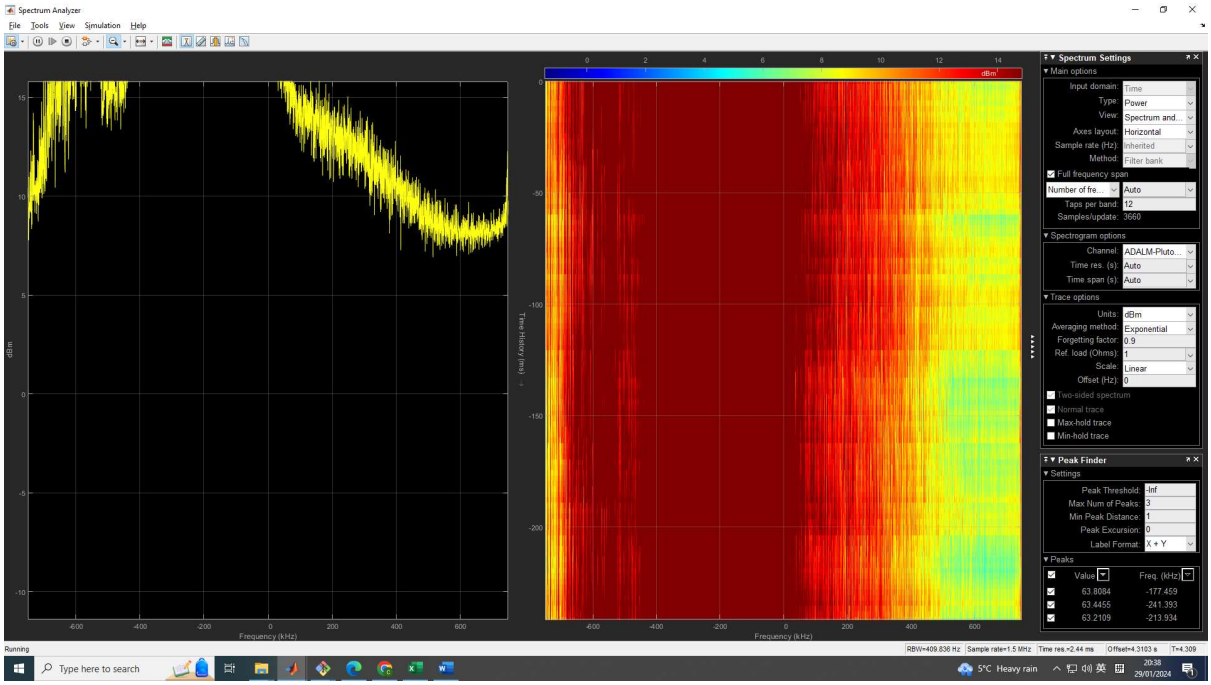

Fig6 Spectrogram (center frequency = 315Mhz, increase gain)

According to the adjust of the gain, we find that it is important to find a sufficient gain value to find the channel correctly.

5.3 What happens when you adjust the Baseband sample rate parameter? Hint: Be sure the Full Frequency span box is checked in the Spectrum Settings panel of the Spectrum Analyzer.

When we adjust the Baseband sample rate to 4e6, we find that the X-axis is stretched, which helps us observe other signals in a larger range. But this often results in us losing the detailed information of a certain signal.

