Lab 4 – GPS Receiver Processing

Due: 4/26/2023

This lab utilizes the IFEN IF data

Part I: IF Simple Data Analysis

Read in a subset of sampled IF data (maybe 0.1 seconds to 1 second)
   a) Provide a plot of the IF data (vs. time)
   b) Provide the histogram of the data
   c) Provide spectral analysis of the data

Part II: Acquisition

Write software to acquire GPS satellites from the sampled IF data
   d) Provide a 3D plot of the autocorrelation vs. code phase and Doppler for SV #7 using 1 ms of data
   e) Repeat part a) with 10 ms of data. How does the performance improve or degrade.
      Repeat with the next 10 ms of data.
   f) Add random noise with a $1\sigma=6$ and $1\sigma=12$. Can you acquire the SV with 1 ms of data?
      What about with more data?
   g) Repeat part b) for at least 3 more SVs (1, 14, 17, 21, 30 are good choices).
   h) *(Optional)*. Using information from Part II, remove the databit(s) and repeat part a)
      over 40 ms set of data and compare the results.

Part III: Tracking

Write software to track the GPS signal and decode the data message
   a) Decode the data bits for SV#7. What is the zcount following the first preamble?
   b) Plot the Doppler and carrier measurement vs. time for SV #8
   c) How much noise can you add to the IF and still track the GPS signal? How does this
      compare to the noise value to which you could acquire the satellite?
   d) Calculate the delta psuedorange from SV #7 and at least 3 additional SVs to compute
      the position and receiver clock offset. Using that time calculate the psuedorange for the
      4 SVs. How does your position solution and psuedoranges compare to the Novatel or
      Trimble receivers?