

Mid-semester Examination

14/09/2016

Time: 2 hours

Instructions:

1. Absolutely no Internet access is allowed during the exam, except to download the data file for Question 1.
2. This is a 'closed-book' exam – you are not allowed to open to any files on your computer, including previously developed GNU Radio codes.
3. Save important snapshots and your GNU Radio source files in a folder (the folder name being your roll number); you have to provide this folder to your TA.

1. [10 marks] In this question, you have to build the flow-graph for SSB-SC demodulation. You are provided a data file containing the output of the RTL-SDR dongle corresponding to the SSB-SC transmission of a music clip. Using this file as input, build the demodulation flow-graph in GNU Radio to extract and play the originally transmitted music clip. You are not allowed to use any built-in demodulator blocks.

The transmission parameters are as follows:

RTL-SDR output is sampled at 960 kHz. AM carrier frequency is 150 kHz.

You can download the data file from <https://www.ee.iitb.ac.in/~jayakrishnan.nair/data.bin>.

Useful information: You can use the "File Source" block to read the data file into GNU Radio. Remember to set the output type to complex, and to configure the block to repeat the data in a loop so that you have a continuous data stream to work with.

- (a) Once you are able to extract and play the music clip successfully, show this to your TA.
 - (b) Save a screenshot of your flowgraph, as well your .grc file into the submission folder.
2. [10 marks] In this question, you have to generate a (complex) signal using GNU Radio with a spectrum as shown in Figure 1.

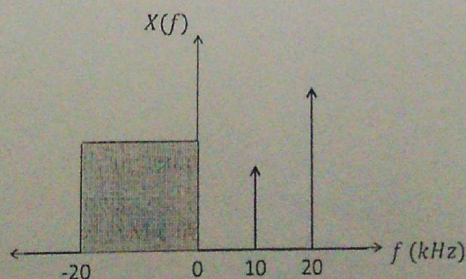


Figure 1: Target spectrum

Follow these steps.

- (a) Generate a signal in GNU Radio with a spectrum that looks (roughly) like Figure 2. Show resulting spectrum to your TA. Also, save a screenshot of the same, and your .grc source file.
Hint: You can use white Gaussian noise
- (b) Next, generate a signal in GNU Radio with a spectrum that looks (roughly) like Figure 3. You have to use the Hilbert transform block. Show resulting spectrum to your TA. Also, save a screenshot of the same, and your .grc source file.

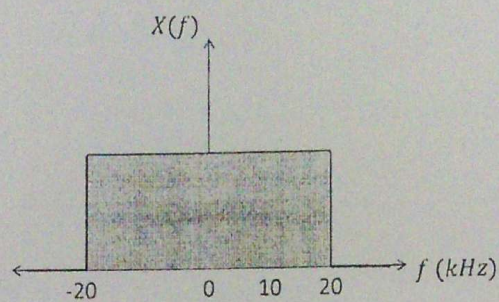


Figure 2: Step (a)

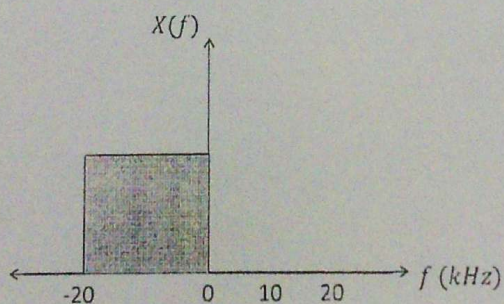


Figure 3: Step (b)

- (c) Next, generate a signal in GNU Radio with a spectrum that looks (roughly) like Figure 1. Once again, you have to use the Hilbert transform block. Show resulting spectrum to your TA. Also, save a screenshot of the same, and your .grc source file.