UCSD MAS WES268A - Lab 2 Report DRAFT

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Contents

1 Part 1: Generation of Passband Noise Waveforms

1.1 Narrative Questions

1.1.2 - The center value of the histograms I and Q is zero. This is because the noise is generated using a Gaussian distribution with a mean of zero.

1.1.3 - From Figure 2, we can see that the IQ spectrums show a flat frequency response indicating that the noise power is uniformly distributed across the frequency range hovering around the -40dB range. This is characteristic of additive white Gaussian noise, which has equal power across all frequencies. Using an RBW of 50 Hz and one-sided bandwidth of 250kHz, we can calculate the total noise power as follows:

$$P_{noise} = (10^{-4}) \times B/RBW = (10^{-4}) \times (250,000/50) = 0.5$$

We can verify that this is correct because it is consistent with our value of σ:

$$\sigma_{noise} = \sqrt{P_{noise}} = \sqrt{0.5} = 0.7071$$

which matches our set value of σ in the simulation VI seen in Figure 1 and Figure 2.

1.1.4 - Just like in step 3, we can calculate the total noise power using the same method but only for the in-phase component. Using an RBW of 50 Hz, one-sided bandwidth of 250kHz, and a power level of -40dB uniformly distributed across the frequency range, we can calculate the total noise power as follows:

$$P_I = (10^{-4}) \times B/RBW = (10^{-4}) \times (250,000/50) = 0.5$$

Again, we can verify that this is correct because it is consistent with our value of σ:

$$\sigma_I = \sqrt{P_I} = \sqrt{0.5} = 0.7071$$

which matches. LabVIEW only displays the one-sided spectrum for real signals because the negative frequency components mirror the positive frequency components. Therefore, it is redundant to display.