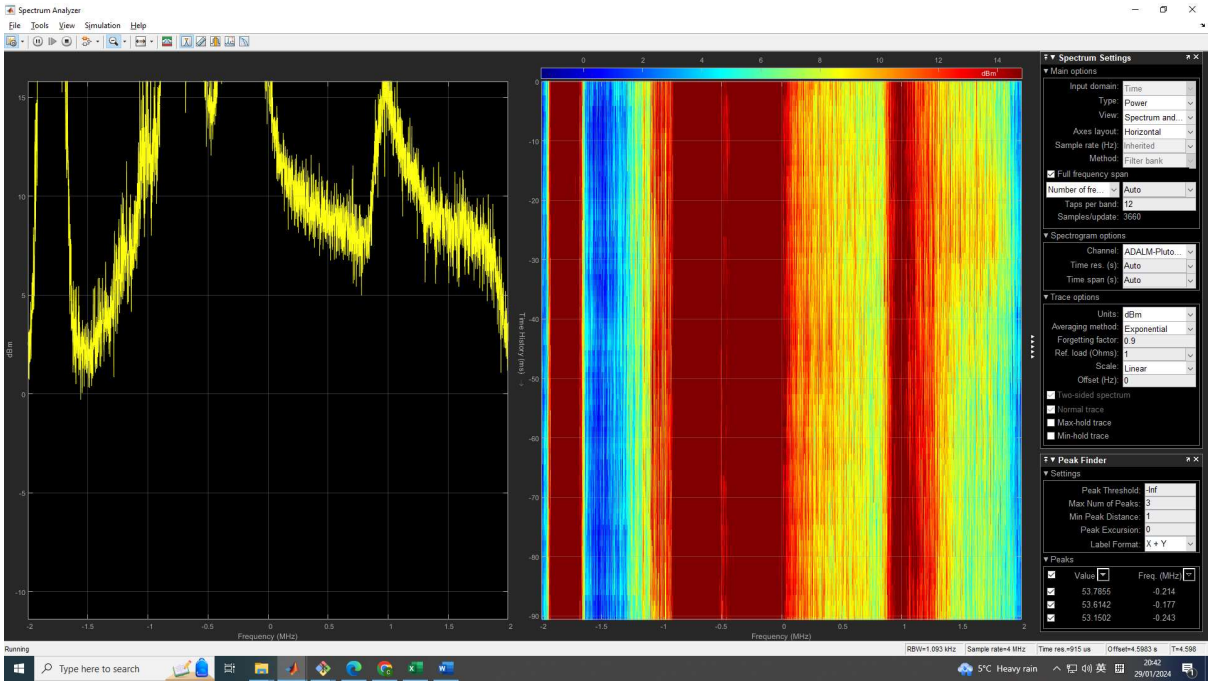

Fig7 Spectrogram (center frequency = 315Mhz, increase sample rate)

If we decrease the sample rate to 1e6, the range will decrease, and we can focus on the detail of

one signal.

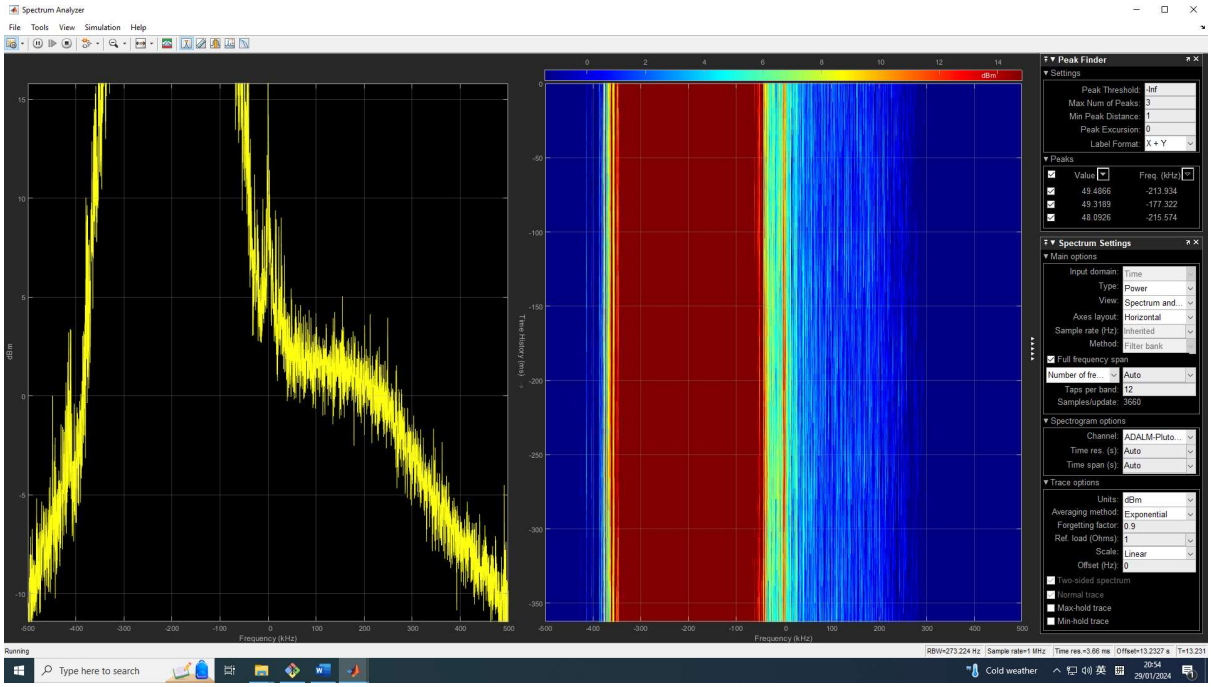

Fig8 Spectrogram (center frequency = 315Mhz, decrease sample rate)