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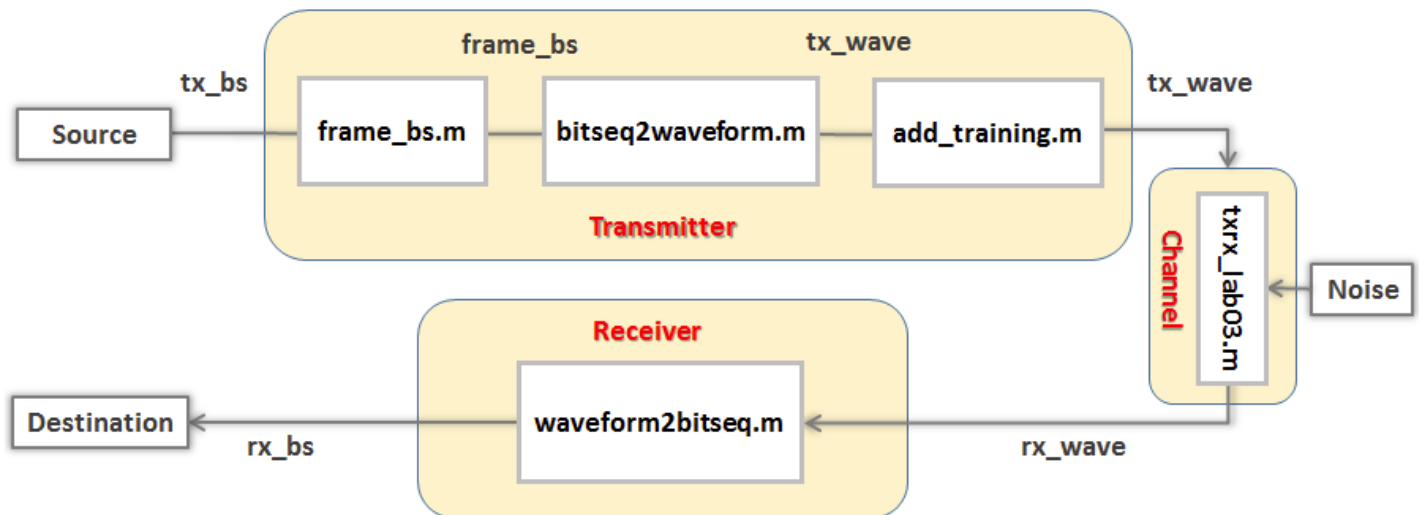
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## LAB 4 - PERFORMANCE EVALUATION (1 point possible)

In this task, you will evaluate the performance of a communication system operating at various bit rates. To adjust the bit rate, you will change the bit time in samples per bit (SPB).



```

1 tx_bs=rand(1,1280)>0.5; % generate sequence of 1280 random bits
2
3 SPBlist = 1:15;          % list of bit times to test
4 num_SPB = length(SPBlist); % number of bit times to test
5 BER = zeros(1,num_SPB); % initialize bit error rate array
6
7 for i = 1:num_SPB,      %generate the SPB list
8     SPB = SPBlist(i);
9     tx_wave = format_bitseq(tx_bs,SPB); % create waveform following protocol
10    rx_wave = txrx_lab03(tx_wave); % simulate channel
11    rx_bs = waveform2bitseq_lab04(rx_wave,SPB); % decode received waveform
12    BER(i) = compute_BER(tx_bs,rx_bs); % compute the BER
13 end
14
15 figure(1);
  
```

```
bitrate = 0.5./SPBList;
plot(SPBList,BER,'r');
hold on;
plot(SPBList,bitrate,'b');
```

Run Code

Hide Answer

You have used 0 of 10 submissions

## INSTRUCTIONS

Let's first look at how the code works. It first defines a random 1280-bit sequence, and a list of 15 bit times in samples per bit. The **for** loop simulates the communication channel you built in the previous labs for each of the 15 bit times. The function **format\_bitseq** combines the functions **frame\_bs** and **bitseq2waveform**, which you have written, with the function **add\_training** to encapsulate a given bit sequence into a frame and add the training sequence. The resulting waveform is transmitted over the channel, and the bit stream is estimated by the function **waveform2bitseq**, which you also wrote. The function **compute\_BER** calculates the BER of the recovered bit sequence by comparing the input bit sequence **tx\_bs** with the decoded bit sequence **rx\_bs**. The BER is defined as the ratio between the total number of bits received in error and the total number of bits in **tx\_bs**. Here the MATLAB variable **BER** is a 15 element vector containing the BER at each of the 15 bit times contained in the variable **SPBList**.

### Step 1: Modify the code to compute the bit rate and plot results

If you run the MATLAB code as presented you will see an empty plot. To complete this task, you should add code under the comments starting with

% Place your code below that

This code should

1. Compute the bit rate in units of Mbps (mega-bits per second) for each bit time in **SPBList** assuming that samples are transmitted at a rate of 500 kilosamples per second. Store these values in a 1x15 vector called **bitrate**.
2. Plot the bit error rate and the bit rate as a function of the bit time in samples on the same graph. The bit error rate graph should be plotted first using the color red. The bit rate should be plotted second using the color blue. For more on how to generate multiple plots on the in the same graph in MATLAB, please review the videos Line Plots (/courses/HKUSTx/ELEC1200.1x/3T2014/jump\_to\_id/3ccb91e06d15423da7f2bf7ca82fa9ec) and Multiple Plots (/courses/HKUSTx/ELEC1200.1x/3T2014/jump\_to\_id/323f8adb3bf94250b0de9e45b5fc73a3).

### Step 2: Submit your work

Once you have completed your work, click on the **Check** button to submit your answer. Based on the graphs, how do the BER and the bit rate change when the bit time is increased? Are these changes desirable or not?



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