1.2 Figures

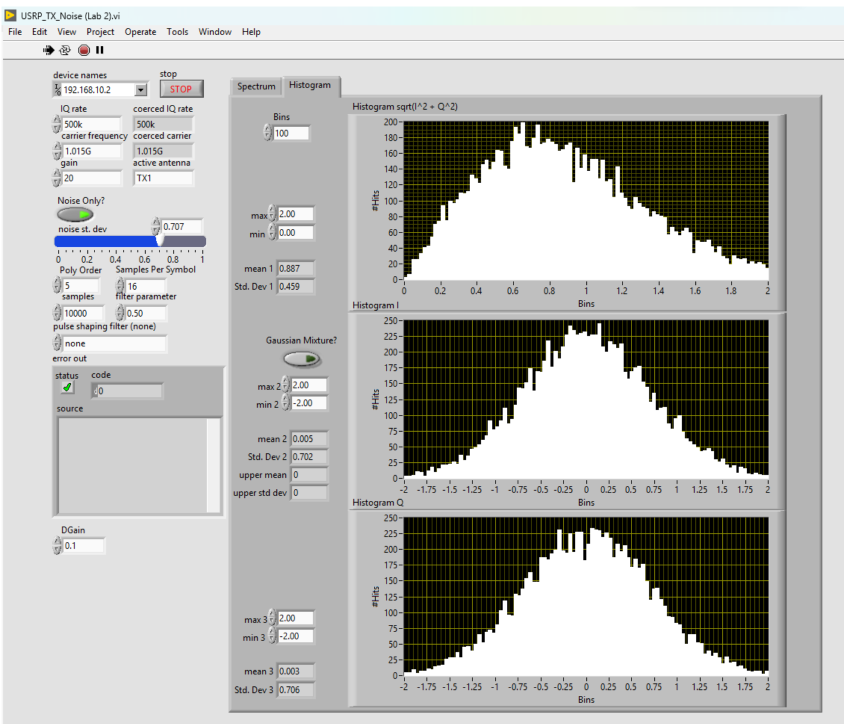

Figure 1: 1.1.2 - Histogram of I and Q components of passband noise

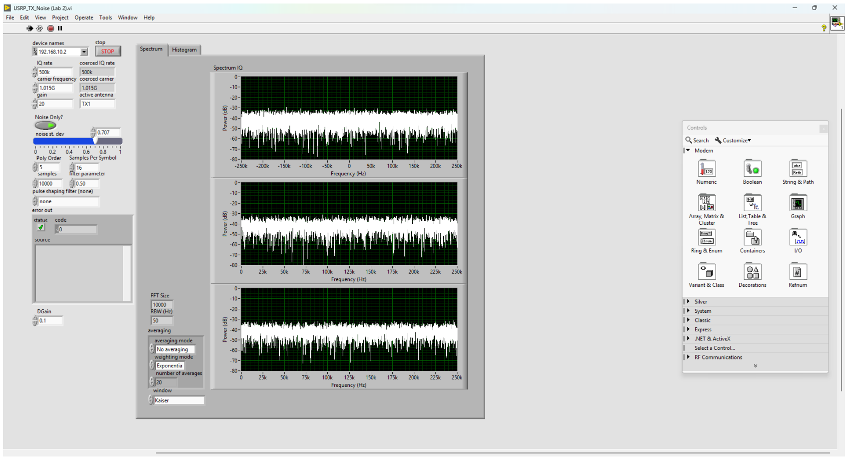

Figure 2: 1.1.3 - Spectrum of I and Q components of passband noise

2 Part 2: Up Sampling and Pulse Shaping

2.1 Narrative Questions

2.1.5 - As we vary the Filter Parameter β of the Root Raised Cosine Filter, we observe changes in the power spectrum of the shaped signal. Specifically, as β increases, the bandwidth of the signal also increases. We can see this in Figure 2. This is because a higher β value results in a wider transition band in the filter's frequency response. Conversely, a lower β value results in a narrower bandwidth.

