EE 340: Communications Laboratory

# LAB 10
# End to End Digital communication

# Aim

So far, we have only looked at constellation diagrams in our experiments on digital communication. The goal of this experiment is to have you perform end-to-end data transmission and get a feel of the challenges involved.

Here are the steps we'll follow:

- End to end data transmission using BPSK (Binary Phase Shift keying)
  You have to transmit a text file and recover it at the receiver
- End to end data transmission using Differential BPSK
- Repeat using QPSK

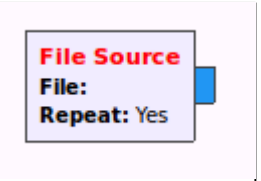
# Task 1

- Transmit the text file uploaded on moodle using BPSK, and demodulate to recover the file.

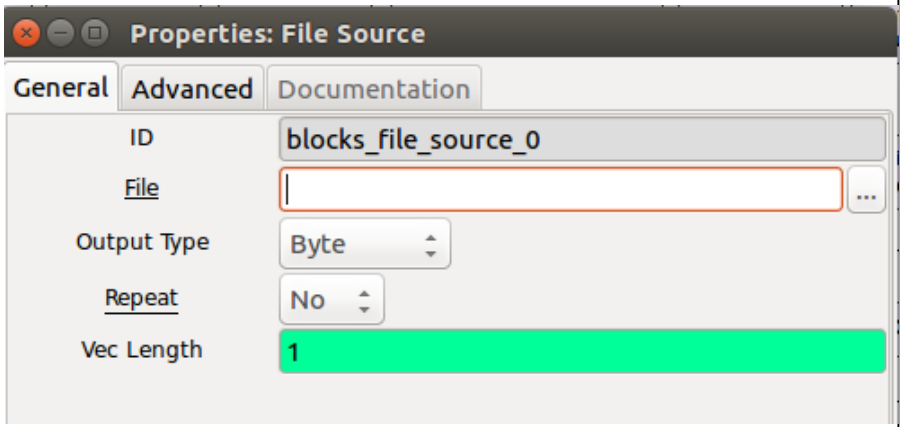
  This involves expressing the file as a bit string first. The following slides mention some GNU Radio blocks you might find useful for this task.

# Useful blocks

**File Source :** Reads raw data values in binary format from the specified file.




**Note :**
Choose text file which was uploaded on Moodle.
Output Type = **Byte.**
Repeat = **No**.



# Contd.

**Unpack K Bits:** Converts a byte with k relevant bits to k output bytes with 1 bit in the LSB.

Since a text file consists of characters which are in Ascii format (each Ascii character is represented using 8 bits), we use this block to extract the bit-stream corresponding to the text file.

Eg: Ascii code for “A” is 1000001. This is packed format and output of file source block will be this as one byte. But, we need every bit of it such as 1,0,0,0,0,0,0,1.

If Input to Unpack K Bits is 10000001 then output will be 00000001 00000000 00000000 00000000 00000000 00000000 00000000 00000001. So every output of Unpack K Bit will be in byte format but will represent 1 bit.

The output of this block will be of the same format as that of random source and further processing to be done will be same as what we did in previous labs.


**Note:** K= 8.

# Contd.

**Float To UChar:**

To change the format of data stream from float to Uchar (Byte format)

# Contd.

**Pack K Bits;** Converts a vector of bytes with 1 bit in the LSB to a byte with k relevant bits.

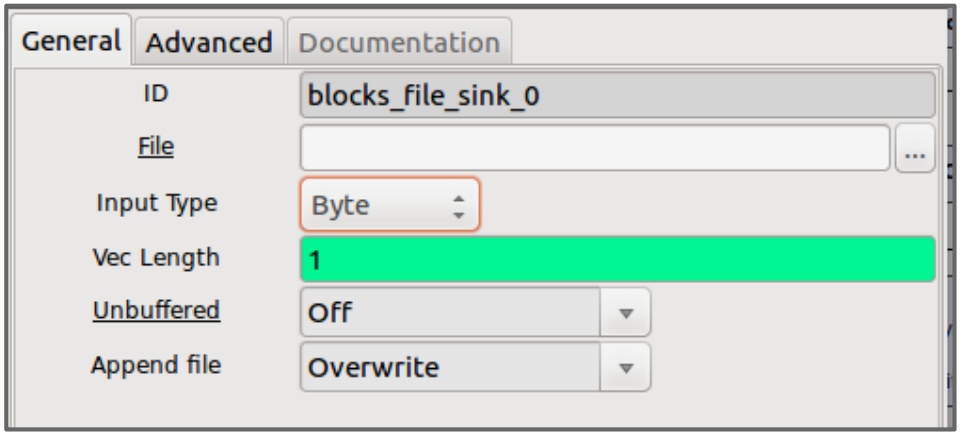
After Processing the data in bit format. To read whether we performed modulation and demodulation correctly or not we need to pack this bits format into a byte again. And for doing so we will be using **“Pack K Bits“**

**Note:**
Input and Output of this block will be in Byte format only.
K=8.

# Contd.

**File Sink:** Outputs raw data values in binary format to the specified file.

**Note :**
Save file with .txt format

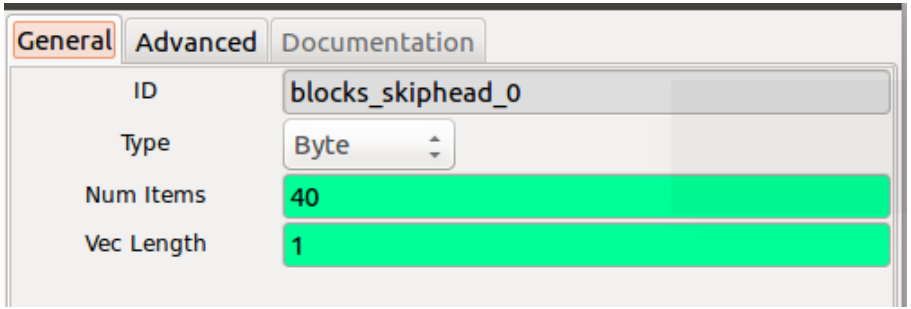
# Contd.

**Skip Head:**


Skips the first N items, from then on copies items to the output.
Useful when there are metadata or junk at the start.
The Processing in GNU Radio adds some junk value at the start,
If we don't use this then packing bits in byte format will cause wrong packing of ASCII code.

**Note:**

Since number of junk bits added depends on your flow and on modulation scheme so you need to do iterative trial to get the correct value.
Ask T.A's for Help.



# Task 2

- Task 1 assumed you have perfect phase sync between the transmitter and receiver. But what if you had a 180° phase shift between the txmitter and receiver? Your constellation diagram would look perfect, but your decoding would be wrong!
- One solution to this problem is differential BPSK – encode information not in the phase value of the output symbol, but in the phase differences

- Task 2 is to repeat the end-to-end transmission of the text file using differential BPSK signalling

# Task 3

- Repeat Task 2 using differential QPSK