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2.2 Figures

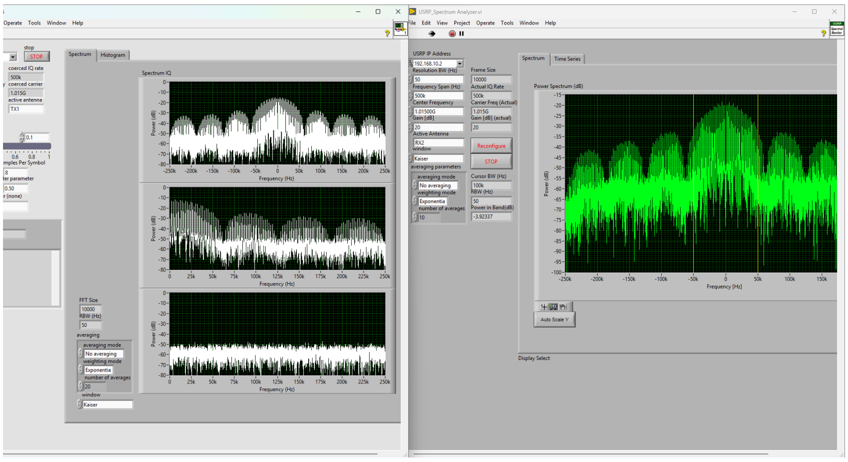

Figure 3: 2.1.3 - Side-by-side TX and RX VI

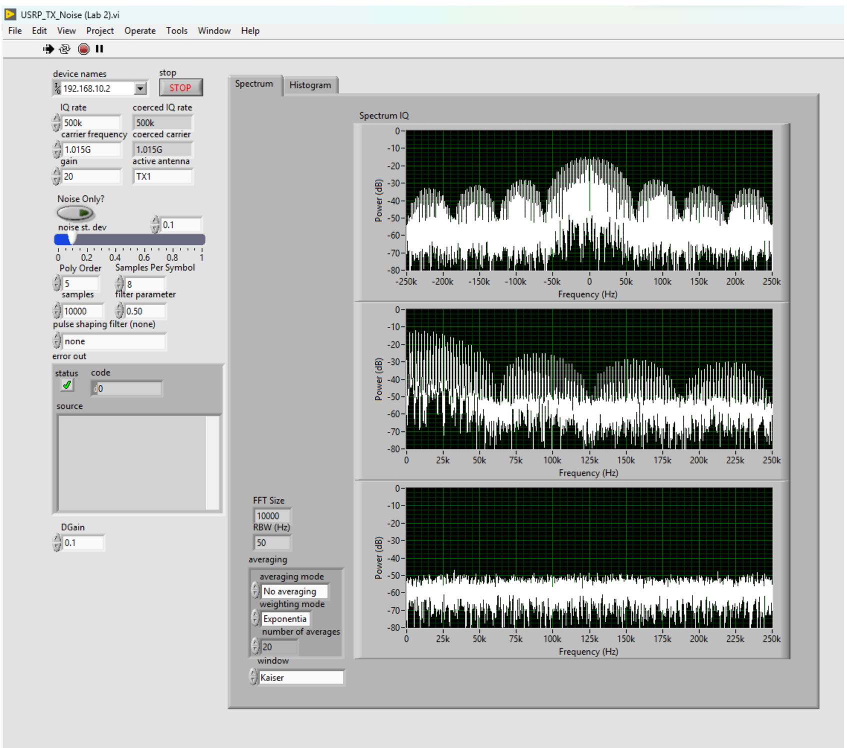

Figure 4: 2.1.4a - Power Spectrum (No filter)

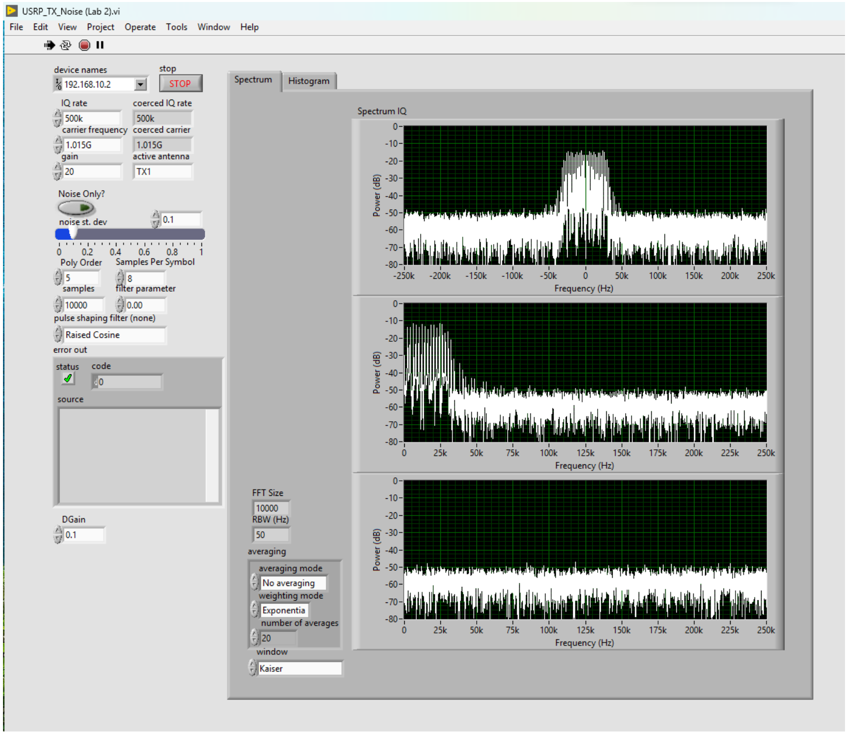

Figure 5: 2.1.4b1 - Power Spectrum of $\beta = 0$ (Root Raised Cosine Filter)

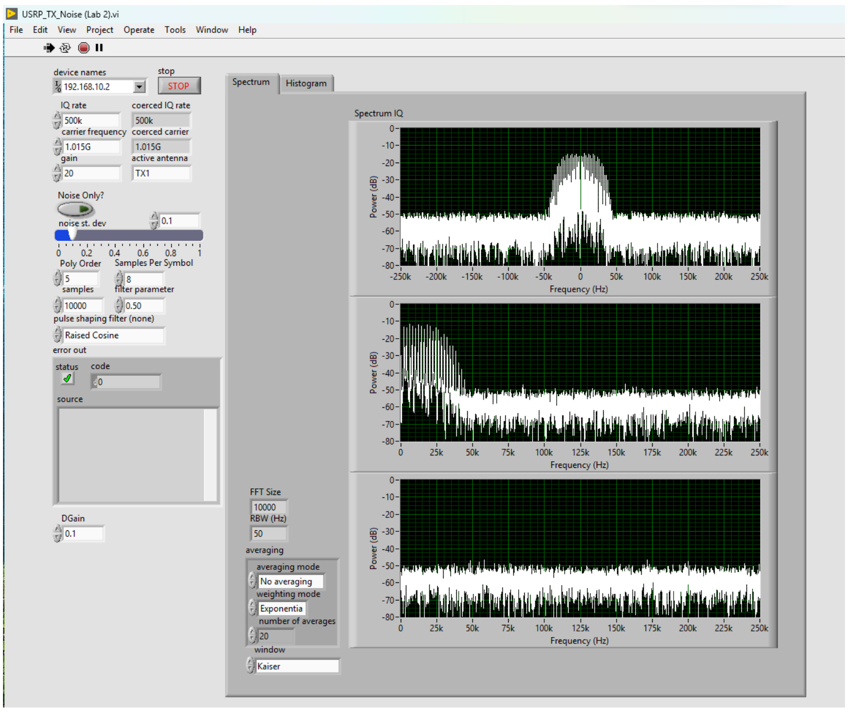

Figure 6: 2.1.4b2 - Power Spectrum of $\beta = 0.5$ (Root Raised Cosine Filter)

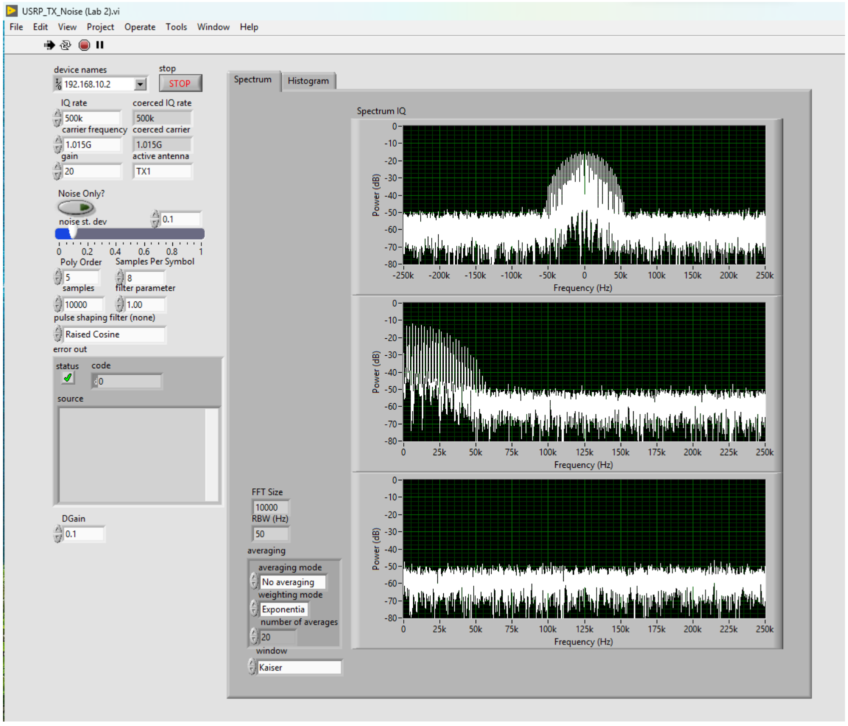

Figure 7: 2.1.4b3 - Power Spectrum of $\beta = 1$ (Root Raised Cosine Filter)

3 Part 3: Generation of Pseudo Random Binary Sequences (PRBS)

3.1 Narrative Questions

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4 Part 4: Eye Patterns (Simulation VI)

4.1 Narrative Questions

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